DISSERTATION

DISSOLVING BOUNDARIES AMONG APPLIED DISCIPLINES: A NARRATIVE STUDY

OF TRANSDISCIPLINARY COLLABORATION DURING A CHARRETTE

Submitted by

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ABSTRACT

DISSOLVING BOUNDARIES AMONG APPLIED DISCIPLINES: A NARRATIVE STUDY

OF TRANSDISCIPLINARY COLLABORATION DURING A CHARRETTE

Charrettes have a long history of use in medical, architectural, and planning professions. An extensive literature search found little application of the charrette model implemented to advance, support, and identify transdisciplinarity (TD) research, transdisciplinary teaming models (TDM), transdisciplinary learning (TDL) supporting transformative learning (TL) among participants. This study highlighted differing approaches among teams as they navigated ideation and proposed solutions advancing comprehension among students of applied disciplines and how each approached, negotiated, and solved community-based problems.

I implemented a TDM charrette to address TDL in educational settings. This two charrette case study implemented 1) an exploratory investigation joined a competition to create a high school of the future in underserved Montbello, Colorado, and 2) a proposal to renovate and develop a historic homestead on a working cattle ranch and wildlife reserve to support a multi-generational educational program, in Sedalia, Colorado. Charrettes included college students from architectural design, construction management, education, environmental sciences, and fish and wildlife. High school students were joined by POs from education, business and ranching professions, artists, and authors. Participants were challenged to create programs using site attributes. Charrette's culminated with team project proposals shared with invited stakeholders. Using Hall's four-phases of TD team based experiential learning and Kolb's Learning Style Models I used visual narrative and a sustainability lens to reflect and incorporate participant

experiences and outcomes. Findings identified how students experienced charrettes, how they interacted with other disciplines, participant observers (PO)/facilitator observers (FO), and project stakeholders. TDM emphasized the importance of self-reflection revealed by mutual learning of transferable solutions, synthesis of results, and the visibility and relevance to problem solving. Outcomes showed how participants explored, described discipline knowledge; how shared skills shaped and influenced information sharing, leading to transformative learning (TL).

Key findings identified knowledge derived from multiple modes of inquiry gained from TDL addressed problems, contributed to transferability. Challenges identified recruitment of participants from more than three disciplines. This study described and shared how participation advanced knowledge production and integration to solve unstructured problems. The TDM charrette supported TDL and knowledge production that bridged solution oriented approaches among participants leading to TL.

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To my friends and family for keeping me afloat and on track, to the late-night calls of support and for always believing in me; especially Nancy, Barb, Ro, Kirk, Fu-Tung, Amy, Fritjof, and the team at Cherokee Ranch. All shared my vision and supported my every dream; I thank you.

I would like to thank and dedicate this dissertation to two influential people in my life, my late husband, Ken Mersfelder, and Lynn Hoernecke-Pilsner. I miss you both every day but listened as you whispered words of encouragement when I needed them most. To my dad, Big A, you shared your love of wildlife, the outdoors, and construction. You taught me determination and gave me the ability to deal with conflict and confrontation. I always remember your words, "I may not agree with you, but I will support you in everything you do." To my mom, Marian Domres, who is always there for me, her open-door policy made home comfortable for me and my friends, her adopted kids; for providing me a sanctuary to finish this journey. To everyone I have forgotten, you were the behind the scenes glue that kept me going, thank you!

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DEDICATION

To all who noticed that kid in the back row, for that one person who always asked questions for those who were afraid to; to all who defy the odds. In the words of the Dalai Lama, *just as ripples spread out when a single pebble is dropped into water, the actions of individuals can have far-reaching effects.* I devote this work to all the pebbles in my life!

I have long imagined that integration among disciplines would benefit students, communities, and the private sector. I often struggled to succeed or even thrive in more traditional academic pursuits with fixed courses in classroom environments. As one who is always looking for new ideas, concepts, and collaborations; as a non-traditional learner with a learning disability, and more importantly, someone who learns in pictures. As an object visualizer, I am not a linear thinker rather I think in pictures. Bubbles if you will; always in constant motion, floating often 10 at a time. This is where I live, able to jump from one to the other, rarely in order. Bubble thinking built skills required to excel at design, construction, project management, and when working with wildlife and endangered species; it gave me the ability to see multiple scenarios and options. I see connections among the juggling.

Not until Drs. Carole Makela, Katharine Leigh, and Temple Grandin introduced me to Transdisciplinarity (TD) did I find a home for my research and studies. TD helped me realize that my way of seeing things was not separate but part of an evolving circle; one where others thought and envisioned learning as I do. I dedicate this work to all those who see the world through a different lens; those who find something new every day that sparks an idea, a vision, or dream. I devote this work to those who are inspired and jump to accept the challenge of "it can't be done." Do not stop exploring, looking, or listening; start a ripple, follow it, you might just change the world.

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RELEVANT STUDY CONCEPTS AND TERMS

This study utilized key concepts, disciplinary ways of thinking, and language to describe, explore, and explain participant experiences. Descriptions of these concepts and discipline specific language identified as:

Action Research. Collaborative and adaptive research that lends itself for use in community situations. Follows an exploratory stance carried out in a repeating method until an understanding of the problem is achieved. Intended to foster deeper understanding of a situation, starting with conceptualizing moving through cyclical process to interventions and evaluations to solve the problem.

Bloom's Taxonomy. Benjamin Bloom (1913-1999) published a framework for categorizing educational goals (Bloom, 1956) revised by Lorin Anderson (2013). Bloom's taxonomy implemented a multi-tiered scale to promote higher forms of thinking rather than just remembering facts (Bloom, 1956). Anderson discussed cognitive domains as clear and distinct, outlined as remembering, understanding, applying, analyzing, evaluating, and creating. Krathwohl and Anderson revised Bloom's Taxonomy and combined the cognitive processes with three levels of knowledge (factual, conceptual, and procedural) to form a matrix; improving the usability with action words, adding cognitive and knowledge thus another level of knowledge-metacognition (as cited Anderson, 2013).

Blended Learning. Blended learning combines in-person teaching with asynchronous learning methods, supported with digitally enhanced materials; often supplemental to FTF learning materials. Blended learning is similar to but distinct from Hybrid learning. (Morganelli, 2020).

Blue Jeans. Video Conferencing Technology – cloud-based video conferencing offers private 'meeting rooms', operates with Cisco, Microsoft Lync, and Google. Has the ability to work with any platform and conference program across different devices, including smart phones, connecting people from anywhere on any device.

Charrette. This study employed a charrette based method for data collection and analysis. Condon (2012) defined charrette as "a time limited, multidisciplinary design event organized to generate a collaboratively produced plan for a sustainable community project" (p. 1). Used something about observational ugh

Facilitation/Facilitator (FO). Facilitation is a powerful approach to foster and implement change. Facilitators (FO) supported the research and charrette in two areas identified as: 1) implementation and 2) support. FOs helped teams understand their common objectives and assisted them to plan how to achieve these objectives; in doing so, the facilitator remained "neutral" meaning they did not take a position in the discussion, rather directing participants to available resources while coordinating the charrette activities, timelines, and field exercises (Lessard, 2016). FOs worked closely with direct observations and participant observers during the charrette, while also piloting the charrette; FOs were stationed at each location.

Global Information System (GIS). A geographic information system (GIS) is a system designed to capture, store, manipulate, analyze, manage, and present spatial or geographic data. GIS-based maps and visualizations are a type of language that can improve communication among different teams, disciplines, professional fields, organizations, and the public. Implementing GIS allowed participants to visualize, question, analyze, and interpret data while off-site to develop and understand

relationships, patterns, and habitats at the site; GIS aided teams when making decisions

about the site. It was utilized to access and identify areas such as cattle fencing

route/corridors, maintenance, and natural resource identification, linked to identification

of archeological sites, habitats, and endangered species tracking. Having access to the site

and making informed decisions about the location were critical to off-site team success.

Google Liquid Galaxy and Google Earth/Maps. Both are Windows based open source

programs; the Liquid Galaxy protocol is an electronic wrap-around multi-monitor

workstation where teams viewed the site through immersions by flying over site foothills,

buildings, valleys, and underground; these programs unlocked data through visualization

(Skytland, 2012). We pre-filled the Ranch site using GIS overlays to provide a real-time

view of what on-site participants might see. For example, all corrals, buildings, and roads

were visible. While on-site participants had access to the physical site of 344 pre-

determined acres, virtual teams had access to the entire Ranch footprint of 3,400 acres.

Liquid galaxy allowed off-site participants to view on-site participants with a short time

delay.

Halls Four-Phase Transdisciplinary Model. Hall et al. (2012) developed this model to

highlight the interacting goals and learning process involved in the TD cycle. The model

identified four distinct phases: *development*, *conceptualization*, *implementation,* and

translation. "Although these phases are presented sequentially the collaborative process

is recognized as recursive, with movement among the phases as the research

collaboration unfolds, so that team members may return to the prior phases as needed to

address unfolding research questions" (p. 415).

Hawthorne Effect. "the alteration of behavior by the subjects of a study due to their awareness

    of being observed" (Statistics How To, n.d., para. 1).

Kolb's Learning Style Model. Published in 1984 his learning style model developed from his

    learning style inventory (McLeod, 2017). His experiential learning cycle is represented

    by a four-stage learning cycle; including how a learner experiences each of the four bases

    identified as: 1) *concrete experience* (doing, having an experience), 2) *reflective*

    observation (reviewing, reflecting on an experience), 3) *abstract conceptualization*

    (concluding, learning from an experience), and 4) *active experimentation* (planning,

    trying out what they have learned). Kolb's learning model involved the acquisition of

    abstract concepts that can be applied in a variety of situations (Kolb, 1984). In McLeod's

    Simply Psychology article, Kolb was quoted as, "Learning is the process whereby

    knowledge is created through the transformation of experience" (as cited in McLeod,

    2017, p. 38).

KUBI™ Robotics. KUBI from Revolve Robotics is a videoconferencing option that allows

    remote participants to communicate face-to-face with participants in a different location.

    A telepresence robot KUBI allowed remote users to look around the Ranch location

    during video calls. Off-site teams could ask participant observers to instruct (telling) the

    KUBI (robotic platform) where to aim enabling a pan and tilt using a remote iPad. This

    provided off-site participants to utilize KUBI robotics as if they were in the same

    location; six KUBI units were utilized during the charrette; use of KUBI(s) humanized

    the video calling experience among team participants while giving remote users the

    agency to establish situational awareness. KUBI(s) telepresence works in conjunction

    with *Blue Jeans* applications allowing users to look around the room and to access on-site

teams. KUBI(s) were utilized to enhance awareness of the users' remote surroundings, increasing interaction, improving collaboration, and removing the burden of others having to physically scan, pan, and share what they are experiencing when using a cell phone.

Mezirow's 1991 Transformational Learning Theory. Described as "constructivist, an orientation which holds that the way learners interpret and reinterpret their sense experience is, central to making meaning and hence learning" (1991b, p. 244). The theory has two basic types of learning: instrumental and communicative. "Instrumental learning focuses on discovery through task-oriented problem solving and determination of cause and effect relationships" (p. 32). "Communicative learning involves how individuals communicate their feelings, needs, and desires" (p. 33). Mezirow proposed four ways of learning using schemes and transformative learning.

Naturalistic Observations. Refers to studying life-world situations as they unfold; non-manipulative and non-controlling the researcher is open to whatever emerges. Researchers immerse themselves in the setting being studied, is valuable to researchers who want to learn about people in a specific social or cultural setting. Most often includes time, situation, and or event sampling. Studies have greater external validity as data comes from observed subjects in a natural environment; can be conducted in any kind of social or organizational setting.

Observation Form. For this study observation forms represent instruments used by PO/FOs to document participant interactions. PO/FOs were provided supplemental forms that identified measures and criteria to aid observers in determining what to gather and how to gather; developed to support recording and comparing observations made at different

times and days by different people. Forms used collected observers' interpretations of the phenomenon being observed. Observation forms were developed by the researcher.

Participant Observation/Observers (PO). One of the most common methods for qualitative data collection, participant observation can be the most demanding, requiring observers to become part of the culture or context being observed. A more accurate description within the context of this study would be the term "direct observation", as these individuals strived to be as unobtrusive as possible so as not to bias the observations. POs were permitted to direct charrette participants to available resources when asked but focused on watching rather than taking part. Consequently, video and audiotaping were employed as a tool for post-charrette review thus allowing POs to make clarification of notes and observation; while not permitted to be utilized to change observations (Trochim, 2007).

PODs. PODs utilized in this study are defined as "a streamlined enclosure, housing, or detachable container of some kind" (Dictionary.com, n.d.). Following Bloom's taxonomy of educational objectives, learning pods were developed in a series of three accretive types: acquisition, exploration, and discovery (Bloom, 1956). For this study Learning PODS were characterized as "a self-directed community, grouped by geographic location, working together on learning projects" (Lackney, 2007, para. 21).

Problem Based Learning (PBL). "Students work in collaborative groups to identify what they need to learn to solve the problem. Engaged in self-directed learning, they apply new knowledge to the problem, reflect on what they learned; including the ability to think critically, analyze and solve complex, real-world problems, to find, evaluate, and use appropriate learning resources; to work cooperatively, to demonstrate effective

communication skills, and to use content knowledge and intellectual skills to become

continual learners. Students facilitate self-directed leaning to solve complex problems

that do not have a single correct answer" (Savery, 2006, pp. 11-12).

Rubric. For this study rubric was sourced as an evaluation tool or set of guidelines used to

identify and record participant interactions of learning expectations, and objectives;

measured against a set of identified criteria and measures.

Snip & Sketch. A WINDOWS 10 application (app) used to create, annotate, save, and share

screen shots. This app allows screen captures of documents created by the user who can

utilize tools for drawing, highlighting, changing colors, and writing/drawing wherever

wanted. The advantage of this app is that images can be modified, written on, drawn on,

cropped, and copied; when placed in a WORD document, images hold their ratio when

enlarged or decreased; especially useful with tables and lists. Utilized to replicate, create,

copy, and/or insert tables, figures, photographic images, and when creating a

photographic montage.

Stakeholders. Identified as key decision makers these invited individuals joined the charrette in

two roles: as participant observers and as acting "jurors" for participant presentations

during the last day of the charrette. Those who assisted as POs conducted direct

observations and/or assisted with field exercises, while those whose time was more

limited acted as jurors for student presentations of their projects during the last day of the

charrette, both roles required stakeholders to make value judgements and observations.

The objectives and benefits of inviting stakeholders were: 1) strengthen and encouraging

active involvement for the project by communities and other stakeholders, post charrette,

2) reduce the risk of social conflict and delays during the charrette, 3) location and site

specific experience and extensive knowledge with a long history of involvement with the

Ranch, and 4) important collaborators for moving the project forward post charrette

(Roggema, 2014).

Storytelling. Stories are communicated by individuals who steep narrative with meanings and

explanations. The storytelling process was used by participants to convey experiences. It

follows a patterned sequence related to context; they spark emotions and stimulate

cognition based on inferred events. "The audience creates new knowledge through

inferring the meaning of these stories, using their past experience to gain new insights,

skills, and wisdom that are relevant in real-life situations" (Lugmayr et al., 2017,

p.15721)

Template. For this study templates were identified as documents not created by the researcher.

The researcher utilized templates to identify criteria and measures, modified to meet

study goals and applied when developing researcher rubrics and/or observation forms.

For example, PO training exercises used templates created by others, while participant

field trip exercise adapted a template creating an observation form for sensory and

mapping exercises.

Transdisciplinarity (TD) Research. "Transdisciplinarity connotes a research strategy that

crosses many disciplinary boundaries to create a holistic approach. It applies to research

efforts focused on problems that cross the boundaries of two or more disciplines… and

can refer to concepts or methods that were originally developed by one discipline, now

used by several others, such as ethnography" (DBpedia, n.d., para. 1). "The Belmont

Forum elaborated that a transdisciplinary approach is enabling inputs and scoping across

scientific and non-scientific stakeholder communities and facilitating a systemic way of

addressing a challenge. This includes initiatives that support the capacity building

required for the successful transdisciplinary formulation and implementation of research

actions" (DBpedia, n.d., para. 2). TD is participatory research that cuts across disciplines;

is life-problem orientated exploration that integrates knowledge, skills, and experiences

from a diverse group of people. **"TD aims at a more thorough integration of knowledge**

focusing either (1) on *transdisciplinary concepts and methods* **which are shared by**

more than one scientific discipline or (2) on the implementation of *participatory*

processes **within the research process which allow from the beginning deliberations**

with practitioners, citizens, and stakeholders about the purposes of a research project on

the one side and an integration of first-hand nonscientific knowledge on the other"

(Arnold, 2013, para. 3).

Transdisciplinary Learning (TDL). Exploration of relevant issues or problems that integrate

the perspectives of multiple disciplines to connect new knowledge and deeper

understanding to real life experiences (Carrillo, 2008). Transdisciplinary learning,

compared to discipline learning, draws together disciplinary and stakeholders'

knowledge, and transforms it into a new, co-created TD knowledge. It advances the

learner to higher domains of cognitive abilities and sustained knowledge and skills

McGregor, 2017).

Transdisciplinary Team Model (TDM). A transdisciplinary team allows members to

contribute their own knowledge and expertise, but efforts are collective in determining

best ideas or approaches. "A transdisciplinary team is one in which members come

together from the beginning to jointly communicate, exchange ideas and work together

to come up with solutions to problems" (Kokemuller, n.d., para. 3). Defined as the

sharing of roles across disciplinary boundaries so that communication, interaction, and

cooperation are maximized among team members (Davies, 2007; Johnson et al., 1994).

TDM teams are described as members commitment to teach, learn, and work together to

implement coordinated skills and expertise to problem solve (Fewell, 1983; Peterson,

1987; United Cerebral Palsy National Collaborative Infant Project, 1976).

Transformative Learning (TL). Transformative learning is the process of effecting change in a

frame of reference. It is the acquired body of experience (associations, concepts, feelings,

conditioned responses), its frames of reference from their life world. "A frame of

reference encompasses cognitive, conative, and emotional components, and is composed

of two dimensions: habits of mind and a point of view. Habits of mind are broad,

abstract, orienting, habitual ways of thinking, feeling, and acting influenced by

assumptions that constitute a set of codes. These codes may be cultural, social,

educational, economic, political, or psychological. Habits of mind become articulated in a

specific point of view—the constellation of belief, value judgment, attitude, and feeling

that shapes a particular interpretation" (Mezirow, 1997, p. 5)

CHAPTER I - INTRODUCTION

> Thus, the task is not so much to see what no one yet has seen, but to think what nobody
> yet has thought about that which everybody sees.
>
> Arthur Schopenhauer, 1851
> (Quote Investigator, 2015)

There has been an increasing interest in transdisciplinary (TD) research among

universities, sustainability, and the private sector over the last decade. With this comes the

increased need for research and literature on transdisciplinarity. It brings with it the diverse

characteristics of the researcher and how TD is perceived, practiced, and theorized among

varying disciplines; historically, research has been conducted within disciplinary silos. Literature

offered vague notions of how to accomplish this transformation among interdisciplinary

approaches, networks, and power structures; rarely addressing how to move beyond guarded

networks within university settings, coupled with private sector cultural norms (McGregor &

Volckmann, 2011). Madrazo-Nunez (2011) of Universidad Veracruzana said:

> Transdisciplinary is an exploration of how knowledge is going on in people, in
> communities, in societies. (TD)… is not a new paradigm, but a methodology…For me
> transdisciplinarity is like the lens – like the lens that makes you aware about what you are
> doing when you are creating knowledge, when you are interacting with reality. (p. 73)

So, what does this all mean? I made critical distinctions between intradisciplinary, cross-

disciplinary, multidisciplinary, interdisciplinary, and transdisciplinary. I conceptualized a

sequence of phases; 1) collaboration to frame the problem combined with co-production of

knowledge that was transferable and solution oriented, 2) integrating, producing, and applying

new knowledge, and 3) integration of phase one and two leading to innovative problem

solutions, performed in a recursive cycle while highlighting reflection and transformative

learning as recommended by Lang et al. (2012). I invited researchers, participants, and

stakeholders to step out of their disciplinary and/or professional comfort zones while getting them to work together on the challenges of the day. Stirling (2015) stated:

> The frenetic activity intensifies with the advent of other buzzwords: "global assessment" "ecosystem services" "planetary management and the "nexus" of challenges around food, energy, water and the environment. As attention focuses ever more intently on complex worldwide problems, it makes growing sense to pull research out of its disciplinary silos and focus directly on the problems at hand. (p. 2)

Cherokee Ranch and Castle Site Overview

The Cherokee Ranch & Castle Foundation (CR & CF) has a long and significant history in Colorado; listed on the National Historic registry on October 21, 1994, ID# 5DA.708. Located at 6113 Daniels Park Road, Sedalia, Colorado; it sits east of Highway 85 and north of Daniels Park Road; with map coordinates of 3945878 - 104.91389 (Historic Douglas County, 2016). The National Historic Registry stated that CR & CF is associated with events that have significantly contributed "to broad patterns of our history…it embodies the distinctive characteristics of a type, period, or method of construction…or represents a significant and distinguishable entity whose components lack individual distinction" (United States Department of the Interior [USDOI], 1994, Statement of Significance section, para. 1) with Agriculture, Architecture and Exploration/Settlement areas of significance. The National Register of Historic Places identifies the property as having 26 Contributing and 10 Non-Contributing Resources:

19 Contributing buildings (4 Historic Building Groups),
1 Contributing Site,
5 Contributing Structures, and,
1 Contributing Object.

Resources feature a combination of cultural landscapes that represent development beginning in the mid-18th century, including a:

- 20th century replica of a 15th century Scottish Castle, designed by Burnham Hoyt
- Purebred Santa Gertrudis cattle operation

- Prehistoric site (encompassing two prehistoric rock shelters), and
- Wildlife Preserve.

Noteworthy within the non-contributing resources are the Mountain Man Trail and cabin ruins, presumed to date to 1847 (USDOI, 1994). The register identities Cherokee Ranch as, "a multifaceted property that is an historic cultural landscape" (USDOI, 1994, Continuation Sheet section, p. 11). The Ranch is typical of larger ranches through the acquisition of smaller homesteads. The ranch meets historic criteria A and C with a period of significance dating from 1868 to 1944, with the 50-year date identified by the National Register. Criteria A requires a site to have a "significant association with local exploration and settlement, specifically the homesteading and development of early ranches" after 1862 (USDOI, 1994, Continuation Sheet section, p. 11). Criteria A include method and types of construction as ranches had to be continuously operated as an agricultural site since the late 1860s; "Cherokee is believed to be one of the longest operated ranches in Douglas County" (USDOI, 1994, Continuation Sheet section, p. 13). This is significant as many homestead families left after the 1845 and 1851 droughts, the lowest flow years recorded (Colorado River Basin Climate, 2005). In 1935, President Franklin D. Roosevelt withdrew all public lands from future homesteading, further enhancing the value of Cherokee Ranch.

The Ranch meets historic criterion C for the architectural significance of the ranch buildings. The Blunt and Flower houses are both representative of 19th century ranch dwellings in Colorado. The Blunt house is an early example of a Dutch Colonial dwelling in rural Douglas County. Stylistic features include a gambrel roof, pedimented window heads and a three sided one-story bay window with wood panel trim. (USDOI, 1994, Continuation Sheet section, p. 14) The Castle is an individual contributor and eligible for separate listing in the National Register for architecture and design; significant for design and masonry work of interior walls and

stairways, towers with gargoyles, turrets, battlements, and rock faced walls. The design reflects 15th century Scottish architecture while replicating changes that might have been made over five centuries.

Preservation and Renovation of Historic Properties

The National Park Service [NPS] and the Secretary of Interior [SOI] Technical Preservation Services, preservation service and guidelines identify "standards four approaches to the treatment of historic properties 1) preservation, 2) rehabilitation, 3) restoration, and 4) reconstruction" (National Park Service, 2016, para. 1). When choosing appropriate methods to develop the site I reviewed historic and cultural landscapes; determined them to be interrelated and to encompass a wide area of practices at the Ranch.

Preservation options were identified onsite and given a high priority with preferred outcomes for retention of all historic frameworks through conservation, maintenance, and repair of existing and contributing structures. Rehabilitation plans required the retention and repair of historic materials affording more leeway for replacement due to the deterioration of buildings; while respecting preservation of materials, finishes, spaces, and spatial relationships that give the site historic character (NPS, 2016). Participants focused on reusing original materials while rebuilding non-surviving structures was an option. If using this option participants were instructed to replicate as closely as possible original plans, materials, and concepts.

Landscapes and Natural Environments Cherokee Ranch covers 3,400 acres and is home to three major eco-regions; Southern Rockies, High Plains, and Southwest Tablelands. These landscapes incorporate natural environments while supporting existing infrastructure. By

supporting existing infrastructures, this practice conserves ecosystems while providing a wide array of benefits to people and wildlife.

The Ecological significance contains habitats and species found in the Chatfield Basin Open Space Conservation Area (OSCA) plan identifying seven key conservation corridors and six conservation areas, totaling 8,200 square miles. The Basin area is comprised of 1,250 identified species consisting of more than 550 plants, 71 mammals, 345 birds, 28 reptiles, with more than 250 butterfly and invertebrate species (Chatfield Basin Conservtion Network, 2006). This area is home to federal and/or state rare, imperiled, threatened, or endangered animal species including the bald eagle, Preble jumping mouse, Northern leopard frog, and ten species of butterflies. Spring migration patterns include 3,000 to 4,000 raptors (17 species, including Peregrine Falcons), as the area has the greatest diversity of bird species of any state park in Colorado (Hellmund, 2004**).**

Study Framework

This study differentiated the term transdisciplinarity (TD) and my use of TD research. Moving forward I classified the different aspects, fully defined in Study Terms, as:

- TD (research strategy)

- TDL (learning)

- TDM (model)

In this study I proposed a framework to guide purposive transdisciplinary (TD) research to create transdisciplinary learning (TDL) using a transdisciplinary model (TDM) piloting transformative learning (TL). Jantsch (1972) described this framework as *outcome space.* Mitchell et al. (2015) explained a systematic approach to TD, "by bringing into focus the relationships between entities and components (situation, knowledge, and learning) and the

causal links and interplays between them", identified in Figure 1.1 (p.91). Mitchell's (2009) conceptual map depicted the three outcome spaces indicating a TD project within our field of vision that is itself embedded in the broader landscape. Mitchell et al. (2015) further identified aspects and core attributes to transdisciplinary research (TD), in Table 1.1.

Based on the resources identified I collected data about group dynamics during a charrette. These data are shared using visual narrative and descriptive statistical research including, but not limited to, observational data collected by Participant Observer(s) (PO), Facilitator Observer(s) (FO), and survey methods employed in a natural environment.
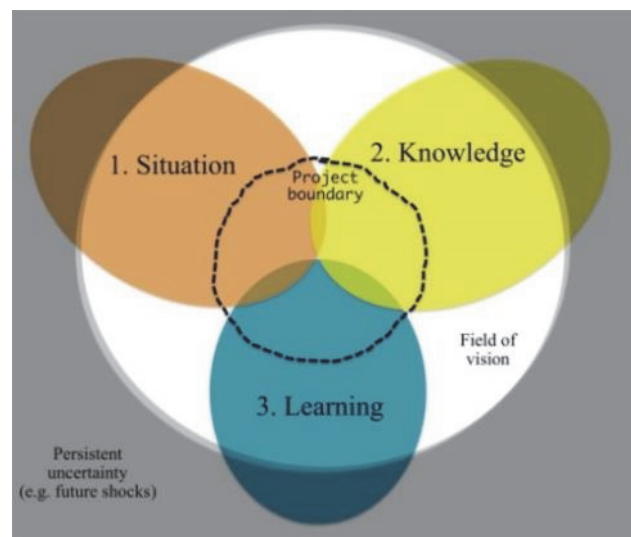
Figure 1.1
Conceptual Map of Three Outcome Spaces Indicating a Transdisciplinary Project
Note. From "Beginning at the end: The outcome spaces framework to guide purposive transdisciplinary research," by C. Mitchell, D. Cordell, and D. Fam, 2015, *Futures, 65*, p. 91. (http://dx.doi.org/10.1016/j.futures.2014.10.007). Copyright 2014 by the Authors. Published by Elsevier Ltd. Under a Creative Commons License. Open Access.

Table 1.1

Aspects and Significance of Core Attributes of Transdisciplinary Research

Aspect	Significance
Intention	What is the intent of the research project? (i.e., purposive, normative, descriptive?). e.g. the research might be outcomes-focused with a (moral) commitment to improving the situation, or the intention may be to better understand the situation.
Worldview	What is the worldview or orientation of the research team? This can influence the theoretical lens, in addition to where boundaries are drawn around the project and the problem situation, and, which stakeholders participate and who are excluded.
Experience & Qualifications	What are the existing qualifications, formal training, life skills? Life experiences? Sense of role and responsibility in the project? This will likely influence the theoretical framework and methods selected by the team, in addition to the quality of research.
Past engagement with the situation	What experiences, engagements, or relationships in the situation under investigation does the research team have? This could positively or negatively influence trust in the researchers by other stakeholders, such as perceived reputation (e.g., 'street cred' or perceived as 'invested' in a situation as changing or staying status-quo).
Funding Arrangement	Who is funding the research? This has implications both in terms of the outcomes of the research (e.g., whether it is likely to be implemented by the funding body – e.g., a government department or water utility); and, in terms of trust (e.g., if funded by an industry/governmental group the research may be perceived by others as biased if care is not taken to ensure independence).
Degree of engagement across disciplines	What is the degree of engagement across theoretical and epistemological perspectives? e.g., across social sciences, engineering, political economics, ecology, systems thinking? Or within the same theoretical/epistemological framework? (e.g., biology, geology, engineering, etc.). This has implications in terms of the degree of transdisciplinarity, and hence opportunities for emergence and insights through engagement across disparate philosophical perspectives.

	What is the degree of engagement across sectors and stakeholder groups, e.g., across governmental, industry, NGO, community, and other organizations? Or is it limited to one stakeholder group (such as industry)? This has implications in terms of breadth of perspectives included in the analysis and hence the outcomes. It may influence the saliency, credibility, and legitimacy of the research if it has engaged widely among stakeholders.
Degree of engagement with the situation	

This study sought to advance how transdisciplinary teams commit to mutual and TL, and to reinforce how individual participants and teams shared knowledge among disciplines. A visual narrative, this study utilized data collection and analysis techniques dependent on instrumentation for measurement and observation (Borg & Gall, 1989).

To achieve the outcomes proposed the study utilized Mitchell et al.'s (2015) hierarchical framework adapted from Jantsch (1972); a systematic approach to focus on relationships among entities and components of transdisciplinarity and the casual links and interplays among them (see Figure 1.2). The intent was to produce information about aspects of transdisciplinary teaming, transformative learning, and how implementing TD research can help students learn better. It explored whether certain interventions could improve learning by applying causal-comparative, correlational, and experiential methods. I concluded this study would be beneficial for policy makers, stakeholders, educators, and the private sector.

Statement of the Problem

Transdisciplinary researchers have suggested numerous ways with which to create change when there was little support explaining transdisciplinary theory. I utilized a transdisciplinary model (TDM) as the framework that provided the scaffolding for ideas and conceptual models implemented to understand the problem when exploring TL among

disciplines. I utilized a TDM to explore relationships among components of a problem to exam the dynamics among cooperative teams. A TDL approach was implemented to address wicked problems. "The framework begins at the end: it distinguishes by beginning at the end of the problem" (Mitchell et al., 2015, p. 95).
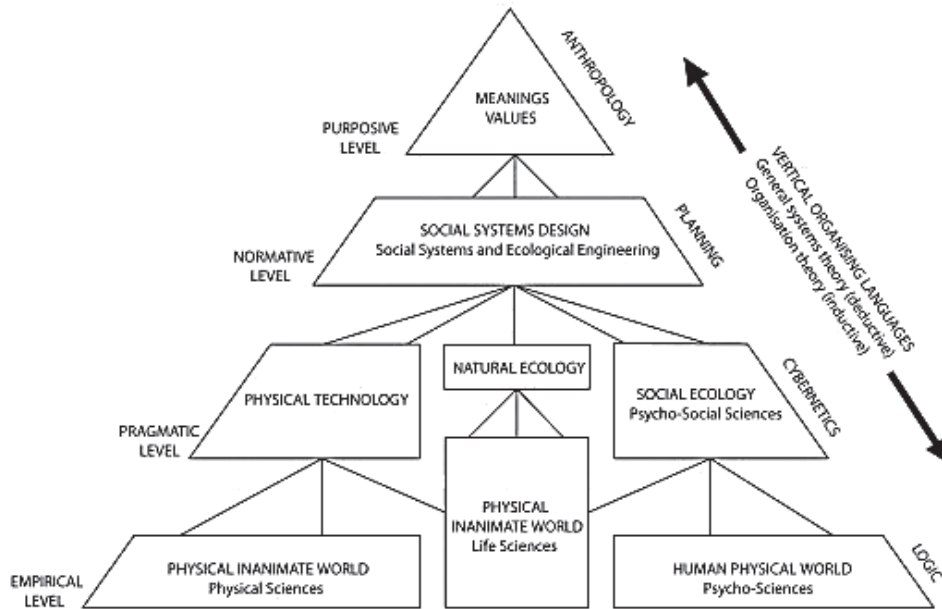
Figure 1.2
Education Innovation System, Viewed as a Multi-Level, Multi-Goal Hierarchical System
Note. From "Beginning at the end: The outcome spaces framework to guide purposive transdisciplinary research," by C. Mitchell, D. Cordell, and D. Fam, 2015. *Futures,* 65, p. 5 (http://dx.doi.org/10.1016/j.futures.2014.10.007). Copyright 2014 by the Authors. Published by Elsevier Ltd. Under a Creative Commons License, Open Access.

Purpose of the Study

By looking at ecology landscapes and sense of place combined with historic resource management, the purpose of the study was to explore the impact of TDL between on-site and off-site teams, and how or if TL occurred within project outcomes. The case study analysis was based on the premise that TDM teams would uncover trends and issues not previously exposed revealing ways to resolve existing and emerging problems and project outcomes. Cherokee

Ranch was selected for the study site as it demonstrated how human activities and interactions impact complex physical, social, economic, cultural, and historic sites. Using a theoretical framework this study encompassed an in-depth analysis grounded in interactive relationships among people and their environment.

<p style="text-align: center;">**Objective of the Study**</p>

The objective of this study was to explore the elements of TDL and TL among individuals and teams. It focused specifically on addressing how TDL and TDM were fundamentally similar in approach and how individuals/teams organized knowledge and transferred that knowledge to effect transformative learning (Montuori (2013); Montuori & Donnelly, 2013). This study looked at the intricacy of TDL as inquiry-driven versus discipline-driven. To achieve the objective, I explored how TDL necessitates creative/design thinking by understanding of one's self, relations, and interactions. It required disciplinary organization of knowledge allowing participants to explore, inquire, and cross various sources of relevant information needed to complete a project. I focused on developing a picture of interrelationships between TDM teams that explored four major components of TL identified as: 1) experience, 2) critical reflection, 3) reflective discord, and, 4) actions taken by studying the construction of knowledge sharing, not on the more traditional reductionist approach of a single system.

<p style="text-align: center;">**Goal of the Study**</p>

The goal of this study was to identify the transfer of knowledge through collaborative learning by conducting an in-depth case study analysis. Study participants were sought with varying backgrounds and specializations merged in the charrette process, joined by eight participant observers and four facilitators. Participants were assigned to one of eight teams, comprised of eight disciplines, divided among four off-site and four on-site teams.

The stimulus for this research evolved from private sector requests. Charrettes are a collaborative model most often used by architecture and design professionals, project managers and community developers to resolve planning phase problems (Lakshminarasimhan, 2011, para. 1). In the current business environment projects are globally distributed, and often teams must communicate virtually; requiring project participants to contribute and communicate with both virtual and on-site teams, and among stakeholders and communities. The overarching purpose of a charrette is to avoid issues in the project scope. I implemented a charrette model as a tool for participants to define a transdisciplinary project scope. Research showed that project failures most often occur when teams are unable to translate knowledge among disciplines (fields) as members come from diverse backgrounds, expertise, and experiences (Roggema, 2014). Charrettes present participants with the opportunity to identify interconnections among their team members, providing life-world experiences.

Significance of Study

Transdisciplinarity is a conceptual and methodological framework. The Institute for Social-Ecological Research (2015) noted, "social-ecological transdisciplinary research integrates basic science and applied scientific research, always remaining focused on solutions to practical problems of everyday life" (para. 3). "Through transdisciplinary approaches, researchers from a wide range of disciplines work with each other and external stakeholders to address real world issues" (Hadron et al., 2008, p. 19). TDL engaged participants in collaborative, cross-disciplinary exercises among students, stakeholders, and domain experts, while simultaneously utilizing TDM. Noted by The Institute, TDL allowed participants to strengthen and prepare, to create, contribute, and practice live-world problems' while sharing life experiences. It required participants to see problems through new lenses beyond disciplines in search of solutions to

entire problems; forcing them to investigate literature, history, ranching, and economics among other fields. Case studies that incorporate multiple methods are beneficial for understanding and increase trustworthiness and validity of study findings (Merriam, 1998; Patton, 1990; Stake, 1995, 2000).

This study was important as its scope has not been presented at a scholastic level to translate knowledge acquisition and sharing among disciplines into TD practice. The study advanced systems knowledge, social, cultural, and natural systems thinking and broader approaches to problem solutions. This research supported a deeper understanding of how and why implementing a TDM based study fostered place-based learning. Apart from studying ethical challenges of historic renovation problems, it considered political, economic, and societal prerequisites while addressing needs on problems of perception and assessment, habitats, and landscapes.

By merging several forms of problem-based learning (PBL) this study combined perspectives, knowledge, and methods from different disciplines, coupled with life skills and knowledge exchanges aimed at problem solutions. It contributed to the knowledge of several disciplines by preparing participants, on even a small scale, to further develop integration of knowledge derived from societal needs supplemented by newly structured and prioritized approaches as they inform decisions (Mauser et al., 2013). This research crossed boundaries and disciplines, leaving traditional subject matter behind reconstructing the problems in various arenas, and transforming the relationship of science and society, systems, and structures.

Transformative learning incorporated a holistic view of all systems required for this site to thrive and become self-sustaining as it looked at all approaches equally, creating innovative concepts and solutions identified as social, cultural, environmental, intergenerational, and

technical aspects of change. It addressed societal relationships to ranching, sustainability, natural environments, habitats, renovation, history, and education as it reinterpreted a problem within the frame of available knowledge and applicable solutions. Participants refocused to question unknown knowledge (Gray, 2008). Interactions provoked a process leading to crises that constituted TL by means of a paradigm change. "Transformational learning "is the process of effecting change in a frame of reference" (Mezirow, 1997, p. 5).

Lamont and White in 2005 reported on an NSF workshop where 24 participants from four disciplines joined to discuss research design and evaluation. Participants were charged to:

> (1) articulate the standards used in their particular field to ensure rigor across the range of qualitative methodological approaches; (2) identify common criteria shared across the four disciplines for designing and evaluating research proposals and fostering multidisciplinary collaborations; and (3) develop an agenda for strengthening the tools, training, data, research design, and infrastructure for research using qualitative approaches. (p. 3)

I implemented shared criteria identified for designing and evaluating research across disciplines. I concluded this study added to the body of knowledge by reshaping a set of pre-defined ideas, selected from a broad spectrum of experiences.

Researcher's Role and Perspective

As the researcher I crossed several situations, from being a fully active participant, facilitator, and non-participant observer, organizer, planner, and funding source. Assuming these roles, I wanted to yield a holistic perspective and relational exploration of both settings and participants. It was important to identify my roles as both an insider/outsider for XQ and Cherokee studies, even though each varied in depth and activities. I had previous associations with members of our XQ team, faculty at Montbello's Noel Community Arts School (NCIS), and as a graduate student and community member active in charter school development. My goal

was to balance these roles and associations while supporting all activities required to complete this research.

Reflecting on my professional career and passions drove this research and revolved around 25-years in architectural design and construction, specifically working with sustainable construction, project management, interior design, education, community development, and alternative learning environments. Coupled with my volunteer work and study with endangered species, habitat loss, and communication among diverse groups of volunteers and communities, I leaped headfirst into pursuing my research. My combined interests with my desire to create alternative learning environments drove the dream of a cross-organizational approach to teaming and project development. I wanted to push individuals beyond their comfort zones as they collaborated among differing disciplines and approaches to problem solving. My journey was driven by the desire to break down disciplinary boundaries, to merge existing disciplines while introducing knowledge from external sources as volunteers, community members, and stakeholders. These concepts are challenging in most organizations, especially those with strong separation of functional areas.

Transdisciplinarity is the *real-world* context for me; and projects based on experiential learning is the lens I provide to explore a problem that crossed multiple disciplines (Evans, 2015). "Transdisciplinary learning is the exploration of a relevant concept, issue or problem that integrates the perspectives of multiple disciplines in order to connect new knowledge and deeper understanding to real life experiences" (Carrillo, 2018, para 1). This created connections across disciplines as participants discovered ways to integrate separate subject/disciplines, ultimately relating what they learned to projects and life (Drake et al., 2015).

I focused my career, education, and volunteer experiences on exploring collaborative learning, specifically developing protocols that enhance student collaborations, effecting private sector preparations. Previous charrette experiences and TD program development found that students, communities, and teams are often wary of collaborative projects. Most finding them to be time-consuming, contentious, and generally not beneficial, either personally, professionally, or academically. I trust that some of these negative feelings resulted from participants not having experienced any instruction on how to successfully collaborate among disciplines before commencing a project. Past personal experiences with team projects resulted in less than stellar project outcomes as teams would part and parcel out the work. Each team member in this scenario completed a portion of the final project, rarely working in a collaborative environment nor crossing disciplines. These experiences and conversations with students showed teamwork dull, time consuming and yet another box to check off for degree or course completion.

My passion for using a TDM was that it allowed individuals to approach a situation or problem from their own perspective and then share findings. Efforts became collaborative and team members worked together toward a resolution; the lines became blurred and each member allowed others to contribute their own knowledge and expertise. The stimulus for this research evolved from private sector requests including agriculture, sustainability, education, architectural, and construction fields. Each reported that new hires, many arriving directly from an academic environment, lacked communication and/or collaboration skills. Employers and colleagues expressed a need to expand on TDM teaming and knowledge transfer across global locations to provide employees with a shared environment. Many discipline specific participants lacked expertise, knowledge, resources, and ideation outside of their "silos". By incorporating learning environments, I desired to create a more multicultural, global experience, and education

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for students, co-workers, and colleagues without having to incur the prohibitive cost of traveling to sites in other cities or even abroad.

CHAPTER II - LITERATURE REVIEW

Transdisciplinarity concerns that which is at once between the disciplines, across the different disciplines, and beyond all disciplines. Its goal is the understanding of the present world, of which one of the imperatives is the unity of knowledge. (Nicolescu, 1996, p. 3)

Interest in TD has flourished in the last 10 years, as it cuts across disciplines, theories, and methodologies. Motivation for transdisciplinarity launched from the need for researchers to explore questions at the intersection of their respective fields, conducting joint projects and delivering methodologies that can be utilized to integrate knowledge. This chapter explored transdisciplinary and transformational theory, theorists, learning cycles, charrettes, PBL, and blended learning necessary for positioning this study. Earlier TD researchers have studied societal problems such as sustainability and debilitating diseases and has recently expanded transcending well-established disciplinary silos. Challenges of working across disciplines have been debated in many arenas; addressing group think, institutional distinctions, and leadership to name a few. A recent search for journal articles on Transdisciplinarity identified 11,096 shared articles among numerous disciplines and in multiple languages.

Origins of Transdisciplinarity

Early literature reviews addressed the TD environment and spanned a wide range of contexts. Reviews began with seven framework principles and one description. Klein's (2008) literature of TD identified a framework of thinking about evaluation as:

1) variability of goals
2) variability of criteria and indicators
3) leveraging of integration
4) interaction of social and cognitive factors in collaboration
5) management, leadership, and coaching
6) iteration in a comprehensive and transparent system; and
7) effectiveness and impact (p. 116).

Any discussion of TD required descriptions; classifications were as varied as the research and depended ironically on the disciplines from which the author came. Significant in the origins of TD are the possibilities for new synthesis in education, technology, and science as blended learning. Beginning with an early founder, Piaget (1972) in his essay, *The epistemology of interdisciplinary relationships*, concluded:

> TD has various kinds of interactions between disciplines and mentioned TD as a "kind of aside" as a higher stage succeeding interdisciplinary relationships…which would not only cover interactions or reciprocities between specialized research projects but would place relationships within a total system without any firm boundaries between disciplines. (p. 138)

Jack Mahan (1970) addressed TD in his doctoral dissertation as the synthesis and integration of knowledge while adding ethical considerations. Bernstein (2015) reviewed Mahan's work and wrote a synopsis of his TD definition as:

> Transdisciplinary inquiry would be characterized by a common orientation to transcend disciplinary boundaries and an attempt to bring continuity to inquiry and knowledge. Other characteristics would be attention to comprehensiveness, context, and frame of reference of inquiry and knowledge; interpenetration of boundaries between concepts and disciplines; exposing disciplinary boundaries to facilitate understanding of implicit assumptions, processes of inquiry, and resulting knowledge; humanistic reverence for life and human dignity; desire to actively apply knowledge to the betterment of man and society. (para. 3)

While definitions provided varying viewpoints, reviews addressed TD research and I utilized the description of TD from Harvard researchers at The Harvard Transdisciplinary Research in Energetics and Cancer Center (n.d.):

> Research efforts conducted by investigators from different disciplines working jointly to create new conceptual, theoretical, methodological, and translational innovations that integrate and move beyond discipline-specific approaches to address a common problem. (para. 3)

The integration of problem-centered methodologies, TD required the researcher to discover new science by exploring questions while bridging academic disciplines with public and

community needs (Leavy, 2011). Any discussion of TD, TDL, and TDM required examination

of origins. In its relative brief history, three main science discourses emerged identified in Table

2.1 (Osborne, 2015).

Table 2.1

Historic Transdisciplinary Examination

Theories	Author/Proponents
Systems-theoretical approach to producing an integral education/innovation approach	Jantsch, 1972; Kim, 1998; Somerville & Rapport, 2000
Sociological science-policy approach to new forms of knowledge productions	Gibbons et al., 1994; Nowotny et al., 2001; Nowotny, 2003
Collaborative solutions of 'life-world' problems of environmental sustainability and health	Thompson Klein et al., 2001; Pohl & Hirsch Hadorn, 2001; Hirsch Hadorn, 2008

Note: From "Problematizing disciplinarity, transdisciplinary problematics," by P. Osborne, 2015, *Theory, Culture & Society, 32*(5-6), "Transdisciplinarity: A Brief History" section, para.1. (https://doi.org/10.1177%2F0263276415592245). Copyright by the Author. Creative Commons License. Open Access.

Jean Piaget (1896 -1980), in collaboration with the French Ministry of National

Education and the University of Nice (Apostel et al.,1972), introduced TD at a Parisian seminar

held by the Organization for Economic Co-operation and Development (OECD), during talks

with Erich Jantsch and Andre Lichnerowicz (Gibbs, 2015). Beavis and Gibbs (2020) quoted

Piaget who gave the following description of TD:

> Finally, we hope to see succeeding to the stage of interdisciplinary relations a superior stage, which should be 'transdisciplinary,' i.e. which will not be limited to recognize the interactions and/or reciprocities between the specialized researchers, but which will locate these links inside a total system without stable boundaries between the disciplines. (p. 144)

Apostel et al. (1972) conceptualized TD in the early 1970s, however, McGregor (2015)

noted it is recently that TD has become accepted as a "necessary paradigmatic, methodological,

and intellectual innovation" (p. 10). There were two dominant camps of TD discourse supported

by physicist Basarab Nicolescu (1942-) and philosopher, Edgar Morin (1921-); coined as Nicolescuian transdisciplinarity (Nicolescu, 2010). The other launched from the Swiss or German School and emerged from the International Transdisciplinary Conference held in 2000 (Stavinschi, 2013).

Nicolescu is the President and Founder of the International Center for Transdisciplinary Research and Studies (CIRET), a non-profit organization bringing together 167 members from 30 countries (Nicolescu (n.d.). In 1991, he and René Berger co-founded the Reflection Group on Transdisciplinarity (GRT) at UNESCO (Stavinschi, 2013). Many researchers contributed to the development of TD. Nicolescu (2010) said, "A key date in this development is 1994, when the Charter of Transdisciplinarity was adopted by the participants at the First World Congress of Transdisciplinarity at the Convento da Arrábida in Portugal" (p. 21).

Reoccurring themes established TD as challenging as it covers a multitude of areas including wicked problems, ecological imbalance, climate change, conflict and aggression, unsustainable consumerism, and political, religious, and economic problems to name a few (McGregor, 2015). The term "wicked problems" was coined by Rittel and Webber (1973) who believed such problems are not easy to solve or control. TD research addressed scientific inquiry while integrating and synthesizing content, methodologies, and theories from disciplines that shed light on research questions (Gray, 2008). While a case for 18th century development can be made, consensus followed the conceptual structure of transdisciplinarity with incorporations of 19th and 20th century German and French philosophical traditions. Early practitioners included Michel Serres (1930 -), Michel Foucault (1926 - 1984), Jacques Derrida (1930 - 2004), Bruno Latour (1947 -), and Peter Osborne, (2015).

As I explored TD, I found each discipline had a distinct path, method, knowledge base and culture. Traweek shared,

> There are many scientific methods, paradigms, and cultures differentiating scientific disciplines which certainly can complicate the building of these bridges. At the same time, there is potentially significant "value-added" in cultivating collaborative research teams that are willing to cross-fertilize across disciplines. Concepts (e.g., objectivity, causation) that orient scientific work evolve over time, a process that can be accelerated when borders between disciplines blur. (2000, para. 4)

In 1994, separate from the First World Congress on Transdisciplinarity another project took place presenting a different approach to TD. Gibbons et al. (1994) presented Mode 2 Knowledge Production, which added "another layer of complexity by describing a means of knowledge production that focuses on problems driven by social need and included the emergence of new non-university/non-disciplinary actors in identifying problems, finding solutions, and articulating research based policy" (p. 4). Practitioners believed Gibbons et al.'s. view was a more practical approach than what Nicolescu offered.

By collaborating on the book, *The new production of knowledge: The Dynamics of Science and Research in contemporary societies* with researchers from diverse fields on specific projects Gibbons et al. (1994) transcended boundaries. This involved knowledge from a design that included work of experts drawn from academia, government, and industry (Bernstein, 2015). Bernstein's article stated:

> They (Gibbons et al.) stress that such knowledge production and problem solving are not merely applied research and development, nor are they limited to sciences, technology, or medicine but extended it to the humanities, as in museums, architecture, and modes of research that rely on information technology. (para. 13)

Mode 2 evolved alongside increased globalization at the end of the Cold War (1947-1991). Jayne Glass (2011) depicted the increasing transdisciplinary capacity Modes 1 and 2 based on Gibbons et al. (1994), see Figure 2.1. Mode 1 operates in a space autonomous from

social interests and goals; a heterogeneous knowledge production sites close interactions among scientific, technological and industrial actors. This provided a flexible and open form of research, continuous re-evaluation, and redefination of expertise; Mode 2 Gap defined 'spaces' for open communication.

Figure 2.1
Defined Spaces for Open Communication
Note: From "Doing things differently: Re-evaluating our role in participatory research," by J. Glass, 2011, The University of Highlands and Islands, Perth College, Center for Mountain Studies, Slide 6. (*https://www.slideshare.net/jaynehglass/participatory-research-nov-2011*). Copyright 2011 by the Author. Reprinted with permission.

Growing in recognition and utilization among academics' TD investigation was perceived as the most capable approach for solving problems facing humankind by combining disciplines, while incorporating participation with stakeholders, educators, and communities. Its roots follow a timeline of events such as the Apollo program (1961-1975) when funding was at its peak, a time when big picture thinking and imagining were what universities envisioned. In 1962, Rachael Carson's book *Silent Spring* warned of the advent of environmental collapse due to indiscriminate pesticide use. The period 1968/1969 was marked by student unrest, protests,

and generational conflicts combined with the counterculture movement with radical alternatives to the status quo. Dissatisfaction with 'the establishment' lingered, followed four years later by Organization of the Petroleum Exporting Countries (OPEC) and the oil crisis. These events set into motion a massive withdrawal of funding to universities by the Bush/Cheney administration compounded by an economic recession and congressional budget cuts. The 1970s brought about interdisciplinary cooperation and collaboration with advances in the women's movement, gender studies, and environmental science coupled with peace and conflict studies. Initially introduced in the 70s TD remained undeveloped and almost uncited until the early 1990s (Bernstein, 2015). Major events led change toward TD fueled by inflation, the proposal for the World-Wide Web, Nelson Mandela's release from prison; cloning/genetic engineering, while Google, Apple, and Microsoft were born. Apartheid, The Bosnian/Gulf Wars, and ethnic conflict in Rwanda, and the Avian and H5N1 flu epidemic, became deadly to humans (Bernstein, 2015).

Emergence of the Transdisciplinary Approach

Exploration for the emergence of TD began by examining the history and development of sustainability; rapidly transcending these scopes to include medical, environmental, social and community research, including a history of academic disciplinarities. Common threads across literature showed that TD addresses the complexity of problems tackled as wicked problems. Byrn (2017) recognized current problems as too complex to be undertaken by a single discipline or even from interdisciplinary connections and interactions. Problems required integral thinking and multiple disciplines to cross the arts, humanities, and sciences including members from public and private sectors, and project stakeholders. TDL and TDM were the purposeful incorporation of life, real-world, big-picture views. Each embraced the complexity of shared conceptual frameworks that integrated diverse discipline-specific theories, models, measures,

and analytical methods while contributing toward further understanding of socially patterned problems (Wright et al., 2008). The TDM considered ethical values, addressed collaboration and integration across non-academic fields. Transdisciplinarity developed from the need for a hybridization of knowledge, by combining multidisciplinary and interdisciplinary methodologies. To understand the emergence of TD it was important to distinguish transdisciplinarity from multidisciplinarity and interdisciplinarity (Leavy, 2011). TD was envisioned not as a reorientation of these core concepts but rather to complement an alternative to discipline-based inquiry that might offer and support asking different questions (Gray, 2008). TD investigation fueled research questions that transcended specialized knowledge bases because they were beyond the purview of an individual discipline (Committee on Facilitating Interdisciplinary Research, 2004).

Transdisciplinarity represented a change in how and why we think about research and education while challenging the separation of academic divisions across traditional disciplines. It opened prospects for researchers to examine mutual interest projects across disciplines while not limiting disciplinary crossing to joint or cooperative work. Further research prompted questioning how TDL created both possibilities and constraints, illuminating one aspect of a subject while obscuring others (Kottler, 2009). TDL and TDM addressed getting people to work together through new initiatives or projects. It identified challenges involving professionals, educators, and stakeholders from all sectors of society in research and teaching. Brundiers et al. (2013) created a transacademic interface manager (TIM), as an overview of sustainability research and education. The authors outlined capacities TIM required to successfully operate, then proposed an educational approach for training students to become TIM qualified. TIM was conceptualized around sustainability research and educational projects involving

divergent functions along the lifecycle of participatory sustainability research projects, see

Figure 2.2.
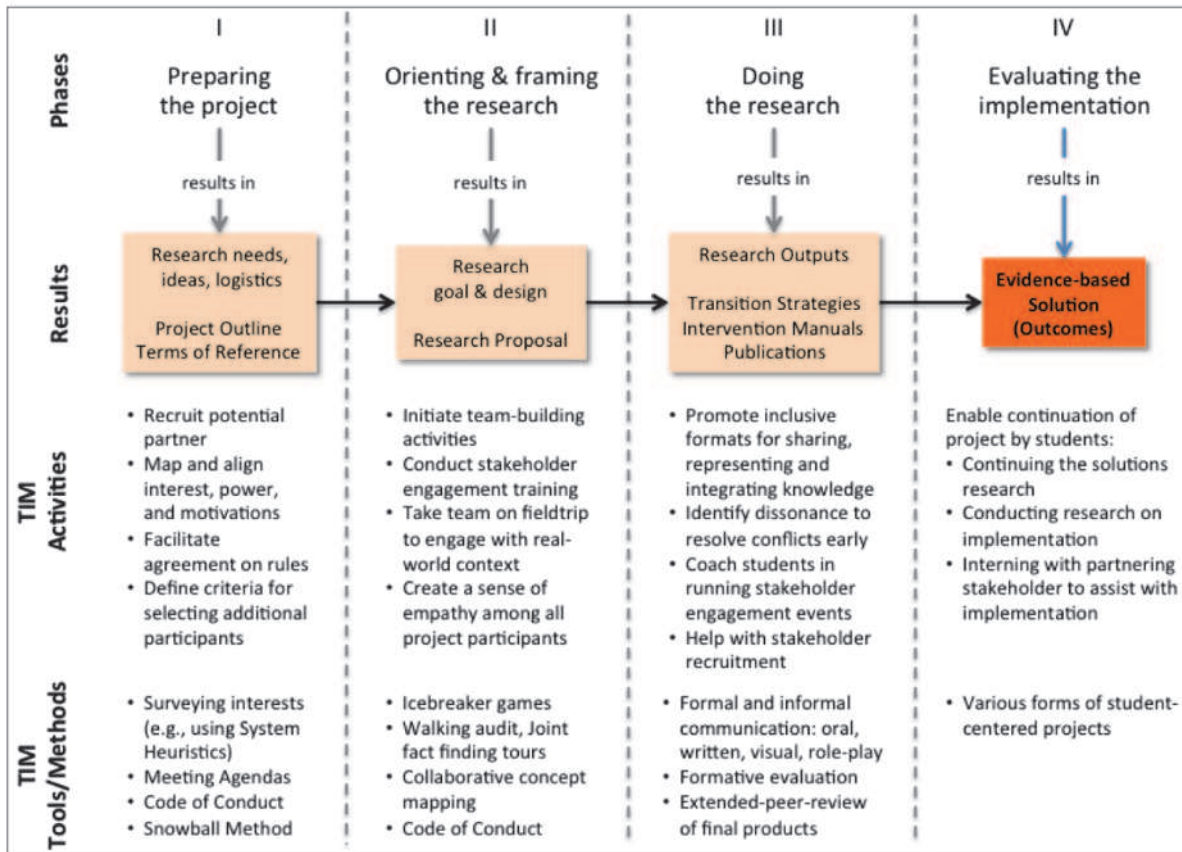
Figure 2.2
Overview of TIM's Activities Along the Lifecycle of Participatory Sustainability Research
Note. From "The role of transacademic interface managers in transformational sustainability research and education," by K. Brundiers, A. Wiek, and K. Brundiers, 2013, *Sustainability, 5*(11), 4623. (https://doi.org/10.3390/su5114614). Copyright 2013 by the Authors. Under the Creative Commons License. Open Access.

Additional case studies reviewed provided data on the phases of TD research that

supported this study. First, was *Innovations in Sustainable Tourism Education – Turkey* by

Hatipoglu et al. (2014) that provided a learning methodology for education on sustainable

tourism development and global citizenship, see Figure 2.3. Second, was *One human settlement:*

A Transdisciplinary approach to climate change adaption research (Serrao-Neumann et al.,

2015) on climate change adaptation, depicted in Figure 2.4. Phases of TD provided a reflective

stakeholder analysis of the research approach and addressed problem framing, team building, co-

creation of solution-oriented TL, and integration, coupled with a reflective analysis and

application.
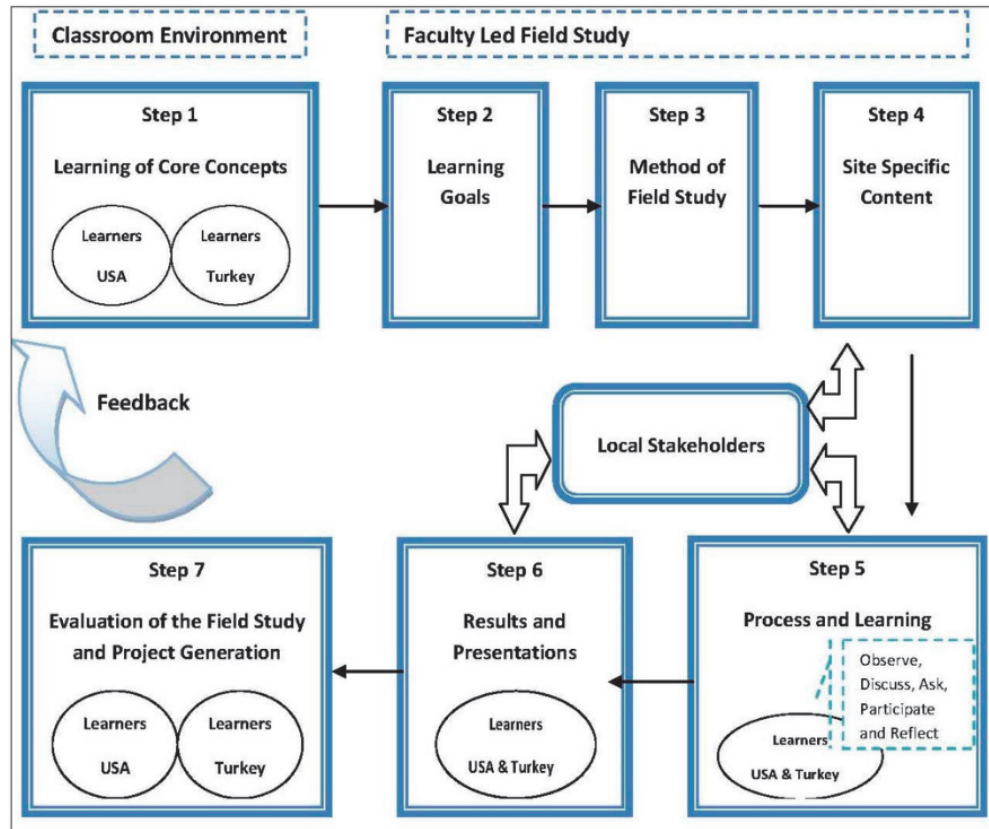
Figure 2.3
Learning Methodology on Sustainable Tourism Development and Global Citizenship
Note. From "A referential methodology for education on sustainable tourism development," by
B. Hatipoglu, B. Ertuna, and V. Sasidharan, 2014, *Sustainability, 6*(8), para. 1
(*https://doi.org/10.3390/su6085029*)*. Copyright 2014 by the Authors. Under a Creative
Commons License. Open Access.*
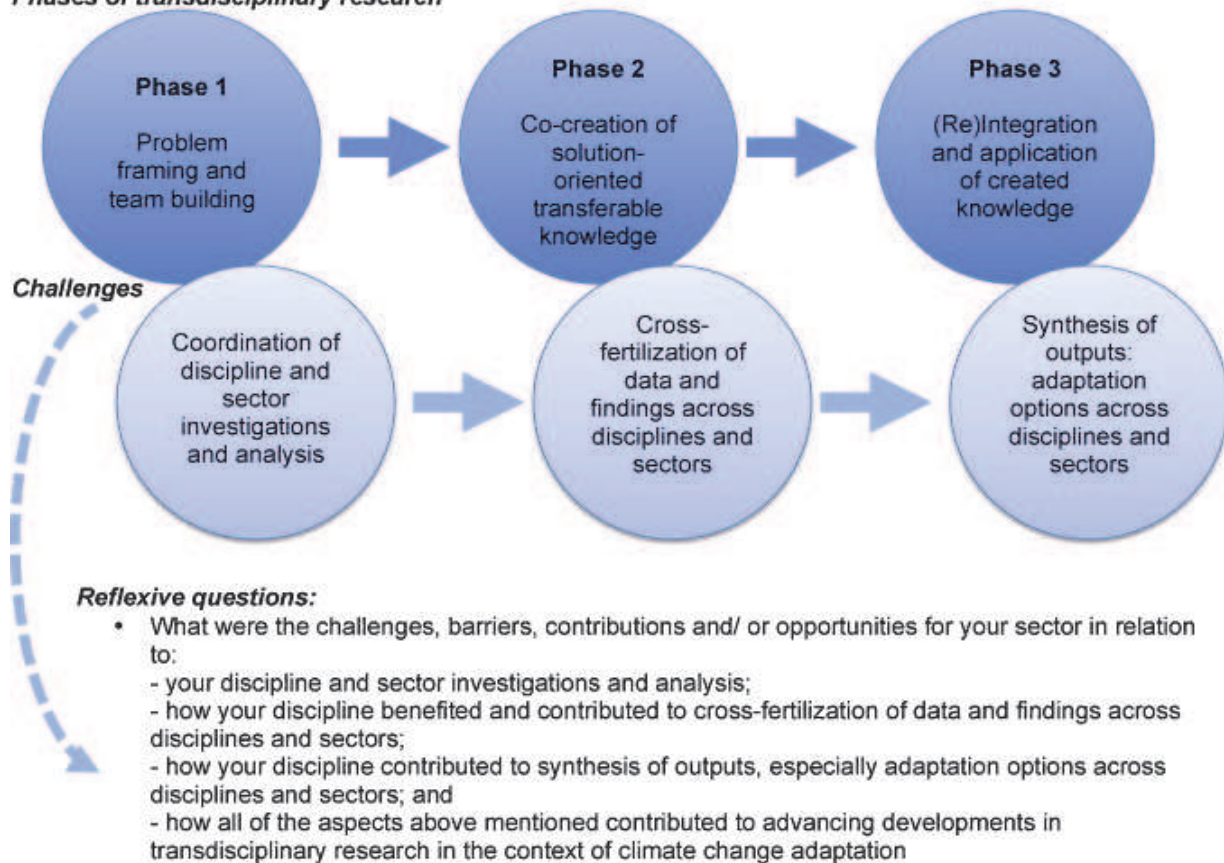
Figure 2.4

Transdisciplinary Research Phases

Note. From "One human settlement: A transdisciplinary approach to climate change adaptation research," by S. Serrao-Neumann, G. Schuch, B. Harman, F. Crick, M. Sano, O. Sahin, R. vanStaden, S. Baum, and D. Low Choy, 2015, *Futures, 65*, 4. (*https://doi.org/10.1016/j.futures.2014.08.011*). Copyright 2014 by the Authors. Published by Elservier Ltd. Reprinted with permission.

Literature identified early barriers to TD as: 1) the difficulty researchers have understanding and valuing each other's language, 2) concepts, and 3) methods (Committee on Facilitating Interdisciplinary Research, 2004). Doucet and Janssen (2011) stated:

> There is growing evidence and awareness that the earlier established discipline-bound epistemology alone cannot effectively deal with the world's complexity. This is not to say that the production of discipline-specific knowledge is no longer relevant. Quite the opposite is stipulated here…knowledge production does not need to be abandoned, but rather *complemented* by a new form of knowledge production that focuses on the *combination* of different types of knowledge. (p. 1)

Further research discovered a reoccurring and overarching theme, best described by Wright et al.

(2008) as:

> One obstacle became apparent from the early stages of developing a proposal for this research program – how to engage scientists to step outside their more narrow disciplines to contribute substantively to high-risk research that went outside of a paradigm that more likely ensures academic advancement (i.e., research driven by an individual investigator with recognized expertise in a clearly defined discipline either related to disease outcome, exposure assessment, or particular methodology). (p. 1730)

Transdisciplinarity Approach and Methods

There was an inherent logic, ideal, and purpose in the TD approach. Jantsch (1972) wrote

that while interdisciplinary studies bring people or theories together there is no commitment to

change boundaries and relationships among them. In TDM inquiry boundaries are tested, moved,

realigned, or reduced, becoming an organizational principle rather than a way to create new

knowledge (Jantsch, 1972). TDL links were introduced among disciplines that provided

opportunities for concepts, aims, and structures to change. Discipline viewpoints were not

eliminated rather they were taught and conducted in the framework of new relationships with

each other and societal problems (Apostel et al., 1972). Serrao-Neumann et al.'s (2015)

reflective analysis (Table 2.2) of key TD challenges focused on three crucial tasks performed by

research teams as: 1) coordination of discipline, sector investigations, and analysis, 2) cross-

fertilization of data and findings across disciplines and sectors, and 3) synthesis of outputs,

especially adaptation options across disciplines and sectors.

Table 2.2

Key Challenges to a Transdisciplinary Research Approach

Transdisciplinary research phases	Topics for reflection	Identified challenges

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Problem framing and team building	Coordination of discipline and sector investigations and analysis	• Finding an accessible common language between the technologically based disciplines and social sciences • Dealing with novel and/or undefined disciplines • Overlaps and trade-offs between sectors in terms of roles and responsibilities for climate change adaptation • Understanding the requirements of other sectors
Co-creation of solution-oriented transferable knowledge	Cross-fertilization of data and findings across disciplines and sectors	• Achieving sufficient frequent interaction and discussions between sectors • Establishing robust collaborations between sectors • Bridging sector-specific concepts to other disciplines/sectors • Coordination of research methodologies • Maintaining the integrity/boundaries of specific disciplines and researchers' experiences
(Re)-integration and application of created knowledge	Synthesis of outputs, especially adaptation options across disciplines and sectors	• Recognition of sector-specific issues by other sectors • Identifying and capitalizing on the synergies between sectors • Learning about innovative approaches and tools from other disciplines

Note. From "One human settlement: A transdisciplinary approach to climate change adaptation research," by S. Serrao-Neumann, G. Schuch, B. Harman, F. Crick, M. Sano, O. Sahin, R. vanStaden, S. Baum, and D. Low Choy, 2015, *Futures, 65,* 8. (https://doi.org/10.1016/j.futures.2014.08.011). Copyright 2014 by the Authors. Published by Elservier Ltd. Reprinted with permission.

Theorists

The growing body of literature addressed TD and TL, concentrated on early adopters and

unique features of how each were bound together. While there was no one person credited with

coining "Transdisciplinarity", it was viewed as an evolutionary process first referenced by Jean

Piaget in 1972. I found the term identified by two other practitioners: Andre Lichnerowicz, and

Erich Jantsch. Research showed that relevant contributors included Basarab Nicolescu and Julie

Klein while Nicolescu, Howard Gardner, and Benjamin Bloom. Each played important roles in the advancement of education, learning, transdisciplinarity, and TL. Jack Mezirow and Paulo Freire furthered TL theory and David Kolb developed Experiential Learning Theory (ELT). While many contributed to TD thinking and learning, others contributed to TL, a select few recurred throughout research. I explored major contributors for this study and included summaries of their contributions identified as Piaget, Nicolescu, Gardner, Mezirow, Freire, and Kolb.

Jean Piaget (1896-1980)

> The principal goal of education is to create men and women who are capable of doing new things, not simply of repeating what other generations have done—men and women who are creative, inventive, and discoverers, (who) have minds which can be critical, can verify, and not accept everything they are offered. (Piaget, 1964, p. 499)

Jean Piaget's early work revolved around four stages of cognitive development and learning theory. A constructivist, he believed that knowledge is created, and learning occurred when adolescents created products or artifacts (Wood, 2010). He described three mechanisms for learning, as 1) assimilation, 2) accommodation, and 3) equilibration (Orey, 2010, p. 8).

Piaget's learning theory was based on how and what was learned, and how it was organized according to a plan or model defined as schemas. "Schemas are mental representations of something tangible or intangible that can be applied to an object, situation, or event" (Orey, 2010, p. 9). Assimilation began by adding new knowledge to existing knowledge, reinterpreted to fit then assimilated with existing ideas/knowledge. Piaget believed this occurred when ones existing beliefs no longer fit with existing knowledge and needed to be adapted to fit the new situation. This process was required to advance new ideas, information and/or knowledge. Piaget's theory differed from others as:

- it is concerned with children, rather than all learners.

- it focuses on development, rather than learning per se, so it does not address learning of information or specific behaviors.

- it proposes discrete stages of development, marked by qualitative differences, rather than a gradual increase in number and complexity of behaviors, concepts, ideas, etc. (McLeod, 2020, para. 25)

Piaget believed individuals were more likely to learn when engaged with materials/items personally significant and important to them (Wood, 2014). A developmental psychologist, he believed TD allowed specialized research to be "placed within a total system without boundaries between disciplines" (Piaget, 1972, p. 138). His better-known theory (Development Stage Theory) began with four stages of cogitative development identified as: sensorimotor, preoperational, concrete operational, and formal operational periods.

Criticism of Piaget's work stemmed mainly from five themes: 1) terminology, 2) stage theory, 3) cognitive capacity, 4) action-oriented approach, and 5) inattention to culturally specific influences (Massey University, n.d.). Carlson and Buskirst (1997) mentioned terminology as a concern, as they believed Piaget's research lacked the ability to be replicated (Babakr et al., 2019). Piaget used terms like 'accommodation' and 'assimilation' to indicate change that occurred in a child, yet he did not define what had changed. Failure to define terms created problems for other researchers, as they were unable to establish a cause-and-effect relationship among Piaget's variables. Lourenco and Machado (1996) believed Piaget underestimated young children's development; noted that some children developed earlier than Piaget thought. Gray (1994) stated,

Piaget offers no substantial evidence for a qualitative difference in cognitive capacity between two children of different stages. The most important aspect of Piaget's theory is that each cognitive stage is different, not just as a matter of degree, but rather a child's type of thinking is quite different depending on the stage it is in. Providing evidence for a qualitative difference between stages has not been comprehensively achieved. (para. 4)

The authors believed there was no need for stage theory. While Vygotsky believed Piaget was inattentive to each child's culturally specific influences (Massey University, n.d.).

Paulo Freire (1921-1997)

Paulo Freire in *Pedagogy of the Oppressed* (1970/2000) claimed:

The teacher is of course an artist but being an artist does not mean that he or she can make the profile, can shape the students. What an educator does in teaching is to make it possible for the students to become themselves. (as cited in Dredger, 2017, p. xxi).

Freire's work was based in South America (Brazil) amid people with limited literacy skills. Using a theoretical approach that so threatened those in power he was exiled in 1959. Best known for the concept of critical pedagogy in, *The Pedagogy of the Oppressed* Freire (1970/2000), discussed his belief that the aim of education was radical transformation.

Transformative education was based upon participatory learning and reflection; used exploration to advance confidence in one's learning ability leading to altered values (Hope & Timmel, 1984). Freire talked about what learning is and how skills and knowledge were acquired as:

… the fallacy of looking at the education system like a bank, a large repository where students come to withdraw the knowledge they need for life. Knowledge is not a set commodity that is passed from the teachers to the students. Students must construct knowledge from knowledge they already possess. Teachers must learn how the students understand the world so that the teacher understands how the student can learn. (New Foundations, 2014, para. 8)

His teaching viewed people as subjects, not objects, as learners continuously reflected and acted on transformation of their environment. Like Mezirow, he viewed critical reflection as central to TL in context to posing problems and dialogue with other students (learners). Freire believed that to gain knowledge from one's social reality one needed to act with others, reflecting upon their reality, based upon critical reflection (Freire Institute, 2017). However, unlike Mezirow's personal transformation, he was more concerned about social transformation

where they "[learn] to perceive social, political, and economic contradictions and to take action against the oppressive elements of reality" (p. 19).

Jack Mezirow (1923-2014)

In Transformative Learning Theory-An Overview, the author communicated Mezirow as,

Transformational learning offers an exploration for change in meaning structures that evolves in two domains…First is instrumental learning, which focuses on learning through task-oriented problem solving and determination of cause and effect relationships…Second is communicative learning, which is learning involved in understanding the meaning of what others 'communicate concerning values, ideals, feelings. moral decisions, and such concepts as freedom, justice, love, labor, autonomy, commitment, and democracy (Mezirow, 1991, p.8 as cited in Taylor, 2000, p.5)

Mezirow was a constructivist whose early work focused on social action and community development. He was credited with developing Transformative Learning theory in the field of adult education (1978) and with a conceptual framework of how adults learn and hold commonalities with experiential learning (Dirkz, 1998). Transformative theory recognized critical dimensions of adult learning that enabled and structured assumptions and expectations that framed thinking. Grounded in the environment of human communication, it explained change in meaning structures that evolved in two domains of learning based on "1) instrumental learning (learning by task orientated problem solving) of cause and 2) communicative learning based on relationships, which is learning from what others communicate" (Mezirow, 1991a, p. 8).

Mezirow's Transformative Learning Theory was a major influence for progressing transdisciplinarity. In *Transformative Dimensions of Adult Learning* the author discussed the process of 'perspective transformation' as having three dimensions: psychological (changes in understanding of the self), convictional (revision of belief systems), and behavioral (changes in lifestyle) (Mezirow 1991, p. 96).

David Kolb (1939-)

  David Kolb is a lecturer and researcher at Weatherhead, School of Management at Case

Western Reserve University (Cleveland, OH). Kolb specializes in experiential learning,

individual and social change, career development, and professional education. He is the founder

of Experience Based Learning Systems (EBLS); has been a leading influence in the development

of learner-centered pedagogy (management and business). He is best known for his Experiential

Learning Model (ELM), Experiential Learning Theory (ELT) and his Learning Styles Inventory

(LSI) (Kolb et al.,1999; Kolb & Kolb, 2006). ELM built on the works of John Dewey, Jean

Piaget, and Kurt Lewin, consisted of four elements:1) concrete experience, 2) observation,

3)reflection based on concrete experiences, and 4) formation of abstract concepts based on

reflection, and testing new concepts (van Vilet, 2013). ELT emphasized learning through

experience (Kolb & Kolb, 2006). Defined by Kolb et al. (1999) as "the process whereby

knowledge is created through the transformation of experience" (p. 41). Knowledge findings

from the combination of grasping and transforming experiences (Kolb & Kolb, 2006).

  Kolb believed people learned in different ways and while some are more adaptable than

others, he believed learners receive and process information in several ways; as each experience

is predicated upon cultural difference (Kolb et al., 2001). Differences' are jointly combined with

preferences in learning styles, as individuals prefer differing ways of approaching and working

through learning situations. There have been many studies of ELT and LSI since first

publications (Joynt, 1983; Kolb & Fry, 1975; Kolb et al., 1971). Both Learning Styles and the

Four-Stage Cycle of Learning are discussed in-depth later in this review. Another criticism from

the authors of *Reflection: Turning experience into learning* is the model does not sufficiently

acknowledge the power of reflection on learning (Boud et al., 1985). Wheeler (2012) stated,

"Probably the most important criticism of the cycle is that depending on the learner, and/or the activities they are engaged in, some stages of the process can be bypassed, or repeated several times in any sequence" (para. 3). Criticisms addressed every aspect of Kolb's work from ELT to his experiential education perspective; others from a training perspective, from informal education to adult education, and ESL perspectives (Dennison, 2009).

Basarab Nicolescu (1942-)

Nicolescu is a professor (University of Paris) and theoretical physicist at the National Center for Scientific Research (CNRS). He founded the International Center for Transdisciplinary Research (CIRET) and Studies, and co-founded with Rene Berger, the Study Group on Transdisciplinarity at UNESCO (1992). He is the founder and director of Transdisciplinarity Series, Paris, and author of numerous books notably the *Manifesto of Transdisciplinarity* (2002). In it, he stated:

> Transdisciplinarity concerns that which is at once between the disciplines, across the different disciplines, and beyond all discipline… its goal is the understanding of the present world, of which one of the imperatives is the unity of knowledge. (p. 3)

In 1985, he proposed the inclusion of the meaning "beyond disciplines" based upon his background in physics described as the limits of disciplinary knowledge:

> For me, "beyond disciplines" precisely signifies the Subject, and, more precisely, the Subject-Object interaction. The transcendence inherent in transdisciplinarity is the transcendence of the Subject. The Subject cannot be captured in a disciplinary camp. The meaning "beyond disciplines" leads us to an immense space of new knowledge. The main outcome was the formulation of the methodology of transdisciplinarity, which I will analyze in the next section. It allows us also to clearly distinguish between multidisciplinarity, interdisciplinarity, and transdisciplinarity. (Nicolescu, 2010, p. 22)

He described multidisciplinary as concerning itself with the study of a topic in several disciplines at the same time, with the perspective that any topic will be enriched by incorporating perspectives from numerous disciplines:

As one can see, there is no opposition between disciplinarity (including multidisciplinarity and interdisciplinarity) and transdisciplinarity, but there is instead a fertile complementarity. In fact, there is no transdisciplinarity without disciplinarity. In spite of this fact, the above considerations provoked, around 1990, a more or less violent war of definitions. This war is not yet finished. (p. 4)

He described interdisciplinarity as having the goal of transferring methods from one disciple to another, while having a different goal than multidisciplinarity. He stated, "Like multidisciplinarity, interdisciplinarity overflows the disciplines, but its goal still remains within the framework of disciplinary research" (Nicolescu, 2010, p. 22). He provided this description of transdisciplinarity with the goal to understand the present world, of which one of the imperatives is the unity of knowledge.

Howard Gardner (1943-)

In his 1997 video interview with Edutopia, *Big Thinkers: Howard Gardner on Multiple Intelligences* stated:

We have this myth that the only way to learn something is to read it in a textbook or hear a lecture on it. And the only way to show that we've understood something is to take a short-answer test or maybe occasionally with an essay question thrown in. But that's nonsense. Everything can be taught in more than one way. (as cited in Edutopia, 2009, Section 4, *On technology and multiple intelligences*, para. 2).

Gardner, a developmental psychologist best known for his theory of multiple intelligences, was influenced by the works of Jean Piaget (Cherry, 2017). In 1983 Gardner outlined his theory identifying eight types of intelligence as 1) Visual -Spatial, 2) Linguistic - Verbal, 3) Logical - Mathematical, 4) Bodily - Kinesthetic, 5) Musical, 6) Interpersonal, 7) Intrapersonal, and 8) Naturalistic; with the possibility for a ninth identified as existential and moral intelligence (as cited in Armstrong, 2009). Theory implied traditional views of intelligence are limited; proposed that individuals have various kinds of intelligence.

Gardner believed that individuals learn and understand in diverse ways and said these differences:

> Challenge an educational system that assumes that everyone can learn the same materials in the same way and that a uniform, universal measure suffices to test student learning. Indeed, as currently constituted, our educational system is heavily biased toward linguistic modes of instruction and assessment and, to a somewhat lesser degree, toward logical-quantitative modes as well. (as cited in Lane, 2011, para. 2).

Gardener goes on to argue:

> A contrasting set of assumptions is more likely to be educationally effective. Students learn in ways that are identifiably distinctive. The broad spectrum of students - and perhaps the society as a whole - would be better served if disciplines could be presented in a number of ways and learning could be assessed through a variety of means. (as cited in Lane, 2011, para. 2)

He chairs the Steering Committee for Project Zero, an education program which investigates the nature of intelligence, understanding, thinking, creativity, cross-disciplinary thinking, and ethics at Harvard Graduate School of Education; and as Adjunct Professor of Psychology (Harvard Graduate School of Education, n.d.). Gardner's theory is widespread among educators as it provided a conceptual framework for organizing and reflecting on assessment and pedagogical practices.

Critics of Gardner's theory came from psychologists and educators, they argued his definitions of intelligence are too broad and that the eight intelligences represent not intelligence but rather talents, personality traits, and abilities. Armstrong (2009) stated, "most of those making this complaint about MI theory come from the psychometric, or testing, community" (p. 191). Collins (1998) shared that Gardner's theory lacked solid research support while others believed that MI theory dumbed down the curriculum to make students believe they were smart. Gardner in a September 1997, interview with Kathy Checkley for *Educational Leadership* stated:

> One myth that I personally find irritating is that an intelligence is the same as a learning style. Learning styles are claims about ways in which individuals purportedly approach

everything they do. If you are planful, you are supposed to be planful about everything. If you are logical-sequential, you are supposed to be logical-sequential about everything. My own research and observations suggest that that's a dubious assumption. But whether or not that's true, learning styles are very different from multiple intelligences. (as cited in Checkley,1997, "You have identified several myths" section, para. 1)

Kolb's Learning Styles

Experiential learning theory (ELT) is the process by which knowledge is created through transformative learning of experiences; knowledge results from the combination of understanding and transforming experience. Kolb (1984) developed The Learning Style Inventory (LSI) and the Four Basic Learning Styles. He explained individuals prefer a certain learning style, formed throughout one's life by three stages of personal development, defined as:

Acquisition – birth to adolescence (individuals develop and acquire basis abilities and cognitive structures),

Specialization – school, early employment, and firsthand experiences (development shaped by social, educational, and organizational socialization), and

Integration – mid-career through later life (expression of non-dominant learning style).

Kolb's (1984) model works on two levels, a four-stage cycle, and a four-type definition of learning styles, see Figure 2.5, each represented the combination of two preferred styles, influenced by several factors, identified as:

Four stage cycle –

Concrete Experience - (CE)
Reflective Observation - (RO)
Abstract Conceptualization - (AC)
Active Experimentation - (AE)
Four type definition of learning styles -

Diverging (CE/RO)
Assimilating (AC/RO)
Converging (AC/AE)
Accommodating (CE/AE)

Kolb's learning styles

Concrete Experience
Feeling

Accommodating
(feel and do)
CE/AE

Diverging
(feel and watch)
CE/RO

Active Experimentation
Doing

Processing Continuum
how we ... things

Perception Continuum
how we think about things

Reflective Observation
Watching

Converging
(think and do)
AC/AE

Assimilating
(think and watch)
AC/RO

Abstract Conceptualisation
Thinking

Figure 2.5
Kolb's Learning Styles
Note. From "Kolb's learning styles," by A. Chapman, 2020), Business Balls, Diagrams section, para. 3. (*https://www.businessballs.com/self-awareness/kolb-s-learning-styles/*). Copyright 2019 by the Author. Published by BusinessBalls.com. Reprinted with permission.

People have strong preferences for a learning style; knowing one's learning style preferences can help when making educational and/or career choices. The ability to change ones learning style is rarely accomplished and when individuals receive instruction in alternative learning styles, they tend to learn more slowly (Kolb & Kolb, 2006). For example, if you need printed instruction to accomplish a task and are given a project without notes or instructions you become frustrated. As with any behavioral model Kolb's did not follow strict rules, as many individuals are successful working among varied learning styles (Kolb, 1984).

Carl Jung believed that learning styles resulted from one's preferred way of acquiring knowledge and not from one's ability. Jung used descriptions such as extroversion and

introversion, featured and measured by Myers-Briggs Type Indicator (MBTI) that links to Kolb's Active-Reflective (doing/watching) relationships. Similar were the descriptors of feeling/thinking to Kolb's model of Concrete Experience/Abstract Conceptualization. Based on Kolb's model of four basic learning styles I identified attributes that made each distinct as:

Diverging. Dominant for this learning style were concrete experience (CE) and reflective observation (RO). This group learned and performed best when allowed to brainstorm ideas as they have a broad range of interests and liked to collect facts and information. They preferred situations that required idea generation; they excelled at viewing problems with a different perspective and used imagination to problem solve. They were well suited for careers in nursing, sociology, law, the arts, social work, or public policy.

Assimilating. Dominant for this learning style were abstract conceptualization (AC) and reflective observation (RO). This group learned and performed best when given precise instructions requiring theory and sound logic. They preferred to focus on abstract concepts and excelled at grasping a wide range of information and concisely putting it into a logical format. They preferred ideas and concepts to people and learned best from lectures, reading, and exploring analytical models. They required time to think things through. They were well suited for careers in biology, math, physical science, and information technology.

Converging. Dominant for this learning style were abstract conceptualization (AC) and active experimentation (AE). This group learned and performed best when asked to find solutions to practical issues. They excelled at technical tasks and were less concerned with people or social issues. They preferred to work with experiments, new idea simulations and practical applications. They adapted well when asked to find solutions. They were well suited for careers in engineering, medical technology, economic or environmental sciences.

Accommodating. Dominant for this learning style were concrete experience (CE) and active experimentation (AE). This group learned and preformed best with hands on experiences. They excelled when allowed to immerse themselves in new and challenging experiences. They preferred and relied on people for information rather than on their own technical skills. They excelled when carrying out plans and preferred to work in teams. They set goals and actively worked in the field to figure out several ways to achieve objectives. This is the prevalent learning style within the general population.

Every learning experience provided the learner with a choice; effected by early learning experiences, heredity, and world experiences. These patterns form what was called learning styles. By understanding one's learning style participants better understood their learning cycle beginning with experiences, continued with reflection, which led to action (Kelly, 1997). Kolb & Fry (1975) measured participants' engagement in the four stages of learning styles (or preferences) as:

> ***Concrete Experience (CE) Stage 1*:** (a new experience or situation is encountered, or a reinterpretation of an existing experience). Feeling and developing by asking questions each person voices their values, personal goals, local visions for the future and their ideals. Seeks to answer, "What should this project be?" (Individual, Group and Inter-Group dialogue (direct observations) identified as observations and recall of information, knowledge of major ideas and knowledge of places, dates, and events). (p. 41)
>
> ***Reflective Observations (RO) Stage 2*:** (of the new experience of particular importance are any inconsistencies between experience and understanding). Watching and describing by observing and relating facts. Shared memories of events, as well as hard evidence of what is fact, contribute to building of shared knowledge. Seeks to answer, "What is this project about?" (Experiential and understanding, comprehension – understanding of information shared across disciplines, grasping of meanings from others outside of their discipline/field, interpretation of facts (compare and contrast), order, group and infer causes and ability to predict outcomes). Includes application – ability to use transdisciplinary information, use methods, concepts, and theories in situations, solving problems using required skills and sharing knowledge across disciplines. (pp. 41-42)
>
> ***Abstract Conceptualization (AC) Stage 3*:** (Reflection gives rise to a new idea, or a modification of an existing abstract concept). Doing and sharing by thinking and

designing innovative ideas/concepts for change (conceptual). Seeks to answer, "What could this project be?" Supports the idea that a team, contributing their specific interests and knowledge can create something better than any single person or group could alone. (p. 42)

Active Experimentation (AE) Stage 4: (the learner applies new information to the world around them to see what results). Links their lives and projects by integration of skills and synthesis; accepts different ways of thinking and seeing the world; putting ideas into action through doing while relating to private sector problems. Collaborative action is within the goal for this project, all working together on issues within the now focused goal or strategies – ability to use old ideas to create new ones, generalize from given facts, and relate knowledge from several areas/disciplines and the ability to predict and draw conclusions. This stage includes action research and analysis – ability to see patterns, identification of components, and organization of parts, while recognizing hidden meanings. Also, includes evaluation – ability to compare ideas, assess values of theories, and make choices based on reasoned arguments, while verifying values of evidence and recognizing subjectivity. Concerns that brought a diverse team together now shift to reasonable, sustainable, and agreed upon action plans (Transformative Stage). (p. 43)

Once one comprehends the four learning styles it made the next step easier to understand. The ELT model proposed that all learning required abilities that at first glance may appear to be opposite, requiring the learner to choose which set of abilities to utilize in different learning situations. For example, some learners preferred to receive additional information by experiencing it, making the experience concrete and tangible, relying on their senses. Others used symbolic representations or abstract conceptualization, preferring to analyze and systematically plan rather than relying on sensing the experience; others identified as 'watchers' preferred to sit back and observe those involved while others identified as 'doers' jumped right in and began doing things as they preferred active experimentation. Figure 2.6 shares a graphical representation of the reflection process referred to as Kolb's Experiential Learning Cycle.
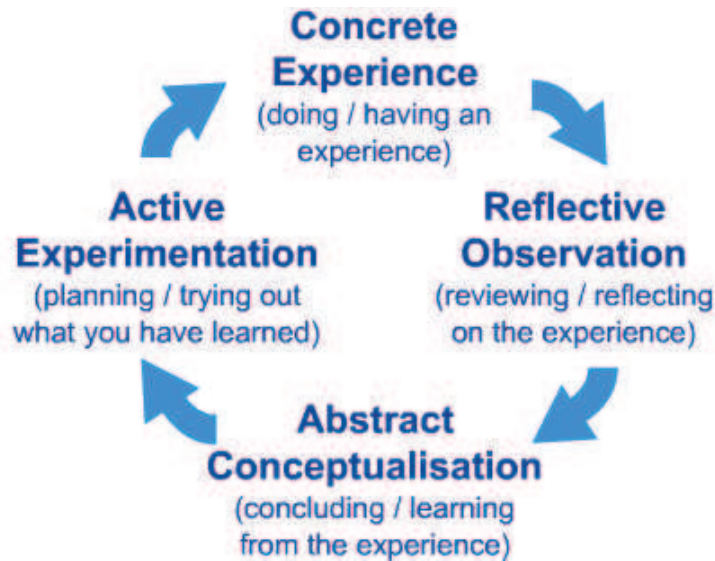
Figure 2.6
Graphical Representation of the Reflection Process - Kolb's Experiential Learning Cycle
Note. From "Four-phase model of transdisciplinary research: A four-phase model of transdisciplinary team-based research: goals, team processes, and strategies," by K. Hall, A. Vogel, D. Stipelman, G. Stokols, G. Morgan, G., and S. Gehlert, 2012, *Translational Behavioral Medicine, 2*(4), 419. (https://doi.org/10.1007/s13142-012-0167-y). Copyrighted by the Authors. Published by Oxford University Press. Reprinted with permission.

Hall's Four-Phase Model of Transdisciplinary Team-Based Research

This model emerged as an innovative and promising approach on how to address complex scientific questions and life-world problems (Figure 2.7). Hall brought together multidisciplinary scholars with stakeholders, community members, and non-academics, teams engaged in generally sequential phases described in the Four-phase model poster which said:

> Development, Conceptualization, Implementation, and Translation—with the processes and outcomes of each phase influencing the subsequent phases. But there may be recursive loops, as well…For example, insights about new research directions or translational applications that emerge during the second through fourth phases may lead to mid-project changes in the composition of a TD team to bring in additional areas of expertise. The four-phase model can be used as a "roadmap" to guide effective TD team science, or to inform improvement oriented evaluation during an ongoing TD team science endeavor. Ultimately, it can help to support enhanced achievement of scientific and translational goals. (Hall et al., 2012, para. 2).

43
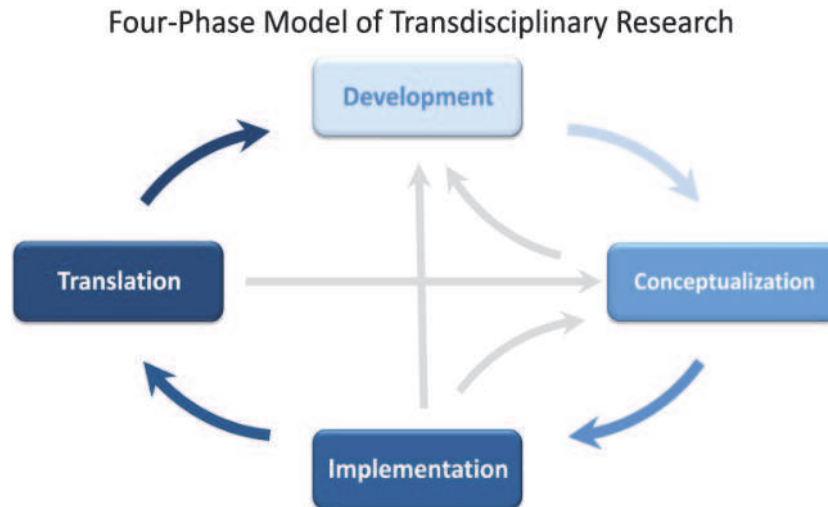
Figure 2.7
Hall's Four-Phase Model of Transdisciplinary Research
Note. From "four-phase model of transdisciplinary research: A four-phase model of transdisciplinary team-based research: goals, team processes, and strategies," by K. Hall, A. Vogel, B. Stipelman, D. Stokols, D.,G. Morgan and S. Geehlert, 2012, *Translational Behavioral Medicine, 2*(4), 417. (*https://doi.org/10.1007/s13142-012-0167-y*). Copyright 2012 by Oxford University Press. Reprinted with permission Oxford University Press.

Hall's Four-Phase Model of TD (Hall et al., 2012) identified team development and

evolution across phases as:

Development. Phase one goals were to define the scientific and/or societal problem. The

four-phase model identified key team processes as: "(1) to generate a shared mission and goals,

(2) to develop critical awareness, (3) to externalize group cognition, and (4) to develop a group

environment of psychological safety" (Hall et al., 2012, p. 417). Development included

identifying project complexities and interconnections that fell within the problem to be

addressed. It began with a small group of individuals who identified the problem by initiating

this phase. Once the problem was identified, the next step was to ascertain disciplines and

perspectives relevant to solve the problem. The development phase was essential to form a group

of collaborators from closely aligned and widely divergent fields. This required paying close

attention to those disciplines not considered and why it was believed they were not relevant to

the problem. For example, it was important to consider individuals who had expertise in disciplines not directly related to the problem but who could inspire novel ways to approach the problem. Individuals and discipline experts from the selected backgrounds were next brought together to delineate the boundaries of the problem by collaboration. It was important to look outside of academia to include stakeholders and community members.

Hall et al. (2012) noted psychological safety and trust building, coupled with safe open communication as critical at the development phase, as members from divergent disciplines/fields may not feel comfortable expressing ideas, thoughts, and opinions about the wide-ranging nature of the problem. Participants must feel they can communicate their ideas, opinions, and assumptions without fear of embarrassment, rejection, or punishment. By building safe environments early on, teams promoted active listening and debated characterized by mutual respect, affording open sharing of ideas while promoting collaboration. Development fostered co-learning and constructive work toward early innovative, creative, and productive outcomes. This process served to foster group cohesion and buy-in as an awareness of a shared mission develops, an important first step in collaboration; critical awareness and psychological safety were required as the team moved into subsequent phases.

Conceptualization. Phase 2 required teams to refine research questions, hypotheses the conceptual framework, and research design that integrated individual members' disciplinary perspectives and knowledge to address the problem in innovative ways. Once the team outlined the problem, participants needed to work together to identify specific knowledge gaps. This may lead to identifying a specific expertise missing from the team, then inviting new collaborators with the needed expertise to join the team. The four-phase model identified key team processes as: "(1) to create a shared mental model, (2) to generate shared language, (3) to develop

compilational transactive memory, and (4) to develop a TD team orientation." (Hall et al., 2012, p. 420)

Hall et al. (2012) noted teams emerged as collaborators around earlier defined research questions. Development of a shared language began while discipline specific jargon was identified, simplified, and described to the team. This is where the team developed supportive values, attitudes, beliefs, behaviors, and conceptual approaches. They refined questions through increased exposure to multiple disciplines and learning environments that provided a collective team characteristic separate from an individual's personal outlook. Each participant learned about other disciplines and developed an understanding of the relevant expertise of each participant. This advanced individual members to a TDM team orientation. This was key and identified by the collective belief in the value of a TDL approach while establishing common ground for their collaboration. For TDL to emerge, collaborators needed to let go of discipline-specific lines of inquiry and support the goal of integration.

Implementation: The primary goal of Phase 3 was to launch, conduct, and further refine the research problem; identifying when or if the team might need to be reconfigured. The four-phase model identified key team processes as: "(1) to develop shared understanding of who knows what (compilational transactive memory) who does what (compositional transactive memory), and how things get done (task work transactive memory); (2) to engage in conflict management; and (3) to engage in team learning" (Hall et al., 2012, p. 422). When this did not occur team members failed to develop clear goals and processes. It was exhibited when team members worked independently or toward divergent objectives. This resulted in poor team performance and less innovative problem solving. When this happens additional team members may be combined with the existing team. This required new members to learn and become

integrated into existing team routines, processes, and norms thus learning the shared mental modes developed by long-standing team members. As the team moves forward with new members it might require refinements to the research question, hypothesis, and approach; consisting of minor modifications or refinements and may lead to an entirely new program of research. This moves the team back to an earlier phase of the TDL process.

Hall et al. (2012) noted that collaboration among diverse disciplines can result in theoretical confusion or misinterpretation due to jargon, theoretical, and ethical differences. When differences occur, it can result in conflict and may negatively affect the team performance. If not worked through and managed during the collaboration stage, project debates and conflicts can hinder new perspectives and knowledge sharing. This may prevent the team from making strategic decisions reducing team performance. While consensus cannot always be reached allowing respectful debate, discussion, and time for post-debate reflection, teams might generate productive paths forward. This involves an evolving process that requires sharing information, asking questions, seeking feedback, reflecting on results, discovering errors or unexpected consequences, capturing collective knowledge. Members learn task, teamwork, conflict resolution and collective knowledge sharing. The collaboration stage encouraged refinement of research questions and development through regular meetings and was essential for establishing an integrative approach while promoting a shared language and mental modes.

Hall et al. (2012) indicated that:

> The primary goal of the translation phase is to apply research findings to advance progress along the discovery–development–delivery pathway to ultimately provide innovative solutions to real-world problems. The primary goal of the translation phase is to apply research findings to advance progress along the discovery–development–delivery pathway to ultimately provide innovative solutions to real-world problems. (p.424)

The author continued:

Key team processes in this phase of a TD research project include the evolution of the team, as needed, to identify and pursue translational goals, and for members of this newly evolved team to develop shared goals for the translational endeavor and shared understandings of how these goals will be pursued. (p. 425)

Team evolution develops shared goals and an understanding of how to pursue goals. At times teams may need to expand to include members outside of the original disciplines by inviting participants whose expertise may not be relevant to the original question. By broadening participation to include original participants with new partners and related professionals, stakeholders, and non-academics team and project outcomes evolved.

Hall et al. (2012) went on to note that during earlier phases, team goals and composition evolved while translational efforts introduced new goals through conceptualization and implementation phases. It is now critical the team revisit collaboration they engaged in during the first two phases. It is how diverse team participants gained a better understanding of the core issues as these shared perceptions essential to produce interventions, timetables, and action plans for project completion. Outcomes from this phase included development of new collaborations that spanned cross-disciplinary boundaries that can be sustained after the project ends. Long-term outcomes may include new inventions and breakthroughs of improvement in social conditions such as environmental quality. Depending on participants goals, and partnerships team members may choose to establish long-term collaborations where their focus is to advance research findings into practical applications.

Sourcing Storytelling in TD Research

Storytelling is an ethnography tool and useful when the researcher explored TD. Stories integrate knowledge from diverse disciplines and can affect the way people act and implement new knowledge. Griffiths (2007) shared:

But story is actually a piece of disciplined magic, of highly refined science. It is the most powerful educational tool we possess; it is learning distilled in a common language. It is also a privileged carrier of truth, a way of allowing for multiplicity and complexity at the same time as guaranteeing memorability…And so I would argue that narrative is not just a means, it is a method, and a rigorous and demanding one. The conventional scientific method separates causes from one another, it isolates each one and tests them individually in turn. Narrative, by contrast, carries multiple causes along together, it enacts connectivity. We need both methods. Scholars in the humanities know that stories change the way people act, the way they use available knowledge. The stories we live by determine the future. So, in harnessing the power of narrative, in listening to, rediscovering, and generating true stories, we change the world. (as cited in Palmer, 2016, para.12)

TD storytelling can advance TL in two ways. First, researchers and charrette participants work among academic disciplines and community knowledge. Palmer (2016) stated, "… the power of stories lies in their capacity to act as a bridge between these different knowledges and help us to make sense of time and complexity at the scale of a community or an individual's life" (para. 4). Second, stories can create change leading to TL. Mitchell et al. (2016) described stories as having the ability to create change among outcomes spaces as part of TD, described as:

- the generation of new and accessible knowledges
- an improvement in the 'situation' being addressed
- transformational learning of all participants (p. 27).

Charrettes

The term charrette is known to few, practiced by many, and misunderstood by most. Charrette originated from the Ecole des Beaux-Arts in Paris in the 19th century. Palmer et. al, stated, "It has been identified that no singular description of the charrette can be uniformly applied to the diverse array of contexts in which they are currently employed" (p.98). For the purpose of this study charrettes were employed to respond to project objectives and challenges; both as a process and project it sought to advance innovative solutions with a focus on measurable and demonstratable outcomes. Identified in *Transdisciplinary Charrette: A Research*

Method for Sustainable Design the authors shared, "A design charrette combines creative, intense working sessions with workshops and open forums. The charrette allows information sharing and open discussion at the earliest possible stage of a project" (Hes & Bayudi, 2005). It is a collaborative process that harnesses the talents and energies of all interested parties to create a plan for transformative community change. When employed in a design based context the charrette is iterative and may involve the whole procurement team (designers, users, and contractors, etc.). Studies by Walker and Seymour (2008) and Rottle (2006) suggested that "the charrette framework is particularly effective for unpacking and understanding sustainable building design" (Palmer et al., 2013, pp. 97-98).

Charrettes are a collaborative model utilized most often to resolve planning phase problems by architecture and design professionals, project managers, and community developers (Ricardo & Lizarradle, 2019). Action research is the keystone to TDL, and charrettes drive and support action research. A charrette instrument supports collaboration among disciplines, stakeholders, community members, and the private sector. It is intense, strategic, and focused, conducted in a brief period, usually a few days, or a week. Participants shift from single interest silos and separate meetings into a cross-functional, transparent, and compressed design process. Charrettes provided collaborative solutions with broad support from stakeholders (Lennertz & Lutzenhiser. 2006).

It was important to describe different charrettes as currently 'Charrette' is loosely associated with words used to depict the type of project and named as planning charrette, design charrette, and either a green, eco, or sustainable charrette. In 2013, Palmer et al. developed the following four types of charrettes identified as Visionary, Consultation, Project Based, and Research and Testing Charrettes. The authors explained that the categories are based on the

purpose of the charrette, each revolved around activities rather than on product or project. Each

facilitated a more focused discussion on how the charrette model was utilized for research; see

Figure 2.8 (Palmer et al., 2013). Based on Palmers et al. I identified, then color-coded areas I

used for charrette development and information that supported this study as it depicts an analysis

of how charrette types are currently utilized in combination in built environment projects (see

Table 2.3). Color coded information reflects areas I implemented (p. 101). Figure 2.9 depicts

Palmer et al. (2013) analysis of how charrette types are currently utilized in combination in built

environment projects. Using this information, more than one identified charrette type was

implemented during the same project; each tackled specific needs of a project and/or stage of

development, and each varied depending on desired or projected outcomes. Palmer et al., in their

review stated:

> It is evident from the exiting literature that the role of charrettes beyond the boundaries of
> specific projects is not clearly defined; that is, how charrette activities might facilitate
> knowledge development and innovation in parallel with the negotiation of project
> specific solutions. (p. 101)

Charrette Type	Purpose(s)	Examples Relevant to Project	Participants	Possible Outcomes
Visionary Charrettes	Problem definition / Needs assessment[1] Establishing Future Goals Future visions Identifying Opportunities to achieve future goals[2]	Citizens assemblies Active /Participatory democracy[3] World cafes[4] Planning Projects		Agreed goals Identification of opportunities for change Policy Advocacy Implementation Plans
Consultation Charrettes	Stakeholder engagement[5] Positive participation, buy-in, diffusion of confrontation.[6]	Planning Projects and other Design Projects with multiple stakeholders		Agreed Plan
Project Based Charrettes	Iterative design process specific to a defined project Project specific problem solving	Planning Projects Spatial Design Projects (building, interior, other)[7] Other Design projects such as products, software etc.	Any of the examples may involve • the broader community,[8] • project specific stakeholders,[9] or • a multi-disciplinary design team,[10] or a combination of the above at different stages.	Agreed project goals Design Brief Implementation proposal or design Design refinement
Research Charrettes	Data collection[11]			Rapid data collection similar to that achieved through surveys, interviews and focus groups.
Testing Charrettes	Assessment of applicability[12] Model refinement[13]	Development of alternative processes and systems[14]	Industry and/or Community	Knowledge for further project/ model development

[1] Needs Assessment and Visioning discussed by Sutton and Kemp (2006)

[2] See Remtema and Nyland (2009) for use of charrettes to identify opportunities in an institutional operations context

[3] Participatory democracy processes are most frequently described as Workshops or Forums, however it is worth recognizing the similarities with exist with Charrette processes. For example, see 'Participatory Budgeting & Citizen Participation' program in Recife Brazil, awarded the 2011 Reinhard Mohn Prize.

[4] For description of World Café model see Carson (2011)

[5] Stakeholder engagement in relation to Planning Charettes is discussed by many authors including: Lennertz & Lutzenhiser (2006), Condon (2008), Wates (2008), Gindroz et al (2003)

[6] The difference between visionary and consultation charrettes is often the stage of project development, with consultation charrettes generally occurring after a project has commenced and a number of decisions have been made prior to consultation.

[7] This charrette type includes the popular methods employed in building design including those specifically addressing sustainability requirements of buildings and facilitating specific aims such as Integrated Design. For building related examples see Hess (n.d.), Mendler (2005), Cole et al (2012), Lewis (2004) etc.

[8] For example, community participation in design of project previously described in a visionary or consultation charrette.

[9] For example, urban design projects integrating input from residents, business community, legislative representatives, developers etc. (Sarkissian 2009)

[10] For example, complex building projects integrate knowledge from numerous disciplines related to the built environment. (Hess n.d.), Mendler 2005),

[11] Walshe et al (2010), Gibson and Wittington (2010)

[12] Clayton (1998), Clevenger (2010)

[13] Gibson and Wittington (2010)

[14] Gibson and Wittington (2010)

Figure 2.8

Charrette Types by Palmer et al. (2013) Established Through Literature Review
Note. Table 1: Charrette Types Established through the Literature Review. From "Transdisciplinary charrettes: A research method for sustainable design," by J. Palmer, K. Chmeralls, S. Pullen, J. Zuo, L. Wilson, and G. Zillante,2013, *The International Journal of Architectonic, Spatial and Environmental Design, 7*(1), 100. (http://hdl.handle.net/2440/83600). Copyright by Common Ground. Reprinted with permission.

Table 2.3

Adaptation of How Charrette Types Were Utilized in This Study, Color Coded in Blue

Analysis of How Charrette Types Are Currently Utilized in Combination in the Built Environment		Planning Charrettes				Design Charrettes		
Charrette Types and Function		Planning Charrettes – e.g., NCI	Visioning Charrettes for Sustainable Communities – e.g., Condon	Implementing charrettes for sustainable communities – e. g., Condon	Charrettes for Consultation only, employed following development of proposed plan	Integrated Design Process/Whole Building Design – e.g., Lewis	Building Design Charrettes – e.g., Hess, Mendler	'Eco-Charrette' – e.g., Cole et al.
Visionary Charrettes	Needs Assessment	■	■					
	Future goals/visions	■	■					■
	Identifying opportunities	■	■				■	■
Consultation Charrettes	Stakeholder Participation	■	■		■	■		
Project Based Charrettes	Development of project goals and brief	■		■	■	■		
	Development of Design Proposal — With community consultation	■						
	Development of Design Proposal — With stakeholder consultation	■						
	Development of Design Proposal — Design Team Only		■	■	■	■	■	
Research Charrettes	Data Collection	■						

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Testing Charrettes	Assessment of Applicability							
	Model Refinement							

Note: Analysis of how charrette types are currently used in conjunction in built environment projects. Explanations to clarify information in the image I implemented pieces from each type of charrette. For example, for XQ I implemented all areas identified under visionary and planning charrettes. For XQ and Cherokee I implemented stakeholder input and participation thus incorporated consultation charrettes. Project based, Research and Testing charrettes aspects were implemented for XQ and Cherokee. XQ focused on Design Charrette aspects, while Cherokee participants implemented portions from the Design charrette process; this included aspects of Design charrettes. From "Transdisciplinary charrettes a research method for sustainable design," by J. S. Palmer, K. Chmeralls, S. Pullen, J. Zuo, L. Wilson, and G. Zillante, 2013, The International Journal of Architectonic, Spatial and Environmental Design, 7 (1), p. 101.
(https://www.researchgate.net/publication/266376349_Transdisciplinary_Charrettes_A_Research_Method_for_Sustainable_Design).
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Table 3: 'Charrette Methodology Matrix': Correlation of Charrette Types with Project Stages

			Stage 1 Conceptual Design	Stage 2 Consultation and Model Development	Stage 3: Field Testing	Stage 4: Data Triangulation –
Visionary Charrettes	Needs assessment		▓			
	Future goals/visions		▓			
	Identifying opportunities		▓			
Consultation Charrettes	Stakeholder Participation			▓		
Project Based Charrettes	Development of project goals and brief					
	Development of Design proposal	With community consultation				
		With stakeholder consultation		▓	▓	
		Design Team Only				
Research Charrettes	Data Collection		▓			
Testing Charrettes	Assessment of Applicability			▓		
	Model Refinement				▓	▓

Figure 2.9
Charrette Methodology Matrix
Note: Table 3 of 'Charrette Methodology Matrix': Correlation of Charrette Types with Project Stages. From "Transdisciplinary charrettes: A research method for sustainable design," by J.. Palmer, K. Chmeralls, S. Pullen, J. Zuo, L. Wilson, and G. Zillantee, 2013,. *The International Journal of Architectonic, Spatial and Environmental Design, 7*(1), 103. ([https://www.researchgate.net/publication/266376349_Transdisciplinary_Charrettes_A_Research_Method_for_Sustainable_Design](https://www.researchgate.net/publication/266376349_Transdisciplinary_Charrettes_A_Research_h_Method_for_Sustainable_Design)). Copyright by the University of Adelaide. Reprinted with permission.

Charrette principles required inclusion of everyone from the start; participants who might

build, use, sell, approve, or attempt to block projects are necessary participants. By involving

people from diverse fields and areas of interest, participants are more likely to contribute and

share individual viewpoints, resulting in improved project outcomes. Charrettes required more up-front work but, in the end, they saved time, costs, and provided a higher quality project with improved possibilities for implementation. They produced a shared vision and mutual authorship to the plan; those who contributed to the process were in a better position to understand and support the plan's rationale. They drove short feedback loops as participants proposed designs/solutions, revised, and made changes to earlier concepts. This process was often in opposition to more conventional planning processes. Lennertz (2003) discussed how charrette work is concurrently and cross-functionally completed during compressed work sessions while participants search for details in big picture ideas, culling and revising among disciplines to make realistic decisions for final project. The need for TD teaming and knowledge integration was often mentioned as a goal when researchers addressed charrettes. Some wrote about the integration of knowledge at the problem level, others described it during the research level, while others at the solution level (Bernstein, 2015). In reality, it was much more difficult to ascertain when and how integration during a charrette actually functions until the actual charrette was in progress.

Lennertz (2003) identified essential strategies required for successful charrettes as:

1) Work collaboratively: based on valuing all participants' contribution.

2) Design Cross-functionally: planning was a dynamic approach with key decision makers involved throughout; detailed designs are completed individually or in small groups with groups reconvening periodically to discuss and debrief. Collaboration among disciplines helped to achieve finished documents/plans that address all project aspects.

3) Compress work-sessions: A charrette typically lasts for four to seven days, many lasting one to two days, always occurring in a compressed work session while traditional planning lasts over the course of several months. Compressed sessions expedited creative problem solving by accelerating decision making and by reducing unconstructive negotiations; encouraged participants to abandon usual working rather thinking in patterns (thinking outside the box).

4) Communicated in shorter feedback loops: Stakeholder inputs and reviews built trust and fostered understanding and cooperation. Misunderstandings were quickly resolved before they have a chance to escalate; charrettes shortened feedback loops, more importantly rapid and regular feedback loops created unique solutions to problems, generated ideas, resulting in a better project.

5) Study the details and the whole: Buy-in was accomplished by designing in detail; advanced cooperation and agreement while it looked at the big picture reducing fatal flaws in the plan.

6) Confirmed progress by measuring outcomes: measured progress via agreed upon outcomes sets in motion an environment of transparency in the decision-making process ensuring that the project is executed as planned.

7) Produced feasible plans: charrettes differ from other workshops, as the goal is to develop a feasible plan, by maintaining open communication and fully informing members as the project progressed.

8) Utilized design to achieve a shared vision and created holistic solutions: Design was a significant tool for establishing a shared vison. It used drawings that educated other team members while aiding in discussions. As Lennertz emphasized, "talk with your pen".

9) Included a multiple day charrette: Most charrettes required a three to seven-day period, with simple projects attempted in fewer days. The extended timeline allowed for at least three feedback loops, viewed as required to facilitate change in participants' perceptions and positions.

10) Hold the charrette on or near the site: When participants worked on-site it fostered understanding of the local values and traditions. It provided necessary access to stakeholders and information, it also made it easier for people to participate. (pp. 1-4)

Charrettes as Transdisciplinary Agent for Change

A brief overview of the process garnered various concepts and implementation methods. Charrette development implemented experiential learning for TDL and combined resources for TL. This study utilized material from *The Charrette Handbook: The Essential Guide for Accelerated, Collaborative Community Planning* (Lennertz & Lutzenhiser, 2006). Critical to any charrette is planning; this established boundaries around project design by identifying constraints to avoid having too many possibilities to draw from, further developed in Chapter III. While

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most charrettes were local, others integrated regional or global teams, many worked across changing physical locations.

When pursuing TD using the charrette model, literature addressed what and how students learned to be educated citizens. After extensive case study reviews, it was decided that solely using the resources and labs of one academic institution (campus) would limit the study to one homogenous community; failing to fully implement 21st century skills required by many who plan to operate/work in a global environment. More and more private sector expectations require employees to be able to work in digital environments and to participate effectively in a diverse collaborative organization (Derry, 2005). "Many current educational uses of technology are restricted to what can be thought of as gift wrapping" (Fischer, 1997, p. 13); that is technology is implemented to enhance learning and not viewed solely as a new technology add-on (Papert, 1993).

Harris and Lyon's 2014 inquiry for the Nexus Network (food energy, water, and environment) reviewed 76 publications on TD and identified common approaches incorporated within their investigation. It acknowledged traditional boundaries among disciplines and between academia and private sector participants. Researchers identified three challenges facing TD involved as theoretical, methodological, and practical/potential challenges of charrettes, categorized as:

- Theoretical challenges: Framing problems, balancing reductionism, and holism, managing theoretical pluralism.
- Methodological challenges: Different conceptions of 'proof'. Experiential vs. Experimental data, synthesizing results from multiple scales, data types and sources.
- Practical challenges: Different actors desire different outputs, communication across boundaries, building trust and collaboration (p.1).

Transformative Learning (TL) Theory

Transformative learning emerged within the field of adult education and reflects a conceptual framework for understanding how adults learn (Dirkz, 1998). McGonigal described how thinking changed from simply acquiring knowledge that fits into pre-existing belief structures by challenging thinking habits in an environment that provided opportunities applying new knowledge and innovative approaches to problem solving (Stanford University, 2013.) By transforming ones' approaches, conditions, and processes, learners make perspective transformation. Mezirow (1991a) described perspective transformation as:

> The process of becoming critically aware of how and why our assumptions have come to constrain the way we perceive, understand, and feel about our world; changing these structures of habitual expectation to make possible a more inclusive, discriminating, and integrating perspective; and finally, making choices or otherwise acting upon new understandings. (p. 167)

Participants were challenged to find ways to manage tensions arising from the TDL process; identified as recognizing diversity of values, methods, and rewards among participants. Team selections should balance size and diversity to encourage knowledge creation. Attention needed to be given to trust building in collaboration with being sensitive to how unequal power relationships can shape the process (Harris & Lyon, 2014). "This can lead to an inherent paradox in which transdisciplinary research seeks diversity of participants and perspectives but requires their alignment towards common goals and research outcomes" (Harris & Lyon, 2014, p. 2). Balancing the views of a diverse team in a TD approach required:

> **Living with tensions:** Transdisciplinary research required the management of diversity and "tangled agendas". There was no single, right methodology, except being aware of tensions.

> **Formation of team:** Teams needed to be big enough to be diverse but small enough to build relationships.

Negotiation of the research approach: Developed methods of engaging all partners. Facilitator and stakeholder workshops can be key to ensuring effective communication, managing expectations, and maintaining equality among all participants.

Knowledge creation: To avoid the pitfalls of a multidisciplinary or multi-stranded approach, transdisciplinary projects ensured integration of all aspects of the research. Allowed time and space so there was room to fail and the opportunity to learn from mistakes. Time for co-reflection and learning should be part of the project.

Outputs: Negotiation were required at an early stage to ensure outputs satisfied all team members, as well as funders. (pp. 2-3)

Of importance are the social, cultural, and economic factors that influenced TL. Mezirow (1997) introduced TL as a change process that transforms frames of reference defined as "the structures of assumptions through which we understand our experiences. They selectively shape and delimit expectations, perceptions, cognition, and feelings" (Harris & Lyon, 2014, p. 5). In Understanding Transformation theory Mezirow (1994) argued that transformation followed many variations of:

- Disorienting dilemma
- Self-examination with feelings of guilt or shame
- Critical assessment of epistemic, sociocultural, or psychic assumptions
- Recognition that one's discontent and the process of transformation are shared and that others have negotiated similar changes
- Exploration of options for new roles, relationships, and actions
- Planning a course of action
- Acquisition of knowledge and skills for implementing one's plan
- Provisional trying of new roles
- Building of competence and self-confidence in new roles and relationships
- Reintegration into one's life on the basis of conditions dictated by one's perspective. (p. 224)

Mezirow (1991b) continued and identified the Four Components of Transformation as task-oriented learning and as critical reflection in communicative learning. Elements may be found in both types of learning; comprised and described as experiences, critical reflections,

reflective discourses, and actions. He described the process as including meaning perspectives or

habits which include:

> **sociolinguistic** – cultural, social norms, customs, ideologies, language, political orientations, ideology, and secondary socialization such as thinking like a teacher or doctor; occupational or cultural habits,

> **moral ethical** – involves conscience, moral norms, and values,

> **learning styles** – sensory preferences, working alone or together, or focusing overall or parts,

> **religious** - commitment to doctrine, spiritual, or transcendental world views,

> **psychological** – theories, schemas, scripts, self-concept, personality traits or types, parental prohibitions, emotional response patterns, and dispositions,

> **health** – ways of interpreting health problems, rehabilitation, or near-death experiences,

> **aesthetic** – values, tastes, attitudes, standards, judgments about beauty, the humorous. (p. 27).

Transformative learning contrasts the more popular assimilative learning, where learners

acquired new knowledge that fits within their existing knowledge structures. Stanford University

professor Kelly McGonigal (2005) produced teaching strategies to affect TL compelling a

paradigm shift for perspective transformation. In all cases learners' prior knowledge must be

revised and not merely augmented. McGonigal discussed TL theory and identified conditions

and processes for transformation to occur as:

1. an activating event that exposed the limitations of a current knowledge/approach.
2. opportunities to identify and articulate the underlying assumptions in the student's current knowledge/approach.
3. critical self-reflection as the student considered where these underlying assumptions came from, how these assumptions influenced or limited understanding.
4. critical discourse with other students and the instructor as the group examined alternative ideas and approaches.
5. opportunities to test and apply new perspectives (Teaching for Transformation: From Learning Theory to Teaching Strategies, 2015, para. 6).

When these processes occur, students are more likely to revise their underlying assumptions, adopt a new paradigm, and apply this new paradigm (Cranton, 2002). According to Illeris (2003) TL rarely occurred without resistance, even among highly motivated students.

Blended Learning and Transformative Learning (TL)

Blended learning is not a new concept, teachers have used the concept for years; it provides a personalized learning environment while incorporating student engagement. It is employed in both academic and corporate sectors. Young (2002) in *The Chronicle of Higher Education* quoted Pennsylvania State University's president as saying that the convergence between online and residential instruction was "the single-greatest unrecognized trend in higher education today" (p. A.33).

Today's blended learning is a formal program that takes traditional face-to-face classroom in a brick-and-mortar building, then adds an online portion where students monitor their own time and place to learn. Students learn in part through online delivery of content and instruction with other components delivered in brick and mortar environments (see Figure 2.10). At the core of blended learning were multiple modalities. The Christensen Institutes online hub (Blended Learning Universe) described four blended learning models, as:

1) Rotation - students rotated on a fixed schedule between learning modalities; self-paced online learning and sitting in a classroom with a face-to-face instructor. This enabled students to explore diverse types of learning scenarios; this model comprised components associated with traditional teaching methods (para.3).

2) Flex-content and instruction were delivered primarily by the internet, students were permitted to move on a customized, fluid schedule among learning modalities. Instructor(s) provided face-to-face support as needed through activities such as in-person tutoring, group projects or small group instruction (para. 10).

3) Self-blended-a la carte: students elected to take one or more courses remotely (online) supplemented by traditional curriculum, and the instructor was online. Students took courses on-site or off-site (para.11).

4) Enhanced-virtual: an online platform the instructor delivered the entire curriculum, students worked remotely, and instructors were available online, student driven discussions (often weekly) were mandatory (para.12).
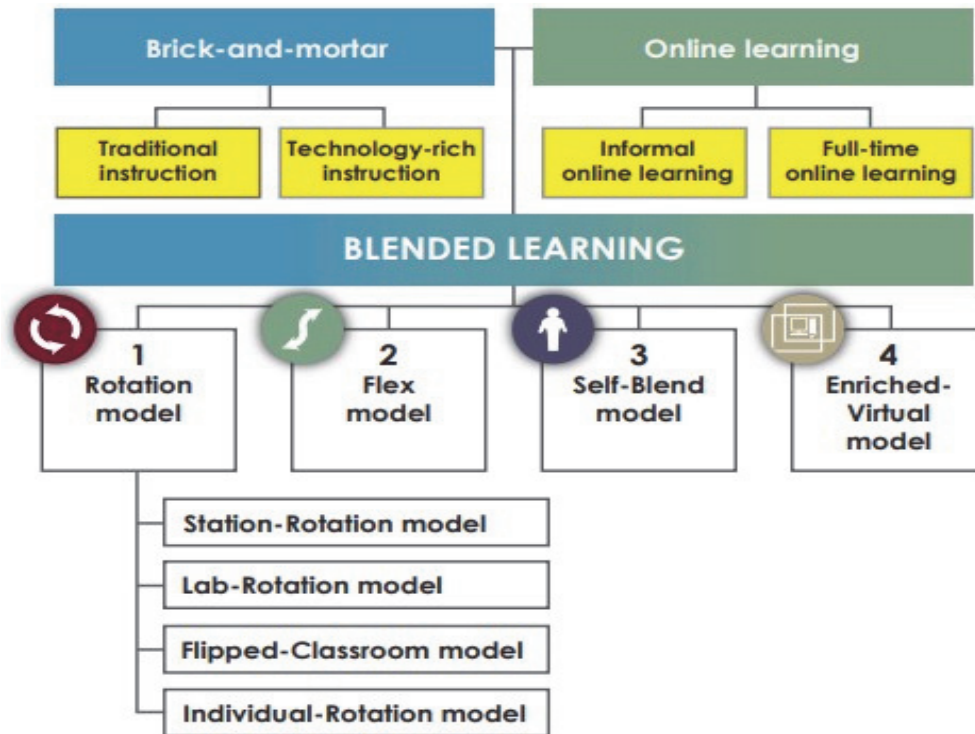
Figure 2.10
Blended Learning Taxonomy
Note. From "Blended: Using disruptive innovation to improve schools," by H. Stakere, and M. Horn, 2014, p. 1. (https://www.christenseninstitute.org/blended-learning-definitions-and-models/). Copyright 2014 by the Clayton Christensen Institute. Published by Jossey-Bass. Reprinted with permission.

To make blended learning effective it must support a community of inquiry, locations were irrelevant, face-to-face, or online (Garrison & Kanuka, 2004). A sense of community and belonging was required and must be on cognitive and social levels if the goal of achieving higher learning was to be sustained. IT required each medium of communication be met (Figure 2.11).
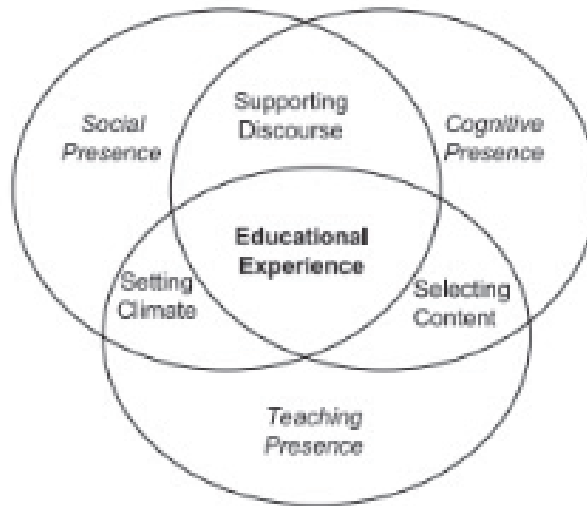
Figure 2.11
Community of Inquiry
Note. From "Uncovering its transformative potential in higher education," by H. Kamuka, 2004. *Internet and Higher Education*, *7*(2)*,* 98. (https://doi.org/10.1016/j.iheduc.2004.02.001). Copyright 2004 by the Elsevier Inc. Reprinted with Permission.

Kalashanker and Prasad (2012) discussed how change occurred from one generation to another, distinguishing the traditional education system with the adaption, implementation, and re-engineering of cutting-edge technologies into the 21st century classroom. They described a survey on current classrooms (FTF) and virtual classrooms. Conducted by the MASIE Center and The Learning Consortium in 2011, shared findings as, "…we received responses from 654 large organizations, detailing current and future uses of classrooms. These organizations included corporate entities (57%), educational institutions (21%), governmental agencies (15%) and non-profit groups (7%) in 46 countries, with the majority of respondents from North America" (para. 2). Findings showed a preference for "more interactive white boards, cameras and microphones to record classes, tablets for everyone, multiple displays, and movable furniture" (p. 1204). The authors continued, "In other words, the 'sage on the stage' teaching

model is being expanded to include virtual expertise, increased learner interaction, and alternative modes of presenting and working with new content" (p. 1204).

Important to interactive dual-site blended education students participated in "real-world" activities to master content. When students mentally, physically, and emotionally touched the material they learned authentic skills to advance academic and private sector future. Stanley (2017) noted that blended learning required students to use all academic disciplines to complete their work. This was accomplished by implementing multiple levels of learning, creating interactive experiences of inquiry-based, project-based, or problem-based learning. These were not isolated classroom experiences rather cross-curricular, cross-disciplinary experiences. Projects that produced a product were observed, evaluated, and restructured compelling students to learn a variety of skills. Blended dual-site environments created an interactive experience where students explored and engaged in multiple levels of learning and experienced five interactions as:

1) student-to-student
2) student-to-teacher
3) student-to-community (on-site and off-site)
4) student-to-material, and
5) student-to-technology

In Online Learning Consortium (2015), researchers conducted a review of student lifestyles and universities rapidly advancing technology. Findings showed preferences and required a shift to flexible learning environments; preferences showed classroom courses delivered on-site (face-to-face) were supplemented and/or replaced by online (off-site) activities and discussions. Key findings from the online report were identified as:

- A year-to-year 3.9% increase in the number of distance education students up from 3.7% recorded last year (2014).

- More than one in four students (28%) took at least one distance education course (a total of 5,828,826 students, a year☐to☐year increase of 217,275).

- Total of 5.8 million distance education students (fall 2014) was composed of 2.85 million took all their courses at a distance and 2.97 million took some, but not all, distance courses.

- Public institutions command the largest portion of distance education students, with 72.7% of all undergraduate and 38.7% of all graduate level distance students.

- The proportion of chief academic leaders that said online learning was critical to their long☐term strategy fell from 70.8% last year to 63.3% this year.

- The percentage of academic leaders rating the learning outcomes in online education as the same or superior to those in face☐to☐face instruction was now at 71.4%.

- 29.1% of academic leaders reported that their faculty accepted the "value and legitimacy of online education". Among schools with the largest distance enrollments 60.1% reported faculty acceptance while 11.6% of the schools with no distance enrollments did so. (para. 2)

Challenges of a Blended Learning Environment

Classrooms are becoming mobile; literature identified interactive environments where students had a full-fledged setting of technologies, (not always readily available). Classrooms were WI-FI enabled, supported access to all class materials using webcams, cameras, LCD screens, digital white boards, interactive tablets, smart phones, and notepads. The investigation addressed three areas:

1) online students' learning/experiences-are they equivalent to that of on-site students'?
2) new opportunities for collaboration
3) learning communities and inquiry

Kalashankar and Prasad (2012) discussed how change occurred from one generation to another, distinguishing the traditional education system with the adaption, implementation, and re-engineering of cutting-edge technologies into the 21st century classroom.

Fadde and Vu (2014) identified blended learning as "enhancing face-to-face classroom learning by adding asynchronous online instruction via web conferencing" (p. 1). I reviewed numerous case studies before finding the Kemp and Grieve (2014) research that aligned closely with my own. Researchers identified multiple case studies, some larger, but most were smaller while few compared students' experiences with learning in two modalities. The authors shared students were in FTF classes and familiar with 'online learning'. A review of FTF and online undergraduate experiences discussed opinions and test performance in classroom (face-to-face) and online learning; it compared Australian third year "undergraduate' university student preferences for academic performance on class material with assessments presented online vs. traditional classrooms (N = 67)" (p. 1). The sample consisted of 13 male and 54 female students with a mean age of 24 years (SD 7.1 years), all spoke English as a first language. Students were familiar and comfortable with the web-based platform and participated as part of their course work on developmental psychology. Participants provided consent for their data to be utilized for research, which received Institutional Review Board (IRB) approval from the university. Students preferred FTF activities rather than online, and there was no significant difference in their academic performance, between scores and modality preference (FTF/Online). Students showed a strong preference for class discussion in a FTF environment versus online as they believed they were more engaged and received more immediate feedback than in an online environment. Kemp and Grieve (2014) stated, "As in Study 1, we conducted a chi-square analysis, and confirmed that significantly more participants preferred to do written activities online (or did not mind either way) than to do them in class, $\chi 2$ (1) = 8.26, p < 0.005" (p. 8). The authors identified themes that emerged from participants preferences about class discussions.

Participants identified preferences for rankings while the authors conducted a thematic analysis. Findings from a small group of respondents shared themes as,

- More engagement: The most common theme to emerge was that it allowed more engagement than online discussion. For example, I would rather be in a classroom talking to actual people and engaging more.
- Better flow of discussion: Another popular theme was that discussion flowed better in person than online. For example, Can actually have a free flowing conversation.
- Personal setting: Some participants noted that the personal setting of the classroom encouraged better discussion than the more impersonal online environment. For example, The discussion in person is more beneficial for learning. Easier to communicate and express ideas in a personal setting.
- Greater range of opinions: Students expressed that in-class discussion exposed them to more opinions. For example, Get more opinions and discussion of them in class (p.8).

Comments shared as:

I think that discussion face to face really allows you to think more deeply and bounce ideas of other people. Writing it online, felt like your answers had to be more formal and exact, whereas in class discussion I felt you could really bounce more possible ideas off each other before concluding …You are able to directly discuss with tutor and peers and therefore directly receive feedback for your questions and other questions. (Kemp & Grieve, 2014, p. 5)

Themes emerged from participants' preferences about class discussions; shared that no one wished to read other student's comments online but had no issues discussing ideas in FTF environment. Respondents noted it was easier to review paper documents. They shared FTF classes provided deeper understanding of material and provided a better flow for disagreements.

When asked to identify 'one good thing' about online learning (Kemp -Study 1) and to identify preferences for written exercises online students (Kemp - Study 2) stated overwhelmingly 'convenience', identified as time and location flexibility. A number of respondents shared that online work encouraged contributions from a 'wider range of students', as many expressed being too shy to talk in class. In summary, responses among the studies

identified students felt online learning encouraged more detailed answers/responses. They

identified disadvantages as being unfamiliar or lacking skills to interact with technology.

Transformative Learning (TL) in Contrasting Settings

Research showed that TL required critical reflection, and it may occur either

independently or in-group interactions, either FTF or virtually. Studies showed that to test the

validity of a transformed frame of reference in communicative learning required critical-

dialectical discourse of assumptions that may occur, not bound by space or location. Garrison et

al. (1999) introduced the Community of Inquiry model, (see Figure 2.11), which described the

educational experience in an online setting. It showed that TL was related to cognitive presence.

"When matching the descriptors and indicators of the Community of Inquiry Model with the 10

phases of Transformative Learning Theory, researcher(s) found that these two theories support

the other's claims. Both emphasize similar areas of learning elements" (p. 88).

Inquiry by Garrison et al. asked *"Is (the) online learning environment a good context for*

applying Transformative Learning (TL) Theory?" (p. 95). The authors continued, "Given the

increasing evidence that Internet information and communication technologies are transforming

much of society, there is little reason to believe that it will not be the defining transformative

innovation for higher education in the 21st century" (Garrison & Kanuka, 2004, p. 95). They

explained that meaningful educational experiences supported learning as:

- online platform provides a learning space that is more open and relaxed than the FTF context
- asynchronous discussions allowed students' time and mental space to read and reply
- the documentary nature of communication allowed students to reflect and discourse structurally while allowing for iteration and reiteration of concepts in various formats
- technologies (virtual world, Blog, stream media) can create "like-real" situations when inspiring students' sense of dilemma

- collaborative learning platforms, for example using Learning Management Software (LMS, social software) provided opportunities for those who live in isolation from learning communities to participate in and be supported by teachers and learners on a similar intellectual journey, and web conferencing provided F2F learning experiences. (p. 95)

When exploring how off-site charrette participants, such as industry and educational experts, differed in their experience literature offered little, while support was surprisingly similar, rarely different outside of the delivery method to those in an FTF environment (Lulee et al., 2009). Findings from the transformative learning (TL) course showed that the instructor must be adept, and during a charrette the facilitator would need to be adept, while student roles were unchanged, depicted as:

- **online/off-site instructors/ facilitators**
  a) role of instructors is vital to TL
  b) instructors as facilitators (Cranton, 1994)
  c) building safe, open, and trusting environment for respectful, civilized dialogue (Taylor, 2000)
  d) posting questions that stimulate reflection on target topics and model this question-posing process to students (Ziegahn, 2001)
  e) structured feedback to participants' learning objectives (Boyer, Maher, & Kirkman, 2006)
- **online students**
  a) be a part of a community of knowers
  b) responsible for constructing and creating the condition for TL
  c) online/virtual Students (includes call in environments)
  d) be a part of a community of knowers
  e) responsible for constructing and creating the condition for TL. (p. 19)

Information delivery methods differed for charrette participants, depending on their environment (FTF/virtual), implementation/participation methods and processes were similar. Mezirow's Ten Steps to transformation were identified along with teaching strategies' including what technologies might support this assumption.

Charrette Case Study Review

I reviewed research that incorporated charrette participant experiences (students/ stakeholders/educators). My investigation began with projects that included process development information, methodology, and associations. Many referenced earlier TD charrettes and/or studies that might advance planning and methodology for this study. Early review showed that charrettes/experiences shared a number of participatory observations. Designers, community members/stakeholders, and academics approached charrettes and TDL problems in differing ways. Case study review acknowledged that collaboration among disciplines working with community stakeholders can be challenging; especially when searching for innovative solutions to problems. To tackle these challenges, advance research, and support this study, I culled data/methods from projects with comparable scope, participants, environments, and community. I focused on studies conducted from 2004 to 2018. Reviews' included studies that incorporated participants from among a diverse group of attendees, specifically searching for processes and outcomes to shed light on participatory projects that utilized local community knowledge, social sciences, and/or design. I reviewed advantages and drawbacks among them.

What follows is a recap of case studies that drew upon interconnected concepts from architecture/design, education, and community service. Each supported experiential learning in a TDM environment. The first, by Sutton and Kemp (2006) involved three charrettes. Researchers explored integrating design and social sciences with local community knowledge and participants, identified as:

- improving opportunities for informal outdoor learning in a suburban community, Charrette I (p. 8).
- maintaining a small-town character while achieving greater density, Charrette II, (p. 9) and,
- making a historically Black neighborhood into a heritage museum, Charrette III (p.10).

Sutton and Kemp stated that study organization and methodology development required at least one-year planning, included recruiting a community partner before planning and offering a charrette. Study methodology and described outcomes varied among each study. Participants included undergraduate and graduate students, university faculty, practitioners, youth, and adult community members. Study disciplines identified as art, architecture, landscape architecture, and urban design. Social scientists' included community and environmental planners, education, history, public health, social work, and urban planners. "Participants formed three or four teams with each team consisting of two design faculty or practitioners and one social science or design student serving as the leader for a group of 13 to 14 students" (p. 129). Design students participated in either seminars or charrettes as part of their required course work, while social science student(s) participation counted as independent study. This resulted in far fewer attendees (one or two per team). Charrettes lasted five days; student leaders invested between 40 to 55 hours and student participants investing 20 to 35 hours, all attended other classes during this time. Designers were expected to develop, utilize, and contribute visual inquiry (topographical maps, photographic data, drawings) then analyze data to simulate a life world environment.

Charrette problems were framed and shared with participants who were tasked to turn vague problems posed by community members into a feasible, achievable action plan/project. Students created seminar assignments to advance early investigation as they conducted a needs assessment followed by an ideation session. Students were required to create visualization tools aiding designers and non-designers during joint decision making; noting that each visual inquiry generated approximately 100 drawings and models per charrette. Charrette procedures were

typical of a small architectural design firm while faculty and practitioners acted as mentors, working hands on with students. Teams jointly developed an overall concept, then in small seminar groups explored alternative solutions and concepts independently. They reconvened to share, develop, collaborate/negotiate findings. They critiqued and coordinated team designs post team review. Students were responsible for taking the lead, much as they would be required to do in a professional environment; each team conducted literature reviews related to spatial and social aspects of the proposed problem (Sutton & Kemp, 2006).

Separate from the university were community youth (students) who, prior to the charrette, created their own vision plan. They presented their ideas to charrette participants in a needs assessment/ideation forum open to and attended by the public, joined by community partners with personal knowledge of the challenge. Community partners took the assessment lead and advanced solutions/proposals. They coordinated and conducted a community/site tour. To assess and measure charrette success, graduate students (Education) administered pre/post evaluations to students and community members. Participants and team members reflected on experiences with interdisciplinary collaboration, community participation, and action. Post-charrette graduate students from social science merged interview data (Sutton & Kemp, 2006).

Case Study #1: Informal Outdoor Learning

Charrette participants were assigned to "create informal learning opportunities at twelve community sites, along with photographs and descriptions linking them to the schools via pedestrian pathways" (Sutton & Kemp, 2006, pp. 131-132). The charrettes site was located between two highways with 70 percent of land zoned commercial included 15,000 area residents compared to 100,000 commuters. The neighborhood had a new community center and five new schools supported by sales tax dollars. The area had sporadic sidewalks/roads and steep

topography, all restricted pedestrian movement. Prior to the charrette, faculty and student teams had worked at two schools where new buildings were constructed. This group shared lessons learned from the construction process with the school district served as the community partner. Concurrently, seminar students conducted a needs analysis including mapping and design sessions with 5th graders who supported the charrette (Sutton & Kemp, 2006). This study included 115 participants comprised of mostly White adults, and immigrant children.

Charrette outcomes resulted in diverse proposals, which community partners continued to collaborate on. They implemented proposals over a three-year period. Student evaluations showed participants devoted 23 percent of comments to interdisciplinarity collaboration, and 8 percent for community participation. Findings showed participants would have liked greater disciplinarity diversity. Difficulties were identified as part and parcel of work while struggling to create common ground. Participants expressed satisfaction working together with community members on a life world issue and dissatisfaction with the lack of input from teachers who did not live in the area or attend the community forum. Teachers expressed satisfaction with student design sessions and university visit, but dissatisfaction with not receiving extra compensations for curriculum planning. Findings copied in Figure 2. 12.

Table 2 Participants, proposals, and outcomes for Charrette I

Participants	Proposals	Outcomes
Community partner: suburban school district serving primarily immigrant children Seminar: 5 design students, 2 social science students with 2 design faculty members and 1 social science faculty member as consultants (10 people) Teaching team: 1 design student, 1 design faculty member, 2 social science students and 1 social science faculty member (all in education), and 1 student with a background in both disciplines (6 people) Charrette: 58 design students, 2 social science students, 8 team leaders, 109 fifth graders, 9 teachers, 3 principals, and 1 district superintendent (190 people)	To create informal outdoor learning opportunities at community sites and link them to the schools via pedestrian pathways, students proposed: 1. Interpretive trails and signage to make children aware of the history of various landmarks; 2. A comprehensive bicycle trail to link existing fragmented pathways, while adding bridges, bus shelters, and interactive compasses; 3. Outdoor classrooms and public art at the three elementary schools; and 4. A habitat corridor to link the yards of private and multi-family housing with the school yards Proposals incorporated sketches by fifth graders	A poorly attended community forum Drawings and models A digital publication of the proposals, organized to illustrate outdoor education theories Two public art projects (totaling $53,500) that the district funded and volunteers built An op-ed piece in a local newspaper and a three-minute spot on a local television station Presentations to school board and city council members New sidewalks leading to one school, though this cannot be directly attributed to the charrette

Figure 2.12

Charrette I Overview

Note. From "Integrating social science and design inquiry through interdisciplinary design charrettes: An approach to participatory community problem solving," by E. Sutton and S. Kemp, 2006, *Am J Community Psychol*, *38*(1-2), p. 8. (https://doi.org/10.1007/s10464-006-9065-0). Copyright by Society for Community Research and Action. Reprinted with permission.

Case Study #2: Addressing Greater Density While Maintaining Small Town Charm

This study addressed a 9,200 persons residential community surrounded by a compact business district with median household incomes 30% above the city's; this area served as the charrette site. The community depicted a small-town atmosphere, shared several historic buildings, a park doubled as a school playground, with a unique natural landscape. Residents supported local businesses, but heavy vehicular traffic and numerous parking lots diminished pedestrian access and quality of life. The city recently mandated increased density in the residential neighborhood. In response a community group of volunteers independently organized and created a local plan. Volunteers acted as the charrette's community partner. Researchers asked participants to provide illustrative drawings of their concepts. This supported and

influenced the planning office that would be producing design guidelines (Sutton & Kemp, 2006).

Seminar students conducted a needs assessment, produced site photography, and held design sessions and meetings with high school students and planners. Seminar information developed the charrette assignment as:

> Provide alternative approaches to meeting city-mandated requirements for increased density along four blocks of the main street in the business district, while also maintaining its small town quality. The students visioning session included two 50-foot long photomontages of both sides of the street; participants were to indicate design preferences by applying cut-outs of various architectural elements to the montage. (Sutton & Kemp, 2006, p. 133)

This study involved 91 participants (mostly White), with a few Asian adults and teenagers (Figure 2.13). The university contributed funds to induce teens of color onto campus for participation without significant results. Participants produced and collaborated on a variety of proposals over 15 months. Post charrette findings showed students devoted fewer comments to interdisciplinary collaboration, with 14 percent compared to 24 percent for community participation.

> Many comments about working across disciplines parallel those made by students participating in Charrette I (a broadened outlook on a real world problem that has practical problems in terms of integrating the disciplines), but the comments of this group indicate resentment about lack of respect from the social scientists and the designers' tendency to dominate. (Sutton & Kemp, 2006, p. 133)

Some students expressed dissatisfaction with serving a middle-class community and shared their dislike of one domineering community partner. Most comments indicated greater satisfaction with the quality of community members input and determination/resolution exhibited to the work. Students voiced concerns about the limited communication they had with community members. Participants shared their personal lack of familiarity with the

neighborhood, which resulted in proposals that did not adequately address local needs.

Community participation created a perceived enhanced value to students' learning, yet this

relationship appeared to enhance conflicts that resulted in students feeling inadequate to generate

noteworthy proposals. Community partners indicated they experienced difficulty understanding

the design and charrette process, their roles, and what outcomes to expect. Partners rated the

process very positively and shared their belief that it provided fundable ideas that "could be

immediately incorporated and implemented" (Sutton & Kemp, 2006, p. 137).

Table 3 Participants, proposals, and outcomes for Charrette II

Participants	Proposals	Outcomes
Community partner: volunteer planning group for a middle-income urban community Seminar: 4 design students with 2 city administrators (designers) as consultants (6 people) Charrette: 51 design students, 4 social science students, 6 team leaders, 12 high school students, 4 young architects, and 15 members of the planning group including residents, business persons, a branch librarian, K-12 principals, and city officials (92 people)	To meet city-mandated requirements for increased density, while also maintaining its small-town quality, students proposed: 1. Elements to preserve; 1. Elements to preserve; 2. Multi-story buildings with features that maintain human scale (e.g., overhangs, porches, bay windows, decorative motifs) and offer a mix of residential and commercial use; 3. A streetscape with traffic calming (achieved through distinctive paving patterns and enlarged sidewalks at intersections), a network of alleys, and green streets linking to regional open space; and 4. Refurbishment of the park to include a new stage, curving public art installation with seating, defined paths, enlarged entries, and demolition of an addition to the original field house Park proposal incorporated high school students' ideas	A very well-attended community forum Drawings and models A digital publication and an exhibition of the proposals, organized to illustrate six design strategies Integration of the drawings into the city's neighborhood design guidelines Two articles in a community newspaper A request for proposals from design consultants that incorporated the digital publication A scholarly paper Codified design guidelines to minimize pedestrian/vehicular conflicts and increase pedestrian-scale architectural features, though this cannot be directly attributed to the charrette

Figure 2.13
Charrette II Overview
Note. From "Integrating social science and design inquiry through interdisciplinary design charrettes: An approach to participatory community problem solving," by E. Sutton and S. Kemp, 2006. *Am J Community Psychol*, *38*(1-2), p. 9. (https://doi.org/10.1007/s10464-006-9065-0). Copyright by Society for Community Research and Action. Reprinted with permission.

Case Study #3 Creating a Heritage Museum

This study addressed a historically Black neighborhood (46%) of approximately 28,300

persons with a median household income 27 percent lower than the rest of the city (Sutton &

Kemp, 2006). During a restrictive housing covenant era[1] an overcrowded elementary school closed due to low enrollment believed to be caused after the state demolished surrounding properties making way for a highway. The site sat vacant for 25 years further segregating the community. Later a community activist group occupied the building for eight years demanding the building be converted to a heritage museum after a neighborhood-based organization purchased the space; community concerns were later expressed about plans for a smaller museum. This resulted in activists raising redevelopment funds with plans to create a mixed-use property[2], adding market rate housing[3], and the heritage museum. The area shared a strong cultural history, had numerous churches, several historically significant sites, and regional ethnic food restaurants. The community supported ethnic festivals and highway demolition created large expanses of open space. A large community threat was identified as rapid gentrification that threatened displacement of earlier, usually poorer residents, shifting neighborhood character. Seeking assistance from the university to provide suggestions for improving site access (post highway construction) they functioned as the community partner for the charrette.

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[1] Restrictive housing covenants (1920s – 1948) were covenants that, under contract, prevented a particular group of people, usually African Americans, from leasing, purchasing, or occupying a piece of property (Welsh, 2018).

[2] A mixed-use building contains at least two different types of uses; most common mixed-use spaces combine commercial space on the ground floor with apartments or offices on upper floor(s). Configurations vary in floorplans and these buildings outperform single use developments and most are more financially productive (Quednau, 2018).

[3] Market rate housing, usually apartments that have no rent restrictions, is available to anyone in the private market, not subsidized or limited in any specific income level. This type of development often drives up rents; has a ripple effect on surrounding neighborhoods. Studies showed it linked to mass displacement of vulnerable/low-income groups (Chew, 2018).

Project development began as seminar students conducted a needs assessment; this included mental mapping[4], design, and writing sessions with 5th graders. Researchers included interviews with residents, conducted archival research, and photographic documentation. Post analysis students identified the assignment as "reconnect the abandoned building to its surroundings, while turning the entire neighborhood, not just the museum, into a display of cultural heritage" (Sutton & Kemp, 2006, p. 134).

The charrette included 94 participants; primarily Black team leaders and 5th grade students, joined by largely White and some Asian students. Primarily White community members contributed to the need's assessment and visioning sessions, numerous Blacks attended the community forum (Figure 2.14). Student evaluations shared fewer comments on interdisciplinary collaboration resulting in 7 percent compared to 59 percent for community participation. Comments indicated students most valued the cultural diversity and the opportunity to work with local residents but expressed concerns about conflicts between Black team leaders and White student(s); additional comments identified lack of community knowledge as a problem. Students were satisfied with university community involvement in the community and the opportunity to learn about important community work by faculty, noting feeling isolated from the community while at the university" (Sutton & Kemp, 2006). Findings showed students lacked responsiveness to community concerns especially area gentrification.

> In all, students seemed energized but also overwhelmed by the historical and sociopolitical complexity of the problem. Their attitudes toward interdisciplinary collaboration seemed colored by a strong sense of disciplinary and cultural inadequacies, with racial tensions between students and team leaders adding a layer to the disciplinary conflicts experienced by social scientists and designers participating in previous charrettes. At the same time, students recognized the great benefit of working with

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[4] Mental mapping is a first-person's point of view/perception of an area and how they interact with it; used frequently to plan activities and develop routes for travel (Rosenberg, 2019).

community members on a problem of profound social relevance despite the difficulties they encountered. (Sutton & Kemp, 2006, p. 135)

Table 4   Participants, proposals, and outcomes for Charrette III

Participants	Proposals	Outcomes
Community partner: neighborhood-based agency in a historically black urban community Seminar: 9 social science students, 2 design students with 2 social science faculty members, 1 design faculty member, and 1 public relations person for the agency serving as consultants (15 people) Charrette: 10 social science students, 46 design students, 8 team leaders, 21 fifth graders and 1 teacher, 5 community members, and 3 agency representatives (94 people)	To reconnect an abandoned building to its surroundings, while turning the entire neighborhood into a display of cultural heritage, students proposed: 1. Gateways to mark main entry points; 2. A network of pathways connecting landmarks and incorporating public art depicting African American and neighborhood history; 3. Open spaces for social activities (farmers market, pea patches, ethnic festivals); 4. Reopening a street de-mapped during highway construction; reconfiguring a street that floods to drain naturally; 5. Creating a network of businesses and arts organizations; launching a public relations campaign; and getting input from the university's business school Proposals incorporated fifth graders' drawings and stories	A reasonably well-attended community forum Drawings and models An exhibition of proposals organized according to four themes contained in the resident interviews An article in a local newspaper Two scholarly publications A forthcoming doctoral dissertation in social work

Figure 2.14

Charrette III Overview

Note. From "Integrating social science and design inquiry through interdisciplinary design charrettes: An approach to participatory community problem solving," by E. Sutton and S. Kemp, 2006. *Am J Community Psychol*, 38(1-2), p. 10. (https://doi.org/10.1007/s10464-006-9065-0). Copyright by Society for Community Research and Action. Reprinted with permission.

Community partners noted positive reactions to students' creativity, energy, and sincerity when addressing needs. They expressed positive reactions to visual "documentation of historic destruction" and the "unanticipated politeness of activists" (Sutton & Kemp, 2006, p. 135). Mentioned was credibility brought by university produced project proposals, while notes identified "the need for ongoing, deeper relationships with the university" (p. 135). Reviews shared the charrette generated innovative ideas and seemed to change minds.

Interesting, and unseen in other case studies I reviewed, was the perceived need to hire armed guards for the community forum, as community partners believed the contested subject

and racial makeup of participants might prompt violence. This action created an insulating

environment and in the end was not needed (Sutton & Kemp, 2006).

Case Study #4 Tackling an Architectural Challenge During a Charrette

The fourth charrette involved a smaller study from the Stanford University Architectural

Design Program (Dhillon Marty Foundation, 2012). This study involved undergraduate students

joined by nine award winning architects from four countries. Participants included professors,

non-education professionals, and students from the U.S., Japan (Tokyo University), and Greece;

divided among teams invited to participate in a weekend charrette and juried competition. There

was no mention of students receiving seminar or course grades. The headline from a Stanford

ARTS article stated: "Local patron Sonia-Dhillon-Marty invites teams made up of Stanford

students and professional architects to her property, Champ de Portola, for a two-day design

charrette and competition. The winning design will be built on her property by 2014" (Stanford

News Service, 2012, para. 1).

Pre-charrette two free public lectures were delivered on the Stanford campus; the first on

October 24, 2012 by Ko Nakamura (Mosaic Design and Kengo Kuma Lab, Tokyo University,

Japan), the second on October 25, 2012 by Takato Tamagami (Takato Tamagami Architectural

Design and Nihon University, Japan). A charrette kickoff dinner was held Friday, October 26,

2012. Architects and students were invited, then assigned to nine teams and given the

assignment, "to design an artist's cottage to be built on Sonia Dhillon-Marty's property in 2014"

(Stanford News Service, 2012, para. 1). Participants were provided a mission statement, a design

concept accompanied by site plans, a project description, and a philosophical statement but little

else. The mission was shared as:

> "To nurture the creative process by providing artists with room, board, and a cloistered
> countryside environment where they can work amid natural beauty without

interruption…our hope is to create a design that makes a paradigm shift in architecture, such as:

1. Innovation in design
2. Innovation in material or its use
3. Paradigm shift in construction and/or design
4. Innovation in design or material that will impact the society at large, such as: beautiful design that can be utilized as temporary shelter, module component that can be added to existing building, people can build it with local materials by themselves, speed of construction
5. The design that solves major issues facing the world: energy, urban farm design that will be attractive as a beautiful garden, vertical vegetable wall, sanitation, water recycling.
6. Design based on openings and not the closed part.
7. Minimum use of space, thus making it blend into the surroundings. Very low profile.
8. Most innovative utilization of space
9. Best connection to nature: starry nights, owls' calls at night, butterflies, and hummingbirds.
10. Best way to create a private space, blocking the noise of the surrounding, blocking the view of the building and from the other building, thus creating a very private space while surrounded by many.
11. Best design to enlist the human senses for creativity and relaxation
12. Off the grid
13. Water conservation
14. Innovative toilet, help bring sanitation to the world". (Dhillon Marty Foundation, 2012, Champ De Portola – Philosophical Statement section)

The objective was to "arrive at designs, or set of designs, which pushed the ideas of architecture and construction-and ultimately leads to a finished product" (Dhillon Marty Foundation, 2012, para. 6). The foundation shared, "My hope was that this exercise might answer few or many questions and concerns that I have outlined above. This is an exercise for Fluidism in architecture" (Dhillon Marty Foundation, 2012, Champ de Portola - Philosophical Statement section).

Teams delivered final proposals in presentation formats (Power Point, Posters, Photographs, Drawings) on Sunday, October 28, 2012 (p.m.) to a panel of five jurors identified as: Stanford Architectural Design Program Director, Microsoft Director of Corporate Citizenship, Stanford professors from biology, anthropology, and the director of the Center for

South Asia. No information was available on the award (team) or if the project was completed in 2014. However, this charrette provided relevant information for determining how much and what type of information to share with participants', including sharing the mission and philosophical statements by the benefactor/stakeholder (Dhillon Marty Foundation, 2012).

This study provided a broad statement of project goals for participants, rather than an itemized check list of 'What to do" while adding a juried presentation format to advance presentation preparation. Varying presentation formats enhanced learning and presentation skills. Findings provided observations and outcomes when industry professionals and students were in a joint project. Results shared that students felt diminished or overshadowed by industry professionals (Dhillon Marty Foundation, 2012).

Case Study #5 Auraria – Two Design Charrettes, Differing Experiences

The fifth was a participatory action research study. In *A Comparative study of two design charrettes: Implications for codesign and participatory action research.* Howard and Somerville (2014) shared two comparative case studies using charrettes to redesign two different spaces at the University of Colorado (Denver), Auraria campus. The first charrette shared a recap of the redesign of first and second floors of the library (December 2010) and the second was a co-designed landscape architectural plan for library courtyard spaces (June 2012). Both studies explored design charrettes and how participatory prototyping advanced participatory action research (PAR) and how that approach contributed to codesign practices in organizational settings. The initiative began in July 2008 specifically to address the redesign. The PAR approach allowed all staff to work with multidisciplinary teams, multiple stakeholders, campus communities, and constituencies. The study involved multiple mixed method data collection including online surveys, participant observation, focus groups, structured interviews, informal

conversations, and organizational statistics. Charrettes were "similarly developed yet leadership and execution varied considerably" (Howard & Sommerville, 2014, p. 46). Both charrettes "followed a three-stage sequence of information sharing, idea generation, prototyping, and prioritization with each stage building upon the former, both in terms of design concepts and in building up elements of making" (Howard & Sommerville, 2014, p. 62).

Charrette I (library facilities redesign) was a two-day event, included 25 campus representatives, master planners, librarians, students, professors, and administrators. Limited capital construction funds required renovation versus new construction be untaken. Campus planners, external to PAR, conducted a bid search to select an architectural firm to complete the project. The bid was awarded to external firms (Humphries Poli Architects, Holzman Moss Bottino Architecture, Martin & Martin Consulting Engineers) with select individuals from each firm planning/acting as charrette facilitator(s). PAR researchers had not met the hired architectural firm(s) prior to the charrette nor had any participated in a charrette before. Library leaders believed that stakeholders' inputs would be invaluable to meet their needs combined with end user expectations; thus, PAR was selected as the research framework. This framework supported all users to influence organizational change (Howard & Somerville, 2014).

Day 1 charrette teams followed a three-stage sequence of information and ideation exercises, where participants brain stormed planning and prototyping (recursive methods) then finalized on a conceptual model (Howard & Somerville, 2014). This day began with a 100-image slide show illustrating current worldwide library design concepts, interior designs, trends, and developments with what the authors called a 'mind-expanding' activity. Participants were asked to identify ideas/concepts they felt best addressed the project; once completed attendees were given post-it notes and instructed to place them on library maps that identified major spaces for

renovation. This activity led to the next step where participants were given another sheet of paper to collectively identify programmatic functions. They placed ideas of 'how to' reimage and rezone library and individual spaces (Figure 2.15). Attendees began Day 1 as a single group later reassigned, divided between two teams of approximately 12 individuals each; each tasked to create library prototype models, see Figures 2.16, 2.17, and 2.18. Post prototyping teams presented their models and discussed options; end of Day 1 architects took the models/renderings and overnight created three possible options, shared with participants Day 2.

Figure 2.15

A Building Break Exercise: Participants Placed Slips of Paper That Identified Differing Programmatic Functions Where They Thought Each Best Worked Using a Vertical Study Model

Note. Please note that charrette is incorrectly spelled (charette) in all these case study images. This was not a researcher typo rather editing mistakes from the source. All documents were copied as is, no corrections were made. From "Design Charette for Auraria Library, Auraria Higher Education Center: Final Report" by Auraria Library, 2011, Design Charette for Auraria Library, Auraria Higher Education Center: Final Report, p.3. (https://library.auraria.edu/sites/default/files/documents/AurariaFinal01132011.pdf). Copyright 2011 by CoDesign Results. Reprinted with permission

A 'Building Breaking' exercise was conducted in which all participants were provided with a set of paper slips with the major programmatic functions of the Library. Participants were asked to place their slips where they thought each program area best functioned on a study model with exaggerated vertical scale. The results were recorded and converted into the diagram below, with the largest words indicated the most repetitions in a given zone.
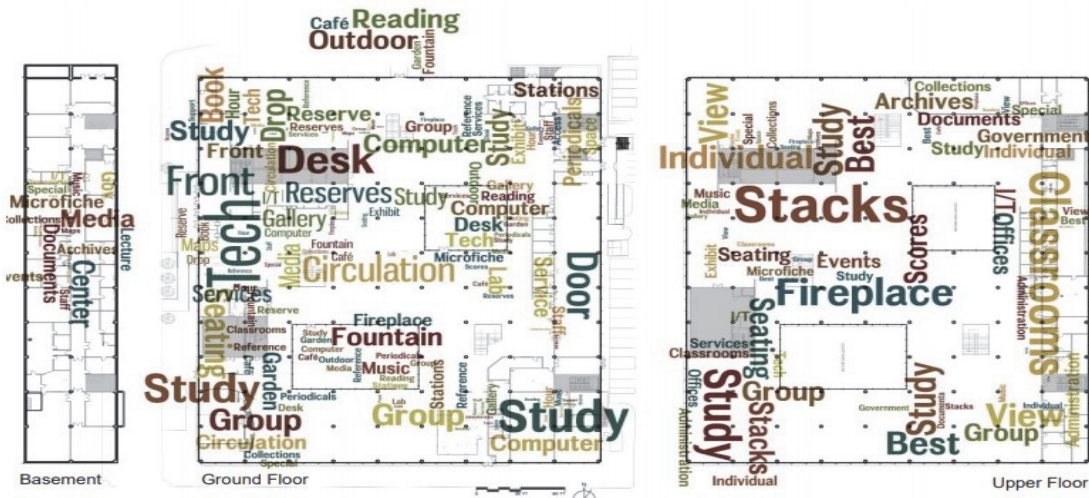
Summary of Key Results:

1. **Entry** to remain or moved to address the Northwest corner of the building
2. **Service entry** to remain for access to alley drive and staff areas
3. The north / northwest corner of the ground floor is favored for an expanded, enlivened **cafe**
2. **Stacks** should be primarily concentrated at the upper floor
3. **Best views** are found at the upper floor, most especially at the northwest and southwest corners
4. The **basement** could potentially house microfiche, government documents, and other limited-use collections if existing classrooms were to relocate elsewhere on campus.
5. The **north courtyard** was favored for enclosure with a skylight and adaptation for new indoor functions as a double-height, daylit space.
6. **Quiet** study and individual uses were favored for the upper floor.
7. **Group** study and collaborative uses were favored for the lower floor.
8. **Service Points** for reference, technology, and circulation were generally co-located placed directly adjacent to the primary entry favored by each participant.
9. **Staff** areas were most frequently located adjacent to the main floor East service entry.

Figure 2.16

Results from the Building Breaking Exercise Were Recorded and Converted into Floor Plans; Larger Words Represent the Most Repetitions by Participants Within a Specific Zone

Note. From "Design Charette for Auraria Library, Auraria Higher Education Center: Final Report" by Auraria Library, 2011, Design Charette for Auraria Library, Auraria Higher Education Center: Final Report, p. 18. (https://library.auraria.edu/sites/default/files/documents/AurariaFinal01132011.pdf). Copyright 2011 by CoDesign Results. Reprinted with permission.

The 'Orange Wall'

Entry Canopy / Roof Deck

Enclosed Skylight Courtyard

Landscape Courtyard

Service Desk

Landscape Edge

Cafe / Events

Center for Colorado and the West at Auraria Library

Day 2 concept study showing the relation of the 'Orange Wall' to a potential addition for Center for Colorado and the West at Auraria Library. This concept derived from the 'wagon wheel' image for the Center, mentioned during Day 2 discussion. The location at the North facade provides a highly visible, signature location that is accessible to visiting school classes. The 'Orange Wall' ties the Center into existing library spaces while providing a valuable wayfinding element This location for the Center was adopted in the subsequent concept plans found at pages 24-25 of this report. It should be noted that the size, form, height, specific program, and other elements of the Center's design have not been established as part of the charette process.

After the 'Building Breaking' exercise, the charette worked in two groups who each assembled conceptual solutions to the needs of the Library using a two-story study model.

Team 1 Key Concepts:

1. The 'Orange Wall', a curving, brightly colored new wall rising through both floors of the building, separates staff from public areas. A major element for orientation and navigation, the wall leads the way to the Center for Colorado and the West and provides a surface for digital content displays.

2. Entry Canopy / Roof Deck: The existing entry is maintained but made more visible with a canopy that offers indoor / outdoor space on the upper level.

3. Skylight Courtyard: The north courtyard is covered over with a new skylight and used as double-height library space.

4. An enhanced **Cafe / Events Space** at the Northwest corner takes advantage of proximity to the campus crossroads.

5. A single, consolidated **Service Desk** is placed in direct line with the entry.

6. **Expanded Restrooms** with a passageway allowing access from both North and South

Figure 2.17
Team 1 Utilized Key Concepts from the Building Breaking Exercise to Create a Conceptual Model
Note. From "Design Charette for Auraria Library, Auraria Higher Education Center: Final Report" by Auraria Library, 2011, Design Charette for Auraria Library, Auraria Higher Education Center: Final Report, p. 19.
(https://library.auraria.edu/sites/default/files/documents/AurariaFinal01132011.pdf). Copyright 2011 by CoDesign Results. Reprinted with permission.
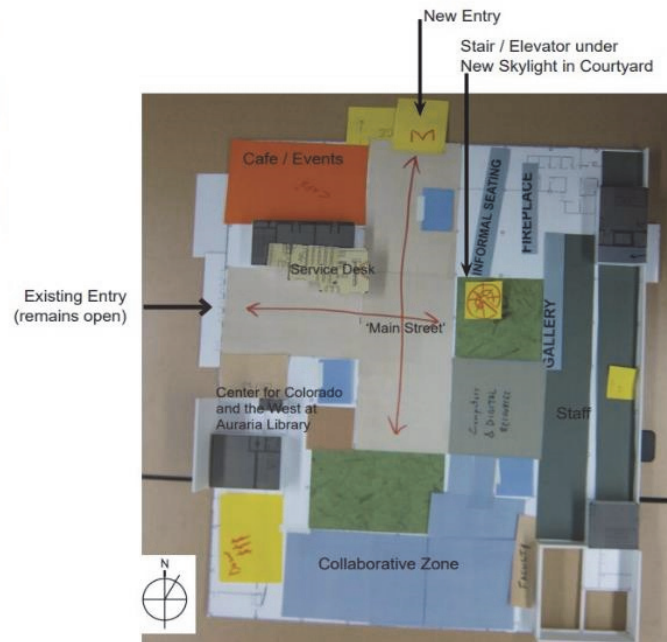
Figure 2.18

Team 2 Utilized Key Concepts from the Building Breaking Exercise to Create a Conceptual Model

Note. From "Design Charette for Auraria Library, Auraria Higher Education Center: Final Report" by Auraria Library, 2011, Design Charette for Auraria Library, Auraria Higher Education Center: Final Report, p. 20. (https://library.auraria.edu/sites/default/files/documents/AurariaFinal01132011.pdf). Copyright 2011 by CoDesign Results. Reprinted with permission.

Day 2 began with a site walk, which provided participants time to experience the space. Returning to the charrette participants broke into smaller groups to discuss individual observations, they identified key features they believed were needed. Participants' voted on each feature (identified by dots placed on posters to identify and rank importance), that the facilitators later utilized to develop proposals. Participant activity shared in Figure 2.19. Pictorial results (representations) of the building-expanding exercise specified the larger the word, the more repetitions of the idea within the given zone. Figure 2.20 depicted an overview of two-days of charrette experiences. The authors noted that voting was biased as architects outnumbered stakeholders and participant groups. End of Day 2 participants briefly presented a list of priorities, no further discussion was shared. Post charrette architects utilized the listed priorities to develop a charrette report for stakeholders. They included options shared in a phased plan with estimated budgets (Howard & Somerville, 2014).

Howard and Somerville (2014) observed and noted that professional's presence was unevenly weighted and Day 2 architects presented their own proposal. This stifled attendee's buy in, ideation, and project outcomes; it depicted an unbalanced approach that affected outcomes as non-architect proposals closely addressed their discipline and skills. Developers identified results and prioritized what energy efficient windows and infrastructure could have been used. The architect's proposal overshadowed and outweighed what participants and stakeholders identified as priorities.
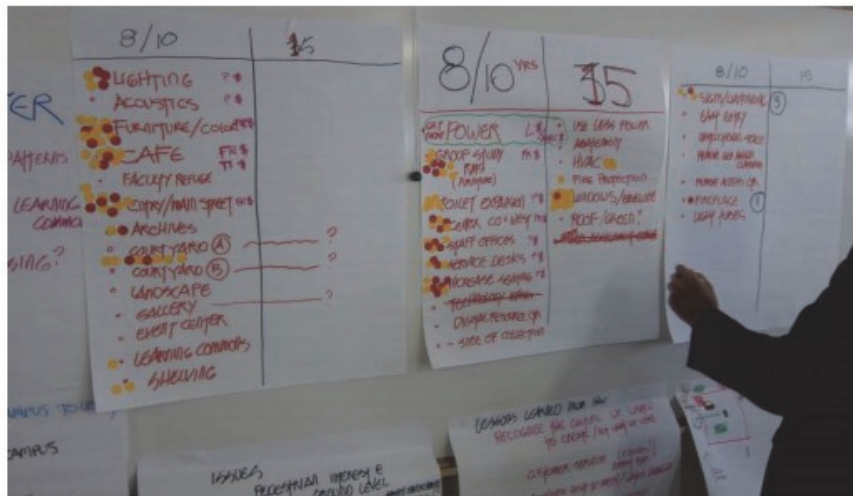
Priorities

Each Charette participant allocated 6 dots to indicate the relative priority of projects for the improvement of the Library. The order below represents the charette consensus on the relative urgency of various projects, without consideration of how these projects can be 'packaged' into separate scopes of work.

0. Electrical upgrades for support of personal electronic devices. (Short-term upgrades have been designed and budgeted, but addi tional electrical work will be needed as part of other projects, along with an upgrade of the building power feed.)
1. New Furniture
2. Entrance / 'Main Street' alterations for improved navigability
3. Additional Group Study rooms and spaces
4. Renovation of the curtain-wall system for improved performance
5. Create a larger / more functional / attractive café space
6. Enclose one courtyard with a skylight to create new library space and improve wayfinding.
7. Increase the quantity of seating available for student use
8. Consolidate staff office spaces
9. Create the Center for Colorado and the West
10. Replace the existing lighting
11. Expand restroom facilities
12. Create a single, identifiable Service Desk at each floor
13. Replace the Heating, Ventilation, and Air Condition (HVAC) system

Figure 2.19
Charrette Participants Priority Lists Using points/dots
Note. From "Design Charette for Auraria Library, Auraria Higher Education Center: Final Report" by Auraria Library, 2011, Design Charette for Auraria Library, Auraria Higher Education Center: Final Report, p. 26.
(https://library.auraria.edu/sites/default/files/documents/AurariaFinal01132011.pdf). Copyright 2011 by CoDesign Results. Reprinted with permission

Figure 2.20
TD Collaboration Among Charrette Participants Day 1 and Day 2 of the Auraria Charrette
Note. From "Design Charette for Auraria Library, Auraria Higher Education Center: Final Report" by Auraria Library, 2011, Design Charette for Auraria Library, Auraria Higher Education Center: Final Report, p. 16.
(https://library.auraria.edu/sites/default/files/documents/AurariaFinal01132011.pdf). Copyright 2011 by CoDesign Results. Reprinted with permission

Facilitators shared context and placed emphasis and importance on an introductory overview of the site. Design team members shared goals and ground rules, establishing the need to understand the purpose, opportunities, and challenges participants might be faced with during project proposals. These were identified and shared as the "purpose was to, gather different users and staff to the library to generate ideas about the various needs, character, and the role of the library courtyard (Catalano, 2012, p. 11) with the outcome of developing a shared understanding

of the current courtyard situation and future vision" (Howard & Somerville, 2014, p. 51). Two

library staff members presented findings and outcomes from the PAR program depicted in

Figure 2.21.

Figure 2.21
Participants Final Presentations
Note. From "A comparative study of two design charrettes: Implications for CO-design and participatory action research," by Z. A. Howard and M. M. Somerville, 2014. International *Journal of COCreation in Design and the Arts, 10*(1), p. 52. (*https://www.tandfonline.com/doi/abs/10.1080/15710882.2014.881883*). Copyright by the Authors. Reprinted with permission.

The Auraria Charrette II addressed another aspect of the PAR initiative, known as the

library courtyard landscape project. Building upon an existing cooperative relationship between

the University's Department of Landscape Architecture and the Auraria Library, this charrette

involved 26 participants comprised of 15 library staff, 3 campus planners and an 8 person design

team. The team included a Landscape Architect Academic who acted as the project developer

and charrette leader working in conjunction with 6 Master of Landscape Architect students and a

practicing private sector landscape architect. Similar to Charrette I importance was given to

preliminary summaries and setting descriptions. The design team worked cooperatively in conjunction with library planners. The charrette lasted one-half day, was held June 2012, on the Auraria campus in the library space adjacent to the courtyard. The large windowed space allowed participants to see the courtyard as they collaborated, advanced, and supported inside/outside connections.

Following introductions participants were divided into five small teams; each facilitated by one design team member. Designers responded to questions while helping participants work through the phases from ideation to concept development. They moved to concept refinement that led to reflection. Tasks were divided into four parts as they completed a sensory exercise. For example, one question asked, "How does the space make you feel now and how should it feel in the future?". Once addressed participants moved on to, "What is the purpose of the courtyard, what's the potential and what could it be used for in the future?". This approach allowed participants to generate lists of "what works," and "what doesn't work," (Figure 2.22).

Figure 2.22
Charrette Presentations, Continued
Note. From "A comparative study of two design charrettes: Implications for CO-design and participatory action research," by Z. A. Howard and M. M. Somerville, 2014. International *Journal of COCreation in Design and the Arts, 10*(1), p. 52. (*https://www.tandfonline.com/doi/abs/10.1080/15710882.2014.881883*). Copyright by the Authors. Reprinted with permission.

The final exercise advanced participants ability to refine early ideation within manageable proposals with ideas/concepts that might be utilized to create the redesign. Participants were challenged to identify and describe differing activities for a joint use courtyard with the goal of addressing future campus/library/courtyard needs and/or uses. The last challenge asked participants to identify what elements might be located within the space and asked them to create a prototype plan from identified concepts using those ideas.

Team leaders (FOs) were responsible for taking notes, concept development, and acted as the presenter. Once all exercises were completed design team members facilitated group presentations then presented their teams proposals; this was done to support vocabulary and design element(s) consistency shown in Figure 2.23.
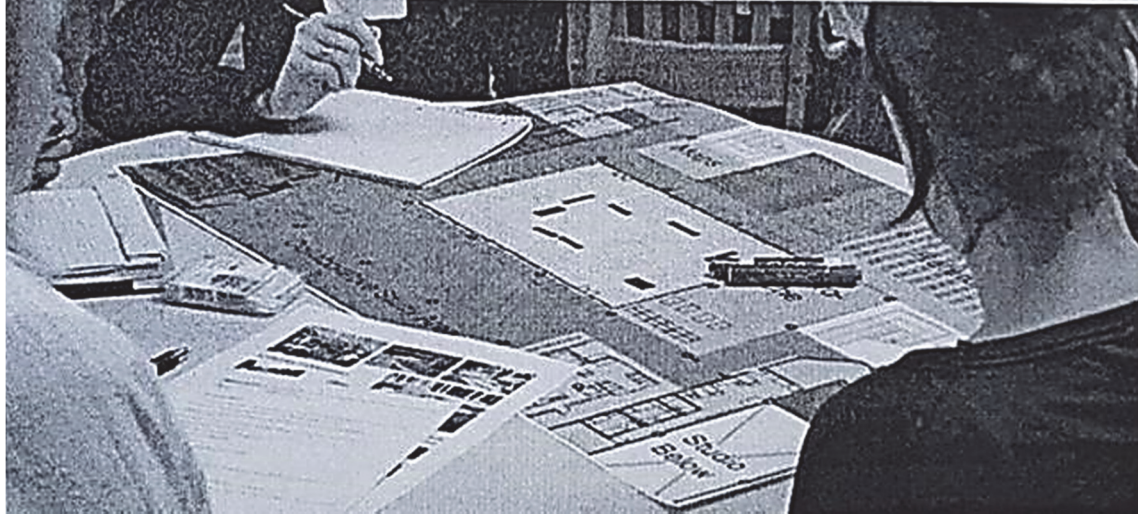
Figure 2.23
Team Charrette Experience Creating Courtyard Concept
Note. From "A comparative study of two design charrettes: Implications for CO-design and participatory action research," by Z. A. Howard and M. M. Somerville, 2014. International *Journal of COCreation in Design and the Arts, 10*(1), p. 53. (*https://www.tandfonline.com/doi/abs/10.1080/15710882.2014.881883*). Copyright by the Authors. Reprinted with permission.

Authors noted similarities and differences between the two charrettes. While both appeared to be successful each provided differing experiences and outcomes. For complete project information, budgets, and charrette experiences see Auraria Library (2011). Researcher lessons learned were shared as Howard and Somerville (2014) related:

- Design charrettes (I) use a foundation of making to create a learning space for participants to both co-create design outcomes and build further shared understanding amongst participants.
- Design charrettes (I) should be collaboratively designed with the PAR team to ensure authenticity of the process of 'designing with' rather than 'designing for' and to gain optimal design participation. (p. 54)

For example, Charrette I participants felt the experience of working with the architects was not authentic stating that study results showed that the architects refined concepts for presentation, yet they had reduced many of the participants' ideas. Architects drew on team

inspiration but advanced ideas they desired that had not caught on with participants. This showed architectural ideas were given more weight and prioritized in presentations (see Figure 2.24).
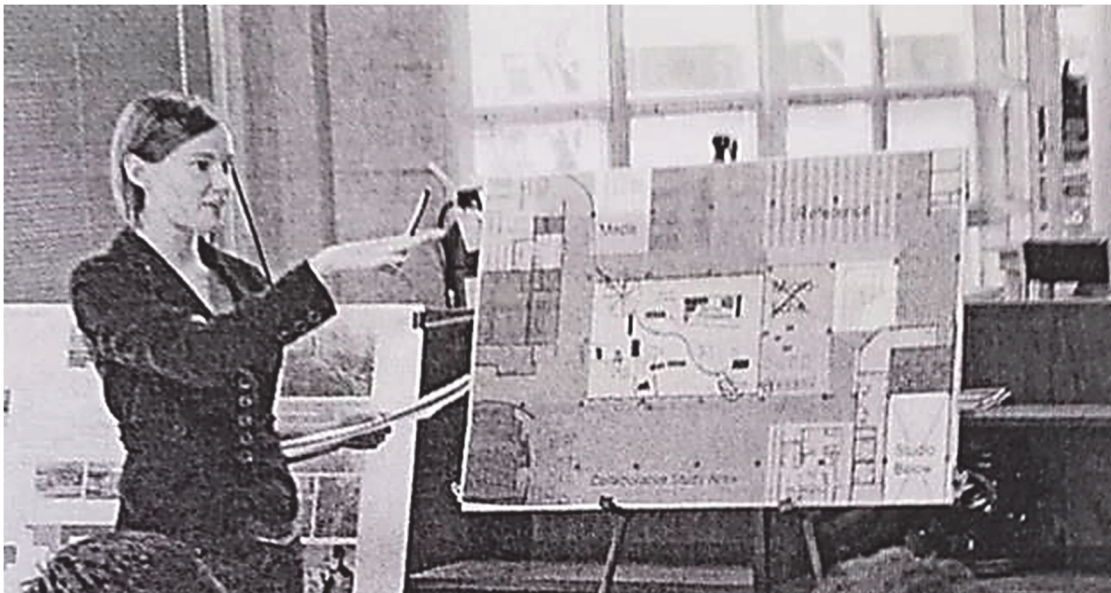
Figure 2.24
Participant Presentation Sharing the Team's Courtyard Concept
Note. From "A comparative study of two design charrettes: Implications for CO-design and participatory action research," by Z. A. Howard and M. M. Somerville, 2014. International Journal of COCreation in Design and the Arts, 10(1), p. 51. (*https://www.tandfonline.com/doi/abs/10.1080/15710882.2014.881883*). Copyright by the Authors. Reprinted with permission.

When teams, including architects, toured the library and discussed/compared each proposal participants shared it was obvious their proposals were discounted. It was noted this occurred as participants worked together to formulate their vision by experiencing the space. Teams reached a shared understanding of what the project should look like while aspects they believed were important were lacking in the third proposal created by the architects. "The architects had underestimated the engagement and investment participants had in the process. Architects went on to refine design (proposals) and report as required by the engagement;

however, the relationship with the firm concluded at the end of the (charrette) project" (Howard & Somerville, 2014, p. 55).

In contrast, Charrette II's strong relationships resulted in a final plan being developed, in less time and with positive interactions that supported shared experiences among participants. In the final report this charrette identified as culminating in "actual planting of the agreed upon courtyard landscape designs with continuing volunteer involvement from landscape architecture academics and students in maintaining the courtyard" (Howard & Somerville, 2014, p. 55). The authors found that both cases provided learning opportunities built upon all phases. The charrette created a learning space that advanced co-creation activities resulting in design outcomes that build shared understandings among participants. Pre-charrette engagement resulted in increased participation over the charrette duration. Charrette II included follow-up sessions where participants further refined presented proposals. Participants shared results among a panel of facilities, planning, and library representatives.

The majority of involved parties agreed charrettes provided stakeholders an opportunity to participate as co-designers, advanced collaboration, and supported project delivery. Final study observations shared that "the outcomes from using other codesign frameworks within PAR initiatives situated outside of the design discipline would be an area for further research" (Howard & Somerville, 2014, p. 59).

Summary of Literature

In summary, literature supported a paradigm shift that comes when TD, synchronous and asynchronous environments, are introduced. Researchers reinforced the need for TDL, and knowledge integration required for success in a 21$^{\text{st}}$ century marketplace, while expressly reviewing benefits and challenges of implementation. The goal of knowledge sharing was clearly

defined by allowing lecture-based courses to migrate to discussion based; while the key was to create active learning environments driven by technology, innovation, and discovery. Blended/hybrid TDM teaming and TDL were consistent with methods of facilitating critical and higher order thinking. Literature showed that the majority of charrettes were multidisciplinary, while processes and outcomes differed, all implemented three or four stages using multiple methods of qualitative and quantitate data collection. While methods varied by project most utilized descriptive discussion-based workshops/seminars that emphasized collaboration and discipline knowledge sharing that led to joint learning. It showed that adaptable classrooms can be innovative, interactive, and well designed to benefit students by incorporating IT enabled systems applied too blended learning with traditional.

Literature showed charrettes can be enhanced by the inclusion of on-site and off-site environments supported by technology, essential for future research. These appeared more challenging as implementation was more time consuming and difficult. Face-to-face and virtual learning environments created user friendly and economically viable settings. They saved travel time and costs and reduced the ecological footprint, while massive quantities of materials were shared online rather than printed.

Combined environments presented differing challenges identified as virtual time delayed responses from participants. This created an often frustrating silence or everyone speaking at once; yet I trust this could be limited when participants use of OWL technology[5]. Mentioned was the inability to establish a difference from FTF 'over speak' experienced in many classrooms or environments. The researchers attributed this to excitement by participants as much as to

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[5] OWL Intelligence System ᵀᴹ automatically shifts the camera to whomever is speaking, eliminating the often 'over -speak' associated with virtual/online meetings.

technology drag. When reviewing three environments (all virtual, all FTF or combined

FTF/virtual), each presented challenges, none were viewed as insurmountable. I believed

adapting Information and Communication Technology (ICT) based tools, educators and

researchers could initiate an environment conducive to learning at any time, among differing

languages, time zones, and cultural settings from anywhere in the world.

Reviews extensively discussed the benefits and challenges of TDL. Literature addressed

TL potential provided higher education while supporting the implementation and utilization of

surveys, TDM teaming, and participant team building exercises. Literature defined the need for

incorporating preliminary research and utilization of a charrette pre-read (course/seminars).

Studies explored the need to shift from assimilating information to constructing meaning and

confirming understanding in a community of learners, among diverse disciplines, communities,

and stakeholders. Research provided key points revealed using TDL and TDM charrettes invited

all participants to collaborate, share knowledge and ideas, resulting in a shared vision. Charrettes

required and facilitated leaning by inviting:

- student engagement directly across disciplines,
- close and continuous collaboration among participants during all phases,
- consistencies in a structured and equitable format,
- responding to various contingencies raised during the process, orientated toward action, making linkages across disciplines,
- generation of knowledge that address societal problems but contributes to solutions,
- placing egos aside for the greater good,
- learning how to step back and let the process drive direction of project design,
- learning to engage with community and domain experts,
- developing social and professional relationships and thinking outside the norm (IPD).

What I learned from the literature review was best summed up with a quote from the

Sutton and Kemp (2006) study by a charrette leader who said:

> The whole issue of broadening the disciplines is that everybody can look at the elephant
> from their perspective, you know, and then you sort of come together on it. And the

process works very well if you have both a facilitation process that enables people to understand it from the [experts'] point of view, and you have a facilitation process that really does not presume anything about the [community's] input…because these people are very well-informed (charrette leader). (p. 1)

The five charrettes reviewed showed recurring themes when examining how charrettes, especially those developed in conjunction with a university, which often has the means and influence to invite distinguished private sector practitioners with department faculty, local consultants and community leaders serving as role models and jurors for student presentations. Inviting professionals from multiple fields afforded students the opportunity to work with well-established professionals who shared experiences, both inside and outside a university environment. The fourth study supported this belief and my desire to add a mission statement and rudimentary project information; how much information is too much was one of the goals for this addition. The Auraria study shared the challenges of working with PO/FO biases, and how personal agendas can influence participants, teams and ultimately project outcomes.

Findings showed that most students participate in charrettes as part of course work doing much of the early ideation, planning, and research first then presented outcomes in on campus lectures or juried presentations. Others attended/competed in charrettes for monetary awards (competitions). Kelbaugh (1997) identified this view revealed that because many charrettes are not primarily for educational purposes students experience a limited role; he shared findings that in most years, one-third of participants lost interest and dropped out while others lacked skills to keep pace with the work.

A reoccurring theme evolved from shared methods, all supported a recursive, iterative layer(s) of data collection. Shared below is a recap of the methods culled from the majority of charrettes reviewed. Researchers, and most charrette planners, implemented processes that

followed some form of plan, act, observe, and reflect. Approaches, processes, advantages, and

challenges were seen as:

- multiple day events (rarely half day, most 2-5 days)
- multidisciplinary/TDM teams
- participant observer (PO) and facilitator observer (FO) interactions can advance and/or inhibit ideation and project development; they can result in positive participant experiences or can taint participants to the entire TDL/charrette process; advancing or prohibiting transformative learning
- community partners/stakeholders familiar with problem/project site become participants
- few to no predefined parameters; most provided a single sentence problem for participants' development
- qualitative, narrative analysis was utilized most in conjunction with focus groups, PO/FOs, pre/post surveys, and evaluations
- participant presentations were either graded course work and/or juried presentations
- participant recruitment among all levels (academic, private sector, volunteers, and community members) experienced problems with sample size and attrition among volunteers and reduced sample sizes
- evaluation of existing site and/or proposed site (field trips, mapping & evaluation) facilitated observations
- brain storming and ideation utilized/addressed planning by all
- team critique of select design solutions advanced planning/acting
- proposals using select criteria advanced design solutions, innovation allowed charrette recipients to act, secure funding, or community support (design solutions-action)
- final presentations: firsthand insights to solutions supported participants' reflection and TL.

McGregor and Volckman (2011) discovered that there is no single way to bring TD to

higher education; rather implementation depended more on how leadership approached change

and context of the university. Results shared initiatives from six universities and one research

council; initiatives ranged from:

(a) redesigning entire universities to a transdisciplinary perspective,
(b) designing first-ever transdisciplinary master or doctoral degrees for a university,
(c) ensuring external funding for transdisciplinary research initiatives within universities,
(d) university-coordinated transdisciplinary projects with industry and/or communities,

(e) recognition of the need for inter-sectoral conversations about how higher education curricula policy can change to reflect 21st century problems. (p. 2)

In conclusion, literature documented multiple theories and study findings that showed TDM charrettes supported and advanced TDL such as codesign, communication, and negotiation skills that were consistent with traditional higher education values. TDM charrettes have the potential to enhance both the effectiveness and efficiency of meaningful learning experiences (Dennison, 2009; Howard, 2006; Howie & Bagnall, 2013). Reviews shared that half of all charrette initiatives explored and relied on corporate funding, mainly secured from industry and stakeholders, others confirmed that ongoing seed and development monies were required to advance and sustain TD work/research. Least discussed or reviewed were the politics of TD research in higher education and how relations among disciplines effect advancing a TDM agenda, while none identified or shared a model approach to successfully implement TDL within the university setting. Multiple reviews identified TDL, TL, and how teams experienced, learned, and shared knowledge among disciplines. Researchers reviewed and discussed how they were unable to measure results or answer questions until post charrette. Specific instruments utilized to measure if, and how TD, TDL and TL or shared how knowledge occurred were not identified.

CHAPTER III – RESEARCH DESIGN AND METHODOLOGY

> The fabric of the university has to reflect the fabric of society. Confining the solution of complex problems within traditional university settings leads to too few perspectives, let alone melded perspectives, and it sets up the university to be out of synch with reality. (McGregor & Volckmann, 2011, p. 109)

This chapter introduced the study research methodology. Numerous TD dissertations from differing disciplines were reviewed to determine the best method to share research design, development, and evaluation processes. Each differed on how to present this portion of the study, depending on their field of study. After careful consideration I implemented an admittedly atypical approach as this chapter was organized as it unfolded. It is recursive and as such does not follow a strict presentation order as many processes occurred simultaneously, or across similar timelines, while other processes were developed in consideration of charrettes reviewed in Chapter II. Harris and Lyon (2014) in their TD research aptly pointed out that the future of TD research depends on the supply of researchers willing to explore these approaches, as there can be tensions among specializations versus embracing an approach that involves numerous stakeholders and disciplines.

This study explored and described knowledge transfer across multiple domains and participants' ability to think critically while sharing knowledge and communicating among disciplines. It described evidence using two reflection and observational exercises and non-reflective dimensions (doing by performing an activity, socializing, and interacting) of TDL. This chapter began with discussions of an exploratory study, the XQ School of the Future Challenge, a competition. It shared an overview of the charrette processes implemented, findings and reflections. This established the basis for deeper understanding of participant experiences

working in a TDL environment and provided constructive findings to advance the Cherokee study. I implemented findings to improve development of TDL and use of a TDM charrette; it augmented survey design and revealed participant experiences during planned challenges to solve an actual problem.

For the purposes of this study blended (hybrid) learning was defined as an environment where students access electronic and online media information combined with traditional FTF teaching/learning. It is an experiential learning experience where online and FTF components work together to deliver blended learning (Christensen Institute, 2019). For example, this study incorporated digitally enhanced pre-charrette research, surveys, pre-read materials, and maps. Location was not as important as methods. For example, study participants were able to access the internet to conduct research during the charrette working freely as a team. They received assistance from PO/FOs and on-site technology experts when required. Participants unable to attend a field trip were able to access activities and similar experiences supported in an online environment.

Exploratory Study: XQ School of the Future Charrette

> What vision of educational learning environments might be created if we could magically diminish the gaps of misunderstandings among perspectives on the school environment held by architects, planners, teachers, school administrators, the community, parents, and students'? What if all these groups better understand the complexities involved in planning and designing educational facilities. (Lackney, 2007, para. 6)

XQ revolved around a competition created by Lauren Powell-Jobs and the Emerson Collective she founded in 2011; open to anyone willing to commit to transforming schools for 21st century students. Teams were recommended, but not required, to address the wide-ranging needs of the challenge. I began recruiting individuals among numerous disciplines, non-academic professionals, and associates to join the challenge as a team. The challenge required a

10-month commitment, should teams advance among multiple phases, and included a final timed

challenge delivered to founding team members. The XQ Super School Project's (2017) objective

was to turn ordinary school development on its head, with the following statement:

> 70% of high school students in America feel that the classroom experience isn't relevant
> to their daily lives; while every year 750,000 high school students drop out and three in
> four admit to "mentally checking out" during the school day. (para. 2)

Once established the founding team agreed our school concept would benefit from architectural

design plans to define and support our model.

Planning and Development Overview. XQ Challenge questions were released in phases every

few months; our team was expected to address specific areas of school design, including

curricula development, financials, and implementation plans. For example, one question in Phase

I asked, "What are your top three insights about the challenges facing your prospective students

in the 21st century, both globally and in your community?" (XQ Institute, 2016, para. 6.).

Our team identified early development needs and goals for the challenge. As with TD

teams this required each member to cross a number of topics and subjects to maintain forward

movement on short timelines. Early steps necessitated team members were able to guide

charrette implementation and act as content experts. I shaped a team vision that invited

participants interested in an exodus from more traditional ways of thinking about education and

school development. I asked each associate to consider the time required and if they could meet

the expected deadlines among challenge phases.

Charrettes are often the 'go-to' method for community development projects among

design professionals. We agreed if a charrette model was implemented feasibility had to advance

research and grant development. We decided to concentrate on four key areas essential to

support team interactions and reflections among disciplines and for descriptive data collection.

We agreed using a TDM charrette for project development would advance our goals and meet proposal delivery. Once founding member consensus was achieved invitations were emailed and/or hand delivered to educators and private sector individuals who expressed interest and willingness to act as PO/FOs or as content experts. Volunteers from education, non-profit/private sector, business, parents, stakeholders, and community members were joined by professors, K-12 educators, charter school developers, high school, undergraduate, and graduate students. I invited speakers from outdoor education and sustainability programs to present relevant program information during the charrette kickoff; power point presentations were recommended. All involved agreed to establish a prototype school based on educational philosophies using a hybrid-learning model that integrated project delivery across community, curricula, and facilities. Due to the number of participants, founders agreed that seven to ten POs would be required; seven were confirmed to assist two Facilitators (the researcher and one professor). POs had extensive education and/or industry experience, many were content experts in curriculum and/or non-profit development, charter school development, architectural design, construction, sustainability, and/or youth development. This team was supported by high school student parents.

During the charrette POs shadowed and observed participants, interacted, and collaborated among teams. POs used a Socratic method to support participants when asked questions by directing them to available resources, instructed not to directly solve challenges or provide answers. They assisted teams in maintaining focus, and timelines for work completion; none were asked to document interactions among participants. The development of TDL offered student participants an opportunity to integrate a hybrid learning environment using IPD during the charrette. While there was no singular context that described a TDM charrette among

disciplines and/or projects, one commonality from the literature was the critical role played by pre-charrette sessions that guided the process.

Charrettes were the tool created to advance an integrated vision among diverse disciplines and participants. In the current environment projects are globally distributed, and often teams must communicate virtually. This required participants to manage both virtual and on-site teams, stakeholders, and communities. I implemented a charrette model as a tool to describe a TDM project scope, while learning through reflection. Research showed that project failures most often occurred when teams were unable to translate knowledge among members from diverse backgrounds, expertise, and experiences (Roggema, 2014). Charrettes presented participants an opportunity to identify interconnections among their teams, providing a real-world experience. This combination created a bottom up, top down approach derived from friction that occurred as silos broke down; friction challenged participants to learn new ways to communicate and supported innovation.

In summary, the decision to enter the XQ School of the Future Challenge, was challenging and time consuming. Much was directed by the demands of XQ and participation required ongoing contributions and involvement. While tempted to omit this process, due to time constraints, this step proved to be a valuable planning tool for the Cherokee study. Completing XQ provided opportunities and exploration/interactions with participants, stakeholders, and educators that I sought for the Cherokee study. XQ identified opportunities to address potential, unforeseen difficulties, and challenges as I proposed a multiple location charrette. Interactions with XQ participants, stakeholders, and educators supplied support for the Cherokee study. Team members reviewed and recommended several survey revisions and supported the researcher's desire to expand the study to include eight disciplines.

XQ Charrette Development

      Understanding the difference between a workshop, brainstorm session, and charrette while identifying what benefits and outcomes to expect from charrettes were important first steps among the team planning process. It was imperative and agreed that participants understood the concept as well as desired outcomes from this project. To facilitate and manage the development of the competition, coupled with perceived challenges of working with a global team, I adapted a Project Organizational Map and Matrix based on Chris Garbett's (2013) matrix. When delving into the charrette concept, I conducted a needs analysis to address required participants. I explored who needed to be there and why, identified what roles needed to be filled, and what expertise was essential outside of the founding team. I concluded that facilitators and participant observers needed to be well versed in the charrette process. A pre-charrette founding team meeting established a clear understanding of overall project and grant process requirements. XQ involved 101 participants including students, between 16-24 years old, community members, educators, and stakeholders who collaborated in FTF and virtual/global environments.

      Pre-charrette surveys were designed to address participants' experiences, personal feelings, and ideation about ways to improve high schools. Questions were formulated to address XQ's Phase I challenge. Pre and post-charrette surveys were delivered online, administered by Qualtrics; divided into blocks. Included were all requisite release forms for charrette participation: audio/video, photographic recording, non-disclosure and non-compete clauses. The XQ study was comprised of several components, based on a Zaillinawati (2006) article. I utilized this research to develop a reference flow chart that aided development and addressed the challenge. Post-charrette 44 college students enrolled in Interior Design course work (3rd/4th year) completed a survey.

Charrette feasibility and early planning allowed me to concentrate on four key descriptive

areas of data collection essential to support observations. I concluded charrette participants

would be expected to address and develop areas identified as 1) an innovative academic model,

2) a sustainable/innovative facility design, 3) a distinctive development and utilization of PODs

on a school campus that supported community, and 4) the creation of a flexible, adaptable

campus for K-12 students with a focus on 9th - 12th grades. I identified end-users (demographics)

comprised of students from high poverty areas, several were homeless. Many had unstable

family lives, the area included high rates of violence, drug use and crime. The community

supported limited opportunities for higher education and/or vocational/technological training.

Between August 2015 (XQ announcement) and November 2015 founding team members

and high school students worked in collaboration with Drs. Katharine Leigh, Carole Makela, and

the researcher. I partnered with fellow graduate student Amy Rubinson and Kathy Zlomke, from

the Colorado League of Charter Schools, to develop a participant binder utilized during the

charrette. Binder development identified four primary areas of interest and encompassed the

following:

1) fact-finding of education programs in the target area, including demographics, and services currently available to the Montbello, CO community,
2) meeting and recording students' visions and inputs from domestic and international participants; conducted one-on-one and in online group interviews,
3) combined with public input, and
4) shared parental review and support.

Fact-finding: The team compiled an in-depth briefing resource book (charrette binder) defining key development areas for use by participants/teams during the charrette. Team members had two weeks to review these materials and each attended one meeting with Domres, Leigh, Makela, and/or Zlomke, followed by review and input from regional, national, and international team members. Survey and essay projects were developed, reviewed by founding team members and delivered during brainstorming sessions with students.

Student Vision: Students filled living rooms, computer screens, and round tables to aid in the development of the charrette binder, adding what was important to them; and to learn more about being participants at the charrette. None knew what a charrette was nor how it functioned; rather they came armed with passion and a desire to be heard. It was their responsibility to share concepts and ideas making the process fluid during charrette sessions.

Public Input: In early October 2015 public involvement and support was sought. Meetings and presentations were shared with staff at The Center for New Energy Economy, three Denver Public Schools, the Denver Department of Education, the Colorado League of Charter Schools, select parents, and teachers of high school students; both state side and internationally. A WELL[6] Building Standard® presentation and the Green School conference were attended by team members Domres, Leigh, and Zlomke.

Public Review: Charrette participants, founding members, and invited speakers attended the charrette on the Colorado State University campus in Fort Collins, CO. Facilitated by Domres and Leigh, power point presentations explained the charrette process, identified the addition of three challenges to be delivered during the day. Challenges compelled, participants to address project changes; each delivered to simulate a private-sector project such as requests for information (RFIs), design changes, and the addition of community services not previously considered. The charrette concluded with team presentations accompanied by preliminary ideas and recommendations that advanced the proposed school concept. Teams addressed sustainability, curricula development, and community access, for a year-round campus open during holidays with extended hours, while envisioning the creation of a cohesive campus of individually developed PODs. Interior Design students had 2 weeks post-charrette to fully develop their presentations for course credit/grades and portfolio inclusion.

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[6] "The WELL™ Building Standard takes a holistic approach to health in the built environment addressing behavior, operations, and design. WELL is a performance based rating system that monitors features in the built environment that impact human health and well-being through air, water, nourishment, light, fitness, comfort, and mind. WELL is grounded in a body of medical research that explores the connections between the buildings where we spend more than 90 percent of our time, and the health and wellness impacts on us as occupants. Well Certified ™ spaces can help create a built environment that improves the nutrition, fitness, mood, sleep patterns and performance of its occupants". (p.1) For more information see https://standard.wellcertified.com/well

XQ Challenge Process. XQ protocols were strictly adhered to ensuring compliance with

proposal requisites. XQ developed grant phases that consisted of application questions

tackling specific areas for proposal development. Submissions included images and videos; each

phase supported research/materials. School concepts included an overview of our educational

philosophy and conceptual school models including architectural plans. Phase I Discover

sections identified as:

Phase I - Discover

1) Students in the 21st Century
2) Youth Experience and Aspirations
3) The Science of Adolescent Learning Design (Invent a school)
4) School Mission and Culture
5) Teaching and Learning
6) Student Agency and Engagement
7) Networks and Partnerships

Once completed I submitted (11.15.2015) the proposal; it was accepted by XQ for eligibility to

advance to Phase II on December 16, 2016.

Phase 2 - Produce a practical plan required to advance to the next phase that expected the
team to address the following:
1) Human capital and training
2) Facilities, technology, and time
3) Implementation capacity
4) Performance management and evaluation
5) Governance
6) Financial model and sustainability

I submitted Phase II documents February 15, 2015; it was accepted on March 1, 2016, advancing

the team to the next phase.

Phase III-The Founding Team Challenge was held May 12, 2016 on the CSU campus
using ZOOM to connect team members. This Phase required us to explore the logistics of
opening a new or redesigned school or to develop a new, innovative programs within an

existing school. During this phase XQ implemented a team challenge designed to identify each team's ability to work together under pressure. Local team members included Drs. Carole Makela, and Renee Harmon, joined by the researcher, Gayle Forester, and one CSU undergraduate architectural design student Amanda (last name withheld to protect identity); Dr. Don Quick supplied and set up Kubi robots and ZOOM; he was assisted online by Francois Etienne, a technology developer, and IT Manager for the Frost Museum (Miami, FL).

Invited content and industry experts attended and participated in the timed event. Attended virtually were team members Fritjof Capra from Eco Literacy, Fu-Tung Cheng from Cheng Design, joined by Dr. Amy Rubinson, all from Berkeley, California; Etienne was joined by Arden Charles-Frederick, a college student, both from Miami, Florida. The addition of these individuals provided the team with expertise from multiple specializations coupled with sustainability and private-sector experiences.

As the founding member I knew and had worked with each team member previously, however most other participants were unknown to one another. This team was charged with responding to questions delivered in real time by XQ developers. Many believed a multi-site environment would be challenging and distracting, especially during a timed event. It proved to be beneficial to our model and it worked well as participants were respectful and open to ideation. We openly debated conceptual pros and cons. Our final submission included a four-hour video recording of our interactions that depicted our strategy for development, negotiations, and outcomes addressing XQ project specific questions. No alterations were allowed to finalized responses by XQ; our proposal and responses/interactions were submitted as above.

Submissions were evaluated after each phase by XQ using quantitative and qualitative rubrics based on our proposals to each phase criteria, then assessed by XQ founders who invited content experts identified as: a) education, b) youth development, c) innovation (architectural design), and d) curricula design. Grant awards were announced late August 2016, with follow up awards through end of year, 2016, discussed further in Chapter V.

To recap, Phase One participant teams created an innovative vision for a school of the future for high school students; participants were required to define and realize students' needs addressing the world they would enter post-high school. Phase Two asked participants to visualize, "dream big", and "sketch out ambitious designs" (XQ Institute, 2016, para. 6); it required participants to define their ideas on how students learn in the 21st century, including youth experiences and aspirations while incorporating the science of adolescent learning. Virtual participation was seamlessly implemented, and findings supported my decision to proceed the development of a two-site Cherokee charrette that would include off-site/virtual participant team members.

XQ Participants and Activities

I secured support and commitment from educators in Uganda and Costa Rica, to participate in the charrette with stateside students to advance a global approach. Educators designed student coursework to address the XQ challenge. This addition facilitated and addressed our desire to globally built an educational program that expanded cooperation among students, disciplines, and across borders. State side 33 participants included 4th year level Interior Design (DM676) students from Colorado State University (CSU), joined by eight 10th through 12th grade high school students from Aurora, CO, and eight junior/senior level Construction Management CSU students. Due to technological difficulties outside the U.S., international students were unable to attend the charrette. The study was structured to highlight risks and strengths in achieving TDL rather than a comparison of differences in knowledge delivery as recommended by Diaz et al. (2009). Multiple disciplines were represented with the goal of TDL resulting in TL.

The XQ binder was concurrently developed with Colorado high school students. I opened my home, invited high school students in Denver, CO. and worked with them to build the binder. Students from geographically distinct locations with diverse interests and skills arrived and developed a local perspective on what schools were currently doing. I explored and asked students to identify what they felt was lacking, addressing specifically what currently worked well, what did not, why, and what their dreams required them to learn to be successful post-graduation. I utilized surveys and essay questions delivered in person or online to participants, depending on location. Pre-charrette reflections included three questions; emailed to students at the Outspan School in Bwaise, Uganda. Student questions were:

- What do you like most about your current school and why?
- What do you like least about your current school and why?
- What would you change and how would you do it?

Students responded to these questions and created process maps and bullet point essays. Most frequent responses included:

- later starts to their day for classes (Ugandan students live on campus and begin their day at 5:30 AM, classes begin around 8:00 AM and end at 4:30 PM, followed by chores)
- better equipped technology labs, communication tools (globally), and boards, these students still used chalk boards, and
- better facilities, most classrooms and/or living quarters did not have adequate daylight to support evening study, after classes.

Interior Design students were provided the following pre-charrette questions for preliminary research. Responses were based upon personal feelings and experiences identified as:

1) what do you think young people need to learn today to succeed in the future?
2) what can we learn from adolescents (13-19 yr. old) about designing a new school and how do you prefer to get lesson?
3) how do you think teenagers learn and grow best?

Content and frequency analysis were completed, and respondents top three answers included

wanting and/or needing:

1) learning how to collaborate and work with diverse groups of people (face to face)
2) how to acquire life skills for living and jobs (responsibility, business skills, communication, how to get a balanced life) and,
3) financial literacy (responsibility, loans, banking, credit, bill pay) tied with time management (organizational skills, study skills, learning skills).

Participant survey questions were formulated to address the XQ challenge and developed

to prepare teams for the charrette by focusing on their personal high school experiences. Surveys

were implemented to gather data on participants personal high school reflections and

experiences. I concluded this approach was applicable for college students to complete the

survey as their memories of high school were perceived to be fairly recent and relevant.

XQ Pre-charrette Survey The student pre-survey consisted of 48 blended format (Likert style,

multiple choice, and fill in the blank) questions (Appendix A). Participants expressed difficulty

in accessing and completing the survey using Qualtrics in an on-campus lab; a new survey was

developed for Cherokee to eliminate technology and time issues noted by post charrette

discussion with student participants. Survey findings were limited by the number of responses

and/or completed surveys. This resulted in insufficient data to do statistical tests; it was noted a

different approach would be required for future studies.

XQ Participant Experiences

Early on student participants voiced reservations about being asked to address a project

without having prior access to preliminary information, reinforced by post-charrette survey

comments. Participant push back was encountered by study protocols that assigned participants a

specific POD for development, unknown to them prior to the charrette. Students expressed

feeling challenged when expected to locate, identify, and implement new knowledge, skills

and/or expertise outside their discipline; especially when asked to create a project outside of their

personal interest and/or skill level. Further resistance was expressed when participants were

assigned a team versus allowed to self-select either aspect. My rational for implementing and

assigning teams was to replicate a life world problem more closely in the private sector as

employers rarely allow entry level employees to pick and choose their assignments/projects.

Attendees from interior design course work were given a post-charrette survey consisting of

seven Likert style multiple choice and open ended, complete the sentence questions. Issues

observed and identified from participant post-charrette surveys included:

- technological problems with participants (on-site and globally) stating they were unable to save or close completed surveys for submission,
- participants did not fully understand terms such as charrette or PODs
- length of the survey (taking too long to complete outside class time), and,
- reluctance to share ideas and information among disciplines for fear of making a mistake.
- three participants expressed reluctance to attend another charrette as they felt overwhelmed by the magnitude and short time frame of the project, resulting in dissatisfaction with the TDM process and charrettes.
- other comments included a request for more pre-charrette information about XQ, their role in study tasks prior to the charrette. Participants felt advance knowledge about the project would have provided directional and concept information thus saving valuable working-time during the actual charrette.

The final proposal included an analysis of charrette findings and was sent to XQ. Upon

completing the XQ Challenge I conducted a second needs analysis to examine and test research

protocols, data collection instruments, and sample recruitment strategies in preparation for an

additional study; identified were what worked well and what did not. For example, the decision

not to develop and have PO/FOs complete pre or post-charrette surveys was not viewed as a

problem at the time as these individuals were not asked to document interactions. While survey

and PO/FOs observation data were not required to complete the XQ challenge it was identified

as a missed opportunity. The lack of extensive data collection using both methods was identified as a potential study flaw to be avoided with the Cherokee study. All comments were recorded and identified, referenced for future studies with changes. I implemented findings for this study, included the addition of a pre-charrette read; surveys were revamped to address Cherokee specifically and revised to better assess team development and knowledge transfer, resulting in TL.

Post-charrette I completed a charrette review and descriptive analysis for inclusion with our final phase response to the XQ challenge. Included with submission were interior design students' post-charrette portfolio mission statements and their completed architectural design concepts. I also condensed and shared each teams POD design philosophy supported by sustainability statements. I completed and submitted my post-charrette sponsor funding report to the Colorado League of Charter Schools. Upon receipt I was asked to present the project at their annual conference. As XQ was a team effort I asked Dr. Leigh, graduate student Cassie White (MS Interior Design) and student team members to join me and present their projects at the conference. The Presentation, "Implementing Design Thinking and the Charrette Process in the Classroom" was delivered to approximately 35 conference attendees on February 26, 2016, in Arvada, CO.

XQ Post-charrette Survey Findings and Discussion

Post charrette personal observations, reflections, and feedback from NPOs was reviewed to identify problems that might affect research instruments for the Cherokee study (Zaillinawati, 2006). I concluded lessons learned from XQ, coupled with developed project management tools, could be applied to future studies, especially when implementing TDL, TDM charrette and TL. Responses were written using descriptive narrative, and no problems were encountered when

conducting a post charrette review. Data were collected from 36 interior design students who

completed the post-survey (Appendix B) with the following findings as:

33% of participants had participated in prior charrettes,
67% had no prior experience, attendees rated charrette participation aspects as follows:
    a. 21% experiencing a "real-world" project
    b. 19% being able to share their experiences about what they think schools should be like now and in the future, and,
    c. 18% being able to use what they were learning in school (classes)
        the most challenging part(s) of the charrette for me were (1 each person):
29% responded with "Other" comments – identified as
    a. working in a hectic environment,
    b. more than discipline knowledge required to create the project,
    c. not having guidelines presented problems for teams,
    d. lack of prior knowledge about the XQ challenge and/or charrettes,
    e. 24% said working with different disciplines was a challenge while,
    f. 25% said they did not have enough information and/or content in the charrette binders to develop a plan,

15% did not understand the challenges given, and, 12% responded they lacked enough time to ask questions of industry and education experts coupled with the inability to collaborate with other teams.

13% responded they lacked enough time to ask questions of industry and education experts coupled with the inability to collaborate with other teams.

The charrette proved to be a valuable learning experience for me:
    a. 52% agreed it was a valuable experience,
    b. 30% strongly agreed,
    c. 12% neither agreed nor disagreed, and,
    d. 3% disagreed while
    e. 3% strongly disagreed.

When asked about the length of time planned for charrette attendance responses identified as:

56% felt it was too long,
40% felt is just right, and.
4% felt it was too short.

When asked, "If the charrette were held again what three changes would you make", responses were:
    a. do not do it on one day, do it for a couple days,
    b. allow people to work anywhere in the building and meet back at certain times,

c. would have liked feedback throughout the process and not just at the end when we got a lot of feedback; earlier feedback would have helped us with ideation,

d. provide students a better understanding of what was going to be happening during the charrette,

e. a site visit in advance would have been agreeable and helpful, and,

f. provide more guidelines for our work and have more professionals from different fields to help, and

g. participants wanted/needed more pre-charrette site and project preparation/information.

Additional feedback included statements such as:

- overall, a unique learning challenge in a positive way,

- I enjoyed the project, but did not enjoy the charrette process as much,

- I would have liked to have more feedback from a variety of individuals or work with another team halfway through to go over ideas and get feedback…getting other ideas would have opened the door to new ideas, and,

- I had an exciting time collaborating with people, it was great to see professionals from other fields share their input when it comes to my discipline.

By completing the XQ study, I identified the need for additional PO/FO training and revised participant/facilitator observation models.

The Cherokee Ranch

While writing up the final sections of the XQ challenge grant I discovered Cherokee Ranch. Ongoing TD exploration showed that a second case study could support my desire to identify TD and further explore TDL, TDM charrettes and TL. I used lessons learned and reviewed XQ participant comments. Once identified I implemented changes for this study, included the addition of a pre-charrette read. Student surveys were redeveloped to better assess Cherokee's attributes/challenges. XQ findings showed that TDM teaming and knowledge transfer resulted in TL, all findings that advanced my decision to complete the Cherokee study.

Cherokee Ranch (Exploration and Feasibility)

I am continuously asked how I found Cherokee and why I wanted to continue this research beyond XQ. I created the following narrative to allow you to join me on my journey of discovery. It began early spring 2016 when at The Tattered Cover bookstore in Denver, CO, joined by a friend we decided it was to be a day of discovery…we searched the aisles for travel books supporting Colorado's front range, one-day hidden treasures; you know the places few locals know about. We stumbled upon the listing in a guidebook as my associate shared he knew about Cherokee and some of the history. We agreed it would be an interesting adventure, so we set sat navs, drove I-25 headed south toward Castle Rock, CO. We were surrounded by multifamily high-rise buildings and big box retailers, strip malls, and commuter train tracks, joined by oceans of paved parking lots. We continued south on an eight-lane divided highway amid a backdrop of air pollution, often blocking Colorado's blue skies. Interwoven with visuals were the sounds of vehicles honking horns. We were engulfed by the thump, thump, thump of base emanating from car stereos, feeling every beat in the reverberations while we sang along to Andrew Bird's song *Tenuousness* on my car stereo.

We noticed our fellow travelers had their car windows closed as we watched them weaving in and out amid traffic as if participating in a LeMans race. Drivers passed us uninterested in our journey, rather focused on how rapidly they might reach their destinations. Twenty-five minutes later we exited the highway and headed west toward Castle Pines. We drove past high end neighborhoods, luxury homes, and a golf course. After we passed a "King Soopers" grocery store and strip mall we approached a roundabout where the landscape noticeably changed. The road became two lanes, one for drivers, bicyclists, and walkers heading in each direction. The countryside now enveloped by rolling hills dissolved the city sounds; we

were surrounded by trees and plush lawns, peeking through the landscape were magnificent horses running along fence lines, manes flowing in the wind. We past white washed wooden fences that ended, to be seamlessly joined by split rail fences. Signs warned of deer crossings; surrounded by dense vegetation that blocked the sunlight emanating a somewhat earie feeling to what lay out of sight. Our last turn showed rock walls and a large metal gate on the north side. On the south sat luxury homes, more golf courses, and cart paths woven among tress, disappearing out of sight.

We had arrived unannounced at the Castle gates. Unexpectedly the gates were open. I turned into the unpaved, gravel drive, and immediately stopped, reluctant to drive beyond the warning signs "Private Property". Looking around for a guard or someone to prevent our forward movement we agreed to continue ahead. We drove past signs, sounds, and sights of wild turkeys that meandered across the road. They blocked our forward progression almost as a warning we were trespassing. We continued past a pole barn with goats grazing in the corrals while heavy equipment sat idle to our left side, abandoned as if the operator was either gone for the day, moved to another task, or tired of the work had simply walked away.

We continued driving along 2.5 miles of the road as it twisted back and forth. As we rounded the last bend the road revealed a small stone house with a sign announcing private residence. We continued past two barns that appeared to protect the present from the past. On our right was another road that ended at a stone wall with open gates allowing one to peer inside. Signs informed us it was the burial grounds of Tweet Kimball and two of her prized grand champion bulls. We turned around exposed to a large open parking lot framed by an expansive, uninterrupted view of the Continental Divide. We saw foothills that backed and supported the Rocky Mountains. To the north sat our first glimpse of the castle. Time had stopped! The

American flag was high atop the castle roof dotted with gargoyles on every corner as if joined in unison; moving with the wind was another flag, we agreed it had to be the Castle Insignia. We envisioned that Coat of Arms, much as one might witness flying above a great European Castle in a faraway land and time. While surveying the site we sat in silence and listened to the wind rustling the tall grasses, we could hear the flags flapping above the castle pediments. We had arrived!

Dressed in casual hiking clothing, nothing elegant as we believed would be required to support such a property, we gathered our courage and resolved to exit the car. We laughed in unison as I hit the car alarm and we heard the familiar 'beep-beep' common to most city dwellers. Laughing we asked ourselves who did we think would break in? We walked confidently past a posted *Closed Private Event* sign and were immediately approached by an event planner in the midst of a wedding ceremony set up. After introductions I shared my association with CSU as a doctoral student and rambled about my research interests. The employee appeared interested in what we assumed was our hutzpah. This led to spirited conversations that evolved around architecture and castle history. I sensed a common interest and shared my construction and architectural design background. We discussed my studies, research, and desire to expand on TD projects with the goal of creating educational opportunities, implementing local sites. I asked for permission to do an out of sight walk about, as the planner stated the wedding was not starting for four hours. She advised us to walk through the castle and meet her back at the entrance once done. Upon completing a self-guided tour we were redirected by the employee to what appeared to be a large garage or barn with copper downspouts and mullioned windows; we were next introduced to the CEO.

Anxious and nervous about our 'rough' appearance and for trespassing I was not expecting our host to be so gracious and enthusiastic. He asked if we wished a private tour of the property, we of course resounded YES! He whisked us away from the castle in a company four-wheel drive vehicle, required to access the rest of the property. He shared the storied history and passionately described the property to us. We spent the next three hours driving a small portion of Cherokee's 3,200 acres as he pointed out artifacts, historic buildings, and some of the many features of the property. We visited three homestead sites, going in and out of buildings, driving over historic roads all while being introduced to the cattle operation. Much later in our association he told me he was as well anxious about our appearance and claims of research interests.

The next day I sent the obligatory thank you note and an introduction letter that addressed the study. Three meetings later we completed a study proposal, a Board of Directors Power Point presentation and identified preliminary outcomes proposed. Post presentation a 30 minute question and answer session was completed; the Board agreed to support this study. I next developed a Memorandum of Understanding, presented it to the CEO who signed and returned it to me...and this study began.

During our next meeting, our host shared I might benefit by an association with a longtime CR & CF supporter from University of Colorado, Denver Campus. He coordinated an FTF meeting and introduced me to Ekaterini Stathopulos, MArch (Kat Vlahos), the Department Chair and Director of Preservation Research (CoPR). Professor Vlahos shared her research interests identified as "Preservation, documentation, and interpretation of ranch cultural landscapes in the American West"; she next asked me about my study concept. The professor listened and asked questions along the way. I explained my desire to explore TD using a

charrette model to explore possibilities for creating educational programs while renovating the homestead house on the Wauhatchie site. The professor, CEO, and I discussed the opportunity for UCD graduate students to attend a mini-charrette. We agreed they would utilize the Wauhatchie site to develop conceptual historic renovation plans for the existing homestead as part of a feasibility study. I agreed to coordinate with students and was provided access to findings to support for this research. The professor asked me to return the following week to join her class; I agreed. Early during the spring semester (2017) I joined architecture students in the professors' graduate level *Regionalism and the Vernacular* course. They listened to and reviewed the project proposal, then voted unanimously to add the proposed project to the course syllabus and to attend a field trip. They agreed to collaborate in a charrette environment implementing a 5-week timeline. The following week class reconvened, and the CEO and I shared a Power Point presentation outlining the project goals addressing Cherokees mission with students.

I provided students a project overview and problem statement; guidelines and project lists were not provided leaving students to identify site problems and create a team proposal of their own design that addressed the feasibility of renovation of a single homestead house (structure). I joined weekly classes and supported a field trip to the site. I worked with students divided among 4 teams, watched, and listened as they developed project proposals. This exploratory investigation supported discovery and feasibility for using Wauhatchie for my own research and charrette. End of semester students presented their proposals to 15 invited volunteers, stakeholders, and ranch employees at the Castle. Having made a final determination that another charrette might advance renovation at the site the CEO asked that I create a proposal; I included a proposed study development plan.

Research Questions and New Perspectives

This study began with three research questions:

RQ1: How does engagement in transdisciplinary (TDL) collaboration lead to students'

(participants) transformative learning among teams,

RQ2: How did participants reveal TDL knowledge, and

RQ3: Are their differences among team interactions in face-to-face (FTF) and

online/virtual settings?

Questions were revised multiple times, expanded, and amended within a TD framework,

shaped by one overarching question and five sub-questions, discussed further in Chapter IV,

identified as:

Overarching Question: How did charrette participation reveal transdisciplinary learning (TDL)

within (TDM) teams?

RQ1: How did collaboration lead to participants' problem framing and team building?

RQ2: How did participants demonstrate critical reflection and knowledge sharing?

RQ3: How did participants integrate and apply new knowledge to their final action plan

revealing TDL, interaction and knowledge sharing?

RQ4: How did blended learning enhance interactions, communications, and knowledge

sharing among participants?

RQ5: How did Participant Observers play a role in the charrette and how did they

intentionally or inadvertently communicate preferences?

Methods and Procedures

Prior to eliminating the addition of online/virtual participants from the Cherokee study I

expanded my literature search to investigate how and if TL occurred in virtual and FTF

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environments. Relevant for future studies I believed it was a critical element for inclusion here. When contemplating a two-site charrette, it was necessary to explore if and/or how TL occurred in a technologically driven environment, while exploring the challenges experienced when adding virtual participants to a charrette. My initial investigations were expanded by asking: In what way(s) does technology influence participants during TDL practices, in either a virtual or FTF environment? I believed challenges might reveal themselves in this environment, at times creating frustration when working in new, unfamiliar formats and when extrapolating information from unknown sources and/or programs. Study revisions eliminated off site participation but required Cherokee participants to work with virtual images of the site while meeting FTF.

To address modified research questions and framing changes, within TDM and TDL investigation, TD research methods and procedures evolved and adapted how data were collected, transcribed, and documented for examination. Proposed data collection methods remained in place, as previously identified. Data were collected in the context of a two-day charrette. I employed Hall's four-phase transdisciplinary model and jointly implemented using a model adapted by Alan Chapman (2020). Chapman's model was based on Kolb's 1984 model, I used it as a roadmap to determine and evaluate TDL team actions. I applied Kolb's model of team-based projects. Study participants cycled through the model sequence, created iterative and recursive feedback loops.

I applied Dewey's narrative concept of experience to support the use of narrative and thematic analysis (Clandinin, 2007). A cross-case analysis was conducted to draw upon the similarities and differences between the XQ School of the Future Challenge and the Cherokee Charrette. The Cherokee study was initial planned with volunteers acting as non-participant

observers (NPO) but as the study evolved NPOs became participant observers (PO) with two

assigned to each team. POs participated and collected observations including interactions

indicating how and if participants were engaged in collaborative experiences and transformative

relationships. To effectively evaluate observations collected by lay persons I provided pre-

charrette training.

PO/NPO/FOs were provided data collection observation forms. Observation guidelines

were structured making visible the charrette, TDL and TDM teaming processes. Data were

collected from the following: pre and post-charrette surveys, field trip that included two field

exercises and a two-day charrette. It included post charrette presentations, and PO/FO

evaluations. I utilized personal field notes, photographs, and audio/video recordings to explore

and discuss research questions.

Design Rationale This study explored the process of knowledge transfer using a TDL model by

documenting, shadowing, and observing TDM teams. It sought to explore and describe

knowledge transfer among multiple domains and the abilities of participants to think critically

while communicating among disciplinary silos. It employed a TD methodology (Nicolescu,

2010) as the study began with participants' views and built up to patterns, theories, and

generalizations as it sought to answer how knowledge was transferred and integrated to achieve

common project goals.

Transdisciplinary Nature of the Research To undertake an effective paradigm shift from

advancing collaboration among all members of the team to a TDL practice model TD

encouraged participants to enlarge their common core knowledge and therefore enhanced the

experience, capability, and competency of team participants (Institute for Social-Ecological

Research, 2015). This study utilized Marilyn Stember's definitions of hierarchical levels

reflecting relationships when diverse disciplines engaged in problem solving. Hierarchical levels

reflected disciplinary relationships when engaged in problem solving identified as:

- Intradisciplinary – single discipline team(s) focuses on a problem
- Cross disciplinary – viewing one discipline from another discipline's perspective
- Multidisciplinary – different disciplines work together, as a team, each drawing on their own knowledge, and bringing their knowledge to bear on the problem
- Interdisciplinary – integrating knowledge and methods from different disciplines on a team(s) to synthesizing approaches, and
- Transdisciplinary - team members commit to teach, learn, and work across disciplinary boundaries to plan and provide integrated services, resulting in services that could not be provided by practitioners in a single field (Jensenius, 2012; Stember, 1991).

Study Design and Rationale

To build upon XQ findings and the UCD mini-charrette I decided to continue with a

more extensive and detailed case study. The study supported students/participants as they cycled

through iterative and recursive feedback loops. Chapman (2020) stated that TL invites

participants to develop a call to action shared as:

> Research questions posed [by student teams] in the conceptualization phase … [are often] refined or reconsidered resulting in returning to an earlier development phase. TD teams often encounter challenges across disciplines in the implementation phase requiring them to refine …[initial] research question and study design, returning to the conceptualization phase. (para. 6)

Literature showed as TDM teams progressed through the phases, they often redefined

goals or decided to work on a new area that developed a different approach. This action

redirected them, returning to the development phase. The translational phase generated new

research questions that allowed teams to bypass the development phase and move directly into

the conceptualization phase (Hall et al., 2012).

This study was based on the understanding that charrette improved outcomes as

participants collaborated to generate new knowledge. I used a TD model to support a charrette in

a peer-to-peer learning process. This learning model supported different activities as teams established a common goal to solve a problem. It was designed to explore the process of knowledge transfer using a TDL model. It documented interactions as PO/NPO and FOs shadowed and observed teams. It utilized a TDM to develop and explore knowledge transfer across multiple domains, it explored participants ability to think critically while sharing individual academic knowledge and life skills among disciplines. It sought to explore and describe knowledge transfer. I employed a TD research methodology (Pasquier & Nicolescu, 2019) as the study began with participants' views and built 'up' to patterns, theories, and generalizations. I sought to answer how new knowledge was shared, transferred, and ultimately integrated as learning to achieve common goals of a project. Participants' utilized an actual project as an instrument for tackling how best to proceed when addressing site surroundings. Teams were challenged to develop an educational/research venue for varied learners using a planned historic renovation on a working cattle ranch. They collected data using two reflection and observational exercises and non-reflective dimensions (doing by performing an activity, socializing, and interacting) of the TDL process.

Cherokee Study Objective and Charrette Development

This study explored elements of TD, TDL, TDM and TL among individuals and teams. It focused and addressed how TDM teams approached, organized, and shared knowledge among disciplines and how they transferred that knowledge to affect transformation (Montuori, 2013). The aim looked at the intricacy of TDL as inquiry-driven versus discipline-driven. This study explored how TDL necessitated design thinking required to understand one's self, relations, and interactions; it required disciplinary knowledge organization allowing participants to explore, inquire, and cross various sources of relevant information essential for project completion.

Hybrid learning consisted of field exercises, electronic delivery of surveys and site materials combined with FTF interactions. The study identified advantages and differences among components of a TDM charrette. Specifically, this research focused on a narrow comparison of the settings rather than including too many criteria and measures that cannot be controlled for comparison (Meyer, 2007). "Research into small groups [8] stresses the complexity and adaptability of these groups as well as their dynamic qualities" (p. 54). The Meyer study was structured to highlight risks and strengths in achieving TDL rather than a comparison of differences in knowledge delivery (Diaz et al., 2009). Multiple disciplines were represented to advance TDL interactions that resulted in TL. While there are many factors that influence learning and knowledge sharing, this study focused on how knowledge was transferred, not what was transferred, among disciplines. Using a charrette model, the study focused on developing a picture of interrelationships among TDM teams. It explored four components of TL identified as: 1) experience, 2) critical reflection, 3) reflective discord, and 4) actions taken (doing), by studying the construction of knowledge sharing.

Anticipated outcomes were identified as:

- development of renovation/restoration concepts, with a vison toward incorporating additional site homesteads in the future,
- alignment of sustainable strategies addressing big picture site issues, such as access to consistent water sources, habitat restoration, agriculture, and cattle operations, while generating self-sustaining revenue streams,
- development of an innovative educational program using project-based, community-service learning opportunities implementing on-site and off-site (virtual) possibilities,
- envisioning and generating energy-efficient buildings which produce educationally appropriate and stimulating places to learn for diverse, multigenerational learners, and
- creating ways to incorporate site specific use of planned spaces accommodating on-site programs offering alternative housing for researchers, interns, and live-learn program participants.

I utilized observation and reflection exercises to explore early communication among unfamiliar participants as literature supported this approach. Kolb's Experiential Learning Cycle (1984) and Hall's Four-Phase Model (Hall et al., 2012) were utilized. Hall's model was sourced to explore and describe knowledge transfer across multiple domains. I explored participants' abilities to critically think as they shared discipline, life and experience knowledge and communicated among disciplines. This study evolved and was modified to address objective and subjective knowledge sharing. As the researcher I took care not to change the situation by my presence, behavior, or attitudes; nor did I attempt to control external factors that might affect results.

Early charrette dates of October 17th and 18th, 2017 were planned. Preparation and development included all instruments, IRB submittal, and project scope. Original dates were rescheduled to accommodate study revisions, coupled with expanded staffing, tech support and GIS site development. Recruitment was postponed pending IRB approval and charrette dates were rescheduled to February 18th and 19th, 2018; selected to overlap President's Day when many businesses and universities are closed. Two days were blocked for field trips, the first overlapped PO training at Cherokee, scheduled for Wednesday, February 14th, 2018, the second rescheduled from Friday,15th (snowstorm) to Saturday, February 16th, 2018.

Data Sources

To address framing changes, the actual nature of TD investigation, data were collected, transcribed, and entered in Excel spreadsheets for examination. Based on literature reviews that addressed TD research I applied Dewey's narrative concept of experience. This method supported a visual narrative and thematic analysis (Clandinin, 2007). All activities were

constructed to provide participants opportunities to develop joint knowledge production among differing disciplines while improving problem solving skills to augment competencies.

I identified data sources necessary to explore and advance TD depicted in Figure 3.1. To support a TDM charrette I used survey results, artifacts, field notes, observations, and evaluations. Instruments involved audio/video recording and data collected from four electronic surveys; two completed by students, two by POs. A cross-case examination was conducted to draw upon the similarities and differences between the XQ School of the Future Challenge and the Cherokee study.
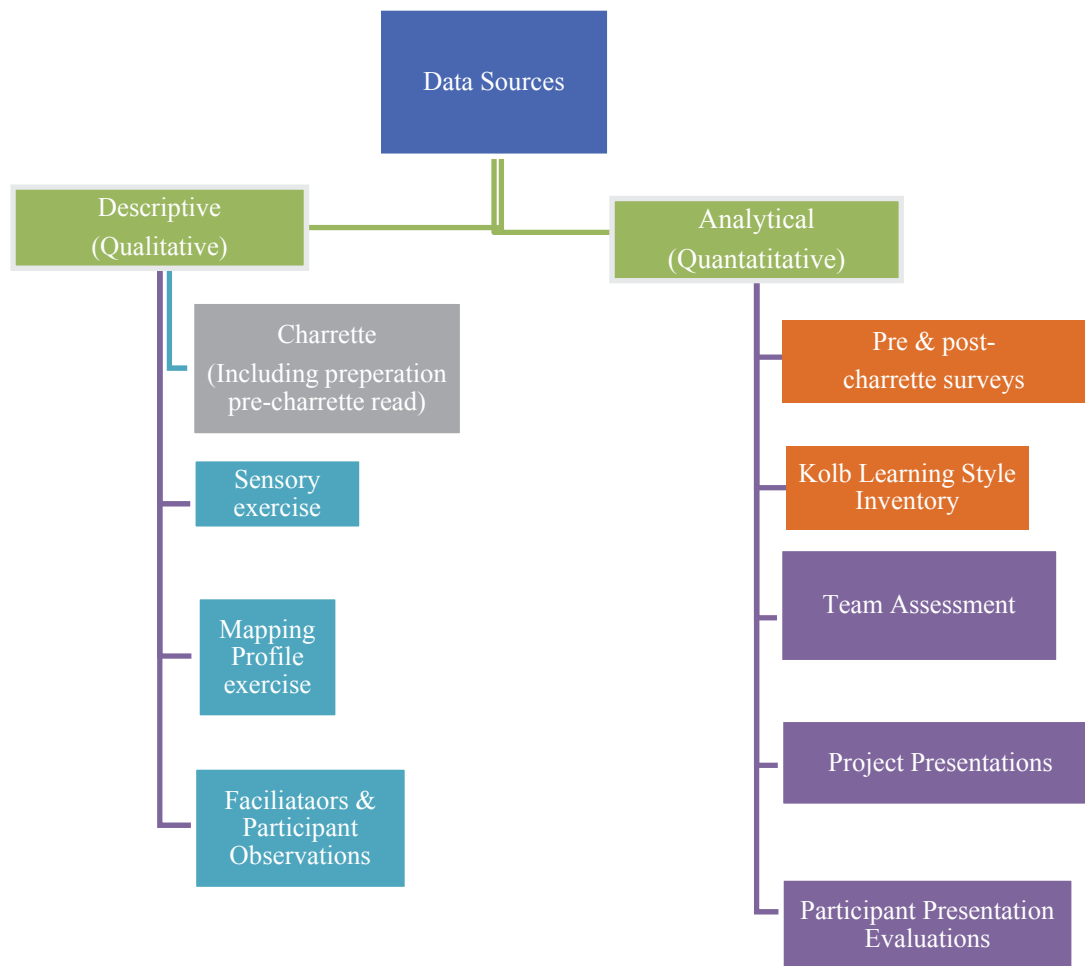
Figure 3.1
Data Sources, Activities Executed, and Experienced by Charrette Participants

Methods and Procedures

POs had site/property information, the ability to communicate discipline knowledge and experiences by virtue of their association with CR & CF as either a volunteer or employee (Schensul & LeCompte, 2013). PO/FOs collected data to document participant interactions. Data indicated how individuals engaged in collaborative experiences and transformative relationships. Reasons to engage PO/FOs were two-fold, identified as 1) lessons learned from XQ and 2) to establish working relationships for participants with people who had firsthand site and property

knowledge. PO/FOs provided site background information, joined by Cherokees education director, were knowledgeable in current and proposed educational programs relevant to the site. Information was shared as oral histories' that described the evolutionary history of the property with two POs having worked for Ms. Kimball. PO/FOs were involved in the activity they were observing (ESOMAR, 2009); each were provided training, and all used pre-designed observation forms for data collection. Observation guidelines were structured making the charrette and TDL process visible.

Storytelling and TD

Literature identified parallels between storytelling and TD research. Storytelling complemented conventional qualitative research methods, used to gain insights into TDL and TL. Participants implemented storytelling to advance their ability to connect different knowledge bases, life skills and experiences to TDL. Storytelling integrated multiple iterations of lived experiences among individuals/teams. This supported my ability to identify coded fragments of multiple stories transmitted by the storyteller to the listener in narrative analysis. I implemented storytelling with three aims, 1) to support information mining, 2) to inform analysis, and 3) as a process to share participants knowledge creation, experience reflection, and to facilitate project proposals (Paschen & Ison, 2014).

Naturalistic Observation

Being a participant observer required building rapport with those being observed; it permitted POs to regularly engage with and ask in the moment participant questions. POs not academically trained in observational methods joined industry professionals in this role; other researchers have used similar approaches. Early recruitment showed the majority of individuals were familiar with the setting and project goals, all had extensive site and historical knowledge.

Two were familiar with the charrette process, but none were academically trained in observational techniques. Volunteers outside of academia or working professionals included mostly retirees and/or volunteers from Cherokee. Career professionals and educators understood participant observation, with the majority having completed one or more activities using direct/participant observation at some point in their careers and/or education. POs joined the study as part of assigned team. They observed and recorded interactions among individuals and teams. This method was chosen as it provided the researcher data collection unable to be completed by a solo individual. PO/FOs supporting data collection as they watched and listened to participants during the charrette. Naturalistic observations were utilized to study the situation as it proposed new opportunities of investigation. PO/FOs documented event's and interactions at different times of the day guided and recorded on observation forms. POs were instructed on data collection and documented interactions identified as 1) behavior sampling, 2) time sampling, and 3) subject sampling.

"To be most effective "evaluations" (feedback) should be an objective evaluation of individual and group tasks or activities, or evaluations of members' individual performance" (Keyton, 2015, p. 265). POs completed daily observations of assigned teams and the researcher was aware that some observations may have attribution bias. "When POs become a part of the team and asked to contribute to the team's success, they often feel personally responsible, but when asked how they contributed to the team's failures many avoid taking responsibility" this type of attribution bias is common among POs (Forsyth & Kelly, 1994, p. 364). POs were permitted and encouraged to share presentation observations outside final team assessments.

Audio/ Video Recording

      Once methods and sources were identified, I decided to add audio/video recording to support review of naturalistic observations. This study was explored as it unfolded, in a non-manipulated, non-controlling environment. I was open to whatever emerged during the charrette, and audio/video recordings provided the tool to review and confirm data. I identified this as a missing opportunity during the XQ study that would have helped validate results. Research showed video recording could eliminate some of the challenges expected with PO direct observations, as it accurately recorded events, and supported direct observation verification (Asan, 2014). Videos allowed for the collection of systematic feedback by strategic review (Seagull, 2003). This data provided consistency between self-assessment and observable behavior. I used videos to review team actions for clarification while documenting quotations and reflecting on PO observations. When combined with direct (real-time) observations they provided information not available from surveys and observations alone. Table 3.1 depicts the video study development guidelines reprinted from *Videotape: New Techniques of Observation and Analysis in Anthropology* (Schaeff, 2009, p. 205). Video recording of participants' ongoing activities in a natural setting were helpful, particularly in a complex, often chaotic environment. Other researchers have used similar approaches and I copied, implemented, and developed processes to conduct video recording using the steps depicted in Figure 3.2 (Asan & Montague, 2014, p. 163).

Table 1 Steps followed to conduct this video study

1. Conceptualising the study
- a. Choose an appropriate research question which can be answered by video data
- b. Identify potential time frame of the study
- c. Decide on the scope of the data collection
- d. Decide on any additional data collection instruments, such as interviews and surveys
- e. Decide on the required number of personnel for data collection
- f. Decide how to link the data from video recording with the other interview and survey data
- g. Choose method to analyse the data (quantitative, qualitative or mixed methods)

2. Legal and ethical issues
- a. Ensure the study meets with ethical guidelines for human subjects research
- b. Describe all details of the procedure of the study
- c. Comply with all legal requirements for recording in real environments
- d. Obtain legal consent for video recording
- e. Ensure all privacy and confidentiality issues related to participants' ID preservation and identifiable video data storage
- f. Complete and comply with all local regulations, such as online HIPAA training in US to be eligible for human subject research
- g. IRB application and final approval in order to start the project

3. Participants and sampling
- a. Determine the number of participants you need
- b. Determine the unit of analysis and sampling frame that will most effectively help answer your research question (for example, do you need a certain number of patients in general or a certain number per physician?)
  Will you recruit physicians or patients first? Will you randomly recruit the physicians or have certain eligibility requirements, such as people within a certain age range? Will participants be paid?)
- c. Inform all participants about the benefits and risks of your study
- d. Conduct the recruitment as planned in the IRB
- e. Get informed consent of all people who agreed to participate in the study

4. Data collection and management
- a. Decide on all technical specifications of the equipment you need
- b. Choose an appropriate high quality camera or cameras
- c. Choose the best audio recording style (built into camera or separate)
- d. Determine the camera layout of the room; get the best angle to ensure a clear view of the patient and doctor
- e. Establish a protocol for recording the interactions
- f. Maximise the captured area by adjusting the camera angle
- g. Create protocols to link the data
- h. Sync the audio and video data for the analysis
- i. Determine protocols for storing video recordings
- j. Secure the hard drives for privacy protection
- k. Back up the data
- l. Train all researchers, camera persons, interviewers, and so on

5. Data analysis
- a. Review the quality of all data
- b. Identify the software you will be using to analyse the data
- c. Clearly distinguish the research questions and analyse accordingly
- d. Create coding schemes to analyse the video based on the variable of interest
- e. A pilot run/trial analysis after collecting the data from a smaller sample to prevent potential mismatch

Figure 3.2

Video Study Development Guidelines

Note. From "Using video-based observation research methods in primary care health encounters to evaluate complex interactions," by O. A. Asan and E. Montague, 2014. *Inform Prim Care, 21*(4), 163. (http://dx.doi.org/10.14236/jhi.v21i4.72) Copyright by the Author(s). Published by BCS, The Chartered Institute for IT under a Creative Commons license http://creativecommons.org/licenses/by/4.0/

Participant Recruitment

Both larger (1,200) and smaller (30) sample sizes were reported by other researchers in TD studies (Hadron et al., 2008). While a large-scale prospective cohort study was not practical due to time constraints and costs, a more efficient method was sought to address a fixed budget and limited time frame. These challenges necessitated a streamlined approach that addressed consent, recruitment, data collection, and follow-up. I developed a sampling plan (see Figure 3.3.) based on recruitment. I targeted students enrolled in college course work, certificate, and/or online degree programs (3rd or 4th year of study and graduate students) from courses among eight disciplines at Colorado universities. First and second year students were not recruited due to their lack of industry or academic experience. I sought content experts from higher education, who held degrees in identified fields or were in graduate school. Those from the private sector held undergraduate degrees and/or had a minimum of 10 years' experience in their chosen field or discipline. POs reflected diverse inclusion and all volunteers had either management and/or instruction delivery experiences. Participants from Cherokee Ranch (volunteers, staff, and board members) had expertise or knowledge in ranch history, cattle operations, and/or historic homesteads. Facilitators (FO) were recruited from higher education.

Volunteers unable to commit to charrette timelines and demands were stakeholders, ranch personnel, and community members, eight were invited to act as jurors, others were recruited to assist with logistics during the charrette. All volunteers were provided a study overview, informed of expectations, asked to attend training, and consented to being photographed, and taped. Participants' attendance commitment was received by e-mail or phone as recommended by Creswell (2009).

Once disciplines/individuals relevant to the charrette were identified recruitment began. Recruitment materials are found in Appendix C. Posters displayed on notice boards around campus announced the study; introductory letters to faculty (CSU/UCD) were hand-delivered and emailed on university letterhead. Each explained the study's objectives, importance, and implications. Separate letters were delivered via email to personal contacts including industry and education professionals with a similar request to join. Participant observer letters were developed and delivered either in person or via email. Follow-up discussion(s) by phone and email focused on answering participant questions articulated the schedule and reviewed online pre-read and survey materials. Recruitment Power Point presentations were created with copies provided each professor that elected to include the charrette as a class project; recommended by Toledano (2015).
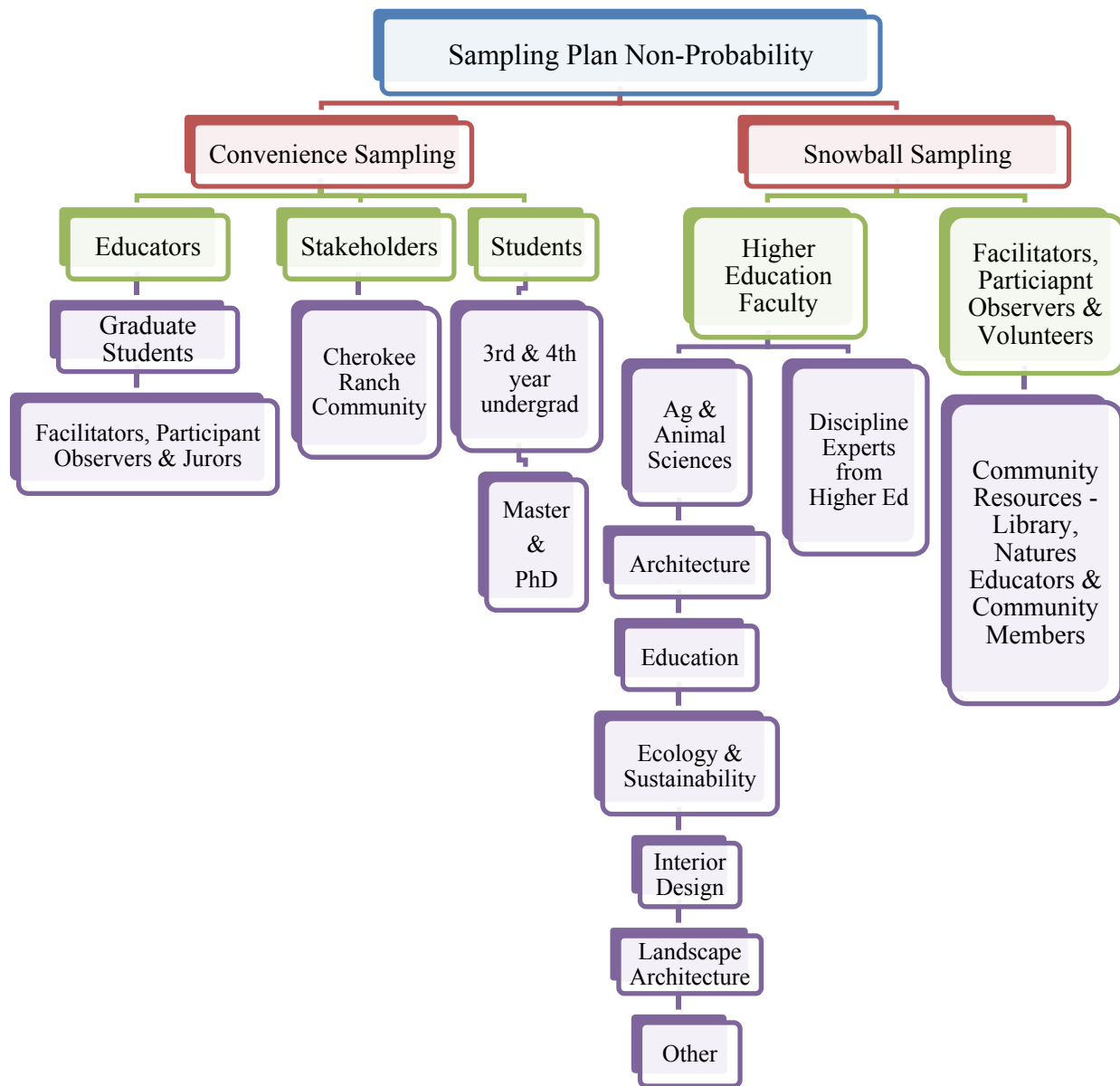
Figure 3.3
Researchers Proposed Non-Probability Sampling and Recruitment Plan

Data Collection and Measurements

Scholars agree that the success of transdisciplinary educational programs depends on comprehensive evaluation of program processes and outcomes. This is essential for achieving sustainability and ensuring ongoing support from administrations and funders…Metrics have as yet not been developed, however, to measure improvement in the quality of research through working transdisciplinary teams. (Gehlert, 2013, p. 12)

This study implemented a TDM charrette to support a TDL environment. I identified expected learning outcomes and used ungraded activities to collect data on participants across multiple sections of a charrette. Data collection employed Hall's Four-Phase model utilizing the following instruments:

- student's participant pre/post charrette surveys
- PO pre/post charrette surveys
- PO/FO observations
- participant presentations

Participant evaluations were based on criterion-based measures identified as:

- knowledge integration/synthesis
- new knowledge generation
- collaboration and team processes
- management, leadership, and networking
- creativity and innovation, and
- research (Polk, M., 2015. pp. 110-122, Polk, M. (Ed.). (2015).

Individuals and teams earned points documented by PO/FOs to establish if criterion-based measures were met. POs were informed and instructed on how criterion scores were to be assessed, tallied, and totaled. Data collection instruments identified specific point scales for each criterion.. I used measures to identify evidence of participants TDL teaming and TL. Assessment utilization explored the degree to which participants learned, shared, and applied discipline knowledge, personal skills and/or experiences**.** Data collection showed how participants spent their time and shared knowledge; it reflected on how participants applied new knowledge and skills acquired as they developed project proposals to solve identified problems. Using multiple data sources resulted in measured TDL.

Survey Development and Engagement

The rationale for using surveys was compelling, as it drew upon respondents' attitudes, beliefs, experiences, and reactions not feasible in other methods. In contrast to individual

interviews, observations provided encounters, experiences, and ideas collected from a larger

body of information in a shorter time period (Morgan & Spanish, 1984). Electronic surveys were

faster and provided ease of use. Utilization of an electronic survey was an appropriate choice as

it sought to collect perceptual information about participants' background. Other researchers

used similar approaches shared in two case studies that incorporated surveys to aid in

development, identified as,

- *Transformative Learning in College Students: A Mixed Methods Study* (Fullerton, 2010), and

- *Collective Learning for Transformational Change: A Guide to Collaborative Action* (Brown, 2013), a case study with a pre-existing survey.

A review of Bloom's (1956) *Taxonomy of Educational Objectives* was utilized to finalize the

surveys adding/adapting questions appropriate and reflective of programmatic goals and

activities.

Pre-charrette Surveys. The student survey included 20 questions with additional instructions to

complete Kolb's LSI 3.1[7] . It included links to the pre-read materials, and Drop Box, see

Appendix D. PO surveys consisted of 23 questions, see Appendix E. Response types for both

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[7]Accessed with permission from MCB200C©1993 David A. Kolb, Experience-Based Learning Systems, Inc. All rights reserved. No part of this publication may be reproduced or transmitted in any form or by any means without permission in writing from the Hay Group 116 Huntington Ave., Boston, MA 02116. Telephone 1.800.729.8074/1.617.425.4500 (Dr. Katharine Leigh contacted and obtained permission for the researcher to use the LSI 3.1).

surveys varied with multiple choice, fill in the blanks, open ended, yes/no, and/or scaled

response (Likert or otherwise).

Participant Pre-survey (Students)

Kalantari et al. (2011) recommended participants received survey access via email and

given three days to log in and complete the survey. On the morning of the second and third days

follow up text messages were sent to participants who agreed to messaging. Upon logging in

participants were directed to the survey welcome screen, which invited participation, introduced

the context of the study, described the procedures, and explained benefits and possible risks.

Consent forms followed by the choice to participate or opt out. The survey did not offer options

to identify reasons for refusal to participate, incomplete surveys were coded as refusal to

participate. The pre-charrette survey was divided into sections as follows:

Section One addressed demographics, field of study, and students ranking information (Q

1-Q6). Demographic questions allowed the researcher to learn more about the students, their

experience, and educational interests/pursuits. Questions regarding field of study and college

provided a means to develop TDM teams. Not personally knowing most individuals, I was

unable to identify special interests and life skills outside of participants collegiate environment.

Questions Q7-Q14 were designed to aid the researcher when developing/assigning teams

as they identified patterns of similarities and differences, focused on previous charrette and

TDL/TDM experiences. The goal was to group half (4/8) of the teams with individuals whose

knowledge, life skills, and perceived interests were complementary; the other teams (4/8)

comprised individuals with different life skills, backgrounds, and disciplinary attitudes/training;

LSI outcomes were utilized to address preferred learning styles for team assignments.

The next section included multi-level, three-point scale questions characterizing factors of the collaborative team environment (Q15-Q20); these questions were designed to establish individuals' beliefs/experiences with and/or about collaboration and collaborative environments; questions identified respondents likes, dislikes, and opinions. Questions were based upon a review of Schensul and LeCompte (1999).

This section was followed by Kolb's Inventory LSI 3.1 (Kolb & Kolb, 2013). Reasons for using Kolb's LSI were, 1) I wished to utilize findings to create teams that embraced and 2) supported differences among skills, beliefs, and life experiences of individuals to develop teams as identified and to assign teams that supported learning acquiring meaning from participant experiences. By creating teams and spaces for participants to take charge of their own learning, participants increased their ability to learn from experiences, and constructed their own knowledge versus passively receiving verbal or printed instructions that guided and defined what and how they learned. Problem solutions were developed as participants learned to share knowledge, problem solve, and negotiate outcomes.

The last section included essential information for participants with pre-charrette read materials, access, and download instructions for ZOOM and/or Blue Jeans software. I included instructions to set up a team Drop Box folder to provide newly formed teams the opportunity to share field trip experiences, data collection and pre-read case study reviews. I concluded completion of the pre-charrette read and survey would advance charrette participation. This saved participant's time; enabled them to go directly to ideation and knowledge development during the charrette.

Pre-charrette Read

There were two important reasons to include a pre-charrette read. First, the materials provided an overview of similar educational, historic, cultural, and architectural projects. Related site materials were identified and collected based upon case studies. I included area maps, structural data, and information, examples of similar projects, previous planning documents, and reports (CR & CF), historical profiles (archives, historic societies data and information), and Historic Preservation renovation regulation(s) as recommended by Segedy (n.d.). Early documents included an overview of the cattle operation, current and ongoing educational, and research programs. Identified were archeological finds, historic roads, and avian research. I included overviews of three historic homesteads, a castle and contributing/non-contributing historic designation reports.

Pre-read materials were collected by the researcher from 1) site field notes, 2) visiting similar ranches used for educational programs or events, 3) library research in Denver, and Castle Rock, CO, 4) online review of local history, and 5) personal interviews with Cherokee staff. Collection began August 6, 2017; the researcher and Daniel Raggi (DR), toured the Wauhatchie site and identified 355 acres shared in a field log. We delivered field logs to Cherokee staff for review. Data collection continued as I joined James Holmes (CEO), travelling to other Front Range properties that offered educational aspects to their programs. In FTF meetings with educators, ranch owners, and staff we discussed the challenges and concerns each encountered during development in hopes of avoiding some early pitfalls. Notes identified what was covered, such as age groups in individual programs. I later explored and documented what was not being addressed by each program. Post data review supported opening charrette concepts for new educational ideas and program development.

I added case studies from the National Park Service's, Teaching with Historic Properties (TwHP) web site. Literature focused on historic property projects that supported educational uses. My search continued at the Denver Public Library, then moved to the Castle Rock library, home of the Douglas County Archives (DCL) and Local History repository. Over the next three weeks DR and I collected (by areas of use) documents including Wauhatchie site specific information from Ranch archives. Data included blueprints and property images taken during Cherokees appraisal, circa 1992. It took four month to build information, including field logs and site visits. All documents were scanned, digitally archived, copied to Drop Box. A link was added in Qualtrics for students use and printed in a single document for charrette use. Table 3.1 provides an overview of data with copies of materials used in Appendix F.

Table 3.1

Overview Pre-Charrette Read Materials

Read	Materials
Study Intro letter	By researcher
Ranch Overview: A brief history	3 Homesteads & Castle Complex Information
Section 1: Case Studies	General reading all participants-prior studies relevant to project
Section 2: Power Point	Ultimate Sustainability a virtual tour of an optimal learning environment, homesteading in Purgatoire River Region – Colorado Preservation; Building a Future with Historic Places; Sustainable Design
Section 3: Case Studies by Discipline	5 ea. Agriculture 9 ea. Architecture, Design & Construction management 8 ea. Education 5 ea. Sustainability 4 ea. Landscape Architecture
Section 4: Community Cultural Wealth	Critical Race Theory discussion of community culture as capital
Section 5: Site Specific Posters	5 Posters by Deb Domres & Daniel Raggi Cherokee Complex-wildlife, flora/fauna &

	homesteads (Site overview-what's currently on-site)
Section 6: Historic Artifacts	Miscellaneous documents, handwritten letters from Tweet's journals; maps, site data, historic documents & blueprints/plans; previous studies on homestead renovations and proposed plans

Participant Observer Pre-charrette Survey

Participants received survey access during FTF training followed up via email; given three days to log in and complete the survey. On the morning of the second and third days follow up text messages were sent to participants who agreed to messaging during recruitment. Upon logging in participants were directed to the survey welcome screen, which provided access to consent forms followed by the choice to participate or opt out. Section one included headers; questions Q 1- Q 6 addressed personal information including demographics as age, gender, location (where they lived), association (university, etc.), employment/role (teacher, professor K-12, etc.), and discipline/department, courses and level instructed. If not, an educator POs identified their affiliation with either CR & CF or as community stakeholders. Each volunteer received sharing directions for creating a personal identifier. The next section (Q 7- Q 16) asked about experiences leading service learning projects and/or charrettes. Q 17-Q 19 addressed materials, equipment frequency.

Q 20 asked respondents to rank teaching strategies, including frequency of utilization/implementation. Q 21 asked about individual's schools and the extent to which they were provided or utilized tools when teaching; for example, tools might be community gardens, service animals, field trips, adult volunteers, or classroom assistants. Q 22 asked what respondents would add to their campus to aid teaching, ending with open ended response to share

with the research team. The final section of the survey announced organization sessions, training times, dates, and online availability. Findings are discussed in Chapter IV.

Team Formation The goal was to assign diverse disciplines to each team. Based upon personal experiences with "teamwork", I hoped to eliminate what is often called 'part and parcel' (PNP) of projects. PNP frequently allows participants to contribute individually while working on a specific portion of a problem without considering input from team members. Prior to presenting findings, the group reconvenes and combines individual sections into a single deliverable. In this scenario, little collaboration takes place. This study discouraged, but did not prohibited, PNP. Individual participants were aware of what others were doing, as they worked in partnership, resulting in a final cohesive deliverable due to the collaborative environment as recommended by Oakley (2004).

Reasons to implement assigned versus self-selected teams varied among the literature. Historically, students expressed the desire to self-select, preferring to work with friends often resisting being positioned with unfamiliar individuals and disciplines. When establishing teams two questions were assessed, 1) are there benefits and challenges of self-selection versus assigned teams, if so, what are they? and 2) how large should TDM teams be to maximize TDL? Other researchers asserted assigned teams work best in a TDM environment (Dunaway & Kenney, 2006). Similar approaches found team's comprised of odd number participants (5 to 9) made better decisions than those of even numbers (Lim & Klein, 2006; Wharton College of Business, 2006). Past experiences and literature showed that teams of even numbers can result in stalemates (two against two) or dominance (three against one). I was concerned that free riding might occur with larger teams slowing ideation and project advancement; or when resentment appears perceived by other members "as doing all the work" (Lim & Klein, 2006). I planned 8

teams, comprised of 8 members per team; the desire was to assign 7 participants to a team with the 8th reserved to compensate for attrition. If all participants arrived at the charrette, one individual from each team would be moved to form an additional team.

It was imperative individual participants be quickly identified among POs and later when reviewing videos, valuable during a fast-paced charrette environment. To aid in identification codes were established, and teams were color-coded. For example, blue represented members from a specific team, identified as Blue T3. To maintain anonymity, I utilized participant created personalized codes, comprised of the last four digits of their phone number; I reduced these to two digits. I selected the first and last digits of each phone number. For example, a participant with 1153 (last digits) was identified as 13; if duplicate identification occurred, I used the first and third digit, documented on spreadsheets for reference. Table 3.2 depicts proposed teams' make up, including personalized IDs, discipline, and Kolb Learning Style findings with color coding. Experiences showed that individuals struggle being identified by a number, so participants were permitted to select any name they desired, even their own, as long as it did not identify them to outside sources watching videotapes.

Table 3.2

Proposed Team Makeup Including Disciplines (Blue Team- T3)

Participant ID	Discipline	Kolb Learning Style
13	Agriculture/Animal Sciences	CE/RO
97	Architectural Design/ Construction Management	AC/RO
52	Ecology/Natural Sciences	CE/AE
67	Education	CE/AC

83	Environmental Sciences/Sustainability	CE/AC
72	Social Work	AC/RO
55	Landscape Architecture	AC/RO
65	Other (History, Art, etc.)	CE/RO

Field Trip

Including a field trip was an important part of the charrette experience and several guideline

documents believed them to be mandatory for success (Condon, 2008). An Atlanta University

Student stated:

> We constantly take real life situations and apply it to what's in the book so that we can
> intermingle the two and come up with solid conclusions for problems that are relevant.
> (Eyler et al., 1996, p. 18)

These provide participants with content access and allowed attendees to make general

connections offering investigational research, and memorable experiences outside of

participants' everyday (campus) activities. Field trip shared experiences advanced early TDL

collaboration and provided target knowledge about problem status. Other researchers used

similar approaches; I implemented and adapted Kolb's Experiential Learning Cycle (1984) and

the Eyler et al. Guide (1996) to develop field trip exercises.

Research showed experiencing a place makes a connection between what one reads to

what one understands outside of a text or class environment. The field trip allowed participants

to gather information and experience the environment. It provided resources to formulate

questions and make hypothesis. It supported participants when creating warranted assertions for

project proposals. I concluded tours and field exercises permitted participants the opportunity to evaluate site use depending on perceptions of systems, relationships, and identified areas or options for change. I expected participants to ask questions as data collected positioned and aided participant's in early project ideation. I began development by physically walking and/or driving the site, then developing an aerial map of specific artifacts to support the project.

It was unrealistic to expect participants to walk the entire site, so data collection was limited to structures, artifacts, and the footprint at Wauhatchie. Participants required additional information to make connections and develop proposals provided using Liquid Galaxy technology. To advance data collection I worked jointly with ranch personnel and the Colorado State University Geospatial Centroid Lab to create interactive layered maps of the property rather than using numerical datasets. GIS mapping turns data into pictures and I planned to implement Google Liquid Galaxy technology during the charrette. We developed property maps that supported participants establishing layered visualizations among points of interest identified as: a) land cover, b) topography, 3) zoning, and 4) parcels built on a base map; color coded for easy use. The GIS color coded footprint made identifying site assets straightforward. Property lines and fencing were identified; shown were cattle paths and connections (roads, paths, cattle crossings) among properties, physical structures, and landscapes. We made maps interactive, so participants were able to toggle between street, satellite, and terrain views. These tools supported participants as they developed and coordinated educational programs, identified wildlife, and movement among human/nonhuman species at the site. Using GIS mapping required practice to implement and understand shared data; I secured on campus staff (volunteers) to assist participant use during the charrette. Field trip participants were supplied printed single layer maps of structures that identified reference points utilized onsite (field trip) and later during the

charrette. Field trip exercises and experiences were coordinated to work in conjunction with pre-read materials.

Field Trip Exercises

Essential to a successful field trip was completion of the pre-charrette read as it advanced a better understanding of the site, shared early ranching problems, and identified the environmental footprint. Participants had access to archeological site information, structures, flora, and fauna were identified with special attention to endangered species, early ranching, and site cultural information (documents were available on-site during the field trip). Completing the pre-charrette read introduced attendees to information that supported early observations, allowed for systematic generation of ideas, and design thinking. This information was sourced to advance completion of field trip exercises.

Sensory Exercise

Knowing is experiencing. The sensory exercise required individuals to assess the physical environment, while making observations and noting their feelings about the ranch. This exercise was completed individually, in silence, Table 3.3. By observing and participating in a physical environment, participants recorded and reflected upon observations and feelings while on the property (Schensul & LeCompte, 2013). Others have used similar approaches and I adapted this exercise from *Reflection in Service Learning* (2017) updated to Center for Community-Engaged Learning (n.d.) and from *Five Senses Mindfulness Exercise* - Clayton State University (2017), recently updated from Walters (2011). The five senses mindfulness exercise required participants to utilize four of the five senses (sight, hearing, touch, and smell). Had the field trip occurred during spring, summer, or fall participants could have sensed taste as edible nuts, grasses, and fruits are viable onsite.

This activity provided participants a relaxed environment and opportunity to interact and meet POs. Interactions supported early team building, as participant's shared and discussed personal interests, discipline knowledge, life skills, and early site ideation. Field activities initiated early communication among attendees, shown to be effective for creative problem solving.

Table 3.3

Sensory Exercise Observation Model

Sense/Experience	Observation/Notes
What do you HEAR	
What do you SMELL	
What do you SEE	
What did you TOUCH	
Additional notes:	

During the charrette you will reflect, share, and respond to the following questions with your team–
DON'T FORGET TO BRING THIS SHEET WITH YOU
- What is your overall feeling while on the site? What did you observe that was unexpected?
- How does what you experienced help you develop the project?
- How does what you observed impact the project?
- What was missing, what was present and what follow up is required related to project development?
Answer after touring the other two sites.
- Was there a connection among the three sites? If so what might it be?

When finished, pause to notice how you feel in this moment and answer the last questions on the observation form. When done you may begin Exercise 2. Please complete Exercise 2, step 1 independently; steps 2 and 3 will be completed with your team during the charrette. You may create drawings, take notes, and photographs.

NO SOCIAL MEDIA SHARING OF SITES OR PARTICIPANTS.

Mapping Exercise

I selected this exercise as mapping requires spatial learning through direct contact with the environment. It supported intellectual development as participants recognized and began to attach meaning to site attributes through information acquisition. Completing this exercise participants created a sense of place, defined, and identified geographic distribution of site artifacts. For example, mapping identified populations (human/nonhuman), structures, and activity spaces. Mapping supported attendees as they formulated spatial relationships and identified property constraints to meet project deliverables (Schensul & LeCompte, 1999, p. 70). Mapping relationships required participants to identify flow among site artifacts within physical spaces. This provided participants information to transform data into actionable insights and advanced project development.

Mapping required participants recognize variables using connected reflection by independently carrying out and subsequently sharing findings. This activity followed the 'What', 'So What', and 'Now What' cycle of discovery (Iowa State University, 2019). Participants identified variables using an observation form (see Figure 3.4), with three categories: 1) circulation and permeability, 2) flexibility and orientation, and 3) social learning hubs. Above each category were five points of evidence that related to a specific aspect of the project. Below these were three classifications that addressed aspects of the project: 1) Efficiency, 2) Effectiveness, and 3) Expression, see Table 3.4. Instructions identified each as:

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- Efficiency represents how visitors/researchers might utilize the site, consider how moving about the property effects historic renovations addressing circulation and permeability; for this study permeability relates to how accessible and passable the property is or might be for vehicles and/or human interactions as both need to navigate the site. Hint: for example, consideration needs to be given to how large exterior walkways as well as interior doorways need to be to accommodate American with Disabilities Act (ADA) requirements.

- Effectiveness identifies the degree, which each variable might be successful in producing the desired results, as you (participant) perceive them to be, for use, and or implementation of the project. Hint: for example, you might discover that it isn't necessary to create extensive safety and security protocols if your ideas (proposals) do not offer or support overnight or extended stays, perhaps consider single (day) use protocols instead.

- Expression identifies and addresses how educational aspects might create social learning hubs using existing or proposed aspects of the site. Expression identifies the degree, to which each variable might be developed to create an educational program. What do you feel is a way to advance transdisciplinary teaming and or research using this property? Hint: for example, hiking to site archeological finds/caves might not be a requirement due to safety concerns, scored low or no evidence.

MAPPING PROFILE: Data Collection Final Analysis (Step 2)   TEAM ID: LOCATION:

Scale		EFFICIENCY					EFFECTIVENESS					EXPRESSION				
		Entry Access, ADA & Community Facilities	Pedestrian Circulation	Separation of Services	Out buildings & Barns	Buildings & Green Spaces	Building Connections & Waste Recycling	Habitat & Species Circulation	Movement & Cattle Operation	Wayfinding & Orientation	Safety & Security	Learning & Meeting Spaces Experiential	On-site housing	Technology Connections	Live Learn Lab	Community Garden & Apple Orchard
HIGH	10															
	9															
	8															
	7															
	6															
MEDIUM	5															
	4															
	3															
	2															
LOW	1															
No Evidence	0															

	Circulation & Permeability	Flexibility & Orientation	Social Learning Hubs
	Historic Renovation	Ecologies	Transdisciplinary
	EFFICIENCY	EFFECTIVENESS	EXPRESSION

Figure 3.4
Mapping Profile Observation Form (Part 1 & 2)

Participants received the following instructions for steps 2 and 3:

> STEP 2: This step allows your team to share, exchange, and discuss observations. Begin by placing your observations on the observation form. For example, column 1 (entry access) has 10 spaces. Enter a check mark for each team members number in the box; once done (15 columns) total the check marks in each column to get one number per column. For example, if in Column 1- 2 team members assigned 3 to entry access/ADA & community facilities, the number 6 box would have 2 check marks; continuing among the team scores identified as follows: 2 assigned an 8 and one assigned a 7, another assigned a 10. Each vertical column gets check marks next to the number selected by the individual. Continue across all the columns and repeat the same activity. Once all responses/observations are placed in the appropriate boxes, total and find the average. So, in the example above your average would be 7.5, you may round up to 8.

> STEP 3: Using the observation form Labeled Step 3 transfer the averages to each column. This works similar to a plot analysis and will give your team a consensus among the identified columns. Utilize this form to begin ideation; feel free to negotiate and change your mind as you identify a proposal model. This exercise is a place to start sharing individual observations from the field trip.

> Your final step will support visual evaluation of the site in a condensed format. Once all forms are competed transfer team numbers (Table 3.6) into vertical rows labelled 1, 2, and 3, this will provide a quick reference and a means to assess what existing, what's missing, and what's needed to support your proposals.

Table 3.4

Mapping Profile Observation Form (Part 3)

Strategic Goal: To renovate the Ranch homestead to contribute to a shared learning environment and experience, collaborative research, and a sense of community by providing an environment that is conducive to dynamic interchange and that enhances the Ranch as a premier educational site, while maintaining its historic designation. Remember to support the Mission to become a world-class educational facility and wildlife preserve.

Project Proposals	Objectives		
	EFFICIENCY (1) Historic Renovation Circulation & Permeability	EFFECTIVENESS (2) Ecologies	EXPRESSION (3) Transdisciplinary

	Flexibility & Orientation	Social Learning Hubs
(1) EFFICIENCY		
Pedestrian Circulation		
Separation of services		
Outbuildings & Barns		
Buildings & green spaces		
(2) EFFECTIVENESS		
Building connections & waste recycling		
Habitat & species circulation		
Movement & cattle operation		
Wayfinding & orientation		
Safety & security		
(3) EXPRESSION		
Learning & meeting spaces (experiential)		
On-site housing		
Technology connections		
Live learn lab		

Community garden & apple orchard			
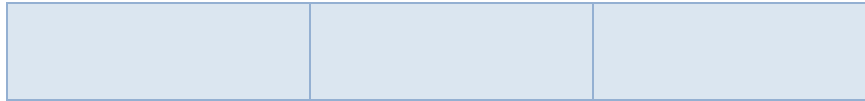
Note. Use the reverse side or additional paper/cell phones to make notes, drawings, or other information you feel will be useful during the charrette. Please hand in all forms, notes, and documents utilized to develop your proposals to the researcher or team POs before leaving the charrette, Day 2.

PO/FO Training

Training developed based on literature reviewed from Schensul and LeCompte, 1999. I previously utilized a number of identified exercises when instructing students on making job site observations or conducting client interviews. Exercises, reprinted with permission and adapted from Kawulich (2005) identified one or more of the following:

1) Sight without sound – students are asked to find a place where they can see an activity but one which they cannot hear what is being said, instructed to watch for 10 minutes observing action/interaction, recording as much information as possible. I utilized this exercise implementing watching television, of an unfamiliar program, without sound, to advance student observation skills. By watching unfamiliar programs bias is avoided as students are unfamiliar with characters, story lines, or plot. Students can draw a setting map then divide a sheet of paper in half; on one side they write what information they collected using sight, on the other side they write their feelings noting ideas of what's occurring. By comparing sides, they can see the difference in observed data, their own interpretation, and the importance of observing both sides.

2) Sound without sight – similar to above students find a place where they can hear activity/interactions but cannot see what is going on. Before beginning students identify the setting but don't identify the participants in the setting. Using 10 minutes students record thoughts, feelings, and ideas about what's happening on the one side of the paper and on the other they identify information using their senses (smells, sounds, touch). Students have conducted this activity on public transportation, airplanes, and by sitting outside of classrooms. In both settings (2/3), students, especially males, are cautioned against using playgrounds or any settings where their actions might be misconstrued; advised not to sit in vehicles or outside private homes. Construction sites are great places to complete 2/3 exercises. By comparing their observations students learn without sight the same interactions can be misconstrued.

3) Photographic Observation – this activity encourages students to utilize photographs to remember activities, settings, and interactions. Students take a series of images (12-36) of activities being watched and then asked to create a written document of what is

there, what's happening or what they perceive necessary to complete a project. For example, pictures supplement notes to tell a story of what is happening. Students number the images and place notes with the coordinating images. In today's technologically driven environment this exercise often proves to be the most challenging as 'selfies' and images do not often support observations. Students are instructed to photograph an activity that tells a story; it might be a family event, a day at the gym or on campus. Students are again cautioned about taking photographic images without consent/releases. Most often family events prove most valuable, but again ethical concerns need to be reviewed and documented.

4) Direct Observation – students are asked to locate a setting where they can join an activity, observe, and not participate; this is often done in class presentations however students are often provided a rubric to assess interactions and for that reason it is not preferable for this exercise. Observations last for 30 or 40 minutes and students record everything through their senses about the setting. Using a divided sheet of paper students note their feelings, thoughts, and ideas about what is happening. Part of the lesson is that researchers making observations need to record physical characteristics, setting interactions between/among participants/teams, and the difficulty connected with doing both, observing and writing. I have utilized ice skating rinks, football games and concerts for this exercise. Students are advised to avoid venues where alcohol is served and are cautioned not to talk to anyone. The challenge here is to record observations chronologically and to remember bits of conversations.

5) Participant Observations – students are asked to participant in any activity that lasts at least 2 hours; participants are not allowed to take notes or photographs. Social events such as family dinners are a good example as participants interact and do not normally take notes. In this exercise students make notes as soon as possible after leaving the event, using memory, students document as much data as they recall. Students must consciously try to remember conversations and detail in chronological order. (para. 2-11.)

Memory Exercises linked familiar places to advanced observational skills. For example, students selected a room in their home then created a map adding physical descriptions of the setting. I have sourced local clothing and/or home stores and asked students to step inside one entrance, make a mental note of what items were where, then leave the store, create a map including descriptions of what was where. Once done students returned to assess their maps for accuracy.

Discussed earlier PO/FO participants meet an early selection process defined by discipline, education, and experience. Individuals selected expressed an interest and were

available to participate in data collection and documentation. Participants conducted assessment

and used observational data collection tools and pre-designed forms. Others have used similar

approaches depicted in Table 3.5; individual roles used to develop volunteer training materials

for non-student participants (depicted bold).

Table 3.5

Facilitator, PO, and Stakeholder Roles

Role of Facilitators, POs & Stakeholders		
Full-participant observation (FO/PO/ Juror)	Partial participation (Participant observer)	**Onlooker observer is an outsider (Non-participant observer)**
How the Observer Is Portrayed to Others		
Participants know that observations are being made and they know who is making them.	Some but not all the participants know the observer.	Participants do not recall that observations are being made or that there is someone observing them (Cameras, audio/video recording)
How the Purpose of the Observation is Portrayed to Others		
The purpose of the observation is fully explained to all involved.	The purpose of the observation is explained to some of the participants.	No explanation is given to any of the participants.	False explanations are given; participants are deceived about the purpose of the observation.
Duration of Observations		
A single observation of limited duration (e.g., 15 minutes)	**Multiple observations during a two-day charrette (four times a day each day)**	
Observation Focus		
Narrow focus: A single element or characteristic is observed.	**Broad focus: Holistic view of the activity or characteristic being observed, and all its elements is sought.**	

I scheduled training for 3 to 4 hours; the goal was to make training fun, interesting, and informative. I included question and answer sessions and provided lunch. I reviewed ethical requirements of human subject research (IRB guidelines); copies were provided for review. Data collection guidelines and observational forms were provided. POs were instructed on making naturalistic observations, identified as the spontaneous behavior of participants. This process was similar to what Margaret Mead used to study different tribes in the South Pacific (Kincheole, 1980). PO/FOs tracked interactions, actions, and project development using point values or check marks (symbols) to identify each criterion. They self-selected observation times and were required to follow a frequency method of observation in sessions divided into smaller equal time intervals. They observed participants at different times to develop data collection. I assigned two POs per team in order to check recorded observations for consistency by comparing individual notes and documentation.

I wanted POs to experience, firsthand the rapid, at times chaotic environment experienced during a charrette. I shared that charrettes are compressed, fast moving collaborative experiences, challenging at times especially when one is expected to collect/document activities among as many as 8 participants. I coordinated with Dr Makela to locate team building training exercises. I needed two different exercises to avoid repeating the same observations devoid of unnecessary or complicated technological use and wanted something POs had not previously experienced. Dr. Makela recommended sources; I selected survival exercise scenarios identified as:1) "Mountain Plane Crash" and 2) "Lost at Sea; available in Appendix H. POs were provided group discussion score sheets, an assessment table, a list of descriptors for scored discussions, and a group skills behavior sheet where everyone circled the behavior that best applied to their

individual behavior in group discussion. I implemented a controlled trial by compressing the

time allotted to complete both exercises and collect data. Exercises allowed volunteers to

familiarize themselves with observation forms, as they documented interactions among others;

participants completed each exercise in 30-40 minutes. Post training POs joined the field trip and

utilized observation forms. Hands on experience provided POs an opportunity to seek additional

assistance, ask questions, or drop from the study. None asked questions while one PO dropped

out. Observational data collected during the field trip, while not used in the study, was designed

to build confidence in observation skills and allowed questions to be answered before the

charrette.

Content Experts (CE)

While recruiting PO/FOs I concurrently sought content experts to join. Content experts

provided critical knowledge of site-specific concerns and communities addressed by the research

project. I identified individuals who might be interested in the project; those who had educational

and/or industry knowledge, training, and life skills. Specialized knowledge provided participants

resources necessary to advance proposals. I selected individuals who understood the charrette

process, sustainability, project development/proposals coupled with project goals, and

teaching/training experience. CEs were available and supportive of participants while sharing

discipline specific knowledge/expertise (Schensul & LeCompte, 2013). The authors stated,

> Individuals such as other researchers, senior officials, university administrators and
> department heads, and key community members hold power and influence over the
> research setting. They control the researcher's access to the setting and the resources
> needed to support a study. If they understand the nature of the project, the reasons for the
> research, and the ways in which it will benefit their constituencies (as well as avoiding
> harm to these same constituencies), they can be valuable allies and assets to the study. (p.
> 56)

To be effective CEs required access to background information relevant to the study. They needed to have research experience in one of the project discipline/areas, and or expertise, and understanding of the demographic characteristics of the people/property of the study focus (Schensul & LeCompte, 2013). CEs blocked two hours of time correlated to charrette days, then joined at pre-defined times to collaborate with participants. They used email, phone, ZOOM and/or text messaging. They supplemented participant content knowledge and answered specific questions. They aided discovery opposed to answers. For example, having access to project information they directed participants to the binder to locate specific structural question, rather than solving or answering the questions for them. I knew industry, education, and content experts had fixed schedules, so I offered options to attend in the most convenient manner as this made joining more appealing. I developed a list of individuals, included recommended times, locations, and roles prior to contacting CEs. Recruitment required FTF, phone, and email communication; documented at 15 hours' time. I sought alternatives to account for attrition. I snowballed recruitment; this added 15 additional hours of researcher time.

PO/FOs Participant Evaluation

During training I posed overarching questions to address observations, noting specific areas of interest and/or missing information; shared as: When new questions emerged what did you observe as participants cycled between project development and problem framing? I supplied the following 'cues":

- Did participants ask for or need/want additional information from educators or industry experts, and did participants utilize the charrette binder before asking for assistance? Identify each.

- How did participants resolve and/or obtain information they felt was necessary from disciplines not included on their team or that they were unable to obtain from educators, industry professionals, content experts or the binder?

Questions aided PO/FOs as they viewed situations/solutions from all perspectives. They identified individuals and teams for interdependence, individual accountability, and group processing. This implemented PO ownership of learning and negotiation skills (Johnson, 2001).

I developed observation classification systems for use as PO/FOs watched and listened to teams by 1) academic and discipline knowledge, 2) skills for success (life world and personal experiences), and 3) teamwork. I applied criteria and measures to assess student learning; forms supported utilization of check marks to document interactions. I tallied and assigned point values based on the types of data being collected. PO/FOs used a 5-point scoring system to identify skill levels depicted as:

5 = Exemplary
4 = Accomplished
3 = Developing
2 = Beginning
1 = Low, and
0 = none identified/documented or observed

PO/FOs were permitted to assess zero points when participants did not identify or address criteria versus earned points if the criteria were identified but not addressed. I developed observation forms to identify communication skills among individuals and teams. I used G, to represent good or NI needs improvement.

I implemented multiple forms to support PO/FOs as they observed similar events over differing dimensions. Observation forms supported traingulation as they used differing criteria and measures related to specific areas of the research questions. PO's assigned point values to

data observed on different days and times. This was planned to avoid receiving emotional responses from PO/FOs. For example, one's initial response is the most memorable, and can have a distorting effect on judgment. If a PO witnessed a disagreement or disliked another's behavior the inclination was to judge other individual observations as either positive or negative. Other used similair approaches and identifed this as confirmation bias.[8]

Using simplified measures(check marks) allowed PO/FOs to record criteria quickly as they addressed how or if individuals and teams worked collaboratively. Check mark totals provided a means to quickly assess processes and/or situations then document interactions of what was seen and or heard. I was able to ascertain and discuss shared insights and understood events, activities, and/or situations that led to TL using this method.

PO/FOs utilized observer cues to identify competencies and skills demonstrated by participants, copied from Center for Community Development, Service Learning Curriculum Development Resource Guide for Faculty (2010, pp.29-30), depicted in Table 3.6.

Table 3.6

Observer Cues Utilized by PO/FOs to Identify Competencies and Skills Demonstrated by Participants

Writing Course Goals and Objectives (Bloom's Taxonomy*)

Competence	Skills Demonstrated
Knowledge (K)	• observation and recall of information • knowledge of dates, events, places • knowledge of major ideas Observers Cues: list, define, tell, describe, show, label, collect, quote, name, who, what, when, where, examine

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[8] Confirmation bias is exhibited when one looks for evidence that supports and/or confirms their own ideas.

Comprehension (C)	• understand information shared across disciplines • grasp meaning from others outside of their discipline/field • interpret facts, compare and contrast • translate knowledge into new context • order, group and infer causes • predict consequences Observers Cues: summarize, describe, interpret, contrast, predict, associate, distinguish, estimate, differentiate, discuss, extend
Application (AP)	• use transdisciplinary information • use methods, concepts, theories in new situations • solve problems using required skills • knowledge sharing across disciplines Observers Cues: apply, demonstrate, calculate, complete, illustrate, show, solve, examine, modify, relate, change, classify, experiment, discover
Analysis (AN)	• seeing patterns • organization of parts • recognition of hidden meanings • identification of components Observer Cues: analyze, separate, order, explain, connect, classify, arrange, divide, compare, select, explain, infer
Synthesis (S)	• use old ideas to create new ones • generalize from given facts • relate knowledge from several areas/disciplines • predict and draw conclusions Observer Cues: combine, integrate, modify, rearrange, substitute, plan, create, design, invent, what if, compose, formulate, prepare, generalize, rewrite
Evaluation (E)	• compare ideas • assess values of theories, presentations • make choices based on reasoned argument • verify value of evidence • recognize subjectivity Observer Cues: assess, decide, rank, measure, recommend, convince, select, judge, explain, discriminate, support, conclude, compare, summarize

Note. Benjamin Bloom created this taxonomy for categorizing level of abstraction of questions that commonly occur in educational settings. **Faculty adapted, From "Taxonomy of educational objectives: The classification of educational goals: Handbook I, cognitive domain," by B. S. Bloom, (Ed.), 1956. Longmans, Green. Copied from Center for Community Development, California State University, Long Beach, Service Learning Curriculum Development Resource Guide for Faculty, 2010. pp. 29-30. https://www.usf.edu/engagement/documents/resourceguideforfacultyrev-11-05-10.pdf. Reprinted with permission.

This allowed PO/FOs to identify and document data; similar to that often found in educational settings. Methods provided POs a classification of competences, easily identified using cues, which demonstrated student learning. To create the form, I utilized 1) *Service learning curriculum development resource guide for faculty* (The Center for Community Engagement, 2010) and 2) the *Taxonomy of educational objectives: The classification of educational goals: Handbook I, cognitive domain* (Bloom, 1956). POs were not academically trained or familiar with curricula development/evaluation, rubrics provided and identified observed interactions among participants. Bloom (1956) used a similar method when analyzing a teachers' success in class discussions. Behavior-based cues allowed PO/FOs to observe and clarify interactions among participants using descriptive statements. Cues established identification of participants' discipline and life skills knowledge and how each facilitated communication among teams.

Six objective classifications based on descriptions of behaviors represented educational objectives. Objectives documented individual behaviors as participants interacted, shared tasks, problems, procedures, or observations. I shared that individual behaviors often differed depending on the behavior or task being performed. For example, I expected identified behaviors might not elevate discipline knowledge/life skills to a level of perfection among differing disciplines. As participants collaborated and shared knowledge among disciplines, POs were able to rapidly identify an objective and how or if participants were able to apply new knowledge to new situations. POs recorded evidence of the translation and TL by participants.

This tool was useful as PO/FOs were able to identify competences displayed by answering, "Did the participant demonstrate identified skills and were they able to retain and transfer information then apply new knowledge to problem solving?" I utilized data to describe

learning experiences and contributions from participants' perspectives. This approach allowed

me to address and describe how TDL and TDM teaming helped and or hindered participants'

sequencing and integration of new knowledge based on evidence collected. I explored how

knowledge evolved from understanding versus rote recall. Bloom (1956) used a similar approach

shared as, "knowledge is of little value if it cannot be utilized in a new situation or in a form very

different from that which it was originally encountered" (p. 29).

Data were transferred from observation forms to spreadsheets. This was a deliberate

design to aid me when evaluating collaboration among those from academia and private sector

practitioners. It supported the search for collaborative research as participants focused on a

societally relevant problem that enabled mutual learning processes among those from different

disciplines. Using observation forms and tables allowed me to easily collect, discover, identify,

and evaluate similarities, differences, and combined contributions generated during the charrette

in the exploration of TDL and TL. Post charrette I examined participant interactions of 1) shared

experiences, 2) critical reflections, 3) reflective discord, and 4) actions taken. Tables identified

specific study areas and outcomes shared by individuals and teams that addressed:

- participant field trip documentation identified potential site difficulties focusing on proposed concepts and how each related to project objectives
- PO/FO observations reflected discipline content and skills related to project deliverables, producing considerable details. Consideration was given to how issues observed related to the project objectives
- PO/FOs and the researcher looked for accuracy and relevancy; consistent with stated parameters/requirements of the project
- participant's developed simplified matrices (field logs) and completed exercises to analyze and document site issues to support cross-discipline strategies to solve team identified problem(s).
- participant's and team collected data were utilized to evaluate how differing experiences and documented observations could be combined and implemented to advance problem solving.

The ability to triangulate and capture different dimensions of the same events across various timelines and activities supported my desire to explore the ways in which each method produced findings and assured validity of the research. I utilized findings to provide a clearer understanding of the problem by reviewing conversations, interactions, drawings, and exercise findings combined with presentation evaluations to identify intra/inter teaming experiences. I viewed this as similar to conducting multiple trials in an experiment when the researcher repeats procedures to identify errors and to minimize random effects. The goal was to converge information from all sources, then identify multiple methods used to implement and assess TDL and TDM teaming.

Assessment metrics and simplified observations rubric (Table 3.7) identified guidelines, shared as:

As participants completed activities/exercises were they able to[9]:

- identify elements of reasoning when thinking about site problems and issues: its purpose(s), the questions(s) to be answered or problem(s) to be solved, the requisite information or evidence required, made and assumptions/inferences, concepts and principles being used, implications or consequences of the reasoning, points of view or frames of reference being used to solve a problem.

- locate, gather, and evaluate information collected from pre-charrette read case studies, site visit field logs, and through team collaboration using a virtual meeting and by sharing information from research to their team via the web; students will utilize research to develop research questions to be utilized when developing an educational plan for a multi-generational audience using the proposed site.

- evaluate sources of information collected, acquired from pre-charrette read, case study sources, field exercises/observations, and shared with their team. Information was analyzed, summarized, and synthesized from academic disciplines and diverse

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[9] Learning objectives/rubric development were adapted from multiple sources as Acoba (2016), Brocatto (2015), Cramer (2016), Edwards (2016), and Koehn (2016).

sources; participants exhibit critical thinking using oral communication and written skills developed to address a proposal.

- illustrate and demonstrate how species and populations interact onsite and demonstrate how humans impact the natural environment, site artifacts, and ecosystems.

- analyze site issues collected and identified during the field trip and develop strategies for informed responses among disciplines.

- information collected from field trip and pre-read were utilized during the charrette to solve identified problem(s) while developing responses to a final Request for Proposal (Stakeholder presentation).

- identify and evaluate (peer review) personal interactions, academic/discipline knowledge, life skills, and strategies that facilitated a transdisciplinary team while exploring and accomplishing mutual goals while teaming in virtual and on-site meetings.

Table 3.7

Field Trip Evaluation Rubric (Example)

Document what you see and hear while following participants during the field trip responding to: DID PARTICIPANTS	Identify how you saw, heard, or experienced participants as they address each of the areas identified, such as making notes, taking pictures, or talking to each other Make notes of information participants asked for or needed from the PO/FO or others not present							
Participant ID (Last four digits of cell phone number translated to two digits)	1613 13	3715 35	9071 91	3756 36	8935 85	2218 28	9189 99	1045 15
1) Identified elements to be used to solve a problem	identified cattle moving across the paths-noted 'cow pies everywhere'		How to fix eliminate this when humans touring					

2) Gathered site information creating field logs: structures, potential uses, renovation vs new buildings, paths, roads and/or access	#36, 99 & 13 spoke about replacing a pole barn							
3) Documented existing site conditions	Drawings shared interiors of homestead all participants documented interiors making floor plans							
4) Illustrated and identified species & populations, ecosystem, & how humans on site will impact the natural environment	#85, 91 & 28 talked about the blue bird project & used the barn for teaching about research-loft open #13 & 15 talked about drew milking stalls used to tell dairy farm history							
5) Analyzed site issues - addressed working cattle ranch and/or other properties (headquarters, castle, homesteads, crops and/or non-human species (horses, peacocks, chickens, bears, bobcats, birds of prey, etc.)								

6) Identified/documented information needed to create/develop an educational program on site								
7) Document personal interactions, academic/discipline knowledge sharing, skills and personal experiences sharing	All participants shared design skills and talked with engineering student who was concerned about water collections and silo stability							
Notes	XXXX (four participants joined in #1 observation/conversation)							

PO/FO Identified Learning Objectives

PO/FOs were provided the following learning objectives as they collected data from

participants, identified as guiding principles commonly implemented when solving community-

based problems. Objectives were project specific identified as:

Students will be able to:
- identify and analyze readings, understand early homestead development at the ranch while having a grasp and understanding of the current ranch operations.
- identify and analyze social and cultural evidence at the ranch, including using historic renovation guidelines from the National Registry of Historic Sites, including a review of the actual guidelines culminating in "Renovation Plan & Vision".
- identify, define, and analyze an educational center on one site: including development plans for site.
- identify and interpret what is currently at the ranch to include using maps, historic artifacts, GIS, archeological sites, endangered species identification, rehabilitation activities of wildlife, and cattle operations.
- identify and analyze presentations from objective #2 on-site by students' individual discipline; combine recommendations formulating a joint vison by filling in the team mapping form, including identifying findings in the final presentation.
- identify and demonstrate risk-taking, independence, acceptance of challenges, and assume new roles in a charrette team.

- demonstrate autonomy and assertiveness while taking responsibility for one's own actions while persevering in the face of conflict/difficulties.

POs collected data, notes, and comments and had the opportunity to share their observations with their PO partner at the end of each day when tallying check marks/points. If POs disagreed or did not observe an objective as met, they were asked to make notes for my review. To assist PO/FOs with completing observation forms I met with each team (either during breaks or lunch, reviewed again as students prepared for presentation delivery). I asked if PO/FOs were able and comfortable recording data, if data were missed or not observed, PO/FOs highlighted (color coded) areas they had questions on or concerns about to make identification easily visible. PO/FOs were prohibited from changing initial observational data, however by sharing during the day it was believed that PO/FOs might be better informed when addressing the next observation form or day's activities.

Individual Participant Contributions

PO/FOs collected data on forms that identified individual participation as 'Collaboration' depicted by C; findings were totaled by individuals, then by teams. This provided an overall score based on culminative points earned during activities; individual points were based on the seven learning objectives. POs received the following during training:

- Individual team contributions observed during the charrette will be assessed using the attached observation form. Please identify participants using their two-digit ID, such as (16) followed by team ID, for example (T3). During each 15-minute observation period use check marks to identify interactions among individuals; then end of day tally check marks for each contribution; then enter the number that best described individual performance on each of the items identified using the 5 point scale. Example: If while observing participant 16 you heard them helping or instructing other participant(s) using the Galaxy program, place a check mark in *Assisted others with technology,* repeat for each occurrence. If 5 or more instances of this activity occurred, the participant could receive 5 points. If participants had interactions with another team, then assign point values to those interactions, adding notes for clarity. For example, if participant #16 contributed

to the discussion by sharing information from the field trip during the 1st a.m. observation, place 1 check mark for that contribution, tally end of day the number of times #16 shared the information. If #16 completed the think, pair, share activity they could receive another check mark; and so, on throughout both days. Once you have completed Day 1 observations save the observation form and use new forms for Day 2.

- Moving to Day 2 and completing an a.m. observation of the same participant (#16), did the participant utilize or expand on earlier contributions? If yes, you will place a check mark in that column. If the work were equally divided among team members, each participant could receive points; a maximum of 5 points per contribution. If a team member did not participate or support the team, they would receive 0 points. This rubric was extensively reviewed for clarity with POs during training.

POs were informed not all activities/interactions would be seen or heard each day, or even during each observation period. I explained they might not experience or see/hear all areas on the observation form. I clarified that PO/FOs needed to focus on what was seen and heard, then document it as such rather that documenting what each perceived as occurring. End of Day 2 each PO tallied check marks and assigned a single score. They identified each by the number of behavioral interactions witnessed and identified on the rubrics/observation forms. PO asked FOs clarifying questions or if assistance was needed. PO/FOs provided documentation, tables, and observation forms for researcher review end of Day 2. Table 3.8 depicts a completed rubric.

Table 3.8

Individual Contributions to TDL Teaming Rubric (Example)

Team ID: RED TEAM

Day 1 Culminative points	Student 2-digit ID							
Contributions (Max 5 points each contribution)	16	42	69	54	89	03	25	32
Contributes to content (completed the pre-charrette read and think, pair, share activity)	5	4	3	3	1	0	5	4
Came well prepared for charrette, shared life skills and discipline knowledge, shared concepts from readings and reasoned critically	3	2	1	0	5	4	3	2
Contributions to efficient group procedures (keeping on track, fulfilled tasks, shared life skills & discipline knowledge as agreed)	1	5	4	3	2	1	0	5
Degree of communication (listened, did not interrupt, respected other opinions, was group centered and open minded)	4	3	2	1	0	5	4	3
Degree of participation (participated in planning, was reliable and resourceful)	2	1	0	5	4	3	2	1
Assisted others with technology, GIS, virtual meetings, research, drafting/drawing.	5	5	4	3	2	1	0	5
Exceed expectations, showed leadership and teamwork skills; shared life skills and discipline knowledge willingly.	4	3	2	1	0	5	4	3
Overall team value (NOT TO EXCEED 35 TOTAL POINTS per individual)	24	23	16	16	14	19	14	23

POs met with me for 10 minutes to review activities/observations both days. I used notes

from daily observations PO/FOs created to assess teams (Table 3.9). Instructions stated:

> You may assign 3 points per identified objective; point values identified as: 3 points equated to participants exceeding requirements as documented by 5 or more instances (seen or heard sharing/discussing the identified variable, 2 points equated to 3 or 4 instances (seen/heard) sharing/discussing the identified variable, and 1 equated to 1 or 2 instances (seen/head) sharing/discussing the identified variable, documented as did not meet requirements but a single point was awarded as PO/FOs acknowledge participants did attempt to meet the objective by completing a portion of the work but fell short of meeting expectations.

Table 3.9

Student Participant Team Assessment and Measures

Name of Person Completing Observation/Assessment:
PO/FO ID _____
Date of Observation: _____ DAY 1_____   DAY 2_____

Objective	Measures (During observations did individuals/teams identify/implement and/or reference the following)	Team Participant IDs: (prepopulated)	Team ID: (prepopulated)
		3, 2, 1 point	Total (overall)
Did participant(s) appear to have completed the pre-charrette research and analyzed the Ranch site?	Identify pre-charrette readings, understand early homestead development at the ranch while having a grasp and understanding of the current ranch operations.		
Did each participant prepare a 3-5-minute presentation to share with their team and during the charrette	Identify and analyze individual contributions to their team, while evaluating their ability to function alone and as a team.		
Did participant(s) projects include a writing component and presentation within a transdisciplinary team of participants?	Identify and analyze social and cultural evidence at the ranch, including historic renovation guidelines from the National Registry of Historic Sites; include a review of the actual designation culminating in a final presentation and recommendations culminating in a "Renovation Plan & Vision".		

Did participant(s) address issues through a negotiated, action research project during charrette	Identify, define, and analyze utilizing the ranch as an educational center on one site; including development plans for the sites.	
Were participants able to identify and describe what is currently going on at the site?	Identify and interpret what is currently at the ranch to include maps, historic artifacts, GIS, archeological sites, endangered species identification, rehabilitation activities of wildlife and cattle operations.	
The project will include writing and presentation of findings and recommendations by TDM teams. Did each team include input from individual team disciplines?	Identify and analyze proposals from objective #2 on-site by disciplines; combining recommendations to formulate a joint vision in the form of a presentation to stakeholders.	
Did the charrette appear to improve participants' awareness of individual strengths, change preconceived ideas, and expose participants to options and points of views other than their own? Did the team appear to respect and appreciate different perspectives and disciplines while identifying similarities and relationships?	Identify and demonstrate risk-taking, independence, acceptance of challenges and assume new roles.	
Did participants develop oral and/or written communication skills, while learning to collaborate and negotiate to resolve conflict? Did the team come to understand relationships among disciplines/fields?	Demonstrate autonomy and assertiveness while taking responsibility for one's own actions while persevering in the face of conflict/difficulties.	

I used more than one observation form to minimize observation technique disadvantages. For example, when POs interacted with participants and not recording observations, they asked questions and confirmed team interactions which clarified participant understanding.

Observing participants over several sessions using multiple observation forms had the following advantages:

- participants activities varied over varied times of day and on particular days, this allowed POs to see more variety.
- repetition of activities provided a better understanding of tasks, interactions, and problems, allowed POs to see the same task(s) multiple time and identified when none of the actions were seen or heard; variations between participants and among teams were better documented for activity frequencies.
- splitting observations into several sessions using multiple observation forms allowed POs to retain mental freshness and supported observing different actions/reactions.
- various sessions and observation forms allowed POs to reflect on what they had already observed, this allowed POs to refocus for the duration of the sessions (Ross, 2018, para. 30-34).

I used multiple observations that focused on details identified based on elements identified as:

- tasks and the steps individuals utilized to address the project
- workflow between individuals and teams
- interruptions and how individuals addressed them
- tools, technology, and artifacts utilized
- information sourced
- problems encountered when addressing the project challenges (Ross, 2018, para. 35-40).

I knew that using multiple observation forms while being active participants might be overwhelming. I believed PO/FOs were qualified to collectively watch, listen, and document perceived interactions; this provided me post-charrette details to identify data collected and determined the impact as I addressed research questions.

Presentation Evaluations

PO/FOs utilized Table 3.10 for final presentation data collection. Instructed not to change or add anything to observation forms anything outside identified measures and/or criteria was placed in notes. Data were collected from each PO and discussed in Chapter IV.

Post-charrette Surveys

I developed post-charrette surveys to identify team dimensions that addressed research questions. Student surveys are in Appendix J; PO surveys are in Appendix K. I implemented survey's as other used similar approaches and pointed out positive and negative outcome possibilities for this method. I identified reasons for post surveys as:

- inexpensive, practical method for data collection targeted to teams. Provided a means to gather large amounts of data while obtaining feedback on respondents' experiences and opinions.
- allowed the researcher to gather information from anywhere in the world; offering an opportunity to address differences among people and sites. Provided means to compare and contrast other research. It allowed the researcher to measure change.
- allowed the researcher to ask multiple questions framed in differing ways.
- maintained respondent anonymity and provided actionable data.

I believed surveys were one viable method to record large amounts of data from participants in a short time frame. Since data was combined with audio/video recordings and PO data collection, I felt positive reasons outweighed challenges. I reviewed length and data collected from XQ surveys then developed Cherokee surveys. Reviews showed that XQ team members completed responses to 57 questions (post-charrette survey) with the average completion time of 20 minutes. I concluded this was an appropriate among of time to maintain focus and responses from participants. I used this information to develop the Cherokee survey(s).

Table 3.10

Stakeholder and PO/FO Presentation Evaluation Matrix

Team ID	STEP 1: Criteria – each objective criterion may earn 3 (Yes), 3 (partially), or 1 point (N, did not meet), no points to be awarded when no observation is documented) Use "Objectives - students will be able to" when assigning points (Attached).		Met requirements (Y = Yes, 3 points)	Partially Met requirements (P= partially 2 points)	Did not meet requirements N=Did not address but mentioned 1 point)	Total____
(TB) Verify team members by ID/code	____ Team	Assign points for each section and total using mapping observation form. Using the final presentation did participants address each area identified on the mapping exercise. (See attached variables identified on mapping exercise)				
	MEETS OBJECTIVES Did the team address and provide a conceptual plan for renovation of an existing building? (Assign 1 point for each of the identified areas) Max 15 points.	This addresses your opinion on the project, did participants meet objectives and did the final presentation and plan capture the project goals? Did participants experience and display TDL and TL?				

	Max 5 points	EFFICIENCY- identify areas addressed (1 point for each variable)			
	Max 5 points	EFFECTIVENESS – identify areas addressed (1 point for each variable)			
	Max 5 points	EXPRESSION – identify areas addressed (1 point for each variable)			

By using electronic surveys' respondents had a private, less intimating atmosphere to share experiences than were possible FTF or by telephone interviews. Participants were given five days to complete surveys as this provided a time to think about key topics and experiences, supporting deeper reflections. I collected and translated descriptions charrette activity. This led to ideas for additional studies, interventions, or actions (Schensul and LaCompte, 1999). Findings based on participants' self-reported experiences identified and provided snapshots of attitudes and behaviors, including thoughts, opinions, and comments on TDL, knowledge sharing, and if attending a charrette changed how they planned to address problem sharing and cooperation in the future (TL).

Participant (Student) Post-Survey

The survey determined the charrette effectiveness as it fostered shared information, knowledge transfer, and competencies among participants. Respondents used personal identifier to support cross-referenced responses. Participants received electronic surveys end of the charrette. It included 55 questions comprised of multiple choice, Likert style and open-ended responses (Appendix I). Participant email addresses were pre-loaded in Qualtrics; with follow up email reminders.

Section I consisted of 16 questions. Q1 that asked if participants completed the pre-charrette read and prepared a 3 to 5-minute review to share with their team pre-charrette. Q2 asked if and how site/project information pre-charrette was helpful and if it saved time searching for project proposal information; Q3 asked about team assignment team. Questions Q4 through Q14 asked about shared experiences and participant observations. Q15 - Q16 addressed experiences communicated with teams either on-site or off-site; these questions were skipped if

not applicable. Questions were adapted from Nemiro (2004) and addressed blended learning environments.

The next section (Q17 - Q19, and Q23 - Q27) addressed discipline specific knowledge acquisition and sharing, TL and TDM teaming; interspersed were three questions (Q20 - Q22) that asked respondents to share field trip exercises/reflections.

The third section addressed collaboration, goals and strategies within respective teams responding, "During the charrette, my team _____" (Q28-Q31), (complete the sentence, multiple choice). Next respondents answered multiple choice questions completing the sentence, "As a team member during the charrette I_____" (Q32 – Q35).

Responding to Q36 - Q44 (multiple choice) participants evaluated experiences, charrette actives, teamwork, and shared work, followed by Q45 - Q50 that sought opinions about team members and teamwork. Respondents were instructed to place a check in the box that best identified opinions, represented by 0/1 as not at all or low and 5 extremely or very much like me. The next question Q51 asked about preferred communication methods scored by communication methods from most preferred (1) to least preferred (10). Questions Q54 - Q55 were open ended, asked to a) describe a positive and negative experience associated with this charrette and b) to identify what they perceived as the biggest barrier/challenges when working on a TDM team, such as if/how they liked virtual communication and working among differing disciplines; Q56 - Q57 asked if they anticipated working with TDM teams in the future. Lastly, participants added anything else they wished the researcher to know about their experience, coupled with recommendations for future charrettes.

PO/FO Post-Survey

End of charrette POs were provided access to the survey, allowed five days to complete with reminders sent via email 3 and 5-days post. The survey included 21 questions, consisted of multiple choice, complete the sentence and open-ended comments (Appendix L). Questions Q1-Q9 asked about their role as a PO. Next questions (Q11- Q14) asked about observations of participates interactions and utilization of supporting materials; Q15 and Q16 asked about field trip and participants activities by completing a sentence. Q17- Q20) asked about charrette experiences and what observations they found using notes, questions etc., responses were selected from a pre-defined activity list. Q21 asked for information, suggestions and/or changes they thought would advance future charrettes and/or studies.

Examining the Charrette Process for Transformative Learning in TD Model Teams

To enhance TD I wanted to explore ways to examine the charrette process and identify team contributions as individuals crossed disciplinary silos. Literature showed that TDL promotes methodological reorientation to core concepts among disciplines. Charrettes were a process in the TDM strategy that effectively integrated all aspects of project development achieved in absence of predefined processes. TDL unleashed curiosity and creativity among participants. TDM charrettes were the tool utilized for participants to create project visions by an all-inclusive team, as they outlined steps to achieve designs and proposals. I used participant involvement to understand and explore how teams investigated, processed, and identified actions/incentives, then transferred information to problems and integrated new knowledge. Other have used similar approaches and I developed a three stage process to explore and examine TDM team actions into TL. Figure 3.5 depicts sources used including: Boyd (1991),

Mezirow (1991a, 2000), Cranton (1994, 1997), Cragg et al. (2001), King (2002), and Taylor (2007, 2017).

While there are a variety of methods available to researchers' this study's PO/FOs acted as full participants, intervening when action or clarification was necessary and when requested by participants. All participants were aware of the observers; their roles, identities and/or associations were explained. Observers were given specific instructions on ethical and legal obligations for students' (participant) privacy. Each PO was provided a "How To" guide in taking notes, including how to create running descriptions of settings, people, activities, and sounds. PO/FO took notes in real time during the charrette. Post-charrette I used them as a memory aid when reconstructing full event notes. Lofland and Lofland (1984) recommend that notes be constructed as soon after observations as possible, preferably the same day.
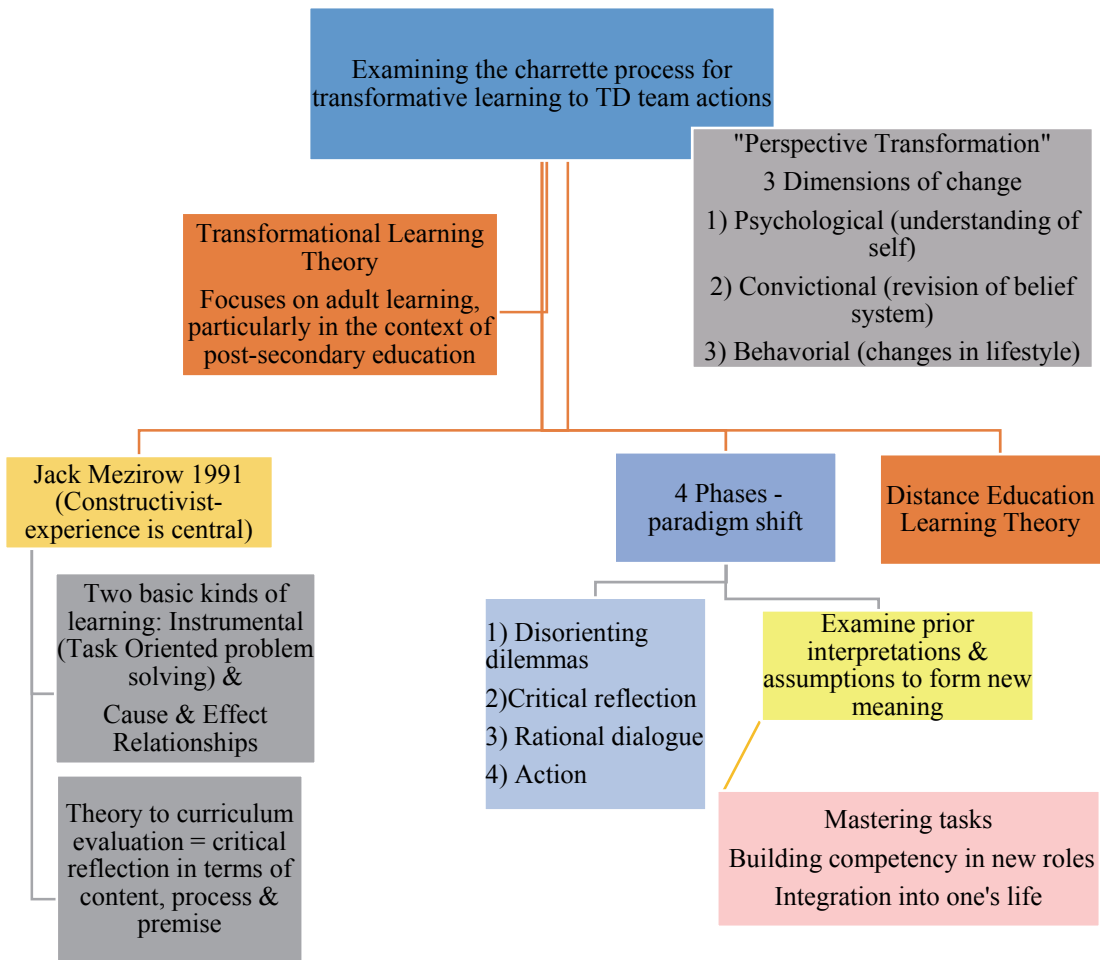
Figure 3.5

Examining the Charrette Process for Transformational Learning to TD Learning and TD Model Team Actions

Transdisciplinary Evaluation I reviewed literature and collected data to develop and identify

participant experiences. I next developed observational forms based on data to be collected.

Forms were reviewed and adapted for use as evaluation measures that identified participant

experiences. I predesigned tables that provided information and a basis for developing and

addressing a TDL assessment framework. I utilized similar approaches by other researchers to

recognize individual and team critical components, team type, and key team processes to use as

the assessment framework. Measures were review multiple times before finalization (Tables 3.11 and 3.12).

Table 3.11

Observational Analyses - Literature Utilization by the Researcher to Develop PO/FO Observation Forms

Type of Analysis and Methods (Corresponding Reference)	Explanations of what to measure: Observers completed observations individually doing a comparative rating of teams., then shared their observations among other FOs/POs developing a comparative rating
Observation (Bryk & Hermansson, 1993)	Facilitators and participants observers detected positive behaviors such as gazing, body directions and gestures to see if the participants were engaged within individual participant teams and among/across teams or during virtual interactions with content experts.
Lag-Sequential Analysis (Connor et al., 2009)	Two-way analysis of nonverbal cues or verbal communication cues between participants and facilitators/participant observers.
Consideration for collection video data (Asan & Montague, 2014)	Video based observation methods used as a data collection tool in health care encounters and from personal experience conducted in primary care settings used to evaluate complex interactions.
Qualitative Research Methods: A Data Collector's Field Guide (Mack et al., 2011)	The guide as a tool for training the data collection staff members of multisite and team-based public health projects; application for smaller-scale or multidisciplinary projects. A guide for experienced to novice shared information for data collection; included case studies.
Factor Analysis (Duggan & Parrott, 2006)	Based on coding of nonverbal behaviors from videos, the mean scores for use of each type of nonverbal and verbal behavior were computed separately to allow comparisons between interaction.
Conversational Analysis (Newman et al., 2010)	Turn taking in the communication among participants and teams during computer use. Completed post-charrette.

Table 3.12

Evaluative Measures Developed by the Researcher with Identified Sources Based on Figures Above

| Principle* | Evaluative Measure* | Tools | | Measures |
		Method	Tool	
Variability of goals	Evaluation of goals based on merging of disciplines	Field observation exercises (2)	a) Ice breaker exercise b) Site mapping profile	▪ Disagreement ▪ Examples of real-world experiences ▪ Examples from classroom experiences
Variability of criteria and indicators	Evaluation of criteria and indicators created from the integrated team	By student participants	Drawings, knowledge /classroom & real-world experience sharing	▪ What was valued to finalize the decision ▪ # communication exchanges
Leveraging of integration	Evaluation of quality of the integration process	Participant (student) surveys - a) pre & b) post	Surveys	▪ Communication styles & opinions/essays ▪ # Options suggested ▪ Does the solution integrate (transcend) disciplinary influences

Interaction of social & cognitive factors in collaboration	Evaluation of mutual knowledge gained from intellectual & social integration	Participant observations Non-participant observations (non-student)	Observation sheets with cues	▪ Visualization of solution approach (drawing, design, visual artifacts) ▪ whole is bigger than its parts ▪ # of people buying in (majority, strongest voices, determinations) ▪ is the team operating/cooperating at a synchronous level? ▪ flexibility ▪ commitment
Management & coaching	Evaluation of leadership, organizational structure, networking & communication	Participant observations Non-participant observations (non-student)	Observation sheets with cues	▪ Leadership: idea support, designs, ideations, alternatives, trust ▪ communication with teams/individuals
Iteration in a comprehensive & transport system	Evaluation of input opportunities & transparency	Observers & Facilitators	Observation sheets with cues	▪ org structure is their hierarchy or flat communication, is there a leader ▪ Roles & communication types, styles of communication
Effectiveness & Impact	Evaluation of outcomes	Invited guests/stakeholders (Jurors)	Comment cards & questions from stakeholders	▪ # of alternatives to solutions, iterations of product statement ▪ External jurors-criteria comments

Recursive Frame Analysis

Literature identified charrettes as sharing characteristics of qualitative or naturalistic research. I identified two prevailing data collection techniques: interviews and observations. Keeney et al. (2015) stated a Recursive Frame Analysis (RFA) uses "qualitative methodology that enables patterns of change to be clearly identified, marked, and analyzed" (p. 25). RFA enabled patterns indicated in shifts, transitions, and changes that took place in conversations. It provided "tracking the discourse associated with communication performance, enabling us to assess whether it moves, changes, or transforms" (p. 26).

RFA followed participant's perspective progression as I reviewed individual and team experiences based on measures and criteria required to address research questions. Measures were instrumental in confirming observational data collected on experiences, coupled with PO/FO notes and reviewed video/audio recordings. Comparison was used and continued to identify relationships among teams at each study phase used to identify links until saturation occurred. Participants/teams addressed strategic goals during final presentations identified as:

- to renovate the Ranch homestead to contribute to a shared learning environment and experiences, collaborative research, and a sense of community by providing an environment that is conducive to dynamic interchange that enhances the Ranch as a premier educational site; while maintaining its historic designation.
- to identify efficiency, effectiveness, and expressions.

Researcher Evaluations

I manually identified and recorded data then transferred outcomes to spreadsheets; examined for similarities and differences. I utilized pattern coding to identify themes in observed human interactions and relationships. Pattern coding provided the basis to discuss frameworks as observations required multiple interactions and iterations among differing observation forms.

. Using triangulation of patterns and themes created new levels of understating of existing knowledge among participants. Coding of materials was completed in the order of delivery and allowed me to reflect and edit findings as data developed. Patton stated, as cited in Hoepfl (1997):

> Observational data were [sic] used for the purpose of description - of settings, activities, people, and the meaning of what is observed from the perspective of the participants. Observation can lead to deeper understandings than interviews alone, because it provides a knowledge of the context in which events occur and may enable the researcher to see things that participants themselves are not aware of, or that they are unwilling to discuss." (Observations section, para. 1)
> I used collected data when describing settings, activities, people, their interactions, and

the meaning of what was observed regarding transferability, and to confirm any transformation that occurred (Hoepfl, 1997). Patton (1990) noted that observations can lead to deeper understandings than interviews alone. The presence of observers may have introduced a reserve and distortion of the natural scene early on for student participants, but as participants began to focus this disappeared.

Data Analysis

Data were analyzed applied to naturalistic observational methods, using narrative. I implemented a dual framework of guided observations that explored thematic and content analysis while addressing the power dynamics in collaborative team sessions. Observation data were analyzed using frequency tables (total number of pre-defined and specific interactive behaviors). Through frequency analysis I identified participants' engagement levels in each of the four-stages of Kolb's Cycle of Learning and Hall's Four Phase Transdisciplinary Model (TDM). Using Hall I evaluated participants attitudes by asking the extent to which participants agreed or disagreed with a question or statement. Using the same model, I explored participants

experiences addressing collaboration, and to identify learner's discovery, and research integration.

Study Delimitations

Delimitations included the study population, number of participants and the sample from which the population was selected. I used non-probability sampling. Teams were formed by areas of study (fields/disciplines) and purposely constructed to maximize a TDM team per participant self-identified skills; developed using pre-charrette survey results. Forming teams by this method was based upon the theoretical proposition that people learn best through experiential learning models as defined by the research of Dewey, Montessori and Mezirow (Mccomish, and Parsons, 2013). This model was appropriate as it placed participants in an experiential learning environment during TD teamwork.

I explored transfer of knowledge while following knowledge content sharing, within the time constraints of a two-day charrette. The population participated in two field trip activities, 1) a sensory exercise and 2) a mapping profile exercise. Data collection was acquired from students based upon accessibility to TD cohorts from local universities, with personal access to the site, or by using a virtual environment. This decision afforded observational comparisons among individuals who experienced the site firsthand, or those who experienced the site in a virtual environment; experiences that delivered differing site exposure for participants.

Summary

The goal of this chapter was to discuss and identify methodology, survey, and instrument development and to provide an outline of research methods and discuss what information might be gained and utilized to answer research questions. I described the focus of the inquiry, identified boundaries, and identified what would be included/excluded. However, as the study

evolved these boundaries moved and at times were altered. I described what, where, and from whom data were collected; divided into phases of the study. I began with open-ended data collection then moved to more focused in successive phases and identified the instrumentation to be utilized beyond self. I depicted planned data collection and recording models, described data analysis procedures and the logistics of data collection; finalized by planning the techniques utilized to determine trustworthiness (Hoepfl,1997).

Sampling and recruitment processes, study participants, data collection procedures, PO/FO training, data collection methods, surveys, pre-read development and observational techniques/exercises outlined the specifics of how the study was conducted. This case study collected observations to build theoretical modeling (Creswell, 2009) for transdisciplinarity and transformative behaviors during a charrette project. Using this methodology, I developed and described how participants sourced experiences combined with prior knowledge and life skills to advance TDL that supported transformative discovery. This chapter identified study variables as communication, collaboration, and transfer of knowledge among teams to explore cross-group differences.

CHAPTER IV - RESEARCH RESULTS

> What sets transdisciplinarity apart from other approaches and what assures its role in twenty first-century education is its acceptance of, and its focus on, the inherent complexity of reality that is seen when one examines a problem or phenomenon from multiple angles and dimensions with a view toward discovering hidden connections between different disciplines. (Madni, 2007, p. 3)

This chapter presents findings that emerged from data collected. It identifies and describes challenges encountered; interprets processes involved in collaboration among participants. It includes photographs and montage to visually address participant experiences.

> People shape their daily lives by stories of who they and others are and as they interpret their past in terms of these stories. Story, in the current idiom, is a portal through which a person enters the world and by which their experience of the world is interpreted and made personally meaningful. (Bach, 2007, p. 281)

This quote draws attention to narrative inquiry as a story, a way of thinking about one's experiences. "Narrative inquiry as methodology works from a narrative view of the phenomenon of experience, building upon Dewey's understanding of experience" (Morgan-Fleming, Riegle, & Fryer, 2007, p. 90). Telling a story is the lifeblood of narrative inquiry and analysis. It is complex and time consuming as I learned watching the charrette videos over and over attempting to dissect layers of conversation within the roar of individual voices, and among teams. I used visual, verbal, and written text as data sources. These were combined with data from surveys, participant observer notes and field trip experiences. I created visual images of team and individual interactions and documented personal impressions, all to gain a holistic overview. I included aspects from each teams' interactions and shared their voices to provide participants' experiences. I employed Bloom's Taxonomy (1956) and Hall's Four Phases of

Transdisciplinarity (2012) to explore commonality in the setting while seeking to understand how and if participants experienced TL during the charrette process. Recursive processes supported discovery of TDL, knowledge sharing, and TL experienced by participants.

Narrative analysis required continual reassessment of research questions as this study involved human interactions, many of which I could not have predicted. This chapter circles among participants and the movement across areas of study and ideation during project development. This approach utilized a community-based participatory (CBPR) orientation, described as "a way of approaching research that shapes how we use methods" (Leavy, 2017, p. 236). CBPR studies involved collaborative partnerships among researchers, participants, and non-academic stakeholders to evoke thinking about and seeing something through a new lens. I participated FTF with participants and stakeholders to assess interactions among individuals and teams. This chapter shared discussions that confirmed analysis conducted was consistent with methodology and addressed research questions; recursive actions were grouped by event/occurrence.

Study Timeline

This study involved a two-year preparation, planning, and implementation process using XQ as an exploratory case study and an additional two-years were devoted to the Cherokee study. I used Cherokee's Wauhatchie (Johnson Dairy Farm) Homestead property to address participant experiences. PO/FO observations were identified and discussed in a recursive manner. To recap Leavy's (2011) work in Essential Transdisciplinary Research, "Transdisciplinary research practices are issue - or problem centered - and prioritize the problem at the center of research over discipline-specific concerns, theories or methods. Transdisciplinary research follows responsive or iterative methodologies and requires innovation, creativity, and

flexibility and often employs participatory research design strategies" (p. 9). This research followed recursive methodologies and required innovation, creativity, and flexibility. It employed participatory design strategies.

Approaching the Study Outcomes.

TD required the collection and evaluation of information from participants; observations were an integral part of the study. To clarify the use of the word 'observation' I sourced Marshall and Rossman's (1989) definition as "the systematic description of events, behaviors, and artifacts in the social setting chosen for study" (p. 79). Naturalistic observations cannot be controlled as participants were watched in spontaneous behavior. POs recorded what they saw in differing ways as they watched interactions and discussions. Observations were collected using event and time sampling. This was implemented to give POs the opportunity to interact with participants knowing that observations required multiple interactions and iterations among differing observation forms.

Storytelling in TD

TDL actions were multifaceted. I explored bridges between TDL, and TL focused on interactions among differing joint activities expressed in stories. Stories from multiple sources created structured redundancies as POs watched similar events. TDL advanced storytelling as it supported reflectivity. Participants remained nonjudgmental and open to others knowledge, skills, and experiences. Stories were shared in an environment that supported participants abilities to freely ask and answer questions. This led new insights for problem solving. Participants shared stories and able to reach agreement rather than disagreements. Combined with narrative analysis I understood and identified how stories conveyed complex meanings that led to TDL/TL among participants. Stories shared in a short time period supported rapid

assessment that improved the charrette process (Slaughter, 1995). Shared experiences provided

clear multiple site options, identified, and shared from field trip data. For example, storytelling

advanced new knowledge and insights into what the future could be identified by human/non-

human potentials for site impact. Stories had a transformative impact on participants as they

addressed community needs. Others have used similar approaches supported by Slaughter (1995)

described as, "…an 'involved self', one who is more likely to become an advocate or an activist"

(p.141). Paschen and Ison (2014) supported storytelling as a self-reflective exercise and

paradigm shift shared as,

> …this means that how we 'story' the environment determines how we understand and practice adaptation, how risks are defined, who is authorized as actors in the change debate, and the range of policy options considered. Furthermore, relating an experience through story-telling is already doing 'knowledge work', or learning. In taking narrative beyond its use as an extractive social research methodology, we argue that narrative research offers an innovative, holistic approach to a better understanding of socio-ecological systems and the improved, participatory design of local adaptation policies. Beyond producing data on local knowledge(s) and socio-cultural and affective-emotive factors influencing adaptive capacity, it can significantly inform public engagement, deliberation and learning strategies–features of systemic adaptive governance (p.1).

Research Questions

Charrettes were shown to be atypical from more traditional classroom learning

experiences. This study explored how peer-to-peer interactions shaped participants learning

environment as they assumed an active learner role more so as a teacher. Charrette exploration

was student centered as this more closely mimicked a life world environment. Identified in

Chapter III, the following research questions evolved finalized as:.

Overarching Question: How did charrette participation reveal transdisciplinary learning (TDL)

within (TDM) teams?

RQ1: How did collaboration lead to participants' problem framing and team building?

RQ2: How did participants demonstrate critical reflection and knowledge sharing?

RQ3: How did participants integrate and apply new knowledge to their final action plan

revealing TDL, interaction, and knowledge sharing?

RQ4: How did blended learning enhance interactions, communications, and knowledge

sharing among participants?

RQ5: How did Participant Observers play a role in the charrette and how did they

intentionally or inadvertently communicate preferences?

Questions guided a framework for collaborative knowledge production and integration of the study course, exploration, and outcomes. It was adjusted during project development to provide commonality among all team members.

Research Methods, Procedures, and Data Collection Results

To address framing changes, the actual nature of TD, research data were collected, transcribed, and recorded for examination. Dewey's narrative concept of experience supported utilization of narrative and thematic analysis (Clandinin, 2007). A cross-case study analysis conducted drew upon similarities and differences between XQ School of the Future and Cherokee studies. Cherokee's observational guidelines were structured and made visible TDM processes during TDL.

Understanding Relationships Using Multimodal Communication.

I combined multiple materials; known as modes to present study context. I incorporated multimodal communication to aid and assist relationship identification, teams began early ideation that led to project development. Used and supported by others similar approaches and methods I hoped to communicate and present research in new and interesting ways. I believed this process better connected research aims and evolving communication practices. To address participant needs of those unable to attend the field trip I photographed then shared images

depicted as site artifacts. Images proved invaluable for charrette participants; both for those who did or did not attend the field trip. Consistent with this process I used Microsoft WORD Snip & Sketch software that created illustrative materials from field and depict charrette experiences.

Recruitment and Attrition

Recruitment began Monday, December 18, 2017 and continued until February 18, 2018. Prospective volunteer names (30), emails, and telephone numbers were managed with assistance from Cherokees community development manager. Cooperative emails introduced the research and invitations were emailed to 64 people between December 18, 2017 and January 31, 2018. Follow up calls and meetings were held while campus FTF recruitment was planned over three days; sessions were delivered in 2-hour blocks as follows:

- Monday, February 5, 2018 at the home of Daniel Raggi (Denver, CO) we jointly introduced the study and presented a power point to 10 Education professionals followed by a short Q and A session.
- Tuesday, February 6, 2018 to 10 industry professionals and students from landscape architecture and construction management (Denver, CO).
- Tuesday, February 6, 2018 to 27 University of Colorado, Denver campus landscape architecture graduate students and industry professionals. This meeting was coordinated and presented with Daniel Raggi.
- Wednesday, February 7, 2018 to 30 graduate students, off campus at a meeting hosted by Student Ministries. This presentation was cancelled due to inclement weather.
- Thursday, February 8, 2018 two information sessions were presented to Interior Design students, attended by 42; supported by the professor at CSU.
- On-campus recruitment (CSU) sessions were held in a central location (Behavioral Sciences Building) announced via posters, held Thursday, February 8, 2018, presented every 30 minutes between 4:30 PM and 7:00 PM; 11 students attended.

I provided food for recruitment meetings and shared Power Point presentations combined with posters developed for the Cherokee Board meeting.

Recruiting Interior Design Students

This was my seventh time sharing Cherokee information. My enthusiasm and passion remained high while I speculated what participants needed to know to get them interested, then

involved. I wondered how to share Cherokee history without overwhelming people with large

amounts of data. In my mind I heard,

> Interesting, it must be interesting. Should I share how I stumbled upon the place and how it changed my direction, my research, or do I give them enough information to draw them in and see what develops. How do I get people interested to do a preliminary reading, take pre and post-charrette surveys, attend an optional field trip requiring 2 hours' drive one way, and then attend a 2-day charrette? I wondered, what is in it for them? How do I get people to the site, and how would I share everything 355 acres has to offer? What about hazards inherent with ranch life. What would I do if asked to do something similar? How would I juggle the time commitment against already overloaded course schedules, work, and social time?

I respected professors time and plans and knew information had to be short as attention

spans wane. I limited class presentations to 30 minutes. My first presentation attended by Interior

Design students listened to brief introduction by the professor before I opened with,

> Join me on a journey through time, I'm here to invite you, lure you rather by the mystery of a 22-room castle, three historic homesteads, all on a working cattle ranch. It's really a challenge to join a cohort of students, stakeholders, and community members, inside and outside the university, to gain private-sector experience during a charrette.

I next heard myself say,

> Your mission (blazing in my head was the theme song from Mission Impossible) is to work with a diverse team to explore and brainstorm ways to create an educational program and wildlife sanctuary using 355 acres. You will be given few parameters and expected to develop the project as your own. This experience will hone professional skills and give you historic renovation, sustainability, education, and design experiences. You will collaborate with students from other disciplines, sharing ideas and negotiating ways to address a life world problem. The castle houses a large collection of rare, period antiques, literary works, and fine art. The site is home to raptors, a herd of elk; pairs of Black bears, bobcats, and lynx, and Colorado's largest blue bird research project…there's archeological finds, historic roads, and cattle. Interested?

The room was still, not a single word…my worst nightmare! During the pause the

professor jumped in and said, "I know some of you have community projects to complete others

might just be interested, but anyone who wants to attend and work on this I will give extra

credit." Saved! Hands went up and I met with interested students for a short question/answer session end of class. I shared links to the pre-read materials and campus meetings times should any wish additional information or clarity. I shared a Power Point presentation that:

- identified project background
- an overview of the property and castle information
- included a 'Cloud' created from earlier collaboration with graduate students from Colorado State University Construction Management program and University of Colorado School of Architecture in 2017

I distributed study and contact information to attendees before leaving. Ten presentations were delivered to prospective participants.

Blast Emails and Snowball Recruitment

Recruitment continued simultaneously with classes and expanded recruitment as I used the CSU campus 'blast' system. Invitations were emailed to 320 selected students among 8 disciplines. Emails were sent three times; each provided project information, contact information, and a request for volunteers. 'Blast' used central administrative email listservs to communicate with large groups of campus email users. Central administrators controlled and updated emails.

Recruitment Findings

Initial recruitment was identified by participant type, discipline, association with Cherokee Ranch or stakeholders. From 64 participants, teams were assigned to each of 8 students among 8 teams. Two additional students acted as assistants (NPOs) roaming among teams. POs were assigned 2 per team, with FOs roaming as needed. NPO/FOs were not counted in totals. This population remained constant until two-days pre-charrette. Tables 4.1, 4.2, and 4.3, depict recruitment progression.

Table 4.1

Recruitment Findings

Overview	How contacted	Number Contacted	Times Contacted	Confirmed	Attended
Participant Observers (PO)	FTF, Phone. Emails	16	3	13	8
Education content experts Graduate students (club)	FTF/phone	11	4	1	1
Students (CSU -13 disciplines)	Email blast	320	3	1	0
Industry professionals, non-academic content experts	FTF, email & phone	47	4	28	1
Professors/Educators	Email & phone	12	2	1	1
Students (DM684 course)	FTF	42	4	7	5
Other students/post grads (Denver)	FTF	23	4	9	0
Facilitator (1 Professor) (1 self/researcher)	FTF & emails	6	2	4	2
Two CSU professors announced & promoted the charrette & offered extra credit for participation	FTF	27		0	0
LinkedIn invitations sent by researcher	Email	120		0	0
TOTAL		626		64	18

Table 4.2

Recruitment Progress

Population	2 months pre-charrette	One-month pre charrette
Participants/population (students, community members, & stakeholders)	71	50
3rd, 4th year or graduate students who signed up to attend (6 disciplines)	57	38
Participant Observers & content experts	12	10
Facilitators (2 facilitators including the researcher)	2	2

Table 4.3

Results: Two Days Pre-Charrette

Participants (39)	Confirmed Participants	Day 1 (15)	Day 2 (16)
Students (6 disciplines)	29	5	7
Participant Observers	8	8	7
Facilitators	2	2	2

Attrition

Two months before the charrette 79 participants had committed to attend, 64 were students: 38 completed releases. Early team development utilized 64 students identified among 8 teams. Each team consisted of 10 participants that included 2 POs per team. This population remained constant until one-month pre-charrette. As participants dropped out, teams were reduced by size and discipline; then reconfigured. Seventeen participants arrived and the FOs reconfigured participants among 4 teams. Day 1 included 7 students, 8 POs, 2 NPOs and 2 FOs. Day 2, 2 additional students joined the study while 1 PO and 1 NPO left for differing reasons. Outcomes with changes over time are depicted in Table 4.4. While a large cohort of participants was confirmed, I anticipated and projected attrition with a dropout rate of 10-15%. This allowed for a loss of 6-10 participants. A 72% unexpected attrition occurred[10], related to events that included a snowstorm, personal injury, flu, and financial constraints. None of the participants

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[10] Attrition was calculated as $(64/x) *x = (100/72) *x$, $64 = 1.389*x$ (1.389) to get x $64/1.389 = x$ $46.08 = x$, thus $x = 46.081$ or 72%.)

identified their inability to attend as lack of interest. All participants expressed perceived value

of attendance.

Table 4.4

Recruitment Findings with Attrition

Recruitment Type	Two-months pre-charrette participant recruitment counts	One-month pre-charrette recruitment Counts	Two days Pre-charrette	Charrette Day 1	Charrette Day 2
Total Participants (students, community members, PO/FO stakeholders, and NPO)	79	52	41	17	17
3rd, 4th year or graduate students who signed up to attend (6 disciplines)	64	38	29	5	7
Participant Observers	10	10	8	8	7
Facilitators (includes the researcher)	3	2	2	2	2
NPO 1 graduate student, 1 2nd year undergraduate	2	2	2	2	1

Denver graduate students shared disappointment at the loss of virtual attendance,

identified travel time, and costs of attendance (parking, overnight stay, travel time) as deterrents.

Team composition (Table 4.5) identified POs by two-digit followed by initials to distinguish

them from student participants.

The night before the charrette a snowstorm impacted attendance of three K-12 educators,

two CR Science Institute members and three community stakeholders as travel was ill advised.

After I removed virtual participation 20 graduate, post-graduate students and/or professionals

from landscape architecture and construction management withdraw. Final participants identified as 7 students from 4 disciplines: with anticipated late arrival of 6 additional students due to changing/conflicting schedules.

Table 4.5

Team Composition

Participant discipline, role & Team ID	Red (T1)	Green (T2)	Blue (T3)	Yellow (T4)
Interior Design - student	16			
PO/Docent CR & CF	75 (JL)			
PO/Rancher-Artist (Day 1)	44(MFP)			
Professor (FO)	02 (CM)			
Interior Design - student		10		
Wildlife Biology – student (Day 2)		45		
PO/Author & Board Member (Retired)		50 (SK)		
PO/CR & CF Employee		06 (DS)		
Early Childhood Education/ student (Day 2)			91	
Interior Design - student			89	
CR & CF Education Director			70 (JC)	
CR & CF Docent			92 (JM)	
Wildlife Biology – student				22
PO/CR & CF				79 (DM)
PO/CR & CF				76 (JD)
Interior Design - student				18

Use of Incentives, Reminders and Direct Follow-up

This study did not utilize incentives. Confirmed participants were contacted a minimum of three times (post acceptance) by telephone, email, FTF, and/or text. Reminder calls were made the night before and continued for no-show participants until 2 hours after the charrette began.

Additional calls at the end of Day 1 were placed; asked no-show participants to attend the next session.

Charrette Development

Charrettes are often financially supported by grants or with assistance from a 'benefitting' agency/project; the researcher self-funded with a $10,100 budget, no outside funding was pursued. Most costly was researcher related travel and extending living costs between Chicago and Fort Collins. If the researcher lived locally this would significantly reduce costs to a manageable level; easily covered by grants, donations and/or agency supported. Non-academic professionals have wider leeway to attend as a work project, often paid, while volunteers rarely receive compensation. It was mandatory to be cognizant of time commitments, costs, advance schedules, and considerations for professors and students who are often viewed as 'free labor'!

Charrette Benefits

Charrette benefits were numerous; implemented early in the conceptual phase they can save time and money. Other researcher identified early charrette participation benefits as they:

1) created and solidified a project vision while encouraging agreement on project goals, addressed needs versus wants
2) saved time and money by soliciting ideas, addressed conflicting ideation, issues, and concerns; avoided iterative redesign activities and changes later, and
3) promoted enthusiasm and supported a project resulting in early-defined direction for project outcomes (National Renewble Energy Laboratory, 2009p. 2).

Conducting a charrette early in the design/decision making process participants:

1) established multidisciplinary teams that set, negotiated, and agreed on common project goals
2) developed early consensus on design priorities
3) provided early understanding of the impact various design strategies made
4) identified partners, grants, and potential collaborations that provided educational expertise, funding, and credibility

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5) supported project goals,
6) identified innovative teaching strategies that allowed the campus to be utilized year-round, supporting students, stakeholders, and community members
7) identified opportunities for end users to acquire needed services often outside of their community, and
8) identified ways to create student and community employment, research and learning opportunities not currently available. (p. 2).

Pre-charrette Survey Findings (Students)

Surveys were revised five times and pre-release evaluated by Drs. Makela, Leigh, and Rubinson. Seven participants started, and six completed the survey. Bullet points represent responses to each question. For example, the first section represents Question 1-Question 5. Participants who completed the entire survey were included in results.

Respondents (Q1-Q5):

- all lived locally (Fort Collins),
- all identified as female,
- 3 were 21 yrs. old, 3 were 22 yrs. old,
- all were enrolled full time as students at Colorado State University, and
- 5 were senior level while 1 was a junior

Q6: Respondents identified their field of study and major where applicable as,

3 = Interior Design Major/No Minor,
1 = Interior Design Major/Construction Management Minor,
1 = Early Childhood Education Major/ No Minor, and
1 = Fish, Wildlife and Conservation Biology Major/ No Minor

A Section Header explained and asked respondents about their experience(s) participating in a charrette; Q7-Q14 - if they had ever participated in a charrette and if so to identify their experiences, responses showed:

Q7- The majority were clear about what a charrette was (4/6),
Q8 - Half had previous charrette experience (3/6),

Q9- Prior charrette projects identified varied - interior design, student achievement, or community-based projects,

Q10-4/6 stated the charrette was part of a class course, students received grades for prior attendance, while 2/6 were volunteers outside of class/course requirements, no grades or extra credit was awarded,

Q11-3/6 respondents stated the charrettes they attended included participants outside their college/discipline,

Q12-2/6 respondents identified those disciplines from Q11 as 1) construction management and 2) education,

Q13-Asked how familiar they were with transdisciplinary (TD) research ranking responses from familiar (yes) to probably yes, might or might not, probably not and defiantly not familiar. Respondents findings showed 1/6 were familiar, 4/6 were not familiar, and 1/6 were definitely not familiar,

Q14-Asked respondents what they expected to learn from the TDM charrette experience, responses shown 0/6 respondents answered this question.

Respondents answered two questions (Q15 and Q16) regarding teamwork and collaborations; Q15 header asked when working in a team or collaborative situation_____ chose one of the following: strongly agree, somewhat agree, neither agree nor disagree, somewhat disagree, or strongly disagree. Findings for Q15– Collaboration by participants were:

Q15-1) Addressing schedules and collaboration, is it practical. Among respondents, (4/6) somewhat disagreed, (1/6) strongly disagreed, and (1/6) neither agreed nor disagreed,

Q15-2) Collaborating was easier than solving problems alone (4/6) somewhat disagreed, (1/6) strongly disagreed, and (1/6) neither agreed nor disagreed.

Q15-3) Respondents strongly (3/6) or somewhat disagreed (3/6) that they did not understand the process or how collaboration could be beneficial in their future.

Q15-4) When asked if they understood how a TDM charrette process works and how it could benefit them in the future (3/6) somewhat disagreed that they did not understand and (3/6) strongly disagreed.

Q15-5) Asked if they believed they had enough experience and discipline knowledge to be a successful collaborator (3/6) strongly agreed, and (3/6) somewhat agreed.

Q15-6) Asked if collaboration was too time consuming and if they ended up doing the majority of the work, respondents (1/6) agreed they ended up doing the majority of work, while (4/6) somewhat disagreed, and (1/6) strongly disagreed.

Q16 header asked respondents to describe their attitude about working in a collaborative environment, identified by responding to 5 questions; using 3-point Likert responses of 1) agree, 2) neither agree or disagree, or 3) disagree.

Q16-1) If when working in a team did, they think everyone should first agree on goals; one third strongly agreed that when working in a team, they would start by developing a needs/goals assessment (2/6), while (2/6) neither agreed nor disagreed, and (2/6) disagreed

Q16-2) When asked if they encourage and help team members when they do not understand or have concerns, 6/6 agreed

Q16-3) Respondents strongly agreed or agreed (2 of 6) that when they encounter team problems or are struggling to get along that the professor should intervene, while (1/6) somewhat agreed, and (1/6) somewhat disagreed

Q16-4) When working on teams in the past, participants were asked if they part and parceled up the work, working independently then reconvening to blend what each had done, 3/6 neither agreed nor disagreed that this occurred, while 2/6 somewhat agreed and (1/6) agreed

Q16-5) A majority agreed that teamwork was productive and that they learned more than working alone (5 of 6) while one respondent somewhat agreed (1/6).

Understanding Communication Styles

Communication styles identified as patterns of behaviors others observe (Gudykunst et al., 1996). Understanding one's personal style and preferences improved relationships among colleagues, family, and friends. A good understanding of preferences and styles help participants

effectively communicate when confronted with disagreements as often occurred when working among differing disciplines, cultures, and environments.

To enhance observational interpretations among participants this section addressed communication styles. Communication styles are individual, unique behaviors; style was viewed as a way of thinking and behaving. Behaviors can be observed as displayed from non-verbal clues such as the length of eye contact, use of gestures, speech patterns, facial expressions, and the degree of assertiveness people project. These behaviors depict how someone likes to do things and provided an overview and general indicator of individual preferences.

Kolb Learning Style Participant Preferences

When determining preferred styles identified placement on the dominance scale is the first step. This aided determining a preferred communication style. Participants were informed choices were preferences and not associated with skills or abilities. When asked about self-perception participants used a sliding scale from (0) Low Dominance to (100) High Dominance, in 25-point increments (0/25/50/75/100) placed on a dominance indicator scale. For example, high dominance individuals tend to give advice freely and often initiate demands, these individuals tend to be more assertive. Individuals who display low dominance characteristics are often cooperative and eager to assist others. To create productive relationships among TDL teams it was helpful to have an overview of personal preferences. Findings helped me explore and observe how or if participants adapted personal preferences to avoid friction or disagreements often created by differing preferences. The ability to relate to another's preferences is an important team skill.

Sociability Continuum

Sociability reflects control over personal emotional expressiveness, often defined as one's tendency to seek and enjoy interactions among others with similar and/or dissimilar styles. This section asked participants their sociability preferences; respondents completed the sentence I perceive myself as_____ (Fill in the blank). Using the same 5-point scale above participants rated themselves in 13 fields from Low Dominance (0) to High Dominance (100). Responses tallied sociability. For example, low sociability frequently indicates reserved individuals; those who act more formally in social relationships and tend to control their feelings. These individuals prefer to work alone, whereas high sociability individuals express their feelings freely and tend to be open and talkative; these individuals prefer to interact with others.

Obtaining preferred learning and communication scores involved a three-step process. I entered individual choices on a master sheet, then tallied for dominance (1) and sociability (2). Once dominance and sociability dimensions were combined, communication style was established. Scores identified individuals within one of four quadrants identified as: Emotive, Director, Reflective or Supportive. Respondent styles were split as 3/6 displayed as Emotive, the other 3/6 displayed as Director; Table 4.6 depicts participants preferences

Table 4.6

Dominance and Sociability Indicator (Students)

Communication Style Results				
Dominance Indicator	Red (T1)	Green (T2)	Blue (T3)	Yellow (T4)

	16[11]	10	Low	91[12]	High	18	High
		45	Low	89	High	22	High
Sociability Indicator							
	16[4]	10	High	91	High	18	Low
		45	High	89	Low	22	Low

Kolb's model provided an overview of different learning styles. McLeod (2017) described learning theory as working on two-levels; a four-stage cycle of learning and four separate learning styles. Respondents did not fully understand instructions as they selected one row/column to place a response, versus going across rows, scoring each column. I tallied findings and identified preferences; consideration was given to participants not following directions. Findings showed these types of applications are best delivered and assessed in a FTF environment as participants needed time to ask clarifying questions.

This section touched on participant's feelings about how they experience, reflect, think, and act in an experiential environment. Responses were categorized on a 4-point scale with 'most like' me (4), second most like (3), somewhat like me (2), and least like me(1). Three participants identified as Convergent (#22, 45 and 10), 2 identified as Divergent (#18 and 91 and 1 identified as Accommodative (#89).

Step three instructions stated: Once you have answered ALL questions total each column, then using your preferences respond to the following sentence placing your responses in order "When I learn _____." Completing this action will result in four or five observations about your

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[11] Participant 16 experienced technology problems when logging into the survey, after three attempts working with our tech adviser, she was unable to complete the pre–charrette survey.

[12] Participant 91 missed 2 of 11 responses on the dominance indicator scale, which might skew results.

preferences. Remember the number 4 is most like you, so began your sentence with your number 4 response; each row will have one number 4". I included the following illustration, "For example, 4 becomes 1, as this is the most like you, so your sentence will begin with "When I learn I am logical (as # 4 on row #1 identified as logical), continue to write and respond to each row. Begin each sentence with your number 4 response (most like you". I completed this section from the limited responses received, findings shared in Table 4.7.

Table 4.7

Learning Style Inventory Student Statements Depicting Preferences

Team/ID	Learning Style – Participant Individual Sentences
(T2) #10	When I learn I am logical, I like to practice and try things out, I rely on observations; I'm an accepting person, receptive and open minded, I learn by doing and thinking about ideas, I listen and watch carefully, am open to new experiences but tend to reason things out; I like to see results of my work.
(T2) #45	When I learn I like to do things, I work hard and get things done, I have strong feelings and reactions, I learn by doing, I like to practice and try things out on my own; I like to see results, I'm a rational, practical person who gets involved.
(T3) #89	When I learn I get involved, am open to new experiences, are observant; like to see results from my work; I learn by doing, am receptive and open minded like to try things out for myself, I practice and work hard to get things done; I have strong feelings and reactions.
(T3) #91	When I am learning I have strong feelings and reactions, I work hard to get things done, and learn best from practice, and doing things for myself; I am an accepting person, receptive and open minded; I am observant and like to see results from my work, I'm open to new experiences; I get involved when learning.
(T4) #22	I learn best when I have a chance to practice and try things out, I'm a rational person, who evaluates things, I like to think about my ideas, break them down into their parts and learn by doing; I listen and watch carefully, I tend to reason things out; I am observant and like to see results from my work; I learn best when I rely on my observations while analyzing things.

(T4) #18	I learn best from having a chance to try out and practice, I like to analyze things, break them down into their parts, I like to think about my ideas and rely on logical thinking; I am accepting, responsible and active; I learn by doing, getting involved, I'm receptive and open-minded; I like to see the results of my work.

Findings provided a basis to compare and contrast interactions among 4 like and 4 dissimilar team members. For example, building teams of the most diverse discipline knowledge and individuals with charrette experience created more disruption as participants experienced diversity of thought and were required to adapt a willingness to think differently. They had to learn to negotiate and support individual creativity. Based on Birds' information teams created from likeminded individuals were less likely or not likely to challenge accepted discipline knowledge as members shared norms (2019). These individuals frequently experienced difficulty problem-solving, often inhibited innovation and creativity, as they tend to think alike (Bird, 2019). Teams comprised of likeminded individuals who think alike ran counter to creative tensions experienced during TDM teaming.

"Diversity is one of the best ways to help test our assumptions and open ourselves up to new ways of thinking about old problems" (Bird, 2019, para. 5). Bird identified three crucial principles that diversity encouraged, supported by main tenets of TDM teaming, as:

1) Reflexivity – by assigning likeminded individuals to a team participants might not question their worldview. But when assigning teams of unlike minded individuals comprised of participants from diverse cultures, ages, gender, and educational backgrounds individuals are more likely to explore differing views, reflecting on predefined assumptions.

2) Empathy – described as the ability to share viewpoints and feelings of others; when developing teams of participants from diverse backgrounds, collaborative experiences tend to broaden their perspectives creating more human-centered decisions, supporting innovation and creativity.

3) Curiosity – teams of likeminded individuals have no reason to question things they are already familiar with. Teams of diverse participants are more curious and want to understand the 'how', 'what', and 'why' of ideas and ways things are done. These teams drive innovation as curiosity is the drive behind creativity. (para. 6-10)

Researcher Learning Style Inventory

I completed the LSI, 1) to test the instrument and 2) to better understand personal preferences useful when observing participants. I used my experience to refine instructions for participants. Results showed high sociability and high dominance, combined results showed an Emotive Communication Style (Table 4.8.). I considered it an easy reflective exercise concluded it was a valuable tool when observing participants. Consideration was given to ask PO/FOs to complete the same, it was deemed unnecessary for this study.

What I found interesting was my scores were one point apart from two identified preferred styles; attributed to numerous years of professional experience and educational training. To avoid communication bias while observing teams' knowledge of personal learning style was deemed helpful. It allowed me to avoid making judgments about participants based upon communication styles different from mine.

Table 4.8

Researcher Learning Style Results

Style	Totals	Learning Style: Diverging (Feeling and Watching - CE/RO)
CE/ RO	31 18	These people can look at things from different perspectives. They are sensitive. They prefer to watch rather than do, tending to gather information and use imagination to solve problems. They are best at viewing concrete situations from several different viewpoints.

Kolb called this style 'diverging' because these people perform better in situations that require ideas-generation, for example, brainstorming. People with a diverging learning style have broad cultural interests and like to gather information (Kolb & Kolb, 2005, p. 49).

They are interested in people, tend to be imaginative and emotional, and tend to specialize in the arts. People with the diverging style prefer to work in groups, to listen with an open mind and to receive personal feedback (Kolb & Kolb, 2005, p. 49).

Learning Style: Converging (Doing and Thinking – AC/AE)

AC	19	People with a converging learning style can solve problems and will use their learning to find solutions to practical issues. They prefer technical tasks and are less concerned with people and interpersonal aspects (Kolb & Kolb, 2005, p. 49-50). They are best at finding practical uses for ideas and theories. They can solve problems and make decisions by finding solutions to questions and problems (Kolb & Kolb, 2005, p. 50).
AE	30	People with a converging learning style are more attracted to technical tasks and problems than social or interpersonal issues. Enabling specialist and technology abilities. People with a converging style like to experiment with new ideas, to simulate, and to work with practical applications (Kolb & Kolb, 2005, p. 50).

Emotive Communication styles described individuals who displayed higher sociability and higher dominance. These individuals usually stand out in a crowd. They tend to be expressive and display characteristics such as activity, social initiative, encouragement of informality, and expression of emotional opinions. Literature showed that knowledge of one's communication style can improve team relationships, enabling more effective communication among people who differ from each other. For a review of Communication Styles, I sourced *Effective Human Relations* (Reece & Brandt, 2006). To further explore the LSI 3.1 see online video presentation, *Understanding Your Communication Style* (Mok, 2015).

Pre-Read and Binder Materials

Development was completed over four months and included field logs from the

researcher's August 2016 Cherokee site visit. Materials were similar to what XQ participants

collected and used. XQ participants indicated that having early reading materials positioned them

to comprehend, analyze then apply data among disciplines. This facilitated collaboration

identified as:

- prepared them with an overview of similar projects
- provided location history and information, and
- invoked early 'team' collaboration
- allowed participants to select prior case studies, shared in a 3-5-minute synopsis during the charrette.

This activity provided initial introductions among team members. Interests were shared

while PO/FOs ascertained if/how individuals were doing their share of the work. There were two

important reasons to include pre-read materials. First, data provided participants an overview of

similar education, historic, cultural, and architectural projects. Second, documents supported

participants' preparation lessening research time during the charrette. Experience showed that by

understanding site attributes participants were better able to focus questions and stimulate

ideation (McCall & Young, 2010).

The pre-read "primed" individual's for active and open participation during an actual

event. Materials allowed participants to be active team members while effectively preparing

groundwork. Supplying these materials with a field trip supported a broader picture of site and

operations. As participants reviewed materials, they were better positioned to develop focused

questions to stimulate ideation. I concluded a pre-read was necessary to advance charrette goals

(Heathfield, 2016). The impact of the pre-read on a charrette:

- increased personal investment in a TDL team and charrette processes,

- built interest and preparedness for interaction,
- kept participants engaged, reduced the need to multi-task, and
- resulted in personal connections with Ranch operations, the site, and history (McCall & Young, 2010).

Participant Observer Training

To ensure the intended audience, is successful in its interpretation, the 'presenter' needs an understanding of the audiences' backgrounds and mindsets, including, for example, their understanding of requirements as a PO (Harvard Business Review Staff, 2015). I utilized comments and responses from XQ post-charrette interviews to address presentation and training material delivery. I deemed this approach valuable as comments and suggestions provided ways to improve project instructions and among invited educators and non-educators (private sector professionals) asked to act as PO/NPOs. Prior to meeting with volunteers I completed a review of adult learning theory and explored how to motivate adult learners. I utilized Knowles four principles of adult learning identified as:

1) involvement in planning and evaluating their instruction
2) experiences provide the basis for learning activities
3) most interested in learning subjects that have immediate relevance and impact to their lives or jobs, and
4) learning is problem-centered rather than content–oriented (as cited in Kearsley, 2010, para. 4).

I adapted aspects from *17 Tips to Motivate Adult Learners*, from eLeaning identified as:

- base training on learners' experiences and interests,
- provide multiple sources of information (videos, lectures, free resources),
- use personal touches and humor,
- challenge learners with games and case studies, make learners look for and find solutions,
- make it visually compelling, as 83% of learning is visual,
- start with an overview then add suspense by sharing an overview and interesting points then move on to details,
- get learners personally involved, add real life stories, and be respectful while asking for feedback; conclude with benefits of being a PO (Pappas, 2013, para. 2).

PO training dates were finalized; individuals were notified by email, text, and/or phone. Observational training was required for all non-academic volunteers. Training dates were reconfirmed, and the Ranch conference room was reserved, lunch was provided by the researcher. Virtual options were available for those unable to attend in person, and conference calls were organized. On Wednesday, February 14, 2018, volunteers (8) attended FTF, two via conference call. Later POs joined CSU students at the Wauhatchie site to practice using observation forms. POs left at 3:30 p.m. and participants left at 5:30 p.m.

Training began with PO introductions. I shared professional, academic, and volunteer backgrounds. Participants' reviewed, signed releases, non-compete, and non-disclosure forms as consent documents were mandatory for charrette participation. I shared a Power Point developed for participant recruitment. The charrette process was discussed, followed by discussions about the planned team exercise. The group was smaller than anticipated and all had volunteered together for at least 10 years. After hearing about the training exercise a vote was taken; majority ruled to forgo team building exercises rather focused on using observational forms.

I identified PO roles and how personal biases might often affects decision making and how personal agendas can overshadow discussions and/or inhibit collaboration, free flow of ideas, and/or out of the box thinking/discussion with students. Final thoughts addressed leadership roles and distinctions between guiding a small project on one site versus using all sites. The pre-survey included a web based pdf that identified how to make observations. It provided a basic understanding of the observation process and techniques and addressed how the observer role might alter observed event (Driscoll & Brizee, 2013). During a 30-minute Q and A volunteers discussed the need to be involved while paying close attention to interactions among assigned teams. We reviewed ways to document situation details by writing as much as possible

while remaining an active team member. Importance was placed on paying close attention to interactions then documenting collaborations. POs documented disagreements and when anyone separated from the group for extended periods of time or when individuals/teams merged to discuss and collaborate together.

Volunteers discussed and practiced ways to ask participants questions rather than leading them to individual preferred plans. I emphasized and cautioned against sharing proprietary ranch information. POs agreed participants could ask questions about the overall property. POs were encouraged to work with students to explore solutions that addressed problems; this collaboration resulted in innovative, clear, detailed concepts and a shared vision for future projects. We discussed how to support participants content specific questions and requests for information during the charrette.

Post training POs joined the field trip, collected data using observation forms. Before leaving I mentioned student participants might not have completed the pre-charrette read thus POs were instructed to collect as much data as was relevant and to contact me with questions or issues, they encountered using observation forms. They observed and interacted with student participants; shared and discussed site knowledge, Cherokee, and current programs. This was planned as a preemptive measure to address any concerns or y glitches encountered using forms or collecting observations pre-charrette. Before leaving I asked volunteers if they knew anyone who might be interested in participating as a content expert; names and contact information were shared. I contacted each with a project overview and preliminary schedule.

Researcher PO Training Review

To ensure reliable data were collected it was critical that observers were qualified and prepared to utilize observation forms, while understanding the TDL model. Training allowed me

to coach POs on active participation while recording direct observations during a specific period of time and to align project goals. Training supported POs understanding of field work (exercises) they observed and provided information about how to conduct observations. Training introduced observation techniques designed to assist volunteers using observation forms and rubrics. This showed POs how to evaluate participant interactions against identified criterion. Training goals, adapted from the *Clinical Observers Training Facilitators Guide* (Rawlins et al., 2013), addressed key steps to becoming a competent observer. I concluded training advanced observation consistency among PO/FOs.

Post training POs were asked to review training delivery and materials. Two (2/8) POs responded to trainer evaluation questions and I followed up with three others by telephone; findings are shared in Table 4.9. Most interesting were comments by POs who shared they felt ready to complete their roles; later adding they became so engrossed in the charrette they 'forgot' to complete observations or make many if any notes. Post charrette I met with POs who stated they would have benefited from completing the scenario exercises. They added a need/wish for additional observational form(s) training. POs shared access to materials and charrette/project information before training would have been helpful. Many commented forms were difficult to follow 'on the fly' and noted once participants became active, observing, and documenting events became difficult and at times impossible. Comments added they would have been more willing to complete the training scenarios had they been provided more upfront project information. Final comments included a wish/need to have been provided a better understanding of expectations. Six of seven POs shared it was harder than they imagined participating and recording interactions while being an active team member.

Table 4.9

Researcher Training Evaluations by POs

Statements	Responses (2 POs)	
The presenter was well informed about the charrette process	Yes	Yes
The presenter was able to explain how to use the forms I would use during the charrette	To a moderate degree. Would have been helpful to have read the packet prior to the presentation (training), then have questions answered during training.	Yes
The charrette forms were easy for me to follow	Moderately	Still studying them
I feel like I can assist my team and the researcher(s)	Yes	Yes
Forms could have been easier for a non-educator to follow	Yes	No response
The presenter was able to explain things to me, so I understood, if not how could he/she improve	Yes – no comment	No response
I think the training was too long or to short, please explain	See comment above	
I left training feeling like I was able to do what was asked of me	No comment/no response	Yes
I would have liked more up-front information about the training	Yes	No response
I left training feeling prepared and ready to participate, if not please add what would have made the training more helpful for you.	No comment/no response	Yes

I evaluated how much information to share and considered time required to read

numerous documents. I kept upfront information until training as I believed it might overwhelm

POs, causing some to drop out. Results showed a project overview and observational forms were

required in advance. This would have saved time and allowed review for FTF training. POs did

not ask clarifying questions or for assistance either Day 1 or 2. Looking back findings showed PO/FOs should have been debriefed end of each day or early the next day.

Training findings aligned with similar approaches by other researchers and I concluded revisions essential to PO preparation. I noted participants heard what I said as a one-way delivery. PO responses revealed presentations are designed for information delivery versus information exchange. Allowing the 'survivor' exercises to be skipped was a miscalculation as research showed activities require participants to go beyond listening to active participation. Had POs completed exercises it may have prevented non-use of observation forms while addressing many of the POs post charrette questions.

Participant Observer Pre-Survey

Responses showed POs identified as female (9) and male (1). Table 4.10 identifies POs organizational associations and professions. Volunteers lived along the Front Range, while four travelled 50 miles to the Ranch; two flew in (one from California the other from Massachusetts). All but one was connected to Cherokee Ranch as either a docent, employee, or volunteer in some capacity. Two POs had prior charrette experience identified, as:

- a construction management class; believed the event to be moderately effective,
- public input redesign of the Denver Performing Arts Complex believed the event was extremely effective.

Non responses to most questions' and/or incomplete questionnaires identified POs unfamiliarity with educational instructional methods.

The survey focused on educator roles, included instruction activities, service learning, and implementation of teamwork in a classroom. POs completed the survey to aid charrette development, learning activities, and life experience (Appendix A). Understanding POs prior experiences and education aided me in making judgments on POs' ability to document findings.

Prior experiences provided a means to review their notes and observations, and if or how these influenced personal interpretations and inferences of data. Findings showed questions needed to be directed to a multitude of individuals respecting the diversity of an overall volunteer and stakeholder population; avoiding questions that only addressed educators.

Table 4.10

PO Demographics and Associations

ID	Gender	Association	Profession
76	F	CR & CF	Volunteer- Heritage Committee
06	F	CR & CF	Community Development Manager (DS)
79	F	CR & CF	CR & CF Volunteer Heritage Committee
75	M	CR & CF	Docent (JL)- Tweets Butler & ranch assistant
89	F	DD - friend	Civil Engineer (CW) (Dropped out ill)
N/A	F	CR & CF	Docent (dropped out)
70	F	N/A	CR & CF Education Director (JC)
92	F	N/A	CR & CF Volunteer rancher & artist
50	F	N/A	Stakeholder – author/previous board member

Field Trip Overview

Adding a field trip was an important part of the charrette as XQ participants shared a site visit would have advanced early ideation. I deemed this experience a valuable learning tool for the Cherokee charrette. Field trip and site exercises aided participant documentation/review. Exercises employed and supported reflective observation; it permitted participants a way to observe existing conditions and landscapes before making decisions. Findings showed participants viewed the environment from different perspectives.

Field trips supported shared experiences, advanced early collaboration, and provided target knowledge about problem status collected from observations and field exercises. They provided participants content access and allowed for general connections. They offered investigational research and memorable experiences beyond everyday activities. Exercises and site tours provided participants firsthand site evaluation, they supported and identified potential uses depending on individual perceptions of systems, relationships, and areas or options for change. On site activities followed participants early exploration as they completed exercises and toured of the overall property.

The pre-charrette read and FTF recruitment included field trip information; participants were informed the site lacked a physical address (called survey perspective). This required participants follow printed directions; a critical skill for locating the property. I created written driving instructions using directional, position and landmark signs/signals as some were unfamiliar using position identifiers; North (N), South (S), East (E), and West (W). Using landmarks provided orientation locators and provided signs at decision points, helpful when wayfinding for those unfamiliar with position identifiers. This approach addressed multiple learning styles and developed driving directions depicted in Figure 4.1.

Figure 4.1
Map and Driving Directions to Wauhatchie Site Field Trip
Note. From *Fort Collins, Colorado to Sedalia, Colorado,* by Google Maps, 2017.

I offered/attended site visits on Wednesday, February 14th, Thursday, February 15th, and

Saturday, February 17th, 2018. The proposed Sunday trip was reschedule to accommodate

charrette date changes; dates coincided with spring break. I emailed participants a 'trip packet'

that included driving directions, observation forms, and instruction for completing both

exercises. I shared I would be onsite, but if anyone needed anything it might be tough to contact

me as cell coverage is spotty at the Ranch. I advised I would bring lunch, snacks, and water.

Before each field trip I communicated with designated drivers and solo participants; we reviewed

maps/directions. Communication showed interesting aspects of early collaboration as I answered

questions such as "how do we get there?" "what do we wear?," "what are we going to do?," and

"how long is it going to take?" The night before I printed additional exercise forms for onsite

distribution. Virtual participants downloaded and printed exercises from Dropbox.

Sensory Exercise

This exercise provided participants time to experience the site. They explored and experienced what it felt like to be at the Ranch. Figures 4.2 to 4.5 share overviews of participants' experiences; Figure 4.6 depicts the sensory exercise findings with a WORD CLOUD created from participants' comments.
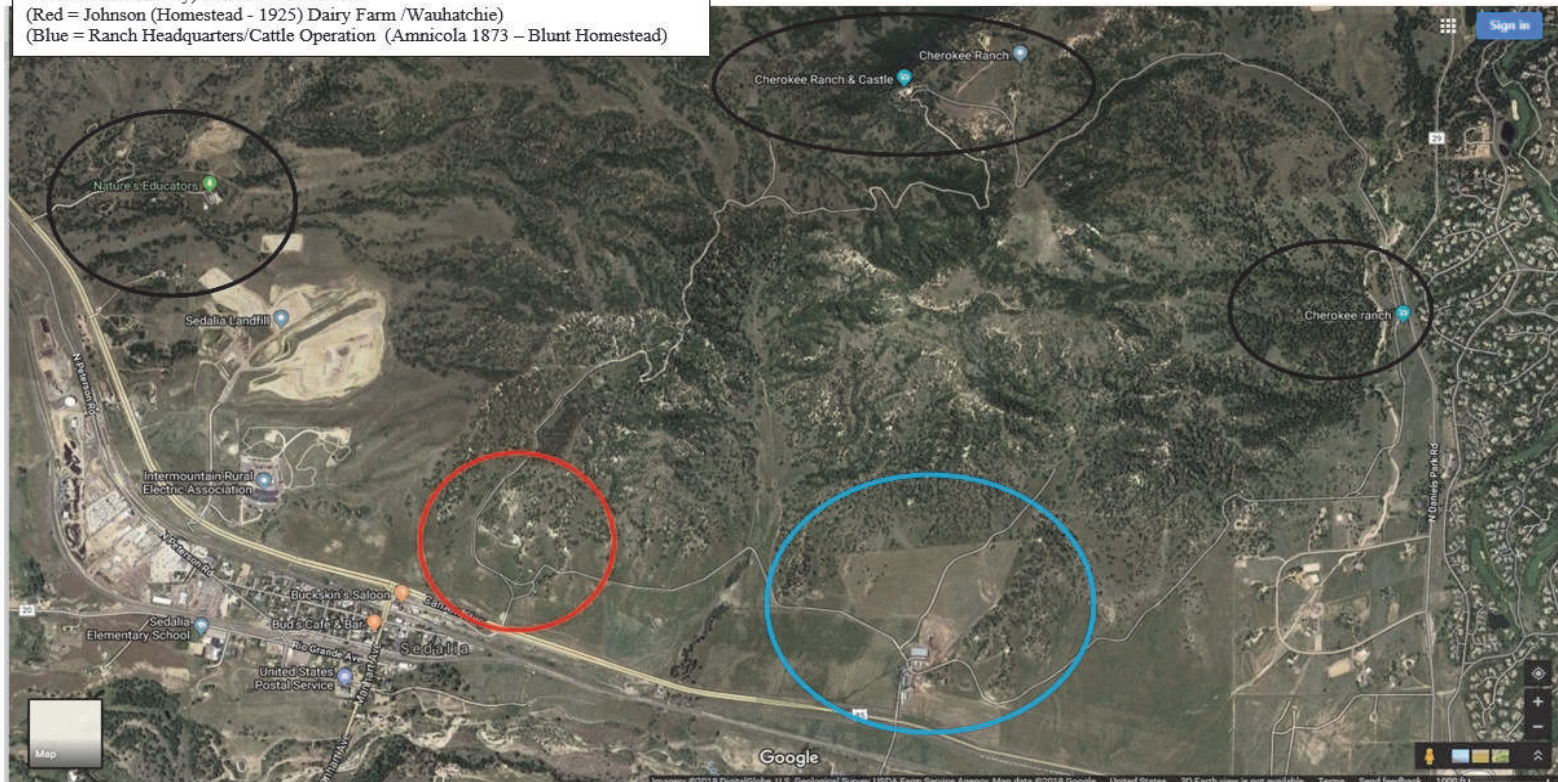
Figure 4.2

Cherokee Site Aerial Overview

Note. Circles identify different sites: Wauhatchie, Johnson Homestead circled in red. Ranch headquarters and Blunt Homestead circled in blue, black circles represent castle road (entry) Sunflower ranch homestead, and the castle; far left depicts Natures Educators, orange balloons depict main road west of property in Sedalia, CO. From "Aerial View Cherokee Ranch & Castle," by Google Maps, 2017.

Johnson Dairy Farm (Wauhatchie) (1925) entrance: contains a one-story wood frame house faced in lap siding and a large wood frame gambrel barn. The design of these buildings represents 1920s rural architectural styles and building types found on Colorado farms of that period.

Figure 4.3
Aerial View of Wauhatchie with Entrance from Highway (red circle)
Note. Aerial View Cherokee Ranch & Castle, by Google Maps, 2017.
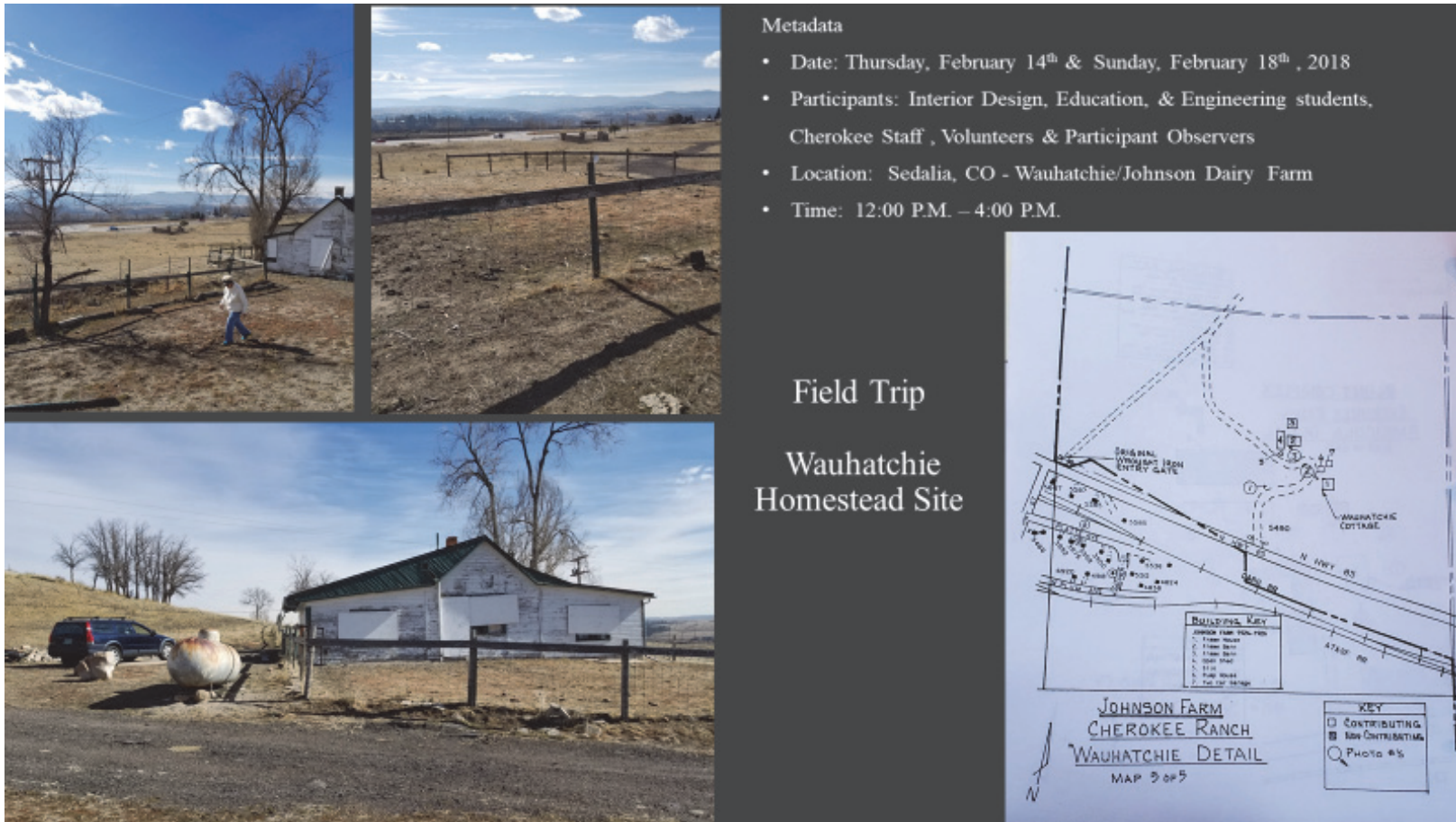
Figure 4.4
Field Trip Site
Note. Top row depicts original garden space; lower image the homestead house.

Figure 4.5
Field Trip Site
Note. Top left homestead house, moving to right the cistern and barn. Middle silo; lower left chicken coop and pump house last image is of garage.

Figure 4.6

Participant Field Trip Experience and Exercise Results

Mapping Profile

The second activity required participants to construct observations and categorize complexities identifying potential project concepts. Findings helped participants as they identified and explored how each artifact related to project objectives. Observations identified the site and reflected discipline and participant skill. Findings were shared among teams during early ideation. Participants created a series of abstract observations and site drawings that documented existing conditions/issues. These reinforced and supported making connections among artifacts for project development. Participants used mapping to advance artifact and document analysis. Findings generated questions that shaped inquiry. Mapping advanced comprehension of site problems and identified the existing environmental foot print. Identification charts were provided for onsite review; these identified endangered species, ranching/cattle operations, and provided a sense of property size. POs shared oral histories and identified artifacts important to historic renovation/usage. This exercise supported systematic ideation, identified, and supported probable interior and exterior structural challenges. Attendees took photographs of existing interiors/out buildings; shared during the charrette among non-field trip participants.

Upon arrival I reviewed how to use observational forms followed by a short discussion on method's to document what they observed. Observation forms identified existing structures and supported relationship identification among buildings, cattle/ranching operations, wildlife habitats, and landscapes. Participants identified individual criteria based on a point system formulation that identified areas of the site. They assigned point values from weak place (1 point) to strong place (10 points) for each asset on the observation form. They used discipline specific skill sets/knowledge that addressed existing site-specific aspects. I explained the

how/why of the next two steps (identified as Steps 2 and 3) and shared that individual data collection would be utilized during the charrette to complete next steps. They documented existing spaces using photographs, drawings, and regulatory protocols for historic homesteads. I led participants as we toured the site, went inside structures, and identified original uses of each building. We discussed site importance and students stated they felt better prepared to identify and make connections after completing a site visit. They shared data collected prepared them to create a multi-site educational program. They identified opportunities and made connections that advanced pre-charrette ideation.

Sampsel (2013) stressed the value of implementing a version of think, pair, share. This activity promoted cooperative learning as it encouraged individual participation (Cornell University Center for Teaching Excellence, 2016). Observational exercises provided a learning together and alone approach by bridging participant's knowledge and the physical environment. Observations included newly acquired site knowledge and awareness of site features. I used this exercise to assist participants with artifact identification and to support early concept development that shaped inquiry. Completing this exercise permitted participants' understanding of site problems and identified the existing environmental footprint. We identified and located archeological sites, flora and fauna, and physically experienced buildings (interiors, exteriors, and relationships among structures). Participants' identified endangered species and categorized relationships between ranching, educational uses, and current operations. Participants explored community culture wealth. Findings advanced and positioned participants to systematically generate ideas; they implemented design thinking as they addressed a renovation project.

Exercises targeted Halls conceptualization phase where individuals ascertain general problems. Exercises identified discipline perspectives to understand the problem. Participants

identified disciplines and knowledge necessary, and identified missing disciplines required to further ideation (Hall et al., 2012). Teams used mapping results/findings to construct their approach to problem solving.

PO/FOs Sensory and Mapping Profile Observations

PO/FOs observed and documented students as they collected data during the field trip. POs noted that field observations/findings were transferred to color coded note cards, used as they shared findings among teams. This data supported participants and synthesized observations from field logs, photographs, and personal experiences. Observations showed participants created drawings and assigned numeric points to what they observed. Participants identified complexities with potential for proposals and how each might support project objectives. PO/FOs believed participants understood the site as most were able to reflect on content related to discipline and skill sets. POs shared exercise findings and visual aids provided teams a means to start discussions of what currently existed onsite and provided multiple lenses for ideation. POs observed participants were able to identify artifacts, structures and roads/paths using Liquid Galaxy. They shared discoveries with students unable to attend the field trip. Discussions evolved as individuals identified relationships among sites and digital representations.

Exercises proved beneficial for all participants. Findings generated information that helped teams think through a question by visualizing the relationships between evidence and themes while building upon and connecting their diverse learning styles. Mapping findings were used to complete the everything on the wall exercise; findings showed participants were able to identify and discuss site specific challenges. Participants moved beyond remembering facts and made connections among disciplines and skill sets then analyzed findings. PO/FOs concluded participants were able to combine concepts gathered from a blended learning environment to

construct a visual representation using multiple methods for project development. Completing the field trip exercises improved participants' ability to connect and articulate key ideas, advanced collaboration and fostered higher levels of learning described in Bloom's taxonomy.

Blending concepts and findings required cooperation as participants shared, negotiated, and debated pros and cons of each other's' ideas/observations. Learning through reflection provided participants an opportunity to share experiences as they identified commonalities, differences, and interrelations beyond a pre-charrette read. Completing exercises required participants to articulate what they observed, followed by negotiating values given to each criterion and measures among teams. Participants were required to consider ideas and observations developed by team members and to agree on numeric values when compiling findings into a single observation form (steps 2 and 3). Participants provided and shared multiple development options as the created an amalgamated outline for proposal development. Participants completed collaborative negotiations, developed solutions, and made conclusions; represented in Hall et al.'s (2012) translation phase. Findings were placed in a bubble chart that identified distribution and variable relationships over a set of categories; findings were comprehensive.

Researcher Field Trip Observations

I developed and provided field trip driving directions, drove the route to experience what participants would do. I learned how to read a map as a teen before Google Maps and sat. navs (satellite navigation systems commonly known as Google driving or Map Quest) were developed. I have worked with international students and volunteers and understanding map reading while learning how to follow verbal and written directions was literally a lifesaving technique in the field. I discussed the field trip with participants during recruitment, and all

understood the time involved to get to the site while some felt it might prove problematic. I advised carpooling and agreed to coordinate setting up ride sharing among participants. It was instead coordinated by students. Coordination revealed an emphasis on direct management and 'buy in' was consistent with studies of charrette participation, as it shaped and depicted early team trust building and self-management.

Approximately 30 minutes before expected arrival I received a call from a student driver. I heard, "I followed directions and I'm in front of a locked gate. Where is this place?" After asking several identifying questions I figured out students were at the entrance to the Castle, on Daniels Park Road…laughing I said, "you used Siri or MapQuest, right?" They answer was a resounding "Yep"! "OK, so get back in the car and I will tell you how to get here. Write this down." Fifteen minutes passed and still no arrivals, my cell rang, and I immediately heard the strain in the caller's voice. My first thought was to get the driver calmed down and focused long enough to tell me where they were. From the description I was unable to ascertain location, so I began asking questions, "What do you see? What do you hear? Do you smell cattle? Can you see the mountains?" I next heard a peacock. I immediately said, "I know where you guys are…you're at ranch headquarters, close." laughing I said, "I'm going to get you here, stay on the line...it's no big deal, breathe!" Hoping my relaxed approach would translate to the driver letting participants know no one was upset, and that we were willing to wait for their safe arrival. I said, "I will walk you through the drive, what kind of car are you in?" I continued saying, "I'm at the site and will be able to see you on the road from here. Look for the big metal arch gates and my car; it's a navy station wagon…it will be on your right side, I'm a mile down the road. Let's get you here as I can't wait to share the site with you." Everyone laughed.

Initial thoughts jumped to don't judge…these students were raised using sat-navs. I wondered how they would orient themselves to the site if they lacked a basic understanding of directions. This reaction made me reconsider how I planned to share the site and tour. I reflected that students did not need to learn how to read a map; if they could find one. Their cars either came with a voice assist or they had cell phones. Technology good and bad, raced through my head. I made a mental note to reflect using directional verbiage during the tour as I believed this would be a value tool during the charrette. I needed to be conscientious of students' feelings while floating in my head were N-S-E-W, life skills, a lost art, a generational tool, or when outside of GPS signals or when cell phones die, what do you do then? As a business owner I had experienced this with employees. I don't believe age was a factor. I have several friends who cannot read a map or give me landmark or route-based directions.

I decided to make it a teachable moment putting aside preconceived ideas. Participants were interior design and engineering majors; visual acuity is a required professional skill in both fields and would aid participants as they completed exercises. My framework was based on the question, "What does one learn reading a map and why is it important?" I decided to relate learning objectives, such as map reading and directions, to participants' knowledge acquisition obtained from life experience. Reviewing directions and reading maps are important to learning; this ability can enhance spatial thinking, an important skill in geography and environmental sciences, linked to understanding history, math, and science. This ability can enhance academic and life skills (Bednarz, 2011).

Once participants arrived, they shared their unfamiliar using printed directional instructions. Drivers laughed, stated they had grown up using sat. navs and how my printed directions "sucked". Participants experienced unseasonably warm weather on site; the recent

snow had melted created muddy, rutted roads; all agreed driving would be problematic on site. Attendees instead walked the site to avoid causing landscape and historic road damage including adding cattle crossing hazards. Everyone had calmed down; shared introductions and I provided a quick review of the site while handing out the sensory observation form. I reminded participants to complete this exercise individually. I reviewed the project and explained we would spend most of our time at Wauhatchie followed by a tour of the other sites time permitting. Everyone agreed and seemed comfortable, sharing self-deprecating humor, slapping each other on the back and laughing all in good humor. That voice in my head said, "Problem one fixed, goal accomplished everyone's comfortable and enjoying the site." Participants held questions until they completed the sensory exercise. Once done we took a break and discussed early observations with POs; we shared snacks and more humor while I distributed mapping exercise observation forms.

We walked in and around structures and buildings, identified purposed use at time of construction. As we toured, I prefaced descriptions using directions. For example, when in the house I walked toward the front porch pointed to the windows and said, "Windows in this room face west, we should be able to see the mountains and highway, so what do you see as the potential for this space? How do you think the sun might impact this side of the house?" Asking, not expecting an answer or response, we moved around the site. We went in and out all buildings, while I identified directional aspects. We continued discussions and visited all three sites; I used directional measures as I discussed other properties.

After leaving the field trip I searched for data on navigation among age groups. I found a plethora of data on how different generations navigate driving. I copied data and sent it to participants in an email, as I believed they felt they had failed in some way. I eased students'

frustrations by letting them know it was not a generational specific issue; four students

responded with a thank you note, shared they felt better. Data allowed me to identify differing

site interpretations and project goals by team.

Researcher Observations of Participant Sensory Exercise Results

> The "imageability" of the environment is, according to Gulick (1966), more than just the recognition of physical features. It is a function of the individual's perception of the form of physical features in the landscape and the social or behavioral significance that a person attributes to the features. Sense of place refers to how people evaluate places and decide that they are distinctive based on their unique characteristics. (Rogers, 1994, pp. 548-549)

Completed exercises supported site/setting comprehension, as personal and behavioral

TL comes about by experiences. Kolb's reflective observation phase supported individual

observations. Participants used reflective observation to identify existing conditions and

landscapes before making decisions. Individuals experienced the site from different perspectives.

Data collected were shared during the charrette and combined with the mapping exercises that

supported a participant's positionality. Findings shaped data interpretations and reinforced

validity of data collected from differing types among multiple sources.

Participants reflected and documented what they saw, heard, smelled, and touched;

findings effected attitudes and behaviors during problem solving. Shared data among teams,

participants established and built rapport. Shared findings supported comprehension and revealed

mutual interests among differing observations. I noted participants used directional terms when

they implemented Galaxy and shared findings. Shared knowledge enabled participants to acquire

new knowledge and perspectives. Both Kolb's theory and Bloom's Taxonomy referred to the

importance of direct observations and I concluded exercises supported and reinforced

experiential learning built upon prior knowledge. Findings showed students benefited from

learning directional navigation.

Participants discovered and implemented new knowledge as they shared personal experiences; teams applied what they observed then translated new knowledge into shared ideas. Negotiations followed and led to solutions. Participants utilized concrete experiences to frame knowledge obtained, followed by reflective observation. Individuals combined field trip experiences with illustrations that shared connections made while on site. They reflected what they learned.

I created montage images from extended site visits, shared in Figures 4.7 and 4.8. Participants requested these as data allowed them to make connections among different sites, habitats, and structures. We visited the Blunt Homestead (the next property to be renovated) followed by a visit to the castle and Flower Homestead; participants took notes and asked clarifying questions at each site, we reviewed images and completed a short question and answer session before they departed. Participant comments collected during the field trip were utilized to develop the WORD CLOUD, (Figure 4.9).

Figure 4.7
Blunt Homestead and Ranch Headquarters

Figure 4.8
Cherokee Castle Grounds/Landscapes

Figure 4.9
Participant Field Trip Experiences Depicted in WORD CLOUD

Participants refined ideas and problem solved as they completed exercises identified in Hall's (2012) implementation phase. Observation forms provided a starting point to reference and categorize existing conditions, this required participants to extrapolate information from printed materials, including maps, images, historic documents, and photographs to document, identify and develop the site.

Participants walked the site, referenced forms then documented what they saw, heard, or envisioned as usable spaces. They investigated each criterion. Participants identified 'no

evidence' with a zero then added reference notes. Identified evidence was documented by the

number of instances observed and categorized; later shared, discussed, and adapted and/or

developed to meet specific project criterion. Some overlap was anticipated. Prior to the charrette

I field tested observation forms and completed both exercises. For example, on the mapping

exercise, I used column 1- Entry access, ADA, and Community Facilities, then identified and

noted:

- 3 points for existing entry either current or able to be developed, zero access ADA requirements for most disabilities as: vision, hearing, mental health conditions, intellectual disability, autism disorder, and physically challenged individuals could in the future utilize the existing site so 3 was assigned.

- Notes were made, supported by drawings, to identified ADA requirements for specific disabilities and what would be required during renovation to servicing individuals with disabilities mentioned above.

- This led to the next column pedestrian circulation, a check mark was placed in the '5' row identified by counting the existing gravel/dirt roads leading from the highway and to each structure; noting access and if roads/paths were adaptable for human/non-human use.

- Moving to community facilities I identified 5 points (house, barn, garage, silo, and landscapes/fields), totaling the observations noted as 10; so, a check mark was placed in column 1 next to 10.

I identified missing areas on the observation form, noted possibilities, and assigned points to

each concept. For example, 3 concepts were identified and documented as 1) non-permanent

housing (tents), 2) identified landscape requirements necessary to deter wildlife from tents if

utilized as overnight housing and/or research stations, and 3) development of underground

observation huts for educational/research use; documented as social learning hubs. I continued

this process and completed the exercise in approximately 35 minutes. As I was familiar with the

property and this was participants 'first visit', I estimated completion time to 1 or 1.5 hours,

similar to the time frame utilized by architectural students during the mini charrette.

Pre-charrette Plan Adoption and Implementation

Pre-charrette planning was critical to the outcome and was developed simultaneously with field trip and proposed delivery phases. A conference room in the Colorado State University Morgan library was reserved[13] and recording equipment assembly was completed with event staff on Saturday, February 17th, 2018. This location provided necessary charrette features for multi person utilization, the downside being the space was windowless. The room supported seating for 75 people, was equipped with surround sound, advanced audio/visual, high definition projectors, and a 321 inch large scale screen implemented for Google Earth, called Liquid Galaxy use. Adaptive technological, audio visual and internet technology (AV/IT) support was scheduled. Library staff provided a full-time employee to assist participants/researcher both charrette days. This location provided required amenities such as a coffee shop, printers, and Computer Aided Drafting (CAD) programs. Library resources included personnel to address questions should participants need assistance. The IT person was available to set up and coordinate videotaping using 4 cameras coupled with KUBI robots to support offsite individuals; KUBI coordination and set up was provided by Dr. Quick; both individuals provided immeasurable support for the event.

I created a floor plan for the charrette space (Figure 4.10), followed by trial runs of Galaxy and camera positioning. I met with campus employees and retested audio/visual equipment on Sunday, February 18th. I assigned NPOs to position directional signs in the parking lot and library to aid locating the charrette. Catering was provided by outside sources while volunteers completed food set up; two POs manned the sign in table. Participants received charrette packets that contained an agenda, and maps to library services upon arrival. POs

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[13] *Note*: This room requires permissions including in depth descriptions of the event six weeks in advance; close coordination and follow up to secure space was crucial for success.

received final observation forms including additional copies of observation criteria, measures, and instructions.

Lessons learned from XQ showed speakers, both in-person and remote, were a vital part of the charrette experience, as were professors and specialists from outside academia. Speakers were selected based on project opportunities and challenges. Presentations were scheduled in 15-minute increments with a keynote kick off e delivered by Cherokee's Executive Director. Consideration and requests were made of architects (historic and landscape), cultural historians, educators', wildlife experts, construction, and design professionals. While interested four committed to attending, only one was able to attend due to competing commitments.
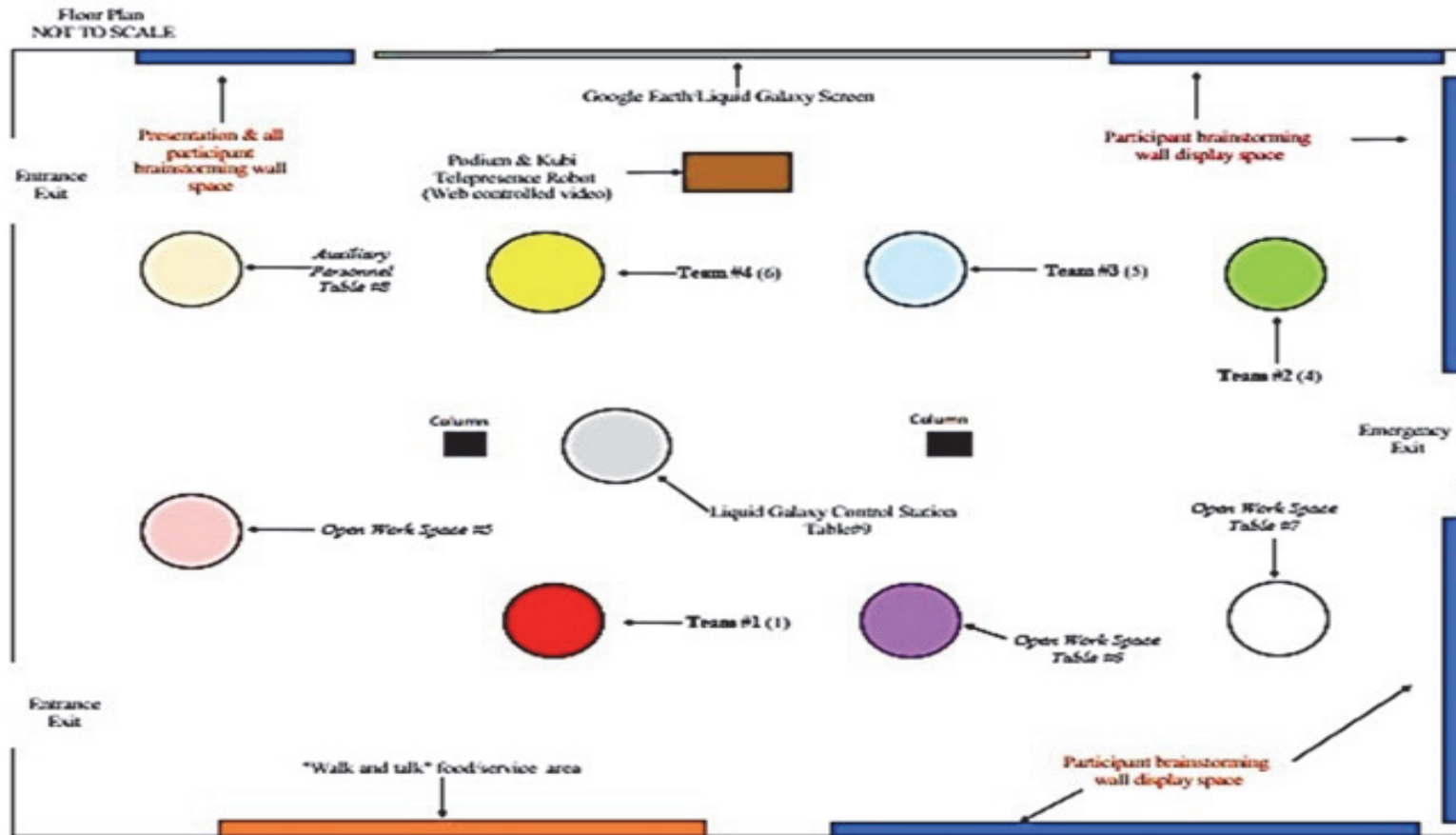
Figure 4.10

Charrette Space Configurations, Colorado State University Campus, Fort Collins, CO - Library Conference Room

Wauhatchie Charrette

In the long history of humankind … those who learned to collaborate and improvise most effectively have prevailed. (Charles Darwin, *The Origin of Species, 1859*)

Charrettes are fueled by information, too much information results in analysis paralysis, too little results in frustration and flawed proposals. Charrettes work through a lens of creative chaos with ambiguity and between a set of fixed rules and opportunities. The goal is rarely for perfection rather something fresh and innovative. Early project discussions with Cherokee stakeholders determined desired outcomes and we agreed project delivery would be visionary. It was less important to resolve all design challenges and participants would not be required to deliver full plans for proposed renovations. Participants worked among assigned teams and I anticipated differing proposals would be developed.

Two weeks prior to the charrette the Executive Director was injured leaving him unable to attend FTF; he briefly joined the charrette Day 1 and attended final presentations using a KUBI Robot. This began a series of unexpected events and the loss of planned presentations by ranch staff and stakeholders. The ranch managers presentation had to be cancelled as he supported cattle/ranch operations, accepting additional responsibilities to maintain business. The storm forced cancellation of a presentation from Natures Educators (NE); a program that leases 79 acres from CR & CF. The NE Director sent a data sheet and brief overview of their educational programs shared as:

> Natures Educators (NE) is licensed by Colorado Parks and Wildlife, the US Fish and Wildlife Service, and US Department of Agriculture. We bring non-releasable raptors and amphibians into nature centers, classrooms, and events teaching about wildlife and respect for all animals. Our goal is to create public awareness about biomimicry and human-animal connections. We have educated over 100,000 people in more than 35 cities across four states and two continents

This presentation advanced participant exploration of an adjoining site. Information advanced

ideation and incorporated concepts with participants proposals. Data were implemented and

included opportunities to support education, agriculture, historic homesteads, and the ranch. I

concluded participants made connections among sites and built upon existing programs within

proposals. The third speaker from the Colorado League of Charter Schools, a consulting member

of the XQ team and a charter school developer, prepared to share needs of school/program

development using a charter model, the flu forced cancellation.

Welcoming remarks and introductions were completed, housekeeping items were

addressed, releases were reviewed and collected. FOs discussed the day's events, and due to no-

shows we reassigned individuals formed as four teams. While teams enjoyed breakfast NPOs

contacted no-shows by cell/text/email. I kicked off the charrette with a power point presentation

followed by a project overview, then concluded with a question and answer session. I discussed

the need for teams to start with a blank sheet, both figuratively and literally. I did not provide an

itemized check list nor detailed problem statement, rather shared the following

> You have the next two days to solve a life world problem connecting three areas: education, historic homestead(s), and a working cattle ranch. Your challenge is to create an educational program linking all three areas. Considerations should include multi-generational access and address aspects of human and non-human interactions; consideration should be given to hunters, researchers, ranching, historic preservation, history, and sustainability. The stakeholder would like you to incorporate and coordination with existing programs, site capacities, historic structures, and artifacts. Give thought to how humans impact the site and interact with non-human species. The property is home to an elk herd, pairs of bear, lynx, and bob cats. The site necessitates safety protocols, alternative energy sources, water wise usages, flora/fauna maintenance and study opportunities. Don't forget to consider the needs of a working cattle ranch. Considerations should be given to fiscal responsibility and self-sustaining programs.

> You have been assigned to a TDM team; you are tasked to share discipline knowledge and life skills while you negotiate areas of interest and develop a site proposal for presentation end of tomorrow. Each team has two POs, each have extensive knowledge about the ranch, castle history, and current/ongoing programs. Use information collected

during the field trip combined with data provided from the pre-charrette read, copied in the binder. Reflect on your data and notes; share your personal skills and life experiences. You may collaborate with other teams and I am available to answer questions you may have, however, to avoid personal bias no further instructions will be provided. It is your role and part of each team's challenge to develop solutions that in your view need to be addressed to advance the mission using tools provided. Let the games begin.

I identified the project as a historic renovation with the goal for each team to create an educational center using a sustainability lens. I reviewed the properties historic values, archeological finds, and cultural history. I shared details about the Grandin cattle handling system under consideration and how it would improve operations. This set the stage for early teaming and collaboration. Figure 4.11 depicts images of the charrette kickoff.
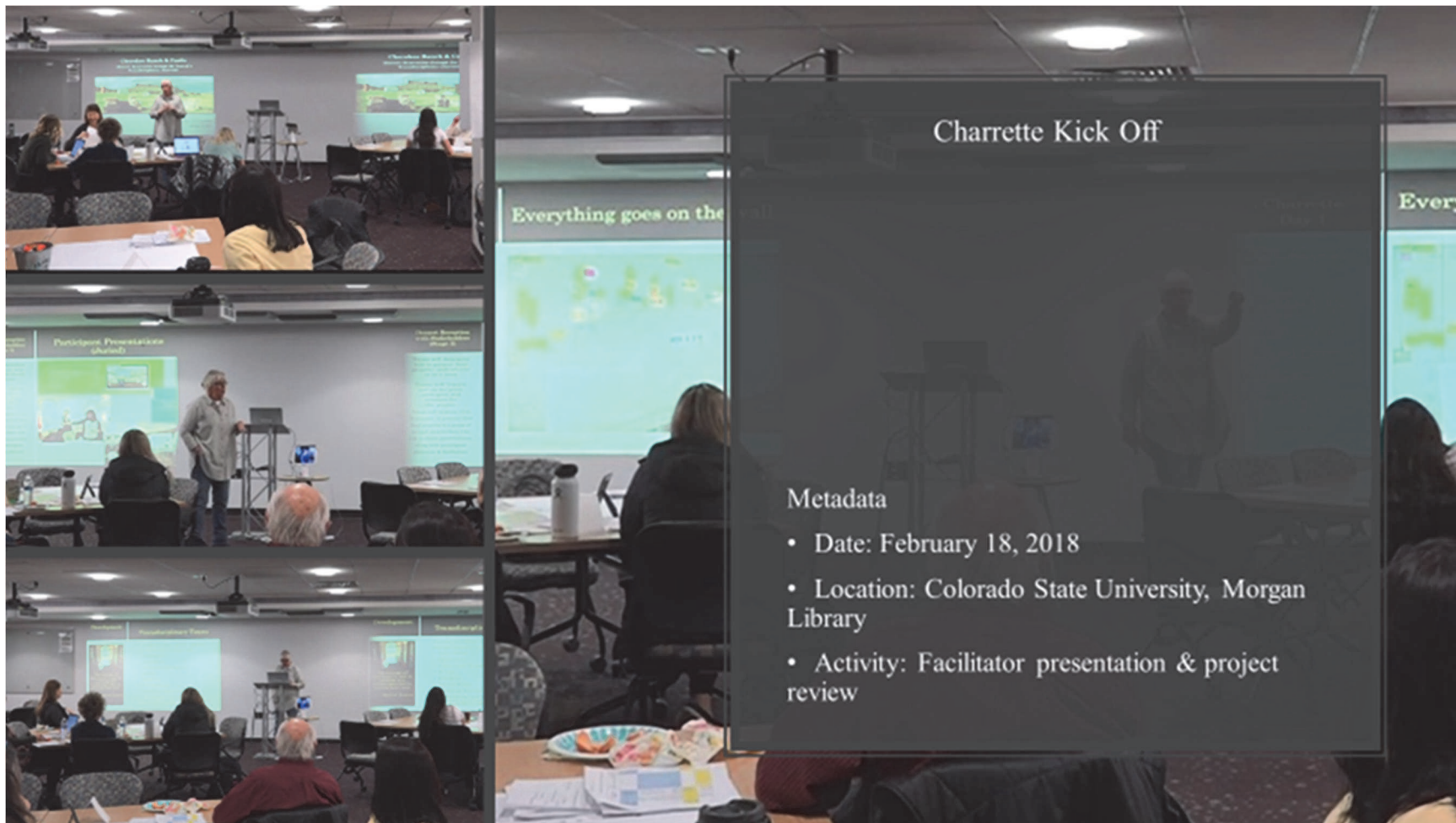
Figure 4.11
Charrette Kickoff Photomontage

After I announced participants would need to create their own vision without a list of

how and what to do, hands stared flailing. The first questions came from T4 participant #18. This

individual had attended the field trip and was familiar with the site; teammate #22 was unable to

attend the field trip. Both were anxious to have me supply a 'how to' list and #18 asked if I had

specific deliverables, stating, "Every project we do we know exactly what is required of us; not

sure what you are looking for." I explained that after graduation their employers would assign a

project and expect them to develop the concept, bring it back finished. I shared questions will

always come up and TDL requires individuals to work together to develop their own 'lists'. I

explained I wanted each team to determine requirements, what would be a luxury or a concept

that could be added and build upon over the long term vision for the property. I shared that I had

worked on this project during earlier charrettes. I stated, "this is your project, I've supplied an

overarching concept now let's begin ideation among your teams." Most were satisfied with my

responses, yet participant #18 continued sharing, "It feels like it's so broad." I sensed her

frustration and said, "I want you to just throw everything out there, every idea, nothing is right or

wrong, then start to funnel down." I stated teams might consider the following:

- Sustainability lens
- Wildlife
- Power and energy usage/needs (currently and future)
- Water usage, supplies, and storage
- Fiscal management and self-sustaining educational programs

I reviewed how to use ideation notes and asked each participant to jot down ideas, then share

them with their team. I followed questions with,

> Key considerations are environmental, educational, and water access. A few goals are
> financial, how will your program generate income, and how will it sustain itself. Your
> proposal should address sustainability, history, ranching and (should) follow historic
> renovation guidelines. I ended with, I will answer questions you have or help you find the

information if needed. I reminded participants to first search the binder for answers or links to additional sources, then ask PO/FOs or use the internet to locate information.

Once all questions were addressed, I introduced the IT employee who shared an introductory presentation on Google Liquid Galaxy uses. Participants took turns working with the program. This exercise provided tools necessary to access the site, move around (fly over) the property, and review what was seen, heard, and documented during the field trip. I shared aerial views and acclimated attendees to the site using directional markers (N-S-E-W), color-coded areas were defined and discussed, with POs input.

During the site review participant T4, #22 (a wildlife biology student) asked, "Is the dump part of the property?" I responded Yes, she continued and asked, "is it out of commission and is it now covered?" Before I could respond I was met with comments by T2 PO/SK; it appeared my response was incorrect. SK added "actually it's not a dump, it's a landfill next to the Intermountain Rural Electric Association (IREA), followed by NE leases this site for their program." PO/SK ended by sharing that Cherokee had purchased the site (255 acres adjoining the "dump" site). The conversation ended with PO/JL (T1) sharing that the dump had been utilized for construction materials, no hazardous materials were collected or stored there. Participant #18 appeared frustrated and pressed for more information. I spent 4 hours with T4 to assist participants working closely with POs, while the other FO assisted T2, T3, and T4.

At this point I was distracted having been called out for misinformation. I spent months gathering information, reviewed, interviewed, and took meticulous notes to make sure the information I shared was accurate, only to be informed in front of students and peers that information had since changed or was inaccurate. I wanted participants to have useful information and believed the POs goal was to clear up misinformation, it was not meant to be malicious. My job was to graciously accept and ask for any other input POs had; I remember the

embarrassment I felt more than the information. When corrected, I heard a few gasps from students and knew I had to address this situation. I asked myself what is the belief for how, and when to correct someone? In my career I rarely corrected an employee or superior in a meeting, I would make a note and follow up in private.

This was a lesson I believed students needed to learn, as communication and team building can be derailed when someone gets their feelings hurt or are embarrassed. I made sure to graciously accept the corrections and asked for others to chime in if I shared conflicting information. I hoped this would provide an example for students when they, as we all do sometimes, make a mistake. At break, two POs approached me and asked about the situation, I stated, "It's OK, I considered it be a NY Times moment, (laughing)…they write, they publish and when its incorrect they publish a correction; today I had editors here to fix it." I continued to discuss this with students who approached me as I moved the conversation to the hall away from working teams. Students expressed how shocked they were that someone would make such statements in public. I said, "Ah, Vince Lombardi always said, 'praise in public, correct in private." Students nodded and I replied, "Normally I would follow that advice, but in this instance the misinformation I shared needed to be addressed immediately…you are going to be using what I/we present, and misinformation will affect your performance. So, my advice to you when, and it is when, you find yourself in a similar situation, and yes it was embarrassing; accept graciously, be sure to thank the person for their help and assure others its ok to speak up. (Laughing) I said, I can tell you I will double and triple check before sharing this information again." I believe we all learned a valuable lesson. Later that morning PO/JL pulled me aside letting me know that some things being discussed had changed. A true diplomat he learned well

during his time working with Tweet and her guests at the castle. I wish the students had witnessed that exchange; it was a true dichotomy of behaviors.

By removing a pre-determined project list and adding POs as participants, coupled with participants' freedom to move inter teams' TDL and TL were achieved. When participants experienced difficulties or were at logger heads, they moved from intra to inter team discussions. They used a charrette environment that supported individuals as they crossed disciplinary silos and expanded team discussions. This advanced ideation that addressed innovation. The charrette supported individual ideas and communication shared as discipline knowledge and life skills. The TDM placed participants in an innovative environment better situated to advance early ideation as they moved toward project proposal development. This led teams to explore and examine new concepts and designs. Unaltered team notes are depicted in 'Everything On The Wall' (Figure 4.12).

Figure 4.12
Team Concept Ideation 'Wall'

Early team collaboration showed participants struggled without a check list, while others began ideation. Students appeared to be further constricted as I provided comments and shared methods to answer their questions. After several conversations' teams appeared to be getting mixed messages. FO/CM eliminated confusion and apparent frustration as she created overview posters to start the process (Figure 4.13). I introduced information stated, "Think what we can do, rather than what we can't do, the constraint you need to address is the 355 acre perimeter (I identified it on the Galaxy map) allotted for use." I added, "Think of it as a box of ideas, rather than a box or simply space."

Individuals gravitated toward posters and one by one were joined by other team members; this immediately sparked intra/inter team collaboration. Collaborations continued throughout the day with POs shared historic information and locations/placement on the maps. Teams reviewed NE programs, water rights purchased, programs and planned events among all properties including discussions about how and what the CR Science Institute does. Teams sourced discipline information, concepts, and theories then combined new knowledge and applied new visions. Knowledge shared was demonstrated as participants predicated and drew conclusions, as they identified and planned ways to approach the problem. They used a recursive model to identify individual components, then shared how each concept/idea might affect project development. Collaboration among participants and teams is depicted in Figure 4.14.

Figure 4.13

Project Concept Created by FO/CM, Consideration Posters
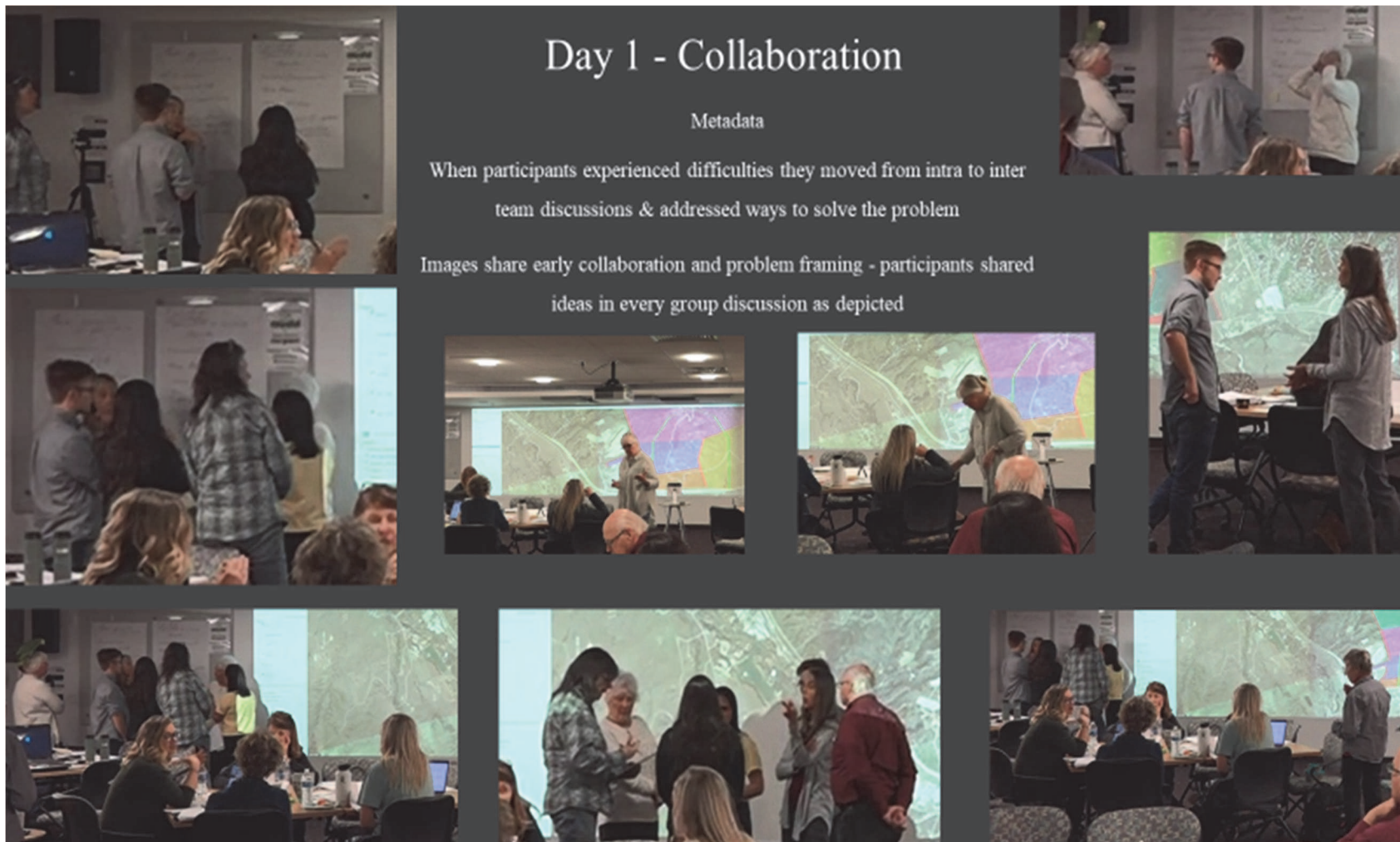
Figure 4.14
Project Collaboration Day 1

Early inter-team discussions involved conservations easements[14] . Participants questioned

what they are, how they work, what effects they might have, and how to address/resolve these

within their projects. FOs were joined by a group of 4 participants (#21, JC, JM, #89) and we

identified/explained easements are a voluntary agreement on a property. The process was owner

driven with goals of protecting open space, water, and wildlife habitat in perpetuity.

Conservation easements have typical restrictions, they included limitations on subdivision or

development of the property, they often limit usage that causes erosion or degradation of habitat.

They placed limits on commercial or industrial use. Cherokee received $2 M (1995) for

agreements with the unit of government (county); expired in 2005.

Late afternoon (Day 1) I recommended participants wrap up ideation and conceptual

models to focus on problem-based solutions bridging discipline knowledge with life skills. I

shared it was time to bring ideation findings to fruition, this allowed for review, revisions, and

presentation prep. I reviewed the day's activities and complimented teams on their progress. I

reiterated what was recommended for proposal presentations and thanked participants. I asked

them invite fellow students to join the charrette next day. After leaving the charrette I updated

misinformation and shared it the following morning; depicted in Table 4.11. General

impressions from Day 1 observations revealed that teams began slowly, as FOs documented each

team and addressed individual questions.

I concluded providing options for program development individually, versus using a

boiler plate set of guidelines participants created their own jumping off points. This approach

advanced and encouraged collaboration and ideation. Post-charrette notes reviewed (Day 1)

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[14] "A Conservation easement is a voluntary, legal agreement that permanently limits uses of the land in order to protect its conservation values. Also known as a conservation restriction or conservation agreement, a conservation easement is one option to protect the property for future generations" (National Conservation Easement Database [NCED], 2020, para. 1). Cherokees Conservation Easement is with Douglas County (2012).

showed I provided too much information and participants pigeonholed themselves within the

constraints focused on one site. Teams took short 10-15-minute breaks, with most opting to work

through lunch. I noticed that late afternoon (Day1) PO/JL began moving among teams for what

appeared to be a long time, leaving FO/CM and PO/MFP to work with #16.

Table 4.11

Cherokee Updated Project Information, Sources, and Outcomes

Artifacts	Map identification data-for use with Liquid Galaxy Maps (Google)
Green area	Identifies 355 acres for proposed use – includes Wauhatchie /Johnson Dairy Farm site and structures
Each site is named after a pasture	Address carrying capacity of 355 acres
Identified non-architectural assets	Cattle pastures and paths identified (color coded) on the map; asset identification included Rattlesnake Road, Mountain Man Trail, Ranch headquarters, Castle and Homesteads; consider Natures Educators as a collaborator/education partner
Pasture fencing	Rafael and the CSU GIS team identified each pasture and fencing on the map, reviewed with participants to ascertain paths and interaction among cattle – free range
Conservation easements	Cherokee conservation easements: they also provide tax breaks and prohibit development (Colorado Encyclopedia Staff, 2017, para.17). • Years Protected 2005 (ten yr. phased purchase of conservation easement beginning 1996 • Acres: 3,105 • Land Category: Agricultural Open Space/Wildlife Preserve • Conservation Tool: Purchase of a Conservation Easement by Douglas County • Cost: $2,000,000 (Douglas County) • Partners: Cherokee Ranch & Castle Foundation with Douglas County as the Conservation Easement Holder • Location: North of U.S. 85 and west of Daniels Park

Existing programs-Castle and Land	An overview of existing programs was added to the binder to identify educational programs and revenue sources available to build on. Proposals should consider how programs could/might support programs, development, renovation, or educational programs (Sources identified as Cherokee Ranch & Castle or by PO initial)

New information	Source	Outcome(s)	New information	Source
Water rights secured back	James Holmes (CR & CF)	Previously CR was leasing rights to water	Purchased water rights	CR & CF
Construction plan allows for water tanks for cows	USDA	No water collection permitted	Water collection permitted using cisterns and planned tanks	CR & CF
Conservation easement	Douglas County has easement	Identified for participants, new info source	CR is the largest piece of property in Douglas County	
8 holding ponds among all sites	CR & CF	Addresses previously thought/perceived water issues	Water collection (See dump site below)	JL
IREA butts to Cherokee – sanitary dump abuts to Cherokees property "dump Site"	CR & CF	CR & CF sold IREA the property	Collaboration with IREA for use and education	DS
"Dump site" Natures Educators	SK – P.O.	Site is not a hazardous materials site; it contains building materials	Additional information was shared regarding water rights for use at the ranch sites; how to transfer plentiful water to ranch was discussed	Close to closing can be redeveloped as wildlife for use with NE
NE rehabbed barn for flight area, director lives on site in a leased house	Renovated areas could be used for tours, a wildlife library	Property can be used separate from house	Plentiful water, easy access for students; safe space. Mitigates/reduces damage to Wauhatchie site from human impact	SK/DS

Prior 5 yr. old map did not identify 225 purchased	Map – this purchase abuts to NE property	225 acres leased back, available for use now/future	Identified on map due W of Castle, NW of Wauhatchie	No longer any gaps in the land between all Cherokee sites
Natures Educators	Map	Renovated spaces with animal ambassador holding area	Animals are not releasable; all ambassadors are housed on site for education purposes	Not open to the public – currently has restricted access
Property West of U S 85 belonging to CR -currently a gravel operation	When quarried out will be redeveloped into a wildlife preserve	Native habitats, grasses and ponds will be developed	Harder to access as crossing highway is required, separate space for education and wildlife-limited use	CR & CF

Day 2 began at 9:00 a.m. with presentations scheduled to start at 4:30PM. I planned for 1 ½ hours, or until all teams had presented and 'jurors' questions were answered. Lunch was delivered at noon and snacks were available all day. Participants again had a working team lunch and individuals took short breaks. NPO/SL was unable to attend while T1 PO/MFP called me early that morning saying she was in the middle of early calving and with overnight snowfall she was unable to attend; two new student participants joined. I assigned one participant to T2 (# 45 wildlife biology major) and one to T3 (# 91- early education major). I collected new participants releases, kicked off the session with a short recap of the prior day's events. I reminded participants to allow time to complete presentations and practice delivery.

This day showed a different dynamic among teams and individuals. Participants produced multiple revisions as they formed a single solution based upon what was discussed/agreed on Day 1. Teams worked around and discussed similar information and addressed parallel problems. Early afternoon participants appeared antsy and POs noted teams began more inter-team

collaboration. This resulted in making observational data collection challenging. I asked POs to do their best as I visited teams in reverse order.

Team Activities, Interactions and Observations

> I like the idea of collaboration…because it pushes you… It's a richer experience….
>
> Frank Gehry (2002)

By mid-morning, most participants began learning in motion. By designing the room to accommodate movement, participants utilized the entire room versus hibernating in assigned space. A report from Literacy and Language Center Media (2016) stated:

> Scientists have provided a significant amount of evidence that the average learner, regardless of age, needs to briefly move their bodies every 20–30 minutes, and many other students learn most effectively with movement breaks in 15-minute increments. This enables learners to maintain focus, integrate learning across both of the brain's hemispheres, enter information into memory, and avoid feeling overwhelmed or information overload. (para. 2)

Even individuals who focused inter-teams were observed walking about as they discussed and shared ideas. Participants addressed options or alternative methods to tackle perceived disagreements with POs noted as 'controlling ideation'. I watched as each team roamed among empty tables using the space for individual planning and inter team collaboration. T1 and T4 maintained team spaces rarely moving to individual spaces. T2 and T3 selected a space to work in partnership as they focused on issues negated by POs that they wanted to keep in their proposals. Both T2/T3 moved away from POs, finalized proposals, and practiced presentation deliveries. I watched PO/JD join T3 and helped assimilate findings. He shared ways to present information while he also assisted and discussed presentation ideas with T2.

Collaboration was the impetus that fostered learning as participants shared life experiences, knowledge and approached making meaning during project development differently. The charrette provided an environment to explore and refine individual perspectives,

unique among disciplines. In *Collaborative creativity in STEAM: Narratives of Art Education students' experiences in Transdisciplinary spaces* Guyottes et al. (2015) shared a colleague's description of collaborative creativity,

> Hargrove (1998) described collaborative creativity as: an act of shared creation and/or shared discovery: two or more individuals with complementary skills interacting to create a shared understanding that none had previously possessed or could have come to on their own. Collaboration creates a shared meaning about a process, a product, or an event. (p. 4)

The abstract conceptualization stage provided participants the opportunity to demonstrate comprehension. Participants accomplished this when they shared and combined observations from the sensory experience with mapping data. They articulated facts observed in relationship to their experiences, identified in Kolb's fourth stage, active experimentation. Participants demonstrated their ability to generalize what they learned as they applied new knowledge to an existing situation (Murphy, 2007).

End of Day 2 I collected team notes used for project proposals (Figure 4.15). Most interesting were student's utilization of color coding implemented to categorize information identified during early ideation. Field trip observations shared during the charrette were utilized to address spatial and site relationships. I applied Bloom's Taxonomy to identify demonstrated skill sets and knowledge transfer as participants were able to:

a. observe and recall information; apply new knowledge combined with educational training and skill to influence TL,
b. interpret, compare, and contrast then translate information among individuals and teams, identified as comprehension,
c. solve problems using required skill sets, identified as application of new knowledge,
d. organize and identify components from collected data such as site observations, photographic documentation; utilize new technology (Galaxy Google maps), identified as analysis,
e. utilize generalized facts, share, and relate knowledge among disciplines, skill sets and concepts in a new situation, identified as analysis,

f. relate and share new knowledge from several disciplines, identified as synthesis, and

g. predict and draw conclusions; using existing knowledge and skill sets to create new knowledge, identified as synthesis.

Participant Field Trip Notes

Participant field notes were shared during the charrette & utilized to address spatial and site relationships.

Using Blooms Taxonomy participants demonstrated skills & were able to:

- Observe & recall information (Knowledge)
- Interpret, compare & contrast – translate information (Comprehension)
- Share TD information – knowledge sharing among disciplines (Application)
- Solve problems using required skills (Application)
- Organize and identify components from site observations (Analysis)
- Use generalized facts and relate knowledge from differing areas in a new situation (Analysis)
- Relate knowledge from several disciplines (Synthesis)
- Predict & draw conclusions – use old ideas to create new ones (Synthesis)
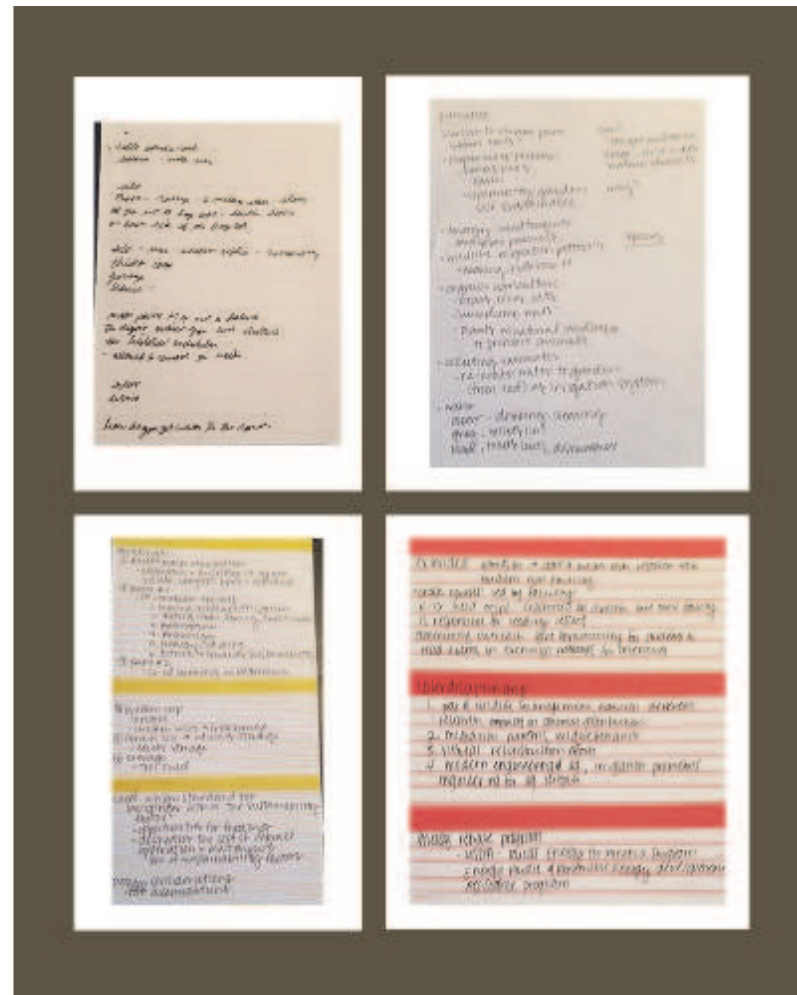
Figure 4.15
Participant Field Trip Notes

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This section communicates viewpoints and experiences among each teams' individual actions and collaborative creativity. Discussed by team it depicts TDL as participants learned to explore, communicate, and reflect through narrative lived experiences.

Red Team (T1)

Two POs (JL and MFP) had history with Cherokee. JL shared stories about his life on the ranch; which began shortly after Tweet purchased the property in 1954. As a young man he and his spouse became Tweets' butler and chef. PO/MFP owns a cattle ranch southeast of Denver (Franktown) and is an international stained-glass conservationist. The other team member was a tenured professor in the School of Education (FO/CM). All were valuable resources for #16. This student proved to be adaptable, responsible, and hardworking. PO/FOs supported her vision and aided project development using a Socratic method. JL began with, "Ask what you want to do, not what we want". MFP explained that students who volunteered on her ranch did what she needed them to do and FO/CM next asked, "What experiences did you have as a kid?" #16 responded, "I grew up on a ranch". CM followed with, "What outdoor experiences didn't you have growing up". JL followed with, "Think about city kids what would they be interested in?" #16 continually repeated the questions before she responded, then began with, "Signage we need signage, directions like what they have at the national parks."

These questions sparked ideas that flowed like water, discussed among her team. CM asked JL what questions people ask about the ranch; JL responded and discussed tours, parties, celebrity, and royalty guests. This discussion advanced ideation to include collaboration among other universities and K-12 schools; JL shared was a review of local K-12 schools. #16 continually looped back to seek approval from the POs, each asked questions that helped her frame a plan. #16 diligently documented ideas 'on the wall' placed concepts under headings such

as house, barn, garage, and silo. Day 1 content expert DB discussed and identified an article

shared by the TGEC Director as:

> Bringing the healing power of horses to the Denver metro area is an amazing opportunity
> for so many audiences of the community…The equine-assisted activities and therapies
> implemented at the National Western Center will include programs for traditional school-
> aged children, youth in high-risk situations, opportunities for youth seeking volunteer
> experience, programming for the senior/elder population, and therapies for individuals
> with physical, cognitive, and intellectual disabilities (Martin, 2018, para.5).

During a.m. break (Day 1) students gathered at a table to catch up, share progress, and

discuss the charrette process thus far. I overhead #18 say to 4 interior design students at the table:

> I can't believe she's a teacher, she won't give me the answers. Before anyone could
> respond #16 smiled, leaned back in her chair, and said, "Don't you get it that's the idea,
> we're here to figure it out ourselves. What are you going to do when you get a job?
> Remember she said if she hired us we would have to figure it out?" (Followed by
> inaudible grumbles). #21 continued "I think she's right, they (employers) aren't going to
> feed you answers, you're going to have to learn to do it on your own or with your team. I
> think this is the perfect place to practice this. If you need help ask any of us, or the ranch
> people, everyone here is cool, and I think they will help us (see Figure 4.16).

Observations of #16 expanded as POs shared how this participant went beyond what was

asked, identified early on as 'showing exceptional leadership skills. She organized participants

during the field trip, remained calm when lost, and willingly agreed to work on a charrette team

as a solo student. As a leader, she worked among all participants and was professional in

encounters. I observed leadership skills as she provided direction for others that created a

mindset model when her cohort appeared frustrated and unhappy with the process.

Figure 4.16
Day 1 a.m. Break

Participant #16's leadership encouraged, and at times redirected negative feedback observed by others behavior. #16 aligned standards to represent goals and methods for achieving them, while promoting individual creativity. At the same time motivating others to appreciate the opportunity to 1) break out and 2) open up beyond a framed classroom environment.

Charrettes often trigger participants' discipline knowledge and skill sets shared to reframe the unknown. Unexpected outcomes can create problems, often displayed as dissatisfaction with the process. Gray discussed how transformational leaders garnered influence among their networks that enabled them to gain social capital. TDM leaders are often brokers used to reduce or eliminate disputes and conflicts (Gray, 2008). Had #16 been uncomfortable or unable to step in the remaining participants might have assumed a similar attitude. This could have led to dissatisfaction or derailed progress among teams. This participant acted as a conflict negotiator and supported the charrette environment. Her early interjections and positive attitude

encouraged trust in the process, turning potentially destructive behavior into constructive

interactions among teams (Gray, 2008).

Post charrette I completed observations of T1 and captured interactions among this team,

including quotes that sparked discussion (all grammar and spelling errors by participants were

left unchanged in the images); these images depict collaborations and project development, see

Figures 4.17 and 4.18.
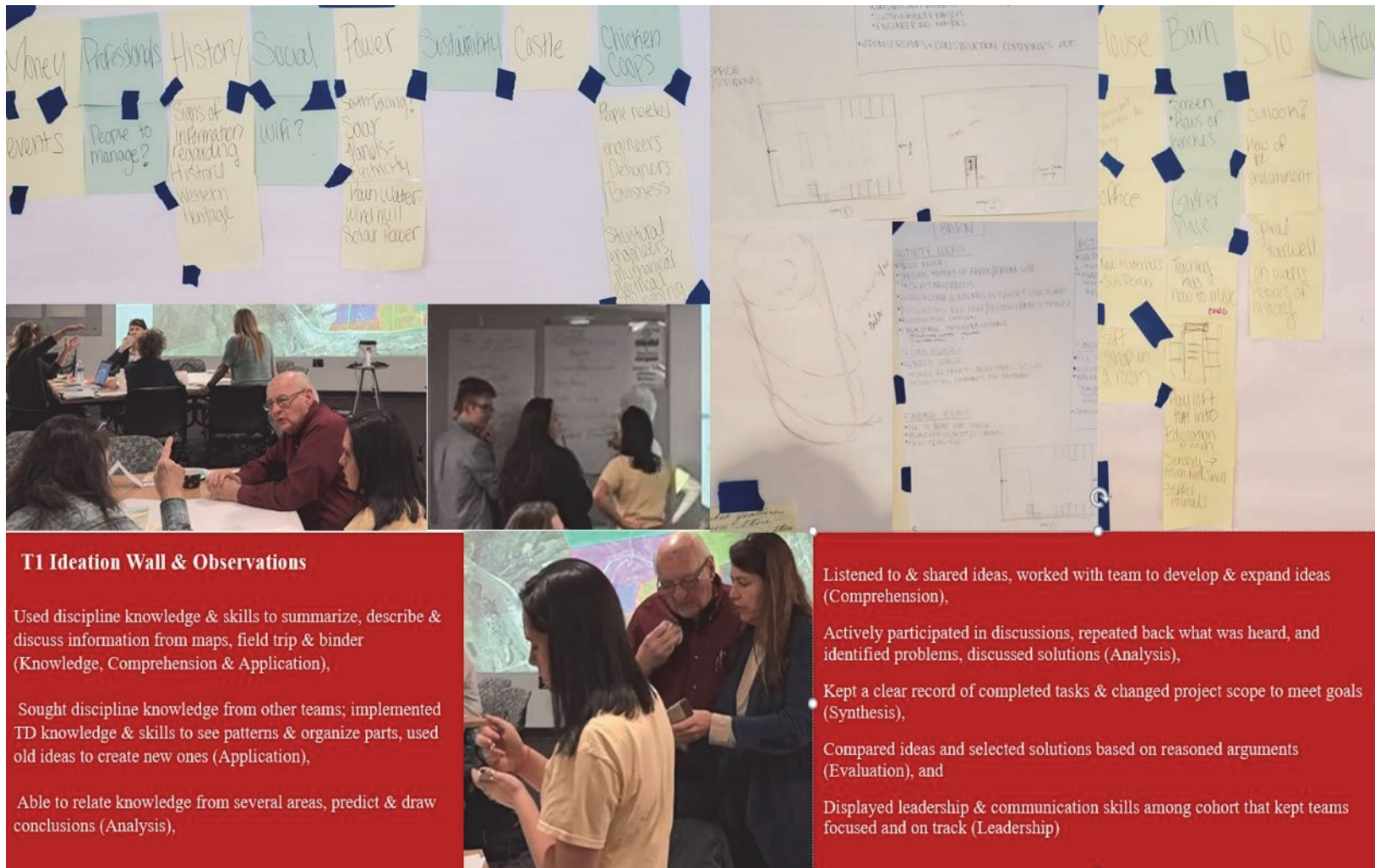
Figure 4.17
T1 Ideation Wall and Observations
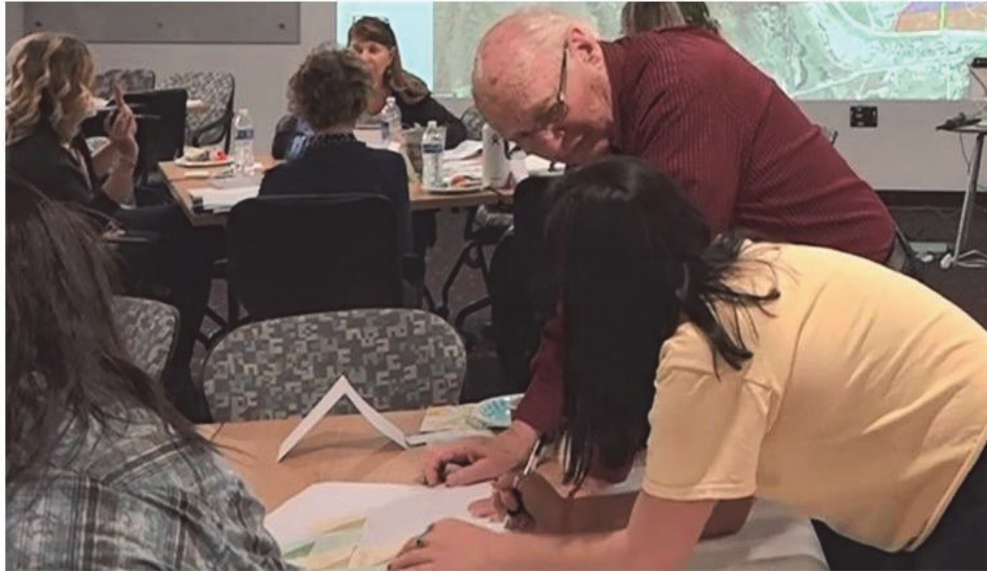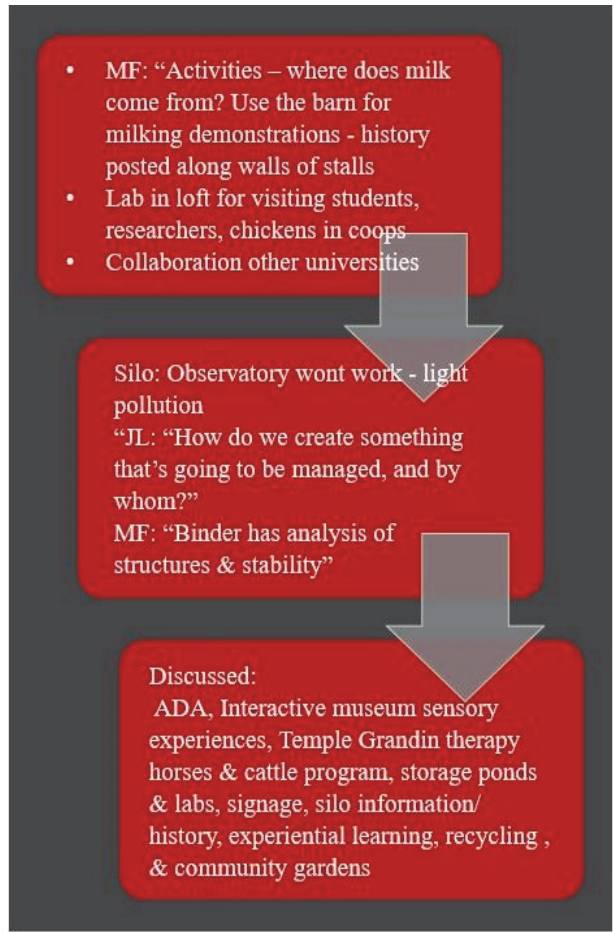
Figure 4.18
T1 Collaboration and Participant Experience

Green Team (T2)

I first observed this team from afar and watched as #10 and PO SK were deeply involved in discussions; they asked questions and extensively utilized laptops, maps, and field trip cell images to source information. Both remained focused and open to ideas, one thing sparked another. They wrapped up one idea, circled back to revisit earlier concepts on their ideation wall, made changes or moved new ideas in a different direction.

Early interactions revolved around volunteers in attendance, their current roles at the ranch and the Cherokee Scientific Institute. They discussed, shared volunteer experiences as I mentioned looking globally, rather than locally or at CSU. PO SK and I discussed how global volunteers often have grant or gap year funds to come for extended stays on-site. SK continued the discussion, "So think about the potential for this property." #10 reviewed what we discussed during the field trip regarding housing volunteers in different areas of the property. She recommends adding mobile units, identified as safari-style tents addressed safety protocols such as planting thorny trees/bushes around tents that provided safety from predators. I heard this concept discussed again Day 2 with the team's wildlife biology major.

I observed as they discussed the historic homestead. I was asked to walk SK through the house, and I invited #10 to share her cell images. I began saying, Let me get that in mind…#10 broke in and asked, "How do you remember this stuff?" I responded, "I have always had good visual skills and years of designing honed that ability. You will get there, but I like what you did photographing every room. I still do that. That's a great resource and skill to have, nice job". I continued, "So there were two bedrooms, one bathroom, a good size kitchen, large dining room…remember the pot belly stove was in there, the front room had another fireplace, then you

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go out and have the gardens (S side), a pump house, chicken coop (N), garage (E) and the barn (NE)." #10 jumped in, excited to share her discipline knowledge,

"So maybe the house is a place for students, and we could use gray water for the gardens. Maybe the pump house becomes a community bathroom using composting toilets. We need a place for older people as well." We all laughed at that comment, and SK asked, "So look at the space with everything around it, what do you want to do?" #10 responded saying, "Personally I would be interested in educating the community about…(inaudible)… the history of this place, the castle, and the ranch, (obtained from video notes). #10 continued (joined SK pointing at Galaxy map), "So this space could support the community garden…(inaudible) SK responded saying, "Lets Google the offices of the natural resources and conservation services;" they went online to find answers.

Conversations continued as the team discussed utilization of other site structures. During the field trip I shared ways the property might be used to generate funds that also supported local businesses and how each might benefit. I shared observations and notes from my 2016 site journal and discussed concepts from the Board presentation. I identified two areas documented as a problem and how when combined they might generate revenue; each utilized site resources…manure and mushrooms! I shared how we met a local chef, interviewed him, and brainstormed how to blend Wauhatchie resources to supply his restaurant with a product. Onsite observation identified the garage was dark and in relatively good shape. Located on a working cattle ranch we had a plethora of product (manure) to grow mushrooms. The chef shared types of mushrooms we could viably grow and agreed to purchase all we could supply, should the concept be developed. I explained the chef currently spent over $800 a week for small amounts of mushrooms. We agreed to form a cooperative with other local chefs to become the local

supplier…two problems and a possible solution were identified. The conversation advanced as follows:

> Participant #10 said, "Do you think we could grow mushrooms?' SK returned to her laptop and said, "OK so here's how you grow mushrooms and here's how we can use the manure to solve a number of problems." SK moved on, "OK let's look at the pump house." #10 shared cell images from the field trip, they continued; I moved to the next team.

Afternoon Day 1 discussions circled back and forth to the site. #10 asked, "Do you know if that cave is on the property?" We returned to the Galaxy map, discussed the location of the cave and DS left to seek assistance from T3/JC the ranch's education director. DS began the discussion on cave dwellings and cultural resources that created educational use(s)/concepts. I had the flexibility to leave and return to observe teams while they developed concepts, located information to support or negate identified impressions, and sought assistance from other teams. I observed participants as they circled back to update and make changes to earlier ideation. #10 was heard saying, "Can't we do some sort of farm to table, make money from selling stuff." SK added cultural artifacts from the castle, and #10 says, "You are right, using this site we could go to the castle, it's right up the road."

DB met with this team to discuss implications and interactions among wildlife, cattle, and humans. I observed as they discussed building and land utilization, each addressed scenic overviews and how an educational program could benefit if they merged the areas then developed an 'out of sight' sustainable, renewable power source that retained scenic views. Consideration was given to concepts that placed renewables behind the barn (E). They discussed with #45 the safety issues involved between human/wildlife interactions. DB reviewed plans for gardens and renewables, addressing wildlife interactions with additions such as wind turbines. After DB left this team, #10 and #45 worked with SK to develop a research lab with T2 and T3;

ideas were shared by discipline during the inter-team collaboration. This team did not share possible effects of wildlife/human interactions in their final presentation.

This team had a solo student participant Day 1 (#10) joined #45, Day 2. Both POs proved valuable resources for the team. SK, a previous Board member at Cherokee, is an author and her organizational/research skills kept the team focused and on track. I observed SK as she completed internet searches to help participants better understand ranch assets. She worked well with #10 and utilized Socratic methods to help her find her vision. I observed #10 implement Socratic methods Day 2 when #45 joined; she recapped the previous day's data and collaboration. They jointly adapted and expanded ideation using discipline knowledge and skill sets. SK was well versed with financial needs, grants, and proposed projects; she was conversant in potential funding obstacles the ranch faced. She shared perceived challenges that faced the current Board and how mixed priorities coupled with differing visions effected community support. Participant #45 rapidly assessed the prior days' work and the team reviewed and revised earlier plans; #45's discipline knowledge supported new ideas. I observed this team as they methodically developed plans, accessed internet resources, and identified information. Hybrid learning was the key to this team's collaboration. It provided participants additional resources that addressed ideation. They developed lists using observations from the field trip and each described, associated, and summarized their findings. They easily translated new knowledge into new contexts and inferred causes. They addressed pros and cons to each identified area of their plan identified as comprehension and application. I observed the addition of a new team member (#45) and the seamless manner all members shared what they discovered the day before. They enthusiastically shared patterns and identified components, they sought additional input from the newest member and utilized her discipline and skill set knowledge. I observed the team as they

met the new member with visible excitement. In fact, the team appeared elated to have yet

another discipline perspective. They merged ideas and reframed initial plans to create new ones

as they implemented new knowledge. Ideation and project development are depicted in Figures

4.19 and 4.20.

T2 Ideation Wall & Observations

Identified site structures methodically, developed options, made changes when discovering new information & revisited to adapt information (Knowledge)

Able to grasp meaning from outside disciplines (POs), interpret facts and compared & contrasted options(Comprehension)

Developed options from research to market place; identified self – sustaining revenue sources (Application)

Identified patterns and components to developing a program, related knowledge from several disciplines (Analysis & Synthesis)

Able to compare facts, verify evidence & subjectively make choices (Evaluation)

Intra & Inter team collaboration developed a shared understanding of how to pursue project goals

Created a TD framework to implement and integrate observations & research to develop solutions to real-world problems

Coordinated binder information with mapping/observation exercises collected during field trip – compared concepts, reasoned & concluded ideas to support evidence

Figure 4.19
T2 Ideation Wall and Observations
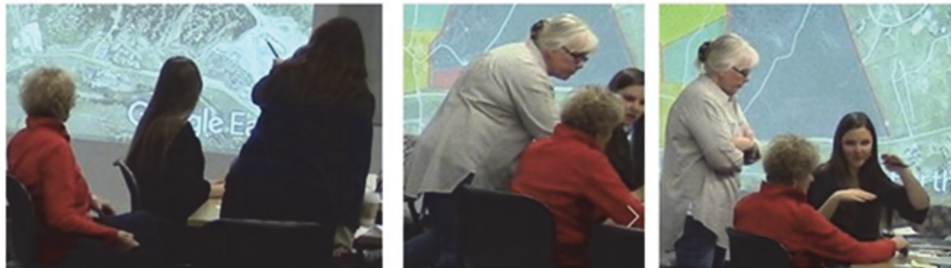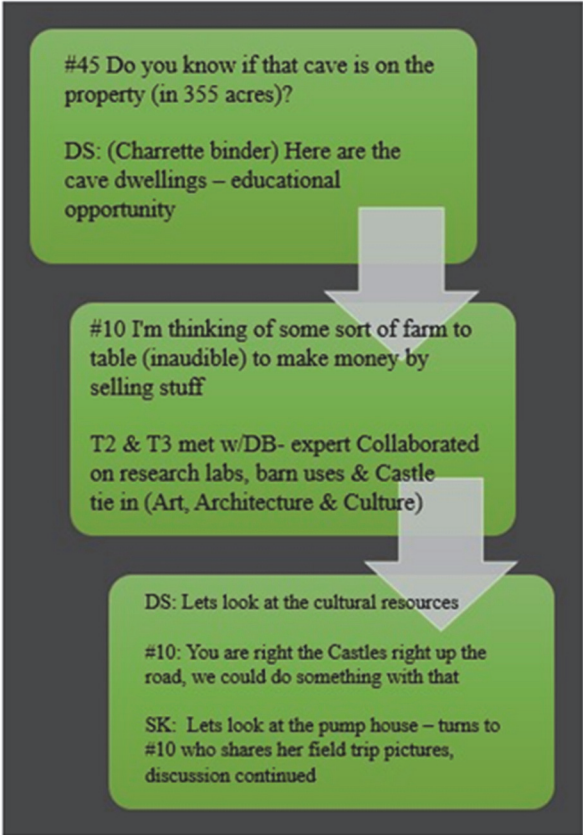
Figure 4.20
T2 Collaboration and Participant Experience

Blue Team (3)

Day 1 PO/JC spoke with NE director; then identified property on the Google map as she shared an overview of their educational program. During the presentation, T4 PO/DH stated, "That's Cherokee property and NE is using it, we lease it to them, but we can use it". POs continued to discuss ideas and the site, always led by PO/JC. As the education director for the foundation I observed as she listened to participants' ideas while she roamed at times among other teams apparently taking notes. Early on this POs power position impacted construction of place and ideation among participants. NPO, #21 joined this team to document interactions among members and noted that JC was "Driving the train to support her job, clearly taking notes for use in her own program development." #21 approached me at lunch concerned with the direction of this member's interaction. I joined this team to observe interactions and did not detect this behavior, rather watched as PO/JM led members in a new direction. #21 began the discussion with, "So looking at all this how do we bring it all together? That's the most important part, how do we bring it all together?" I had a private conversation outside of the conference room earlier in the day with PO/JC and reviewed the confidentiality and non-disclosure agreement each signed.

PO/JM has 20 years volunteering with the ranch and she shared all aspects of ranch history, from Tweets involvement to how the CR Science Institute evolved and support Tweets Mission. This change in leadership reframed the team's purpose and direction. It began with their "Wall" and ideas for a Welcome Center that supported their desire to have, a first stop landing, entrance, and exit; supported by researcher's collaboration. This team addressed tying in historic research supported by castle programs. I observed members as they explored ways to develop an art renovation program in conjunction with art education and history. Having a K-12 educator on

this team, while challenging at times, proved beneficial for project development as PO/JC was able to lead as she shared examples of curricula development suggesting experiential learning experiences. JM led discussions to include T2 and both teams were joined by DB. He shared wildlife expertise and recreation training programs developed on private lands. He continued and discussed how conservation education and hunter education positioned participants to further address revenue generation if they created hunter safety training and education programs.

PO/JM and #21 worked with the members to develop historic roads (usage) and discussed specific ways to incorporate information with way finding and tours. PO/JC helped members with binder usage and resource's but appeared uncomfortable with new technologies, relying on students to implement and assign values to site specific structures and potential usage. Participant # 91 (Early Childhood education student) joined this team Day 2, and as with T2 was warmly welcomed; she jumped right in and paid close attention to the previous day's work. She offered insights to incorporate educational programs using existing sites while she shared alternative ways to work with NE. Participants #91, #89 and #21 rotated among T4 and T2 as they discussed ways to incorporate everyone's discipline knowledge within a joint venture that supported and advanced ideation. I observed #91 and #89 move from their team to Table 3 (unoccupied) as they cooperatively developed presentations out of ear shot from other teams. POs JL and JM joined members at different times and helped synthesize information. I observed a well-managed, professional team who respected each other's ideas, even during disagreements. I watched as #91 took a leadership role Day 2 and while open to working with JC, I observed her debating the pros and cons of proposed ideas supported by JM and #89. Team members had individual conversations with me outside charrette spaces during breaks. They expressed frustration working with PO/JC saying that PO/JM was a valuable resource they wished to utilize

more however she was overshadowed by PO/JC. Most charrette teams experience

communication difficulties at some point. I shared that charrettes are a work in progress and that

differing opinions are expected, even preferred. I offered ways to keep the dialogue on track by

disallowing multiple sidebars, stating,

> Ask JC, or any member, a question when listening to new ideas to create an environment
> of consistent participation. Keep asking questions using discipline knowledge and skill
> sets stay focused and flesh out big ideas…by sharing your knowledge and skills you will
> be able to reach agreement on project goals. If we all had the same skill set and
> knowledge we would never come up with new or innovative ideas, step back breathe and
> look at the idea rather than the person delivering the idea. I think JC, as all members, has
> much to offer, try to tickle out the ideas and overlook personality differences.

This team resolved communication/collaboration issues and moved forward. They used site

evidence to make decisions on plan/program development. Team collaborations are depicted in

Figures 4.21 and 4.22.

Figure 4.21
T3 Ideation Wall and Observations

Figure 4.22

T3 Collaboration and Participant Experience

Yellow Team (T4)

This team struggled with early project development as #18 became frustrated without a check list, she continued to struggle throughout Day 1. Having observed this unfold I joined the team and spent individual time setting things in motion. This team required the most assistance and when #18 became uncomfortable with the size of the project she placed herself in a "box" of known skill sets; began using CAD and "trash" to design interiors. Mid-day (Day 1) #18 moved from the team to a separate table. Once she felt she had accomplished tasks that best fit her discipline knowledge and skill set she rejoined the team and shared her ideas using visual aids. This behavior transitioned the team into a blended leaning environment. This closely resembled other charrette formats, where teams agreed upon tasks supported by discipline knowledge and skill sets, then break up to do those tasks; later reconvened to share and discuss/developed ideas. This was the single team that implemented a 'part and parcel' process. When #18 moved to a (independent) space the remaining team members developed other areas of the project; I rarely observed hostility or arguments within this team and they readily shared ideas.

POs were active in learning alongside student participants and this team utilized available tools, with less reliance on technology and more reliance on discipline/site knowledge acquired from POs. The team readily accepted the challenge and self-instructed using Galaxy Maps, sharing their new knowledge with teams/POs. This was the one team to do this as others relied on the IT professional to direct/redirect maps for them. #22 was well versed in wildlife biology and had extensive volunteer experience working with school age children as a camp counselor. She appeared better prepared for the charrette experience than most and was comfortable working with unknowns outside her discipline. She displayed above average research and conceptualization skills; #22 was articulate and remained calm during discussions often appeared

reserved. Both POs had extensive private sector experience and their Cherokee collaboration/involvement was diverse. They led the team toward areas they believed the ranch needed to address but were not overly influential among participants. Both participants appeared self-aware and confident in their roles. I observed #18 relied heavily on #22 for knowledge and direction.

This team formed slower than other teams as participant #18 had numerous concerns about developing the project, identified as being (self-imposed) expected by team mates to do drawings. I shared that this project did not required architectural plans yet #18 continued to be concerned about being asked to 'draw on the fly'. I shared how 'pretty pictures' are rarely required. We discussed how hand drawing influences one's ability to visualize and I shared my belief that a hand/mind connection is required to excel in any architectural/design or construction fields explaining that CAD was a tool. Time prevented a discussion about the "lost art of hand drawing" and how it might impact careers (Dunlop, 2016). I recall saying, "Hand drawing 'on the fly' is a tool to help your client understand and make changes. They are rarely pretty pictures or even construction documents, rather a tool to conceptualize and revise ideas. Formal architectural drawings are completed in the studio for final presentations". She had questions about the site and interiors of structures; readily asked if I recalled the spaces. I laughed and took a pink marker and rapidly draw interiors, exteriors, labeled items, placed buildings along the site, added roads as we collectively identified/defined potential usages on the team's "wall". We next moved from building to building and discussed options. Everyone talked over each other and the energy level escalated as participants shared ideas, discovered patterns among artifacts. I intentionally made drawings sloppy while talking the entire time, asking questions, referring to #18's cell phone images to provide relational references for #22 (unable to attend the field trip).

By Day 2 this team had developed a comfortable workflow and discussions intensified as they became excited about new information developed earlier by 'part and parceling' out the project. #18 reconnected with the team as she was well on her way to creating a floor plan for the house renovation. Her skill set and knowledge were embraced by the team and I observed her adapting to change. Day 2 #18 was a different person, talking, sharing, and bantering ideas. She offered and supported her vision, was able to negotiate what was most important to her for the project. I rarely observed this team using the posters FO/CM created, and they rarely collaborated among other teams. Other teams gravitated to them for support, ideas, and knowledge; all of which they readily shared. Participant #22 seemed comfortable with a blended learning environment and to have studied/worked in similar environments. Team collaborations are depicted in Figures 4.23 and 4.24.

Figure 4.23
T4 Ideation Wall and Observations

Figure 4.24
T4 Ideation and Observations

NPO Team Observations

Day 1 observations were collected by NPO/SL. Participants were aware of the NPOs role when joining each team. SL noted interactions while documenting TDL. I utilized NPO/SL notes, observations and conversations to support data collected by PO/FOs. Observations are identified by team ID and summarized key points shared below.

Red Team 1

This team identified several challenges; PO historic property knowledge was shared among the team to aid in project development. This team spent considerable time looking up plans and site maps, extensive binder utilization. Team discussions evolved especially during negotiations of what and what not to include, expand or evolve from other site usages, categorized by primary interest areas, identified below.

1) Provide educational field trip opportunities for elementary school children,
2) Make the site accessible, difficult terrain (difficult for walking),
3) Maintain site/property history,
4) Create a sustainable site,
5) Provided a gift shop on site to make money
6) Dairy farm,
7) Not open to the public every day,
8) Events – weddings at the castle, add wine/whiskey tasting rooms to Wauhatchie site,
9) How to control the elk population on the ranch – hunter education,
10) Add team members to charrette – business, MEP engineers, architects, civil and structural engineers,
11) Redesign the house for researchers to come and stay and conduct whatever research they want to study,
12) Function of the entire site?
13) Mountain blue bird houses on the site – they were built based on just an interest and turned into a research project.

Green Team 2

This team spent a considerable amount of time looking at site photographs collected during the field trip and using Google maps. They took inventory of each building and developed

a site map to evaluate options. Ideas led to questions and questions lead to discussions identified

below.

1) Pump house, is it viable?
2) How to make the site more accessible – pave roads and walkways,
3) Create a farm that supports the community and headquarters,
4) Generate revenue having the farm sell beef, dairy, and mushrooms (branded products), to local restaurants, stores and public.

Blue Team 3

This team began with a single question, "What are the challenges to re-design the site?

Key points identified below.

1) Financial concerns: Where will the money come from to finance the restoration?
2) How can the site make money to sustains grounds?
3) Consideration given to operate the site as a museum, wedding, and event venue,
4) Discussed the parameters of the conservation easement (utilized the binder for resources),
5) House raptors in the barn,
6) Address water rights and consumption

Additional questions incorporated the "how to" of adding historical design into the site

along with conservation rules. This led to the main topics of History to include (group made a

list, took inventory of all buildings on the site) artifacts identified below.

1) Castle – what is the connection to the farm?
2) Flower Homestead
3) Pump House
4) Ranch Headquarters (includes the Blunt house)
5) Include history of all existing buildings,
6) Masonry barn was torn down (identified in binder on appraisal forms)
7) All buildings could be restored and utilized as:
   a) Native American artifacts – educational/teach
   b) Wildlife preservation
   c) Preserve the Heritage/History of the site and occasionally educational
   d) Develop opportunities devoted to western heritage and wildlife

Yellow Team 4

The primary focus of the team was discussing sustainable redesign of the site and

buildings; areas of interest and proposals identified

1) Solar panels,
2) Rainwater collection,
3) LEED and WELL building certifications,
4) Building a brewery was discussed

This team's framework development began with questions identified as.

- Is the site a potential day-camp/learning center for kids? Or would students be coming there for a longer period of time? Participant #22 felt that a longer, more intensive summer program for kids would be more effective; even considering overnight stays.
- Combine the concept of day – camp and longer stays during the summer including and revolving around environmental education, and
- Consideration to develop a brewery

In summary, among all teams I (SL) noticed discussions included wanting additional

disciplines added to teams, some mentioned landscape architecture and civil engineering

disciplines to address site and structures. NPO/SL did not assign points to individuals/teams;

thus, the researcher was unable to fully ascertain her assessments, but felt comments and notes

were relevant for future studies and training improvements.

Team Presentations

Teamwork is the ability to work together toward a common vision. The ability to direct individual accomplishments toward organizational objectives. It is the fuel that allows common people to attain uncommon results. (Andrew Carnegie (As cited in Thapaliya, 2017)

Each team had the opportunity to act on the same information, what differed was their

approach and information management. Interpretations were based on interactions among POs

and participants, respective backgrounds, and personal connections to the project. Some

approached the project in a top-down pattern progressing sequentially from one phase to another

in a single series of steps. Others approached it randomly, linked relationships as they shared

information addressed existing structures and/or site challenges. Both approaches implemented

recursive methodology and shared discipline specific knowledge and life skills.

Team Presentation's – Overview End of Day 1 and early Day 2 I reminded participants they

could present as a team or pick a spokesperson to share their proposal; they elected to present as

a team. Participants drew straws to determine presentation order; using consensus it was

unanimous teams would present as a group. Each team was allowed 35-45 minutes to present;

delivery began at 3:30 p.m. and ended at 4:45 p.m.

I provided the requisite materials to create poster presentations (paper, pins, pencils,

colored markers) included technology to share digital materials as slides/power points. POs/FOs

moved front/center during presentations. Microphones were supplied to aid mobility and voice

projection. The presentation setting was similar to an architectural design lab; a large open space

with hard surfaces, 5' rectangular, movable tables/chairs, no partitions other than architectural

supports.

Early afternoon (Day 2), I observed participants becoming tired. I spoke individually with

PO/FOs then with teams; consensus moved the final presentations earlier as anticipated snow

furthered hazardous driving conditions. While participants prepared and set up, I participated in a

conversation that has become a favorite. I concluded it summed up two long days of intense

collaboration and discovery. It began as T1, #16 was preparing her presentation saying, "I'm

freaking out. I'm the only one who has to present alone." I shared what a professor once said to

me, "I know I used to dread presenting but let me share something one of my professors once

said to me, knowing I was nervous she said, "Remember everyone's here to learn and listen to

you, to them you are the expert, no one knows this information better than you. Share what you

know and if you don't know the answer tell them you will get back to them." PO/JL attempted to ease her anxiety and shared stories about his career and the celebrities, royals, and political figures he used to serve. I next overheard JL ask #16, "So how do you feel about the charrette? Did you enjoy the experience?" #16's response, "Have you ever walked through fog before, that's how I feel right now!"

I assisted with set up and reviewed notes for project delivery. As I reviewed observation notes I found comments as, "Well that will never work, or we tried it and that didn't work" so I opened the presentation session with this statement,

> Ladies and gentlemen (inaudible), Thank you all for taking your time to join this charrette and I can't thank you enough for all your hard work. As teams share what they prepared enjoy their presentations. Please allow teams to finish, noting questions, holding until they have finished. Team 4 are you ready to present?

I continued, as T4 struggled with set up, looped back added,

> One more thing, over the last two days I've heard a number of comments about what is currently going on at the property. I want you to listen with an open mind to everything these people have created for you. I realize we each have our own ideas of what should be done at Wauhatchie. Many of you have a long history at the property and have seen people, ideas, and programs come and go. But don't focus on what's currently going on at this property or what's happened in the past; the past brings ideas that might be updated, revised, or spark new directions. There are always ways to adjust or revise what occurred in the past to what can be accomplished in the future…we are not here to say well we tried it and it didn't work, we're here to listen to their vision through a new lens. Let's be thankful for what's been accomplished. Feel free to make any notes you wish each team or me to know on your evaluation forms, and please feel free to ask questions.

> Thanks again for taking your time to join this charrette and I can't thank you enough for all your hard work, especially the PO/FOs, experts, and support people. You all ROCK! Don't forget to make notes once each team has presented, we will begin the Q and A portion by team.

I shared team presentations in reverse order from earlier discussions; this was done to follow actual presentation order. Final presentations are shared as given, corrections, or review

for spelling or grammatical errors was not done. Post presentation discussions I returned to the previous order (Red T1, Green T2, Blue T3, and Yellow T4).

Yellow Team (T4) Proposal Presentation T4 opened their presentation (after prompting) with introductions then shared a mission statement; presenters addressed attracting a diverse multi-generational audience. Participants were well organized and prepared to share both discipline knowledge and life skills. This team presented a visually interesting and well-organized proposal using Power Point, included CAD drawings to support proposed renovations. Presenters addressed utilization for each structure. They were well spoken and displayed collaborative behaviors during a shared presentation; it was well timed and rehearsed. Presenters were observed sharing TDL actions and collaborated outside respective disciplines on proposal activity. They evaluated areas outside what was provided in the binder and established links between PO knowledge and skill sets. The presentation progressed in a linear pattern and spoke to each area outlined in PO observations. I contemplated how much information POs shared from observation forms as I found it unusual the team would address all areas they were being observed on.

Slides were distributed equally among presenters, depicted a shared vision and discipline knowledge integration. Identified and shared within the proposal were Leadership in Energy and Environmental Design (LEED) and WELL® building standards. Both programs require accredited professionals to implement and have certification programs/costs associated with them. LEED building practices addressed sourcing materials and promotes sustainable building practices, WELL building practices addressed the effects of the interior environment on individual's wellbeing (psychologically and physiologically). Neither aspect nor approximate costs were discussed in length rather a brief overview was shared that additional costs of

certification(s) could be amortized. Presenters expressed lowering energy costs and improving

inhabitant's wellbeing while recouping certification costs would be an advantage for the site, for

potential research opportunities/collaborations, and for Cherokee. Presenters proposed several

water reclamation alternatives, such as grey and black water[15] usage but forgot to discuss how

each would be implemented or possible health hazards to human and non-human species.

This team established a brief funding plan for program(s) development and recommended

pre-arrival training programs for researchers/volunteers. They shared development and

implementation would involve modest costs while advancing safety protocols as early

collaboration would benefit TDL and TDM team building. I watched as ideas presented evolved

from conversations I listened to during planning. While presenters addressed every area

discussed I heard few innovative educational plans or ideas for property usage or integration with

other sites. T4 was well versed in discipline knowledge and skilled in areas mentioned, they

addressed unfamiliar areas to stakeholders. I sensed stakeholders might be confused with some

of the areas recommended as they used discipline/industry jargon. No questions were asked by

the audience. I utilized observations from POs/FOs to identify central ideas from presentations,

accompanied by Figures 4.25 and 4.26.

PO/FO Presentation Comments. Central ideas identified as:

- Slide show was effective and well organized.
- Collaboration with other institutions assumed, none identified.
- Model lacked innovation, lacked safety protocols for visitors, while proposal focused on staffing.
- Discussed revenue generation via extended stay among multiple disciplines addressed 20-25 humans onsite any given time (single team to address carry capacity).
- Entire ranch and castle interactions briefly addressed; lacked historic human activity (homestead).

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[15] Gray water is defined as contaminated or used water that does not contain sewage, while black water can contain feces, urine, and paper solid as supplied from toilets.

- Addressed each structure with concepts; site/programs to be student run in summer, tasked to complete all chores/activities to run operation/concepts shared, experiences vs free labor concerns noted by FOs.
- Proposed teachers develop at site programs for students; unfeasible as teachers lack time and resources; must be a collaboration.
- Inclusive multi-generational, lacked diversity.
- Student access for long term studies and staff PhD to coordinate research/grant development and coordination.
- Considered and discussed historic artifacts in the barn and at archeological sites.
- Examined and discussed wildlife/human interactions, and their effects.

Figure 4.25
T4 Proposal Presentation (1)

Figure 4.26
T4 Proposal Presentation (2)

Blue Team (T3) Proposal Presentation

Presenters utilized hand-drawn posters and were asked to introduce themselves. They

began with a development plan. Learning outside college walls was the theme; proposed was a

zero start up budget adding or expanding programs as existing programs generated revenue. T3

presented in a circular pattern as they revisited areas of the presentation shared earlier; this

recursive pattern depicted a TDL model. Participants were cooperative with #91 presenting much

of the information, often adding to what #89 had shared; none overstepped or discounted #89s

information rather expanded concepts. Presenters displayed collaboration and discipline

knowledge integration. Having had one day to work together they exhibited a well thought out

presentation combined discipline knowledge and life skills. TDL actions were shared as they

combined design knowledge with education knowledge to propose programs specifically

addressing farming and interactive, experiential activities using all structures. PO/JCs

educational background coupled with PO/JM site and program knowledge were shared. I

documented that presenters eliminated areas recommended by POs they felt no longer supported

their vision.

The target audience and activities were identified as K-12 field trips, family fun days,

college and high school students, and researchers, adding a study abroad option for international

students. Program development spoke of multiple events occurring at the same or overlapping

times. For example, they added an amphitheater to host concerts while simultaneously businesses

might be holding a team building workshop in a newly constructed pole barn. Another option

shared K-12 students might have gathered for field trip kick offs and later as a follow up.

Simultaneous usage of the site required development of an entry space large enough to safely

accommodate crowds. Creating landing spaces within the homestead house served as a multi-

faceted entry for hikers and event attendees; directional signage would assist visitors/students as they moved toward the event they were there to attend. Additionally, landing space might be shared to provide orientation for hunter safety classes, office retreats and/or day trips. Proposed revenue generation included entry fees (ticketed events) combined with annual "Barn Sales" of donated items – noted were consideration of selling unused castle items generating financial support for proposed programs.

Each structure was addressed including building additional space for weddings, receptions, and corporate events. Funding options were discussed, identified, and supported private hunts, concerts, classes, college courses, and seasonal research (outdoors). The envisioned amphitheater would be developed on the NE bluffs specifying a concrete pour (slab) sited toward the road (W) reducing sound that might impact wildlife. The silo was revamped as an outdoor exhibit for meteorological curricula supported by local weather stations/personnel; inside the silo was a weather station managed by college students, rarely open to the public.

The proposed rebuild of the pole barn was to expand event capacity by 200 people, working in collaboration with castle events. They proposed hunters stay there during the annual elk hunt. Most interesting was a proposed collaboration with CSU to offer credit courses and internships (unpaid) to construction management and architectural design students to acquire hands on learning while generating revenue. Other educational programs would cooperate with the Cherokee Ranch Science Institute (CRSI); presenters recommended additional programs and partnerships be developed and supported by the Intermountain Rural Energy Association (IREA). For example, they envisioned securing support via grants and scholarships for student/community projects, see Figure 4.27 and 4.28.

PO/FO Presentation Comments. Central ideas identified as:

- Unrealistic to start with a zero budget.
- Funding options included entry ticket pricing and donated items for sale; did not to identify where auction items would come from.
- Create an education kitchen utilizing private label beef and produce from gardens to promote community gardens; recommended teaming, and/or inviting local chefs.
- Recommended using the barn's 1st floor for photographic/technological history of farming, recommended installing movable benches for extended films for educational purpose K-12.
- Recommended using the barn's 2nd floor for retreats and/or renting out for weddings, and receptions.
- Create a cattle museum incorporating Tweets accomplishments, combined with her role as the first female member of the Stock Show Board of Directors.
- Implement electronic butter churning stations using existing milking stalls in barn for field trip participant exercises; educational programs K-12.

Figure 4.27
T3 Proposal Presentation (1)

Figure 4.28
T3 Proposal Presentation (2)

Green Team (T2) Proposal Presentation After introductions presenters utilized a single layered power point slide. The presenters' concept revolved around creating a multigenerational space that incorporated undergraduate students, faculty, and post doctorate students from local universities joined by paid employees from the surrounding community. Identified was the opportunity to join forces with the CR Science Institute sharing resources to further develop educational programs. They opened with observations collected from the field trip and communicated how difficult it was to locate and identify wayfinding opportunities; sharing the property first required signage at the entry and among structures. Their proposal revolved around mutually beneficial experiences implemented by paid staff joined by volunteers as needed; identified staffing roles included property, marketing, and program managers, joined by construction management, design, and architecture student interns. A circular entry was proposed to move visitors around the site, entering and leaving within a similar footprint. They recommended using loss-leaders[16] to increase visitor sales as they circled the site. This was the team to address parking problems. Presenters addressed ADA requirements including visual and hearing-impaired visitors/students, expanding this need in program development. Presenters gave considerable thought to employing an in-house chef at the castle to support events combined with outside caterers; not shared during the presentation as this idea was overruled by POs, see Figures 4.29 and 4.30.

During ideation, this team explored and shared closed loop renewables/systems where businesses reuse the same materials over and over again to create new products for purchase. This process conserves natural resources and diverts waste from the landfill. Presenters did not share during the presentation. Notes identified discussions among participants, which addressed

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[16] A loss-leader is a pricing strategy where a product is sold often below market value to draw in customers to stimulate sales of higher priced, more profitable items.

problem solving as when # 22 said, 'let's take cow manure and food waste to create energy and compost; both produce nutrient rich fertilizer and fiber for use as bedding for cows or as soil enhancements. Maybe we could sell it locally to support program development and/or expansion."

PO/FO Presentation Comments. Central ideas identified as:

- Concept: create a multi-generational space; included universities and community programs.
- Signage, clarity of purpose/focus of needed visual displays; One of two teams to mention.
- Addressed and identified strong support for various staffing needs.
- Explored and discussed farmer's market onsite near the entrance, possibly creating parking as program overlaps would generate too much traffic; identified concentration of utilization in a short time frame.
- Recommended expanding public areas with community gardens to supply castle events with produce; both areas would need to address carrying capacity, identified but missed options to address implementation.
- Addressed ADA issues discussed hearing/visually impaired, but did not expand on other disabilities (intellectual, physical, sensory, or mental challenges) such as orthopedic/physical impairments requiring wheelchair access
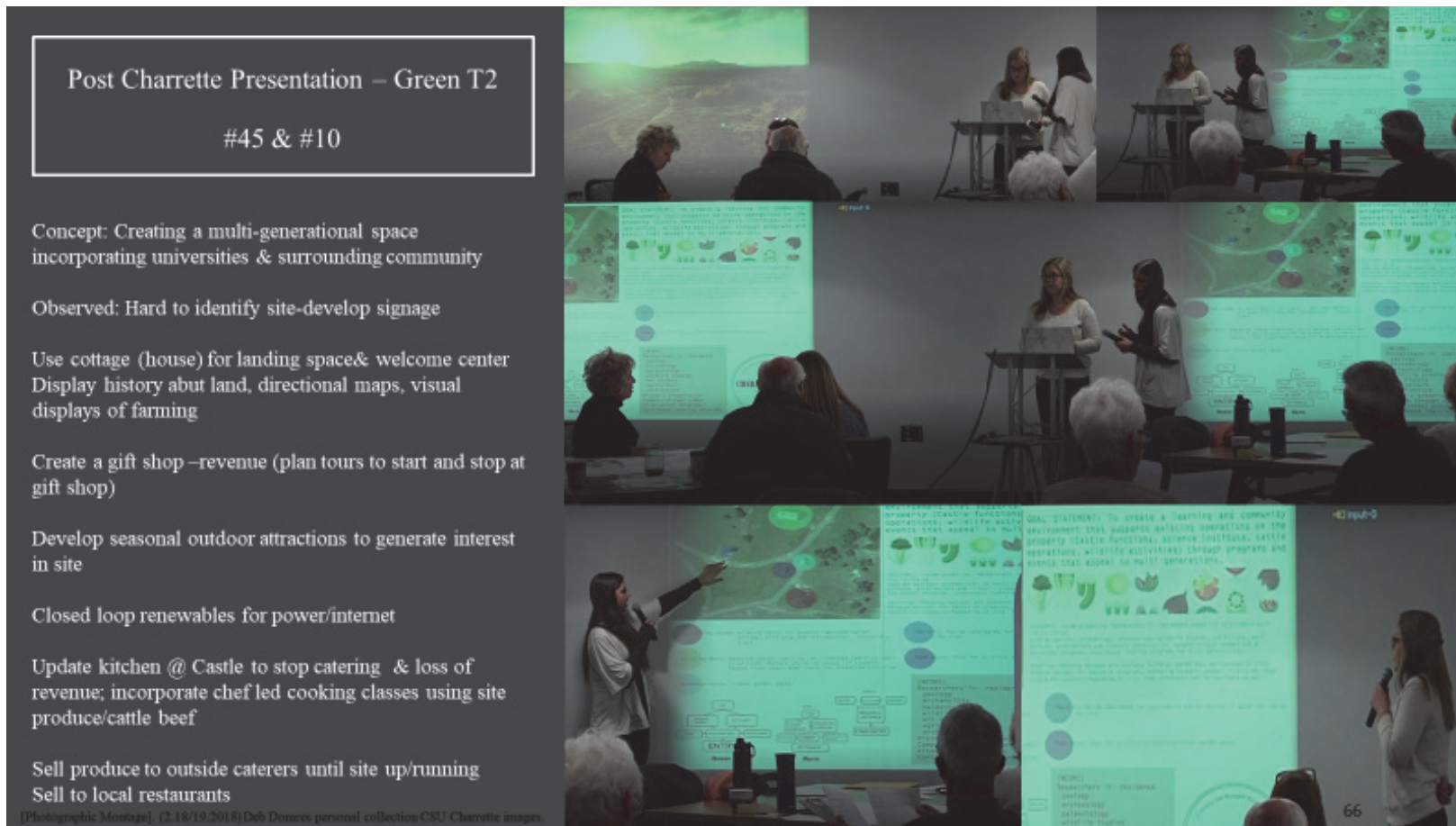
Figure 4.29
T2 Proposal Presentation (1)

Figure 4.30
T2 Proposal Presentation (2)

Red Team (T1) Proposal Presentation This presentation began with the statement, "It all comes down to money", setting the presenters tone and proposal. Using posters #16 addressed multiple funding opportunities such as donations, grants, and educational programs including elk hunts. The presentation flowed among posters in a recursive manner addressing areas forgotten/missed when addressing individual posters. For example, early on #16 spoke of hunters, hunting, and current hunts at the ranch, circling back later she added hunting opportunities that developed hunter safety programs. This would be combined with Cherokees annual elk hunt; she proposed hunters stay in luxury tents or at the Castle guest wing.

The presenter shared conceptual plans for community gardens and hiring an in-house chef to eliminate revenue lost by sourcing outside event catering (current practice for weddings/events at the castle). Mentioned was development and coordination with Colorado State University and the Temple Grandin Equine Center (TGEC). Proposed was the concept to form a cooperative that supported and expanded the equine-assisted therapy program currently implemented at the National Western Center in Denver.

The presenter discussed inviting Dr. Grandin to the ranch for cattle handling seminars, combined with lectures on Autism, education, and a lecture on her personal educational journey. T1 addressed safety for visitors, researchers, and volunteers, but rarely mentioned rattlesnakes as a potential threat. #16 discussed her proposal and the need to rebuild a pole barn site, a once contributing structure for the historic designation. Shared was a conceptual design for an apiary (bee yard) for honey production; then selling private labelled honey products to visitors and community members. The presenter believed this activity would generate enough revenue to support the apiary and could be combined with the ranch's current private label beef sales. The honey production concept was later described as an experiential program working in conjunction

with a proposed mechanical milking station in the existing barn (1st floor stalls) for K-12 educational programs. Safety and fencing needs were described; many of the funding options were designed to include multi-generational programs addressing environmental studies. One of the proposed educational programs included K-12 overnight camping as #16 believed many kids rarely experience the outdoors at night.

Moving back among earlier posters the presenter discussed renewing/regenerating the apple orchard; once viable. An interesting concept this showed that #16 had completed the pre-read as it shared how the Johnsons brought apple trees from their Missouri home and planted them on site. The presenter shared that working with the team they collectively decided to incorporate an interactive, virtual history of homesteading and ranching. The program would be shared in an interactive multi-media presentation to visitors/students in the renovated barn; this concept included signage and imaging to depict early dairy farming displayed along walls of the barn.

The presenter addressed usage for most structures (missed chicken coop and pump house) and discussed accessibility citing ADA (American with Disabilities) requirements. Forgot to mention concepts developed for collaborative educational opportunities including working with NE and CR Science Institute. There were many areas discussed among team members during project development that were missing in the presentation; I attributed this to having to prepare posters alone and nervousness when presenting. The participant ended her presentation with humor stating she really did not understand much about areas outside her discipline (interior design), giggled, and offered her design skills to anyone hiring as she was graduating this term. Figures 4.31 and 4.32 depict the presenter's proposal.

PO/FO Presentation Comments. Central ideas identified as:

- Plans had more than presented; presenter appeared nervous.
- Explored and discussed implementing dryland farming (non-irrigated land with little rainfall that relies on moisture-conserving tillage and drought-resistant crops (Merriam-Webster, n.d.) and making over original gardens working in conjunction with CSU master gardeners.
- Water collection adding wells and windmills (pump water from ground for either livestock or people), recommended adding or combining wind turbines to generate power making the site semi-self-sufficient requiring less energy to operate.
- Creative ideas included camping/hunting tents, mobile units for researchers; coupled with the implementation of drone technology for virtual research and/ or studies. Great ideas were developed during planning but missed in presentation.
- Clarity of flow was marginal, again this was attributed to nerves.
- Recommended Barn 1st floor education center electronic screening history of ranch; during ideation discussed the roles of multiracial cowboys and history.
- Discussed creating a gift shop to sell private label items (honey, castle history books, parking fees and environmental classes) and other income generation, parking fees and environmental classes.

POs noted the presenter as solo participant did a good job, stating they found her to be brave for presenting solo. They all agreed she had good ideas, presented good eye contact, and appeared to be a confident presenter, but inexperienced.
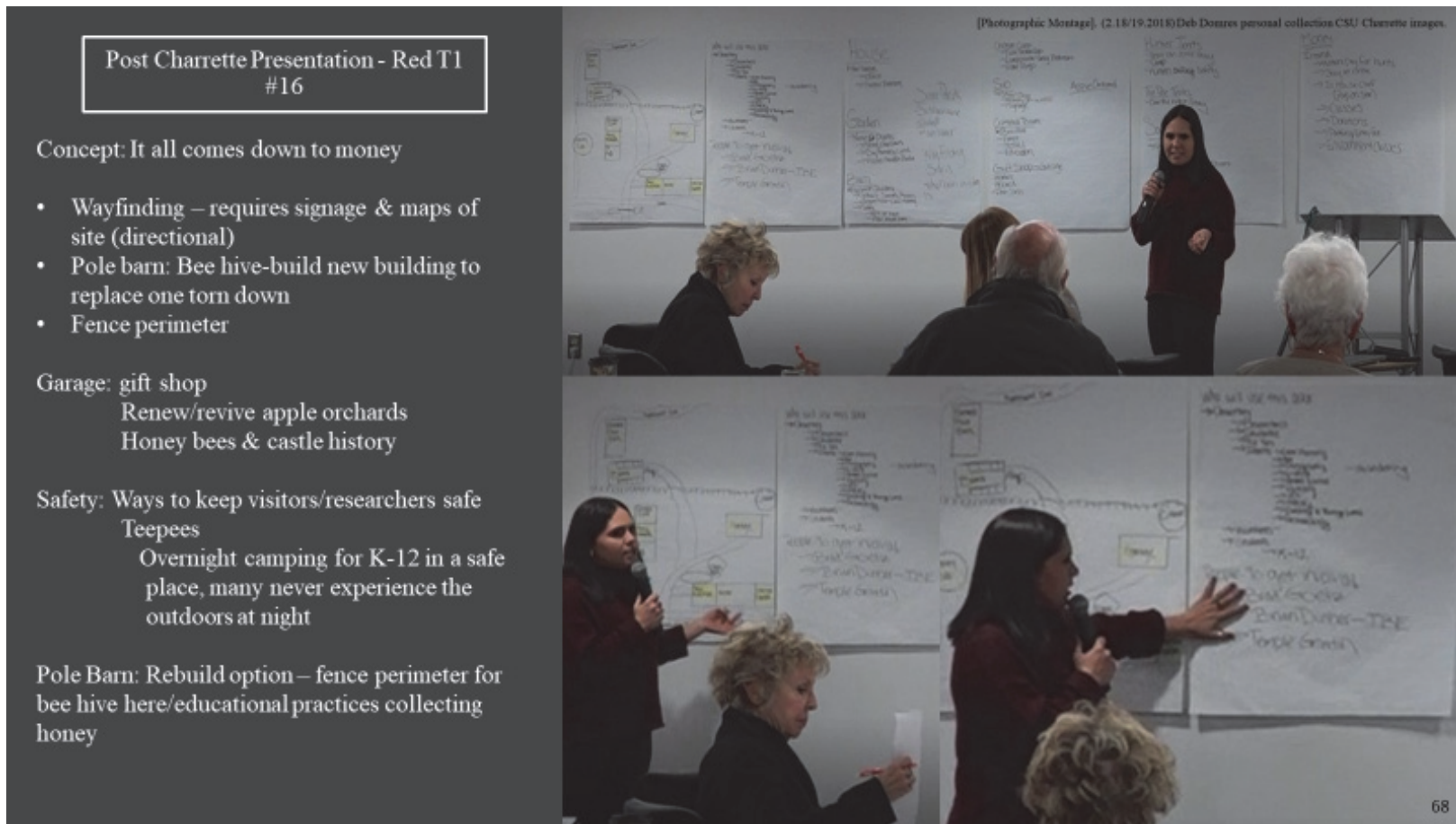
Figure 4.31
T1 Proposal Presentation (1)
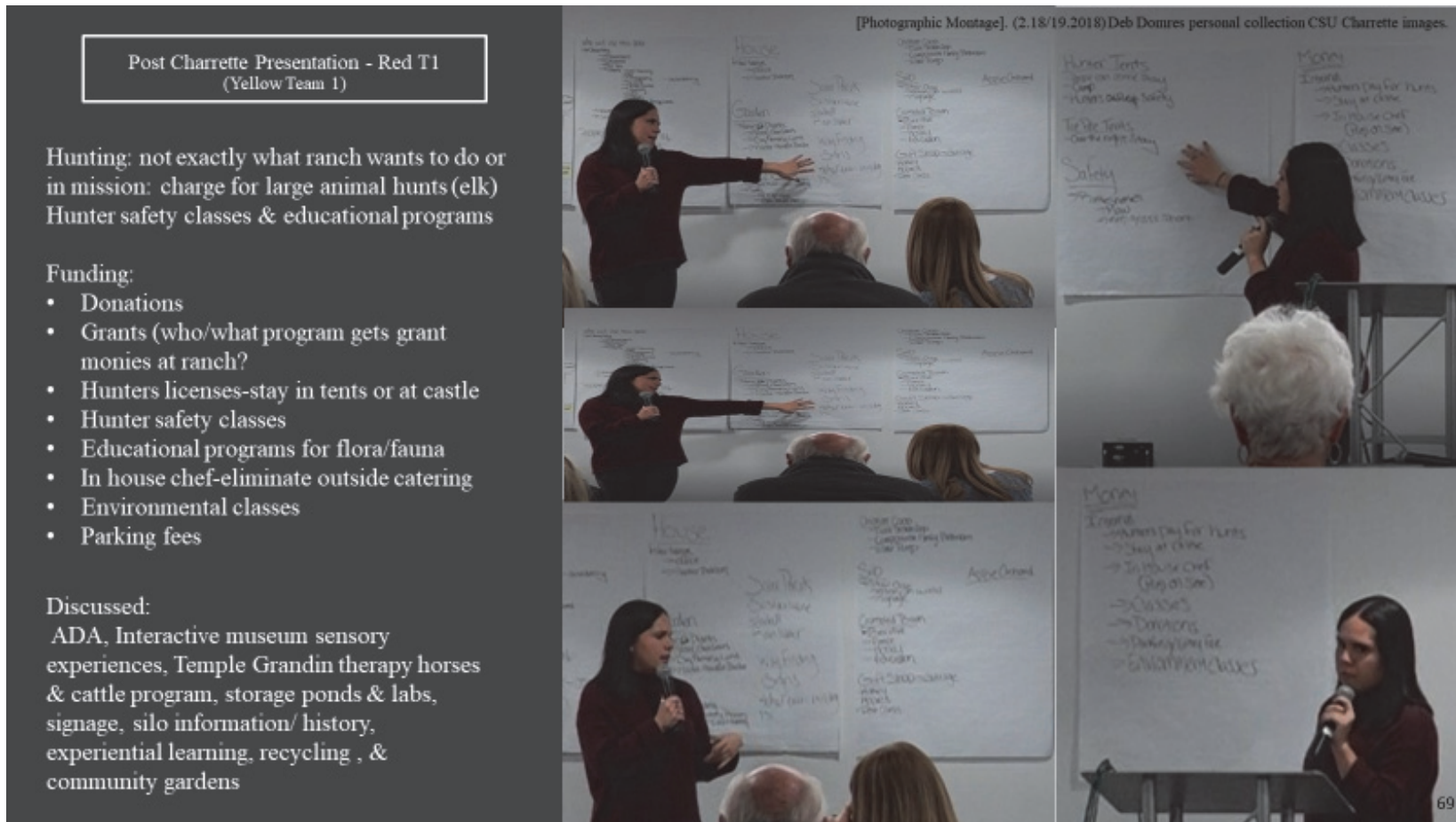
Figure 4.32
T1 Proposal Presentation (2)

PO/FO Presentation Evaluations

I was asked on a number of occasions what points and scores represented; the short response was it was a simple method for observations to be collected. I clarified the process was used to assess activity important to understanding, TDL and to ascertain if TL objectives were met during the charrette. POs used points as it provided accurate, objective measures, and supported easy data collection. For this study, TDL assessment combined both traditional methods and narrative data options. I implemented traditional aspects that included presenting overarching problems and ideas relevant to the participants' locale and lives; areas that focused on social isusses that concerned a local community.

To make assessment easier for POs to understand I differentiated between evaluation and assessment; evaluations often result in a report card, assigned grades defined and calculated using statistical methods. I shared, "Assessment instruments used in more traditional educational settings often include the evaluation of students work, rubrics for learning objectives, and surveys; however, these data sources (alone) are often unsuitable for experiential learning as students need time to reflect on and think deeply about their experiences (Payne & Jesiek, 2018, p. 9). I implemented a three level framework of assessment, implemented multiple decision makers (PO/FOs) and used observation form data to explore four dimensions identified as 1) individual abilities, 2) collaborations, 3) content, and 4) outputs/outcomes.

PO/FOs recorded observations that addressed participant interactions over time. Point values were assigned and explored 1) Observations-knowledge; 2) Relationships to TDL and, 3) TDM team actions; measures were identified by criteria (Mitchell et al., 2015). The rationale for a combination of observational methods/forms supported study goals to develop multiple data sets that provided integration of findings and documented a broader picture of the subject under

exploration (Mason, 2006). By implementing multiple observations that used differing observation forms I concluded this method would lessen observation bias. To build upon PO/FOs initial responses the literature supported my belief that participants may not act/react the same way early on the first day as they would react late in day, when tired, overwhelmed, or even the next day.

To prevent bias and stacking of findings POs were asked to evaluate presentations from teams other than the one they worked with as research showed some might be biased about their group responsibilities; identified as attribution bias. Forsyth and Kelley (1994) stated, *"When POs become a part of the team and asked to contribute to the team's success, they often feel personally responsible, but when asked how they contributed to the team's failures many avoided taking responsibility"* (p. 369). This type of attribution bias is common. POs' assessed presentations as they watched, listened, and documented interactions among team members. They used a two-part observation form and were permitted additional comments. Nine POs/FOs and one content expert attended presentations; the content expert was present for T2 and T1 presentations; evaluations were collected from 7 PO/FOs and 1 content expert evaluated T2 and T1.

Part One

PO instructions stated, "Evaluations address your opinion on the proposal and presentation. In your opinion did participants' meet identified objectives laid out at the beginning of the charrette and did team plans/proposal's capture project goals? Respond to each question by watching and listening for evidence during presentations. Part One presented a 3-point evaluation. Each category and rating was identified as did the: 1) fully address the question (Yes, addressed the question fully = 3 points) or 2) partially address the questions, hitting some but not

all (Partially = 2 points), or 3) not address the question, (No, limited identifications or did not

recognize areas identified = 1 point).

Each observer scored responses to: Did the presentation, 1) consider educational usage,

2) was it creative, and 3) did you learn about or hear innovative ideas? Respond to each question

recognized and discussed as:

Part 1: During each presentation did the presenter identify and address the following

areas?

1. discuss history of the site and current ranch operations?
2. identify and discuss historic artifacts, archeological sites, endangered species, and
   wildlife?
3. address collaboration with K-12 and community programs?
4. identify how they planned to create an educational center on one site: including
   development plans for the site?
5. discuss how their plan addressed the homestead, barn, and outer buildings and
   identify what they propose to do with them (usage)?
6. present an inclusive concept addressing energy expenditure, water, landscapes and
   habitats/artifacts and preservation of the site (Sustainability)?
7. identify challenges and discuss a shared vision to maintain cultural heritage and
   environmental features currently there (On site)?
8. identify challenges and discuss a shared vision for the overall property to maintain
   cultural heritage and environmental features currently there?

Part Two

Meeting Objectives – Did the presenter(s) address and provide a conceptual plan for

renovation of an existing building identified as 1) Efficiency (5 points), 2) Effectiveness (5

points), and 2) Expressions (5 points). POs' added 'plus/minus' to scores. Totals were averaged

based on the total number of observations made using 5 as the highest and 1 the lowest score

awarded. Point values for each category were identified as follows: Yes-addressed the question

fully = 5 points, Partially - addressed the questions, hitting some of the aspects but not all = 3

points), No - equated to 1 point for identifying the criteria but not addressing it or if the team did

not recognize any of the areas. Zero was noted when the PO/FO did not document a point value. Each team could earn a maximum of 15 points.

Presentation Findings

Post charrette each PO/FO submitted their evaluations and I transferred scores to Excel spreadsheets and tallied. For example, if T4 earned 3 points for Q1 from 7 POs then Q1 was assigned 21 points. The maximum points a team could earn was 168 (3 points x 7 PO/FOs (24) x 8 questions = 168). Findings were identified by presentation order, then by question, PO/FO initials shared below totals; depicted in Tables 4.12 and 4.13; these tables represent Part I results, while Table 4.14 identifies Part II results.

Findings were based on 183 points (168 points from Part 1 and 15 points from Part II.) This study utilized points for data collection rather than as test scores might be. For example, in a more traditional learning environment final presentations might be worth 75% of a student's overall grade. Findings might be based on presentation scores as a percentage of each activity. I realize this is a very simplified explanation and normally one assessment would rarely carry 75%. Findings shared below depict Parts I and II below.

- Yellow T4: 122/183 (109 + 13 = 122)

- Blue T3: 146/183 (134 + 12 = 146)

- Green T2: 136/183 (125 + 11 = 136)

- Red T1: 100/183 (91 + 9 = 100)

Table 4.12

T4 and T3 Presentation Evaluations (Part 1)

	T4 Yellow					T3 Blue				
	Y	P	N	O	Points	Y	P	N	O	Points
Q1	2	1	2	2	10	3	2	2		17
Q2	3	1	1	2	12	3	1	3		14
Q3	3	1	1	2	12	5	2			20
Q4	6	1			20	5	2			19
Q5	7				21	2	2	3		17
Q6	5			2	15	6	2			22
Q7	4		1	2	13	2	2	1	1	12
Q8	2			5	6	2	2	3		13
Score	109 /168 - 7 PO/FOs (CM/DD/JC/JL/DS/JM/SK)					134/168 - 7 PO/FOs (CM/DD/JL/JD/DH/DS/SK)				

Table 4.13

T2 and T1 Presentation Evaluations (Part 1)

	T2 Green						T1 Red				
	Y	P	N	O	Points		Y	P	N	O	Points
Q1	4		1	2	13		2		2	3	8
Q2	1	2	2	2	9		2	0	0	5	6
Q3	4	1	2		16		2	2	1	2	11
Q4	6	1			20		6			1	18
Q5	6	1			20		4	5		1	22
Q6	5		2		17		6			1	18
Q7	3	2	2		15		3		1	3	10
Q8	3	2	2		15		2		2	3	8
Score	125/168 - 6 PO/FOs and 1 CE - 7 (CM/DD/JD/DH/DS/SK/DB)						91/168 - 6 PO/FOs and 1 CE - 7 (CM/DD/JC/DH/DS/SK/DB)				

Part II: Meeting Objectives – did each team address and provided a conceptual plan for renovation of an existing building identified with 1) Efficiency (5 points), 2) Effectiveness (5 points, and 3) Expressions (5 points); based upon data collected during the field trip and pre-read/binder materials; maximum 15 points, Table 4.14.

Table 4.14

Team Presentation Evaluations (Part 2)

	Variable			Total Points (15)
Team ID	Efficiency	Effectiveness	Expression	
Yellow T4	5	4	4	13
Blue T3	5	4	3	12
Green T2	5	3	3	11
Red T1	4	3	2	9

Post-Charrette – PO/FO Observations and Assessments

This section addressed participants' experiences and activities defined by PO/FO observations/notes. It includes observations from FTF activities/notes of interactions among participants then reviewed and checked for accuracy after I watched the audio/video tapes.

PO/FOs Identifying Student Objectives and Measures

> Coming together is a beginning. Keeping together is progress. Working together is success. (Henry Ford (Goodreads.com), n.d.)

Measuring teamwork/performance is important to TDL and critical for realistic scenarios essential for this study. Concerned with how observations would be collected, and learning measured, I sought similar studies that implemented multiple data collection methods. I found teamwork research was plentiful and has evolved over the years to include both FTF and virtual teaming. Many studies focused on how teamwork can be measured (Anderson, 2017). I selected

a study by Anderson (2017) that included eight teams of three members each, selected from senior student volunteers (Naval Academy), with post-graduate students observing/participating as POs. Students did not have a history of working together and observers had extensive experience documenting and rating teamwork (p. 520). POs employed Likert type scales that identified as Strong, High, Moderate, Low, Weak, or None. Andersson et al. (2017) collected data from four sources (team member self-assessment, observers' ratings, communication recordings, and outcome-based task scores). The author shared:

> A proposed set of best practices for team performance measurements specifies that assessment methods should (1) be designed to focus on processes and outcomes, (2) meet a specific goal, and (3) be linked to the specific scenario or context. Additionally, measurements should focus on observable behaviors and capture multiple levels of performance, i.e., both team and individual performance. (p. 518)

The Anderson et al. (2017) study confirmed five categories of performance measurement methods identified in *Measuring team performance: A review of current methods and consideration of future needs* as discussed by Kendall & Salas, (2004), identified as:

1) event-based measurement (EBM),
2) automated performance monitoring (APM),
3) behaviorally anchored rating scales (BARS),
4) behavioral observation scales (BOS), and
5) self-assessment reports (SAR) (pp. 307-326)

In team performance assessment literature, performance was often seen as a function of one or more of the following:

1) individual processes,
2) individual outcomes,
3) team processes, and
4) team outcomes (Smith-Jentsch et al. 1998).

PO/FOs were instructed to monitor team performance (explained as a combination of teamwork and task-based outcomes) and to continuously take notes during the challenges

(Andersson et al., 2017). The authors stating, "A proposed set of best practices for team

performance measurements specifies that assessment methods should"

1) be designed to focus on processes and outcomes,
2) meet a specific goal, and
3) be linked to the specific scenario or context. (p. 520)

Additionally, measurements should focus on observable behaviors and capture multiple levels of

performance, (i.e., both team and individual performance) (Rosen et al., 2008). The authors

stated,

> The complexity of team performance makes meaningful measurement difficult. Team performance involves the dynamic interaction of multiple people, often with heterogeneous knowledge, skills, and attitudes. … The dynamic nature of teamwork means that teams change over time and a single snapshot of performance may not be representative of the team's actual performance. In addition, it is frequently impossible to remove observers or raters from the team performance measurement process and it is difficult to develop and maintain the reliability of observer ratings (*Approaches to team performance assessment: a comparison of self-assessment reports and behavioral observer scales,* para. 11).

Additional literature reviewed proved beneficial for this portion of this study as I focused

on processes and outcomes of TDL and TDM teaming, thus evaluations were deemed valid to

assess individual and team performances (Anderson et al., 2017). I further examined agreement

and consistency among PO/FOs assessments. I discovered similarities, differences, and

combined contributions generated from all data sources.

Somewhat unexpected I noted that POs/FOs neglected to complete all observations, nor

utilize all forms. Early on I discovered that following my proposed plan using measures to

identify learning outcomes might alter findings. I reached this conclusion as some PO/FOs did a

better job recording interactions than others. For example, if T4 POs responded to each question

on the observation form and T1 POs responded to half of the questions, unanswered questions

would have received zero points, falsely depicting lower overall scores per team. This process

could result in data loss. To capture competencies of team performance the proposed measures were revised. I decided to measure student quality using measurements identified by criteria and values of units (points). Observation forms focused on observable behaviors and/or responses from individuals and teams. POs identified the number of times participants exhibited an identified behavior. Each captured and described a number of constructs to inform research questions; identified as dichotomous (using two possible point values) and polytomous (using three or more possible point values) scoring.

I developed observation forms based on performance and/or responses to survey questions, field trip exercises and proposal presentations. Points were developed from the composite of sub scores using measures and criteria. This provided means that combined information from multiple smaller repeated measures, supporting the overall comprehensive measures. To gain a better understanding and to simplify shared findings I identified each data source and reviewed measures from multiple levels. For example, individuals and teams might have performed well on one specific criteria, and less on others. By identifying this drawback, I utilized multiple criterion observed during specific times/days. This allowed me to ascertain if the discrepancy was within the team or resulted based on the skill and knowledge levels of individual participants. Thus, findings were measured among multiple levels, as team performance is built on multiple iterations of individuals' performances.

Observation forms linked measures to events based on participant interactions to identify TDL during collaboration. This allowed POs to easily document interactions as to what was seen and/or heard based on the Four-Phase Model of Transdisciplinary Research (Hall et al., 2012). I implemented the same process as I watched audio/video tapes. When POs struggled or were

unable to agree on measures, we met reviewed, and finalized points. I utilized Rosen et al. (2008)

to establish methods implemented when exploring team performance, see Figure 4.33.

Table 2. Summary of Main Methods of Team Performance Measurement Used in SBT

Method	Description	Advantages	Disadvantages
Event-based measurement[56–58]	A general method that generates behavioral checklists that are linked to scenario events and KSAs being trained	Maintains explicit connections between measurement opportunities (ie, scenario events), acceptable behaviors, and KSAs being trained Focuses observers' attention on predefined events Reduces amount of judgment a rater has to make by focusing on observable behaviors	Development of measures can be time consuming relative to other approaches Measurement tools must be developed for each scenario
Behaviorally-anchored rating scales (BARS)[60,61]	Provides brief descriptions of behaviors as anchors associated with each particular rating	Amendable to modification Facilitates accurate ratings by providing concrete examples of behaviors	When behavioral anchors contain specific types of behavior, observers tend to focus on these isolated behaviors and miss
Behavioral observation scales (BOS)[62,63]	Generally uses a Likert type scale to rate the frequency of certain team processes	Avoids potential problems with BARS (rating exceptional or isolated performance) by focusing on typical performance	Requires raters to estimate frequencies and consequently ratings may be influenced by recency and primacy effects
Self-report measures[64–66]	Questionnaires administered to each team member individually	Well suited to capture affective factors that influence team performance (eg, collective efficacy, trust, collective orientation, psychological safety)	Does not capture dynamic performance, translating individual scores to team level scores can be problematic

Figure 4.33
Team Performance Measures
Note: From "Measuring team performance in simulation-based training: Adopting best practices for healthcare," by M. Rosen, E. Salas, K. Wilson, H., King, M. Salisbury, and J. Augenste, 2018. In D. Robinson, and D. Birnbach, *The Journal of the Society for Simulation in Healthcare, 3*(1), p. 38. (https://doi.org/10.1097/SIH.0b013e3181626276). Copyright by the authors. Under a Creative Commons License, Open access.

Contributions to TD Learning and Teaming

PO/FOs identified evidence as they listened and watched participant interactions among

individuals and team members; then collected data that reflected discipline and skill sets related

to TDL. This produced considerable details; consideration was given to how issues observed

related to the project objectives. POs observed participants identified for Individual

Contributions (C) to TDM teaming; each criterion had a measure of 5 points, per PO/FO; point

totals tallied at 70 points per day of observations (140 overall combined points from 2-PO/FO

over two days). I reviewed videos four times for each of seven contributions to avoid skewing

results; video reviews were completed a minimum of 7 days apart. Contributions identified as:

C1: Contributed to content (completed the pre-charrette read and think, pair, share activity)

C2: Well prepared for charrette, shared everyday skills and discipline knowledge, shared concepts from readings and reasoned critically

C3: Contributed to efficient group procedures (keeping on track, fulfilled tasks, shared skills and discipline knowledge as agreed)

C4: Communicated (listened, did not interrupt, respected other opinions, was group centered and open minded)

C5: Participated (participated in planning, was reliable and resourceful)

C6: Assisted others with technology, GIS, virtual meetings, research, drafting/drawing.

C7: Exceeded expectations, showed leadership and teamwork skills; shared skill sets and discipline knowledge willingly.

Data were reviewed for accuracy and project relevance consistent with stated parameters/requirements for proposal development; reexamined against field notes. Learning objectives were identified as contributions. Each observation form identified seven criteria of participant learning. Point values were assigned to participant interactions/actions as teams identified site information focused on proposed concepts and how each related to project objectives.

As shared earlier, PO/FOs were provided 8 observation forms; 5/8 POs completed all 8 forms and recorded observations per individuals/team. PO/FOs used identified learning outcomes and addressed composite team findings. As few POs sought assistance it became difficult, and at times impossible, to ascertain POs basis for scoring observations. Points were tallied among participants/teams, assigned to each observation. Participant scores were totaled/combined to obtain overall points.

Participants unable to attend the field trip received zero points, those who did attend received 5 points if they completed the think, pair, share with their team during the charrette. While one team part and parceled up work. Based upon accepted charrette practices points were not deducted for part and parcel as the team reconvened to share, discuss, and implement

blended ideas. No points were deducted when individuals left to work alone or consult other

teams. Further literature reviews acknowledged both examples as acceptable performance during

charrettes. Points were identified by Team ID, then contribution (C), by identified activity;

individual points were tallied for team scores, see Table 4.15.

Table 4.15

Team Contribution Scores

Contribution	PO/FO results by team				Researcher result by teams			
	T1	T2	T3	T4	T1	T2	T3	T4
C1 Content	8	6	8	10	12	11	8	5
C2 Preparation	14	12	16	20	16	16	12	16
C3 Procedures	20	18	18	20	20	16	20	18
C4 Communication	18	16	20	20	20	20	20	18
C5 Participation	18	18	19	20	18	18	20	15
C6 Technology	15	18	15	15	15	13	18	18
C7 Exceeded expectations	19	20	16	20	20	20	18	18
Total	112/140	100/140	112/140	130/140	124/140	119/140	115/140	108/140

Creditability, Validity, and Generalizability

Conducting a naturalistic, TD narrative study using observers, multiple instruments and

charrettes was not an easy task. For this study planning and implementation occurred

simultaneous. As research design emerged and changed. I had to complete preliminary processes

before the design was fully implemented. For example, I had to make initial contact with

Cherokee, gain access, and garner entry to multiple sites. I had to negotiate consent, build a

working relationship among university departments, create a MOU, and identify participants; all

while developing instruments and training procedures. As the process unfolded charrette design was put into place. I had little control over the inquiry at this point, so I had to remain flexible and open to change amidst continual reassessments over multiple reiterations of releases, observation forms, measures, and field trip materials. Data collection was carried out using multiple techniques. I had to safeguard on site activities conducted with participant safety in mind as I attended to the research process and applied set criteria to establish study reliability. I had to ensure PO/FOs had the necessary skills to discuss participant experiences required to address study areas. This studies creditability, validity and generalizability evolved depending on what the researcher and PO/FOs saw and heard, combined with their own experiences and notes.

Creditability

To address credibility, I explored the study from both process and project based perspectives. Observations were accurate and shared a well-founded depiction of participants lived experiences. This was achieved by prolonged engagement and documented observations among 8 PO, 2 NPOs, FOs and the researcher. To achieve this, I spent months triangulating and cross checking the data and interpretations within and across each category of participants' and team activities, interactions, and proposals. I reviewed and verified observations using audio/video recordings checking interpretations' from among collected data.

To identify and assess student learning, this study focused on how the TDL process contributed to and shaped the perception of relevance, credibility, and legitimacy of the results. Quality relevance were gauged through an analysis of the surveys, charrette participation, and project presentations. The study confirmed it was important to note that relevance, credibility, and legitimacy are closely connected in that these qualities share attention to how different types of knowledge and expertise are valued and used in a TD process.

I concluded one component of credibility was mutual respect and idea exchanges among participants. Each team approached and positioned knowledge sources in differing ways, yet each participant was open to change perspectives. Each made discipline and personal experiences' (knowledge) accessible and relevant to problem solving. These aspects were highly sought by individuals and teams and appeared to be valued in project development (Hansson & Polk, 2018).

Findings indicated this study contributed to the body of knowledge as it used multiple observation forms with differing point values that complemented other data collection methods. Going in I knew that using multiple forms while asking POs to be active participants might be overwhelming; this assumption was correct. I implemented this methodology as I believed it served multiple purposes and opportunities for data collection. Using multiple observation forms POs split observations among differing times and days. This allowed me to collect data that varied over times and days as participants rarely repeat a single action. It also allowed POs to observe the same tasks multiple times and to identify which actions were seen or those that did not occur. Lastly, this approach allowed POs to observe with fresh eyes and ears; while it provided me with multiple iterations that looked at differing interactions among participants. For example, I implemented activities that engaged students in the charrette process. At each stage of the study, participants used brainstorming, information gathering, role-playing, storytelling and/or hands on activities.

Validity

Using data triangulation and analysis I explored consistency when reviewing multiple sources to support conclusions of participant experiences. This study confirmed PO/FOs findings and/or interpretations were consistent with the evidence/experiences presented (Bowen, 2009). Using storytelling was valuable and appropriate to capture nuanced information on participants experiences and how those experiences effected change impacting TL (Leung, 2015). To avoid researcher bias I sought non-judgmental, neutrality, and balance to confirm patterns. I actively listened to participants', PO, NPOs and FOs to learn their stories, experiences, and meanings. Identified patterns created new levels of understanding of existing knowledge among participants. Coding of materials was completed in the order of delivery, this allowed me to reflect and manage findings as data developed. Data represented an appropriate source of measurement to address RQ's identified as:

- mixed methods to link participatory activities (document analysis, surveys, exercises) visual markers to provide context)
- immersive and interactive activities (number, types & sequence of events)
- visual markers supplied context, stimulated discussions, and supplied information
- charrette–participatory roles & adequate level of interaction, observations shared opinions & perspectives
- experiences were relevant, reflective, and negotiated; linked to usable products and transformative learning/change

The amount of data gathered sufficiently addressed RQ's, identified links between process and impact identified as:

- used problem-solving aimed to integrate different types of knowledge
- adequate and productive interactions contributed to new knowledge being applied and resulted in behavioral change
- experiences were relevant, reflective, and negotiated; linked to usable products and TL change
- showed importance of communication, translation, and mediation between   decision makers
- participatory co-production/ co-reflection processes supported social learning

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This study used concurrent validity as I compared data from newly constructed observation forms against templates (created by others) that correlated well and measured the similar construct. Inter-rater/observer reliability explored the degree to which each PO/FO provided consistent observations, tested, and evaluated over time. I used inter-rater reliability to check agreement among completed items on each instrument. This study used more than one person to conduct observations, each used observational protocols and scores based on criteria and measures. Multiple iterations of data review were conducted to ensure systematic comparisons were made and that observations linked to theory.

Generalizability

Generalizability was enhanced using storytelling and narrative, and through detailed information PO/FOs collected that shared accurate descriptions of participants' lived experiences. During analysis I made every attempt to document aspects of participant experiences. I categorized and ordered information that identified and followed TDL and TL; I returned to videos and PO notes to cross check findings. Every effort was made to coordinate data that supported findings. After data was categorized, transcribed, and reviewed against PO/FO notes and videos I concluded findings depicted the study in a true and accurate way. I minimized bias by establishing clear participant/participation guidelines and by implementing pre-designed observation forms. I used charrette audio/video recordings and field trip photographs to confirm participants' experiences. This prevented me from adding or excluding data from experiences. PO/FO notes and surveys helped me stay accountable to what emerged from the charrette and during the research process; addressed as dependability. To aid confirmability all documents, transcripts, and videos will be available for review for five years after this study ends. This study might be difficult to replicate across locations, groups, and

timelines, but observation forms and methods implemented can easily be transferred to other studies. I concluded that transferability might be limited as the Cherokee site was unique in nature.

CHAPTER V – DISCUSSION

> We are not students of some subject matter, but students of problems. And problems may cut across the borders of any subject matter or discipline. (Karl Popper, 1963)

This study was based on the understanding that TD improved charrette outcomes as participants collaborated to generate new knowledge. I used a TD model to support a charrette in a peer-to-peer learning process. This learning model supported different activities as teams established a common goal to solve a problem. In order for a TD model to work I believed two aspects needed to converge. First, communication among participants needed to be less complicated, as each discipline uses terms that can have different meanings dependent on disciplines. Second participants needed to be able to express ideas in a common context that required individuals to reveal themselves, egos, and silo tenets; all open to critique by others. If these aspects were not addressed, I believed communication among participant's would have created frustrations and doubts that derail cooperation, leading to participant shut down or drop out.

I judged individual knowledge would be formed by disciplinary specialization. My first challenge was to provide an environment that supported constructive communication while supporting a model that valued differences and balanced integration serving multiple disciplines. I chose a charrette as the tool/format to support TD and transformative learning. For example, as a design professional I am accustomed to tapping charrettes as a tool to address community based problems. I understood that each discipline contributed information that would be integrated into the final project proposal. The task was to develop teams to support contributions in an environment that incorporated discipline information in the form of hypothesis that would

be tested to address a problem. The challenge was to address differing ideas that lead to action as long as they were not driven by a single discipline's knowledge or individual.

Early (Day 1) integration and various roles of contributors was not clear from PO/FOs notes and observations. There was no way to identify how project participants contributed to TD teaming or if their contributions were valued by others. This aspect shifted later in the day as participants changed their focus from content to process, easily recognized as they completed "Everything on the Wall". Participants moved boundaries to knowledge production and investigation of external, internal, and social aspects of the problem. Instead of focusing on discipline knowledge participants expanded and investigated how each contribution might be integrated. Ideas led to a hierarchy of compromise as participant's explored validity of their own discipline and how educational specialization's influenced findings.

This process led participants beyond disciplines as they learned to approach problem solutions. TDL interventions combined with a team approach established a framework for problem resolution. By reflecting on individual input teams were provided a myriad of ways to approach the problem co-creating and brainstorming the 'in between' space of cross-disciplinary knowledge. Teams took the time to translate jargon into everyday language, so everyone understood discipline concepts. This occurred in a recursive manner until everyone on the team agreed. The charrette supported team members access to cross-disciplinary knowledge and opportunities that advanced new knowledge co-creation. Not required was that individuals completely understand the others discipline knowledge to support co-creation of ideas. Each team constructed traditional and TD discourse differently. For example in discipline interactions, participants had established a common language and individuals had created team identities. PO/FOs and content expert interactions supported team discussions that contributed to learning

while participants focused on discovery over disciplinary rigor. This supported my belief that communication was a critical component of project success. Participants advanced from individual preferences and beliefs as they engaged, integrated, and functioned in new roles. It took time and courage for individuals to find and share their voice. Team members did not hide behind disciplinary doors or retreat to what was known, rather I watched as individuals dropped counterproductive behaviors to accomplish effective communication. For example, T1 #16 lead the way to advance big picture thinking and challenged others to support/buy into a shared philosophy. She tackled and eliminated common battles of intellectual/discipline superiority. I watched as she took the high ground and proactively addressed self-absorbed egocentric behaviors of one PO. These behaviors were identified by other students who shared their belief this individual was self-absorbed, power hungry and unwilling to collaborate with other team members. Neither POs documented this behavior however I did glimpse this individual in a more purposeful acts of self-promotion. TDL fails when team members are not viewed as being on equal footings. These behaviors derailed early creativity and complex problem solving. This can set the project and team up for failure.

As the day progressed, I observed students and POs accept individual differences, encourage diversity and dissimilar thinking. Team leaders surfaced and each portrayed themselves as accepting and nonjudgmental. Team members appeared to relax as NPO/FOs moved among teams. I documented individuals were no longer aware or concerned with videotaping, or PO documenting interactions. Students expressed they were relaxed and no longer felt they were under surveillance. After lunch (Day 1) I watched participants' confidence develop and each owned their role in disputes. Participants were willing to address their ideas and supported them with discipline and skill-based knowledge. As this transpired teams were

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able to focus and redirect their efforts toward collaboration and project goals as a whole; TDL supported blended insights from among participants. Creative interventions evolved from cooperation.

As new participants joined teams (Day2) they quickly contributed critical discipline knowledge accepted by original team members. They shared information then hypothesized, tested, and integrated new knowledge into proposals. Participants did not appear to value their own contributions over those of their teammate's. TD learning liberated individuals and teams from internal hierarchy. This was essential for effective cooperation and ideation integration complementary to activities required to combine best ideas to problem solve.

This study supported my belief that TD should be introduced in parallel to disciplinary specialization. By doing so early in one's academic learning students can develop a sensitivity to limitations of their own knowledge and skills, while developing new ways to communicate affecting transformation. The goal was not to prove that charrettes support TD, rather they were viewed as a tool. Well planned charrettes support the intent and purposes of TD and transformative learning. Charrette models can advance activities and team planning to establish a mutual orientation and adaptive methods to address a common goal. These methods only work if all involved accept common learning over disciplinary rigor.

Additionally, not all charrettes are structured as TD rather developed and implemented to support team work versus the earlier mentioned part and parcel approach to problem solving. This was evidenced in the Auraria charette when the architectural firm approached the project believing their input was more valuable to solving the challenge. This was viewed by participants as the "we know what is best for you" approach. In this case, ignoring stakeholders' input, I believe the planned charrette methodology was not appropriate to achieve intended

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outcomes especially when organized and delivered by professionals paid to develop the project for monetary exchanges. I concluded that TD was rendered obsolete during this charrette as disciplinary conclusions were drawn rendering TD cycling ineffective. What became clear in this scenario was that it is critically important to define the type, purpose, and desired outcomes of a charrette. What is also clear was that charrettes play a significant role in overcoming challenges for projects requiring multiple disciplines to problem solve.

In summary, this study explored and described knowledge transfer across multiple domains and participants' ability to think critically as they shared discipline knowledge and communicated. There were 17 participants divided among 4 teams, comprised of 7 students and 8 POs; they were joined by 2 NPOs and 2 FOs. This study identified instructional learning as the acquisition of new skills and knowledge, such as mastering tasks and problem solving; identified by Blooms higher order thinking. In contrast TL is perspective transformation, a paradigm shift where participants examined prior interpretations and assumptions and formed new meaning, or in other words they answered the WHY of doing something. I used multi-modal communication to understand relationships; used two reflective and observational exercises and non-reflective dimensions of the TL process (doing by performing an activity, socializing, and interacting among individuals).

To reiterate this study's problem statement shared how using a TDM as the framework provided the scaffolding for ideas and conceptual models implemented to understand the problem when exploring TL among disciplines. Literature concentrated on TD, TDL, TDM and TL. The study focused on findings related to interactions among different participants/teams including direct (FTF interactions), and indirect (utilization of binder materials, GIS, and field exercises). The study confirmed measures and criteria identified useful guidelines and references for institutions, individual researchers, and private sector groups looking to advance and use TD.

Findings indicated that interactions contributed to co-creation (between two or more people) of new knowledge then was shared and applied to project development resulting in TL. Findings among participants showed they applied academic knowledge and shared experiences. The study demonstrated a correlation between charrette participation and how TDL interactions supported different activities as teams established common goals to problem solve. Findings built on evidence concluded that using TDM to explore relationships among components of a problem and examine the dynamics among cooperative teams lead to TDL that advanced problem solving.

Literature reviews and observations supported conclusions that data represented an appropriate source of measurement to address research questions. This study used ungraded activities to collect data on students learning. I applied Dewey's narrative concept of experience to support the use of narrative and thematic analysis. Framing changes addressed how data was collected, transcribed, and examined. This methodology was appropriate as it depicted lived participant experiences. Data collection included interaction, continuity, and situation as:

- physical setting(s)
- participants were actively involved in the inquiry as it unfolded
- collaboration with participants captured discipline knowledge and new data
- explored, identified, and addressed a community-based problem, and
- created a story about participants experiences that focused on knowledge transfer and TL

Data acquired from multiple sources provided a means to cross check PO observations for bias and/or telescoping. The rational for implementing a combination of observational methods and forms supported data set development that provided integration of results. Multiple observation forms supported findings as I explored and identified unexpected patterns among individuals and teams. Data collected over different days and times reduced emotional responses from POs.

This chapter addressed research questions, methodology, gaps in literature and study limitations. It includes observations, conclusions, and impressions. I described participants' experiences and included interpretations from PO observations. This chapter concludes with a cross-case review of XQ and Cherokee charrettes. I concluded TD team modelling reinforced productive interactions among students, stakeholders, PO/NPO and FOs; to understand and provide evidence supporting the effectiveness of the study. I confirmed findings showed TDL improved charrette outcomes as participants collaborated then generated new knowledge. PO/FOs used multiple instruments for data collection as they documented written, spoken, and visual representations of individual and team interactions. Interactive participant experiences were examined and reviewed as data generated was flowing and analysis was interpretative. Findings addressed research questions; shared in narrative.

Methodology

As with TD research this study changed direction numerous times. Before I reviewed videos, I developed an observation matrix. I based the matrix on social and cultural evidence that aided project discussion. While exploring research concepts literature showed benefits to implementing multiple instruments, especially when engaged and collaborating with POs recognized by the National Science Foundation (NSF) (2016) as instrument provided:

- direct information about behaviors of individuals and groups while working in and across teams or one-on-one, researchers, facilitators, speakers, and participant observers to enter and understand the situation and context of the activities while participating in a natural, unstructured, and flexible setting, and,
- experiences and perceptions from the participants perspective, the largest data collection for utilization by charrette participants, and, post charrette outcomes, report information/findings, and during program development when implementing teaching with historic properties (TwHP) curricula.

Pre-charrette two professors reviewed observation forms. My reasons for combining data from different sources were to produce more robust and compelling findings than what I believed

I would get from a single method. Findings indicated that using multiple sources of evidence increased creditability and validity as data collection based on different sources provided corroborating information. Observation forms were designed to address more than one research question to improve observed experiences, depicted in Table 5.1.

Participant activity data were collected and identified team-based performance across categories with multiple measures. Learning objectives were identified in observation forms, each form identified 7 criteria for team contributions. Point values were assigned to interactions/actions that focused on proposal development and project goals. Interactions were based on different criterion supported by observational cues provided POs during training. POs received 8 ½" x 11" sheets with blank tables. They watched and listened to participants placed a check mark in the box; each box contained multiple check marks, according to have many times the attribute was observed. Time required to complete observations among multiple forms was calculated at 4 hours each day.

Post charrette I transferred findings to a frequency table then tallied points first by PO then by team. Composite scores were placed on spreadsheets. I averaged points to obtain composite scores shared in findings. I sourced PO observations and notes to assist me post-charrette. I confirmed data reviewed was accurate and project relevance was consistent with stated parameters and requirements from proposal development; enhanced and reviewed against field notes and audio/video tapes.

Table 5.1

Data Collection Observation Form Overview

Source & RQ	Identifier	Categories	Measure	Use

#1/RQ1	Descriptors	6	0-5 points	Identify & rank interactions
#2/RQ 2	Team discussion	7	G-Good NI-Need improvement	Communication by actions
#3/RQ All	Characteristics 6 sub sections *	4	0-5 points	Discipline, character, life skills, teamwork,
#4/RQ 2, 3 & 4	Field trip observations	4	0, 3, 5 points	Sensory exercise (see, hear, smell, touch)
#5/RQ 4	Communication	8	1-5 points	Intra/Inter individual & team discussions (Exchanges & iterations' i.e., 1x1, 1 x1-2 teams, PO x 1 etc.)
#6/ RQ All	Listening Skills	5	G-Good NI-Need improvement	Interactions by attributes/dimensions
#7/ RQ 1	Team performance	3	1-5 points	Team roles & peer interactions
#8/ RQ 3 & 4	Team knowledge	2-part A & B	1-5 points	Interactions, measures & scores
Criteria cues	Observations: students will be able to	8	Yes/No/Partial	Identifying student objectives & measures

Research Questions and Discussion

Learning objectives were identified in observation forms with each criterion designed to measure participant learning. I utilized participant interactions and actions to identify shared team data focused on solving the problem and how each proposal addressed project objectives. Five out of eight POs completed observations and used all forms. Post charrette spreadsheet

findings were used to identify responses and addressed research questions. Data were identified in TDL phases using Hall's Four Phases of Transdisciplinary as 1) Development, 2) Conceptual, 3) Implementation and 3) Translation Data. Video recordings were reviewed multiple times using the same method and observation forms. No changes or adjustments were made to findings by the researcher or PO/FOs.

Findings established the charrette was a safe place for relationship building and discipline knowledge sharing. Analysis confirmed participants lacked pre-read information, coupled by a perceived lack of an expanded discipline cohort. Expected, this aspect was often discussed among participants who believed additional disciplines would have enhanced project development. The ability to stop, rewind, and repeat viewing areas of recordings made documenting participants' experiences easier. This action revealed additional observations POs missed.

Overarching Question

How did charrette participation reveal transdisciplinary learning (TDL) within (TDM) teams?

Findings indicated that participant comments were credible as team members felt free to express their ideas and points of view. Data suggested TDL required ongoing adaptation and recursive actions as both were essential for participants to adapt and deal with unexpected situations and findings. PO/FOs notes showed when a specific discipline was missing TDM teams struggled developing innovative ideas. Findings and interpretations indicated that TDL within TDM teams supported the co-creation of new knowledge production. The analysis used measures and criteria based on team interactions, identified as:

- peer interaction
- positive communication

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- inquiry & multiple paths
- authentic approach and tasks, and
- TD thinking.

POs documented and described how participants used multiple activities to develop, conceptualize, implement & translate findings to problem solving. Teams approached problem framing as an ongoing process, in a recursive manner. They developed questions to resolve identified project problems, shared discipline knowledge, experience, and life skills.

Post-charrette Day 1 POs noted activities began slowly as participants lacked a predefined project scope or check list. Findings showed this irritated and frustrated some participants. FOs moved among teams to help kickstart ideation, and T1, T2 & T3 utilized posters (FO/2) to communicate, identify, and build new knowledge. Findings showed participants shared personal views that built up to patterns and generalizations culled from discipline knowledge combined with findings from field trip activities. Participants expressed ideas and shared personal experiences in differing ways. Many drew pictures, others made lists. Teams worked with POs as content experts; T3 experienced disagreements as1 PO attempted to exert power over the others.

Findings indicated participants shared knowledge and moved from discipline preferences engaged in discussions as they developed new perspectives; none retreated to what was known and most dropped counterproductive behaviors identified as being uncooperative. Findings demonstrated how TDL advanced TL. For example, T4 students spent additional time coaching POs on using Galaxy/GIS programs. T1 #16 rose as the conflict manger among students; she supported positive atmosphere and continually redirected unproductive comments reframed as what could be learned attending the charrette. She related challenges to private sector experiences and identified educational benefits of charrette participation. This supported and

advanced participants sharing common core knowledge and experiences. Individual experiences rarely followed a strict TDL order as many processes occurred simultaneously, while others facilitated communication and translation across cultural, disciplinary, institutional and the private sector.

Post-charrette findings revealed Kolb's experiential learning model and Hall's 4 phases of TD research as collaboration between students and stakeholders resulted in new knowledge being applied to problem solving. Individual and team interactions showed participation in higher order thinking as identified by Bloom. Participants anticipated questions against relevant information; weighed evidence to support and synthesize information. Teams evaluated possible outcomes among proposed ideas. Each took responsibility for personal learning.

Findings supported existing evidence that charrette attendance placed participants in a collaborative environment supported by Dewey's experience and narrative inquiry methodology. Identified as interactions fostered confidence in students' ability to ascertain problems. This advanced trust building and eliminated one's fear of being wrong. Interactions with individuals and teams showed that participants communicated discipline knowledge, life skills, and personal management. Reflections revealed TDL as participants shared discipline and life skills depicted by actions and behaviors taken to reach goals; portrayed as reading, writing, listening, and questioning. Team ideation advanced the creation of a TDL framework to address the problem. POs noted participants were seen searching for and heard evaluating/negotiating information, then refining and sharing it among their team. This displayed critical thinking and problem solving by making connections. Collaboration revealed engagement that advanced ideas and decision making.

To establish consistency and attributes of team interaction(s), positive communication, TDL and TDM inquiry, I utilized an assessment rubric that Herro et al. (2017) "developed for researchers and educators to use to when assessing collaboration" (p. 7). I developed observation forms based on a template created by Herro et al. and implemented this to address differing criteria and measures and to isolate/identify team interactions, shared in Table 5.2. PO/FO data followed and supported observations of TDL. PO/FOs utilized a 5-point scale, teams that received 3 points or above for each criterion were perceived as having successfully revealed TDL.

Evidence identified and supported substantial agreement on all criteria with differences on one classified as innovation. POs identified and measured innovative ideas as 3 (points) among teams and disciplines (authentic approach and tasks) without supporting notes. FOs interpreted this criteria/measure differently as both scored the attribute as zero. FO notes concluded innovative and/or new ideas outside of what would have been learned from mainstream sustainability were absent.

General impressions from video and FTF interaction reviews showed participants omitted innovative ideas in presentations. Video review and interactions showed participants brainstormed and proposed innovative ideas, but most were overridden by POs. Joining teams at differing periods I concluded participants lacked sufficient information or adequate time to fully develop connections and incorporate all ideas discussed during the charrette.

Table 5.2

Overall Charrette Performance by Criteria and Measures Identified by Team Interactions

Criteria	T1	T2	T3	T4
Measure: Peer Interaction				
Monitors tasks/project with team	4	5	4	4
Negotiates roles within group	4	4	4	4
Divided tasks working individually to toward project development/completion	5	5	5	0[a]
Did not divide tasks worked jointly toward project development/ completion	5	5	5	3
Articulated for understanding regarding process and/or content	5	4	3	5
Provided individual/team feedback, asked for assistance and/or redirection	5	3	4	5
Measure Positive Communication				
Respected others' ideas, participated and offered ideas/input	5	5	5	5
Used socially appropriate language and behavior/avoided discipline jargon	4	4	4	4
Listened, took turns speaking and was open to other ideas	5	4	4	4
Measure: Inquiry Rich/Multiple paths				
Developed and asked appropriate questions to relevant knowledge	3	3	3	4
Verified information and sources to support inquiry (binder, maps, internet, PO/FOs)	3	5	5	5

Measure: Authentic Approach and Tasks

Shares connections to relevant knowledge; discipline and skills knowledge	3	4	4	5
Negotiates methods or materials relevant to address/solve the problem	3	4	4	5
Utilized tools collaboratively to approach tasks	4	5	3	4
Developed new and innovative ways to address education and site management/addressed CR& CF mission	3	3	3	3

Measure: Thinking

Discusses approaching task, activity, or problem using multiple disciplines	3	3	3	3
Co-creates processes/products by incorporating multiple disciplines and players, Stakeholders (PO/FOS)	4	4	4	4
Sought research including communicating with experts	5	3	3	5
Totals (Possible overall 90 points) Culminative Scores	69	73	70	72

a. Participant's part and parceled all work, Day 1, a process outside of TD methodology so the researcher deducted points for this aspect. T1, T2, and T3 worked as a team both days so each received 5 points with T4 receiving 0.

Note. Criteria is from "Co-Measure: Developing an assessment for student collaboration in STEAM activities," by D. Herro, C. Quigley, J. Andrews, and G. Delacruz, 2017, *International Journal of STEM Education,4*(26), p. 7. (https://doi.org/10.1186/s40594-017-0094-z).

Research Question #1: Collaboration and Team Building

How did collaboration lead to participants problem framing and team building?

Early collaboration was identified by Hall et al. (2012) as the "Development" phase.

During this phase, participants collaborated and advanced an environment of psychological

safety. They generated a shared mission forming an emerging TDM team. Findings confirmed

participants communicated discipline knowledge using lay language to facilitate team ideation and collaboration. This displayed as participants shared stories, personal histories, and established skill sets. They communicated discipline knowledge necessary for ideation, integration, and problem solving. The study demonstrated a correlation between participants storytelling and how they shared prior experiences combined with imagery, notes and diagrams identified post-field trip.

By communicating new perspectives and observations participants stimulated collaboration and ideation; this continued throughout the charrette in recursive processes as participants shared observable and specific ideas/information. For example, all teams utilized existing structures to identify and develop new building models (prototypes) developing diagrams to communicate individual and team visions. This process advanced team interactions while verbally and visually sharing ideas so others could see what they proposed.

Observations showed teams incorporated and connected discipline knowledge and life skills by crossing subject boundaries to develop joint concepts. Findings indicated participants collaborated intra/inter team to identify discipline perspectives relevant to problem framing. PO/FOs shared personal/professional knowledge and skill sets to advance problem framing as expertise among PO/FOs often lacked consideration, identified during team discussions. Participants accepted and adopted information as PO/FOs generated shared team goals when problem framing; collaboration supported project development, created educational opportunities, and advanced critical awareness.

Findings showed participants displayed positive interactions (making eye contact, provided encouragement, and listened to each other). They asked questions, repeated what they heard, and validated feelings, indicators of positive team building and communication. Teams

established clear goals and objectives that each understood; members presented fully committed to project goals. Individuals contributed their fair share of the work and created open communication leading to collaborative learning, all important to team building.

Findings concluded participants learned, shared, and communicated subject specific knowledge and skill sets; supported by communication results. TDL problem framing and team building required participants to share knowledge, information, and life skills through active listening. Direct observations showed that communication was central to team cooperation, shared discipline knowledge and during critical reflection. Participants revealed cross disciplinary knowledge acquisition and effectively worked with POs.

Communication played a critical role in this study; it was the process through which knowledge, experience, and viewpoint sharing occurred to address the problem. Bagol et al. (2016) supported findings noted as:

> Communication knowledge sharing and synthesis between stakeholders from diverse backgrounds and a range of experiences, perspectives, agendas, and knowledge is a challenge. To address this situation, communication is conceived as a dialog and a participatory process bringing together all stakeholders. This process results in unanticipated and unexpected results that require a high degree of flexibility and adaptability from team members. (p. 4)

The study confirmed a TDM team and participatory approach have inherent advantages in addressing some of the challenges and opportunities of working with complex systems (Bagol et al., (2016). Communication in this context was deemed successful, viewed as participants accomplished the following as:

- peer-to-peer teaching facilitated knowledge acquisition and transfer
- developed sense of place that created shared meanings without losing community values and identify of co-partners
- built a framework for collective knowledge creation and sharing
- leveraged different viewpoints and perspectives to create a consistent whole
- actively participated and engaged in ideation and implementation of the project
- accommodated a multifaceted approach

- identified stakeholder relationships and influence on project
- identified and measured different methodologies and perspectives
- were open to feedback and,
- empowered to make change

Findings showed that communication skills benefited problem framing and team building as participants openly discussed options/ideas increased understanding of the other persons' view. Identified as not necessarily agreeing with each other rather supporting ideas. T4 was identified by participants from T1, T2 and T3 as the "IT" team; documented as participants were leaving (Day 2). #18 shared with JD and DM (T4) what participants told her saying, "I wish I was on your team, #22 is amazing, she knew everything we needed for our proposal." I concluded T4 readily accepted other's communication and learning styles. Participants communicated T4 individual/team ability to work in and around discipline silos over two-days was exceptional and came from extensive, post academic volunteer history.

I observed each team, then followed interactions and communication on video tapes. Observations differed from POs as I watched and listened to each team and noticed participants frequently moved to subgroups. Some left the team all together for short periods, later regrouping. I observed positive collaboration as participants, readily accepted newly acquired knowledge, rapidly and seamlessly implemented proposed and agreed upon changes to project development and proposals. T1's solo participant actively worked with and among all teams. I observed T2/T3 most often working inter-team.

PO/FO findings identified three stages of listening as: receiving, processing, and responding (verbal/non-verbal). This was shown by repeating, paraphrasing, and reflecting on what was said, others nodded. Findings noted that participants displayed above average, active listening skills identified as informal, critical, appreciative, and empathetic shared as:

- informal: listened to learn, primary to the listeners understanding the message, included academic listening (lectures, instructions)

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- critical: based on the evaluation, analysis and understanding of what is being said by the presenter evaluating their message
- appreciative: listened to obtain certain information that was accepted and valued
- empathetic: understood other's feelings and emotions connected the listener to the presenter.

Data were collected by PO/FOs while they watched and listened to team interactions. Eight PO/FOs consistently completed observations; two were either absent the second day or failed to observe/document individual communication. PO scores were totaled per individual, then combined to create team scores; identified under comments when POs documented differences. Findings categorized seven "actions" that identified communication/ listening skills as good (G) or needs improvement (NI); with separate comment columns, see Table 5.3.

When POs saw or heard an action occurring a minimum of 5 times per day, they documented the action as G. When observed 4 or less times they received NI. When POs missed documenting or identifying action no points were assigned. For example, tallied check marks from one PO showed as 7, 7, 6, 5, 6, 7, 7 with zero NI marks, so I placed an X in the G column. If one PO identified 6 actions tallied as 5, 7, 9, 6, 7, 7 and one action with 4 check marks in NI, the NI column received a 1/4 notation to identify one of 4 PO/FOs making observations noted this action needed improvement. This process continued until all findings were calculated per team. For example, T1 #16 received G 4/8 times per day or 8/16 for two days by one PO.

Table 5.3

Team Findings Communication Skills by Actions

Actions	Red T1 #16		Green T2 #10/#45		Blue T3 #89/#91		Yellow T4 #22/#18	
	G	NI	G	NI	G	NI	G	NI
Makes eye contact; is engaged	X		X		X		X	

Provides encouragement	X		X		X		X	
Clarifies for understanding	X		X		X	2/4	X	2/4
Asks relevant questions	X	1/4	X		X		X	
Reflects back what they heard/said	X		X		X	2/4	X	
Does not interrupt	X		X		X		X	
Validates other feelings	X		X		X	2/4	X	2/4
Notes	1/4 POs noted T1 required improvement when asking relevant questions		Day 2 1 PO failed to collect any observations except does not interrupt (equated to G)		2 POs noted 2 - students required improvement in 3 actions resulting in a disagreement as to actions		2 POs noted #18 needed improvement in 2 actions, resulting in a disagreement among POs as to actions	

Note. G represents Good while NI represents Needs Improvement

Active listening was noted as participants became deeply involved with what was being said. Each shared discipline knowledge asked relevant questions and validated other's feelings. When two scores were disputed among team POs I attributed this to personal disagreements and/or differing communication styles among participants and POs. Active listening enhanced participants ability to absorb and share information during project development. Participants ability to cross disciplinary boundaries while effectively working intra/inter team helped develop open collaboration, motivated interest, and enthusiasm for the project. PO/FOs noted reflective communication skills were exhibited as participants questioned each other clarifying images, drawings, and when summarizing concepts. PO/FOs documented, watched, and listened to each team exhibiting active listening (facing the speaker, asking questions, not interrupting) or when responding using yes, no, or nodding.

Calculations proved time consuming and difficult as one PO missed documenting observations on Day 2. Missing data impacted team communication performance scores; I took this into consideration as I reviewed results, as other team POs/FOs completed and well documented what they saw and/or heard. Differing scores were expected as observations were collected at different times of day by POs; the goal was to assess overall communication. Findings supported teams effectively communicated intra/inter teams.

Findings confirmed collaboration was the impetus for TDL. Conclusions indicated each brought varied life experiences, and discipline knowledge to their teams, each team approached project development differently. PO/FOs findings concluded reflective communication skills were exhibited as participants shared images, drawings and when summarizing concepts.

Research Question #2: Critical Reflection and Knowledge Sharing

How did participants demonstrate critical reflection and knowledge sharing?

Post-charrette findings revealed participants began collaboration around team identification. Teams developed research questions relational to what each believed was required to solve the problem. Findings indicated research approach and questions were formulated by individual teams and not the researcher. Individuals moved across Hall's conceptualization phase and established the following as they:

- began early collaboration and developed a shared language for communication
- shared mental models to initiate team development
- learned of each team members expertise including discipline knowledge, life skills and experiences
- culled ideas to develop a shared view, and
- collaborated to integrate a cross disciplinary approach

When POs noted a team needed improvement, they added supporting notes. For example, one comment stated "participant # 21 rarely reflected what was being discussed during ideation, while ignoring other feelings. This action required extra time to reposition ideas for the project

disrupting team ideation". Field trip participants collected site notes and documented observations, data were combined with walking tour visualizations that enhanced ideation and collaboration. The study confirmed participants utilized this experience to critically reflect on how differing experiences and documented observations (when combined) aided teams with problem solving. Intra-team participant discussions utilized data extensively.

I concluded that completed field exercises advanced storytelling among participants. This action supported the development of a shared language and TDL orientation that advanced problem framing. Collaboration led to problem identification implemented to frame proposals as teams utilized complementary skill sets. Communication resulted in completed proposals that accessed collective knowledge made from informed decisions. Findings built upon and were supported by Yoon and Rolland (2012) who defined knowledge sharing as "the process of mutually exchanging knowledge and jointly creating new knowledge" (p. 1143).

The study confirmed critical reflection empowered teams as they developed and shared an understanding of experienced relationships. Teams discussed findings then developed a framework to solve targeted problems; participants shared field trip findings with non-field trip participants. Individuals reflected on prior experiences, used life skills and academic knowledge then translated findings, established interconnections among structures, and different sites. Participants implemented new technology to support ideation observed as teams implemented Galaxy maps, created field logs, drawings, and notes. I concluded TDL circled around shared data that identified multi-site relationships. These actions enhanced personal experiences and reinforced inclusion among homesteads at Cherokee.

PO/FOs findings showed participants moved through Mezirow's (2000) transformation process as they engaged in critical reflection, questioned their assumptions and beliefs that led to TDL. Participant interactions displayed Halls critical reflection phase as they:

- collaborated and focused on individual problems, as they identified challenges
- debated evidence then implemented reflective questioning that supported individual perspectives
- shared concrete examples from disciple knowledge, personal experiences and life skills
- reflected on ill-defined problems then built awareness by observing other participants building alternative perspectives and methods for solving the problem
- listened to others and considered different approaches to problem solving
- worked together outside disciplines to ascertain specific knowledge gaps in the problem, and
- applied higher order thinking and reflection to finalize problem approaches

The study confirmed that individuals adapted to and dealt with new settings, changing circumstances, and knowledge sharing; participants communicated and compared prior experiences. POs shared personal reflections and assumptions about the site with participants, these connections provided participants a platform for TDL/TL. Findings built upon PO observations supported critical reflection identified and supported by Dewey's (1933) five phases of thinking as:

1) suggestions and curiosity in which the mind leaps forward to a possible solution (p. 189).

2) intellectualization of the difficulty or perplexity that has been felt (directly experienced) into a problem to be solved (p. 194).

3) communication of information- utilization of one suggestion after another as a leading idea, or hypothesis to initiate and guide observation and other operations in collection of factual material. (p. 197).

4) the mental elaboration of the idea, or supposition as an idea or supposition (reasoning, in the sense in which reasoning is a part, not the whole, of inference) (p. 209).

5) formulating meaning/testing the hypothesis by overt, or imaginative action. (p. 212).

Critical reflection assisted participants as they identified, from personal experiences, a basis for improving and/or changing a situation. This increased participants capacity for knowledge-building. Participants appeared motivated to find different ways of working among disciplines while POs moved from periodic oppositional ways of working to a cooperative working environment. Participants moved from learners to teachers, removed formal hierarchical roles based upon perceived knowledge and at times age and/or status. Interpretation from charrette activities revealed participants demonstrated critical reflection and knowledge sharing as they applied new knowledge gained through shared experiences. Findings identified Kolb's experiential learning cycle and Hall's conceptualization phase as participants began early collaboration and developed a shared language to communicate project goals. Individuals learned each other's expertise including discipline knowledge, life skills and experiences. They analyzed and discussed experiences, examined, and discussed approaches to problem solving using this knowledge.

The study confirmed critical reflection was demonstrated as participants collaborated and focused on problems that identified challenges, they debated then implemented reflective questioning and supported individual perspectives. They listened to each other, shared, and debated concrete examples supported by discipline knowledge, experiences, and skills. This allowed teams to build alternative perspectives and methods for problem solving. Individuals worked inter team to discuss the property and developed a framework to problem solve. Teams shared project information, skill sets, and expertise communicated among participants that generated new ideas, utilized resources and member abilities.

As teams applied new knowledge, they reflected on prior knowledge, then analyzed new knowledge, followed by reflecting on the problem. Participants integrated different elements to

create a new whole; this advanced their ability to infer and finalize possible solutions. Findings

built upon Dewey's five phases of thinking supported critical reflection as participants identified

a basis for improving and/or changing a situation from their own experiences. Critical reflection

confirmed participants capacity for knowledge building and sharing. Post-charrette I concluded

participant and PO/FO communications formed and linked data rather than simply sharing

information. This study confirmed findings supported Fook (2015) shared as:

> As an overall approach, critical reflection emphasizes the idea that we are all both teachers and learners, even though our formal roles or statuses might be more differentiated. This is an important point – effective critical reflection can only take place in a climate that is egalitarian and participatory. Knowledge creation, through ongoing reflection on experience, is something that never stops in a committed practicing professional at any level. Furthermore, the critical reflective attitude is about always being prepared to question (and change) deep-seated assumptions and practices. In terms of practice teaching and learning, this places the onus on all players to be aware of, and take responsibility for, the learning environment that is created. This means we all need to ask ourselves, as students, managers, university academics, supervisors, senior practitioners, colleagues, or new workers, how we can best create a climate for critical reflection, in the various settings in which we work. (p. 451)

I based observations of Sonnenwald (2006) shared as,

> In general, information sharing can be understood as 'a set of activities by which information is provided to others, either proactively or upon request, such that the information has an impact on another person's (or persons') image of the world … and creates a shared, or mutually compatible working, understanding of the world. (p. 270)

Research Question #3: TDL and TDM Interactions

How did participants integrate and apply new knowledge to their final action plan revealing

TDL and TDM interaction and knowledge sharing?

Findings confirmed participants' synthesized information from different experiences into

a comprehensive set of proposals. They collaborated and comprehended how interrelated ideas

worked together in a given setting, and how those connections advanced project goals. Using

peer feedback participants cooperated to frame, develop, and create presentations that addressed

project questions based on personal experiences and academic/life skills knowledge. Proposals were developed as participants reflected on experiences. POs/FOs identified team discussions informed participants the how and why of making links between relevant and irrelevant ideas while discussing renovations, educational plans, and site management. Participants utilized and sourced new knowledge to propose fresh ideas as they developed plans and moved into the proposal process.

Findings indicated students participated, shared life and field trip experiences then joined resources with binder data. They connected shared information with PO/FO input to develop plans. This process supported participants as they reevaluated, integrated, and learned using a critical lens. They discussed findings in recursive feedback loops until the team identified improvements and/or changes to proposals. These actions resulted in a final plan depicted in Figure 5.1.

Findings showed participants utilized direct experiences and reflected on those experiences. POs documented participants were seen and heard articulating comprehension as they moved from one context to another. Participants created, shared, and applied discipline knowledge through social interactions. They identified what information and skill sets were required to develop and meet project goals, while identifying what information was missing or required to advance proposal development. Participants shared and received information (knowledge sharing) exhibited by collected, organized, and distributed information in written documents, drawings, maps, or shared as ideation. Findings indicated these actions supported knowledge acquisition to structure new ideas. Activities supported new knowledge creation; critical steps to achieving TDL.
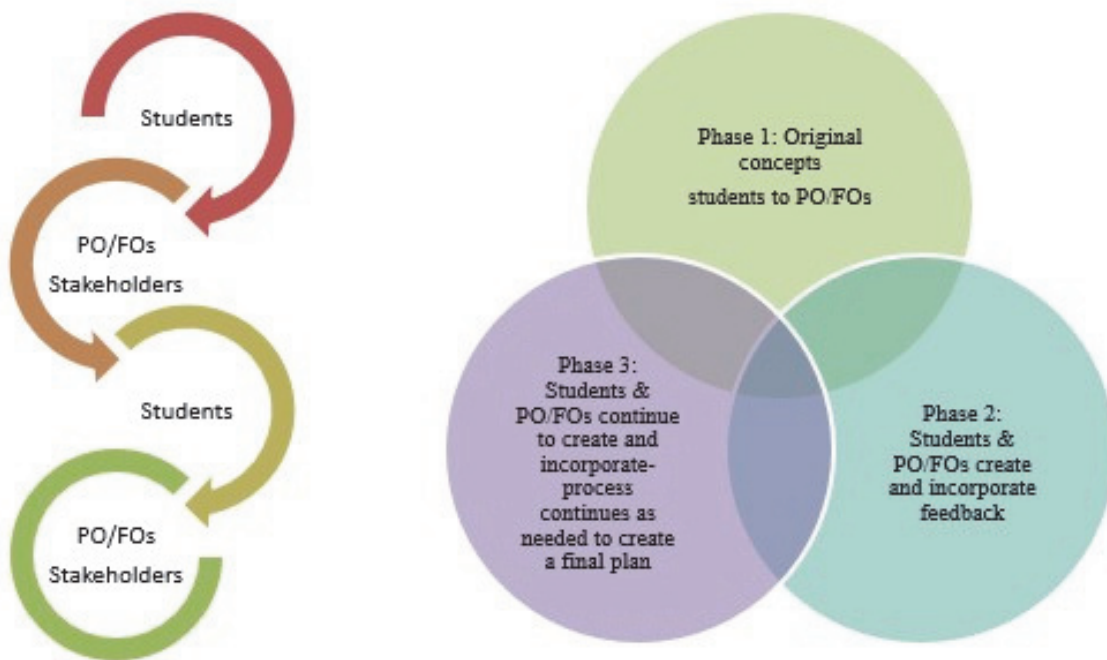
Figure 5.1
TDL Charrette Feedback Model

Charrette attendance presented participants concrete involvement using observations to reflect on differing experiences and perspectives. They formed abstract concepts and generalizations utilized to assess new situations. I concluded from charrette activities that participants articulated facts observed in relationship to their experiences; this demonstrated comprehension. For example, sensory and mapping results were shared with participants unable to attend the field trip. Participants articulated findings and shared observations using notes and observation forms then moved to Liquid Galaxy to identify artifacts at the site. Findings built on Blooms active experimentation phase, as actions identified participants ability to synthesize and transfer knowledge among teams.

I concluded team performance identified interactions by dimensions and attributes, based on 5-point scales. For example, one attribute identified as negotiates roles with group. To support

findings POs watched and listened to teams then identified if or how individuals divided tasks and worked independently toward project development. On the dimension that identified positive communication all teams scored 5's (exemplary).

Research Question #4: Hybrid Learning

How did hybrid learning enhance interactions, communication, and knowledge sharing among participants?

This studies hybrid learning environment verified, supported, and assessed participants TDL and TL. Team problem-solving included varied types of knowledge and life experiences identified as reflective, relevant, and negotiated. To connect hybrid learning PO/FOs identified participant's use among data sources to categorize and identify available materials/resources in two phases. For example, aspects of learning were completed using digitally enhanced activities, project research, materials from the pre-read and Galaxy Maps. Participants accessed the internet to conduct research during the charrette, working independently on team projects. They received assistance when difficulties emerged from IT/FOs. Findings were documented by type of materials required/used. I verified PO collected data using video review; data were transferred to spreadsheet's identified by categories, use, then participant application.

Findings indicated charrette participation and field trip exercises addressed hybrid learning that supported TDM teaming. Participants utilized printed materials, electronic sources, photographs, personal notes, maps, and drawings combined with storytelling. These tools were required to develop hybrid learning experiences, and each played a critical role in TDL. I determined that persons who attended the field trip utilized memory, imagination and lived experiences to share a detailed picture of the site among team members. These individuals were better able to speak to site objectives as they collaborated, problem framed and shared similar

experiences during problem identification. Findings indicated images (pictures, maps, drawings) played a critical role in conversations when combined with printed (electronic and binder) materials and oral histories shared by POs (storytelling). This study confirmed participants used these tools; advanced narrative inquiry forming team identity shared across historic lifespans of the site. To support these results, I collected data then sourced photo-based observation methods (Steps 3 through 5), identified in Figure 5.2.

Photo Based Observation Method

Step 1: Skipped (bias)

Step 3: Classification – I created the matrix (10 categories) before charrette & watching videos)

Step 2: Collection - I completed four rounds per team, followed by another four rounds reviewing post charrette presentations. This process proved daunting and involved approximately 6.5 months' time, logged as 960 hours.

Step 4: Deduction – Observer as participant

Step 5: Final round of observations were completed 10 months post-charrette implemented to verify initial observations were precise; no revisions were made to earlier observations

PBO Method has a 5-step research process.

1 Prediction 2 Collection 3 Classification 4 Deduction 5 Verification

Observer as Participant

The observer as participant stance enables the researcher to participate in the group activities as desired, yet the main role of the researcher in this stance is to collect data, and the group being studied is aware of the researcher's observation activities.

Observer - not a member of the group, participates to conduct observations & generate more complex understanding of activities.

MERRIAM (1998) points out that, while the researcher may have access to many different people in this situation from whom he/she may obtain information, the group members control the level of information given.

ADLER and ADLER (1994, p.380) note, this "peripheral membership role" enables the researcher to "observe and interact closely enough with members to establish an insider's identity without participating in those activities constituting the core of group membership."

Source: Participant Observation as a Data Collection Method (May, 2005)

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Figure 5.2
Photo Based Observation Methods
Note. From "Genres of photographs used in visual narrative inquiry," by H. Bach, 2007, In D. J. Clandinin (Ed.). *The Sage encyclopedia of qualitative research methods,* p. 294. Sage. (https://doi.org/10.4135/9781452226552). Copyright by the Author. Under a Creative Commons License, Open Access.

PO observations and interactions confirmed participants gathered data then shared observations as they discussed the property and project framing. Connections experienced on site aided participants orientation, way finding, and structured possibilities. Findings indicated using Galaxy maps with field logs and drawings created a hybrid learning environment that further

enhanced the charrette experience. Activities allowed participants to grasp concepts of inclusion among the features within the property as they discussed future development and educational utilization. Images combined with written and verbal texts provided support and understanding of relationships in a collaborative TDL process that advanced knowledge sharing.

Charrette participation built trust and rapport as visual and verbal sharing first created then shaped what was told. The meaning behind the images provided a way to reevaluate, negotiate, and transition to project development. Using a hybrid learning environment allowed participants to make connections among observations, experiences, and opinions. Using a TDL environment supported relationship generation among participants and the site as they constructed new knowledge. By exploring sense of place participants shared what was important to them; each differed and communicated from a personal reality often unavailable when in a more traditional setting. The hybrid learning environment produced interactions in a collective narrative that was informative and purposeful. A dimension and attribute observation table were created to track individual and team interactions supported and confirmed using videos.

The study confirmed that a TDM process stimulated communication and knowledge sharing actions. As participants shared storied experiences it made the process interesting and pleasant. POs observed personal bonds and noted shared experiences were a good basis for working together and advanced working toward problem solutions. For example, I listened as participants shared their experiences trying to find the ranch; they vividly shared getting lost in stories using self-deprecating humor. POs documented enhanced interactions and each field trip participant developed a different sense of place, and how being on site effected their decisions.

Research Question #5: Participant Observer Roles

How did Participant Observers play a role in the charrette and how did they intentionally or inadvertently communicate preferences?

Participant observers are sourced in research in two ways: structured and unstructured. This study invited POs to capture the whole of the setting in which individuals and teams functioned. They used their eyes and ears to observe actions, interactions, and communication among individuals and/or teams as they shared personal and reflective events over two days. The study confirmed that PO/FOs made connections among observations, experiences, and opinions. POs played an impactful role during the charrette; they were helpful in building team relationships as each brought relevant discipline and life experiences, coupled with a minimum of 25 years' experience as a ranch volunteer. FO observations showed evidence that POs readily shared responsibility with participants for knowledge production and were active in decision making. Without PO/FO expertise students might have missed the local cultural, social, and economic factors in a rural setting of early inhabitants. Findings confirmed evidence that POs readily shared responsibility with participants for knowledge production/sharing and were active in decision making. Post-charrette I concluded POs were instrumental in the co-production of knowledge. Interpretations showed POs made connections among observations, experiences, and opinions.

Findings indicated what proved to be challenging was shared leadership of conventional hierarchical relations observed as assumed by participants; regardless of whether those assumptions be age or position. Participants were observed to acquiesce to POs when difficulties or disagreements arose; additional areas of PO influence were heard during proposal development as participants veered from their proposed project plan to those familiar to POs.

Two POs displayed resistance to change when participants informed them of proposed plans and methods for creating/expanding existing programs. What I heard was not objections to the context of proposed changes rather the implementation and development strategies of how proposed changes might impact current operations and staff positions.

Transdisciplinary Model (TDM) and Team Framework

Kozlowski and Ilgen (2006) defined teaming as "a team-level property that captures the collective knowledge pool, potential synergies among team members, and unique contributions" (p. 78). This study used the following definition to describe team as:

> A team can be described as follows:(a) two or more individuals who (b) socially interact (face to face or, increasingly, virtually); (c) possess one or more common goals; (d) are brought together to perform organizationally relevant tasks; (e) exhibit interdependencies with respect to workflow, goals, and outcomes; (f) have different roles and responsibilities; and (g) are embedded in an encompassing organizational system with boundaries and linkages to the broader system context and task environment. (Kozlowski & Ilgen, 2006, p. 79)

TDM teams interacted, evolved, and adapted to situational demands to reflect on and transition from an informal group to established teams. Findings showed that teams were driven by tasks and demands to resolve the identified problem or situation presented. When working in a TDM framework teams are commonly comprised of community members, educators, stakeholders and a multidisciplinary cohort of professionals and students. Findings revealed that academically everyone one had different skill sets, personal experiences, and abilities. TDM (three or more individuals) teams were joined by stakeholders; this was important as verifying interactions during each step of the charrette was required. While all academic years can participate, I invited 3rd or 4th year undergraduate and graduate students to the charrette. Of great importance, more so than the number of disciplines involved, was that participants had good skill sets, were able to get along with others, were flexible, dedicated and had a good attitude about

the project. The purpose was to build TDM teams to ensure that the project created and produced a feasible plan informed by decision makers. Teams evolved across Halls four phases of TD as they engaged in combining their resources to resolve task demands.

TDL occurs in TDM teams as a process. Teams were given limited time and resources to discover discipline knowledge, life skills and personal experiences, then to translate findings into new knowledge that supported problem solving. For example, as teams formed participants identified, then combined individual resources, coordinated knowledge, skills, and strengths toward setting tasks and demands of problem solving. TDL evolved as a process that encompassed behaviors depicted as shared information, asked questions, solicited feedback, reflected on results, discovered, and discussed oversights, then addressed unexpected results (Edmondson, 1999).

Transdisciplinary Learning (TDL) and Transdisciplinary Model (TDM) Charrettes

> The complexity of real-world problems demands an integrated approach to finding solutions, one that incorporates knowledge and skills from a variety of disciplines. Upon leaving the classroom, our students will be asked to resolve both personal and social conflicts in a changing world, a world in a state of economic, social, and political flux.…They must know not only content but how to use that content in conjunction with other disciplines to solve real problems. (Glenn, 2003, p. 145)

I chose a TDM charrette as the tool/format to support TDL and TL. Charrette participants were invited from diverse fields as success often depends on who attends and participates. I planned the charrette with participants from seven disciplines as I believed diversity would ensure the charrette was relevant and realistic; similar to charrettes held in the private sector. Participants were assigned a team and challenged to develop a working relationship, solve disputes, and review positive aspects of collaboration. They communicated to identify frameworks underlying their disciplinary views and experiences to anticipate trends required to

advance project goals. For example, students with a background in natural resources develop

skills and knowledge dealing with sustainability, environmental protection, and resource

conservation. Using discipline knowledge this group might list behavioral changes to lived

environments and sustainability that influence future environments. While it proved challenging

to recruit participants from proposed disciplines Cherokee teams included:

Students from:

>
> Architectural and interior design
> Education
> Fish and Wildlife
> Environmental studies

Private sector NPO/POs from:

>
> Education
> Author/Novelist
> Non-profit management and development
> Private sector start ups
> Butler/House manager
> Art renovation/restoration/preservation/conservation
> Project development, and ranching

In 1956 Benjamin Bloom proposed a classification of different learning and skills as a

means for educators to assess leaning objectives. Implementing this theoretical framework was

essential for participant learning. The result of using this framework served as a bridge to

differences between disciplines. Using Blooms Taxonomy provided the metric for measuring

cogitative skills in learning. Data collection involved POs direct observations. I provided POs

with a list of observer cues to support and identify competencies and skills demonstrated by

participants. Findings indicated that using Bloom's taxonomy encouraged higher-order thinking

as participants began with lower-level thinking such as creating lists during the everything on the

wall exercise. They moved to comprehension as they described, reviewed, and made connections

among discipline knowledge and skills, then applied knowledge in a variety of ways to address ranch issues. They continued along this hierarchy, analyzed, and compared ideas, identified possible outcomes, and developed new information as they hypothesized and evaluated findings. TDM activities related to all levels of the taxonomy and directly related to the content of the study. I implemented Dewey's theory of experience and narrative inquiry to develop the TDM experience identified as it:

- rarely tells students what they need to know
- supports interactions using questionings'
- builds confidence in one's ability to learn and trust one's judgement,
- supports flexible points of view, and
- eliminates the fear of being wrong as it respects fact finding.

In TL theory there are 10 phases learners follow; they are rarely followed in any order and most learners pursue some variation of them. They occur incrementally or gradually over time. Findings indicated that TL occurred as participants became actively engaged in developing new knowledge and skills; they used critical thinking, reflection and differing perspectives to problem solving. Participants questioned their own understanding of an issue and moved through the process of TL. They moved boundaries to knowledge production and investigation of external, internal, and social aspects of the problem. For example, participants shared discipline knowledge combined with personal experiences from internships, GIS training, wildlife rehabilitation work, and volunteer experiences. When discussing discipline knowledge, I expanded and incorporated student experiences from areas of learning outside of identified disciplines. Participants investigated how each contribution might be integrated into a hierarchy of compromise while they explored the validity of their own experiences and how these were supported by educational specialization. This process led to participants expanding beyond academic knowledge as they learned to approach problem solutions. By focusing the charrette on

a life world problem, participants were able to collaborate among disciplines and private sector actors, both utilized self-reflection for knowledge co-creation. Participants collaborated, framed problems and objectives which triggered TL through recursive cycles leading to continuous refinement of project goals.

Observations showed participants crossed disciplinary boundaries and set common goals for project proposals. Individuals and teams developed, synthesized, and integrated knowledge from materials and data collected. Participants identified data similarities and differences to develop solutions and made mutual connections among disciplinary knowledge. They successfully addressed TDM teaming, focused on inquiry and processes through the lens of multiple disciplines to solve a complex problem. They provided various perspectives, addressed, and provided realistic solutions. Individuals approached the study from differing skill and knowledge levels, but learning was active, and student centered. It required critical thinking and problem-solving skills.

TDM interventions combined with a team approach. This established a framework for problem resolution. By reflecting on individual input teams identified ways to approach problem co-creation and brainstorming. This created and formed the 'in between' spaces of cross disciplinary knowledge. Each team constructed traditional and TDL discourse differently. For example, in discipline interactions, participants had established a common language and individuals had established team identities; PO/FOs and content experts interacted, supported team discussions that contributed to TL while participants focused on common learning over disciplinary content. This supported my conclusion that communication was a critical component of project success. Participants advanced from individual preferences, developed, and integrated new perspectives. As participants found and shared their voices I watched as individuals dropped

rarely observed counterproductive behaviors (lack of cooperation, support for ideas, project

planning and conflict management) and accomplished effective communication as participants:

- moved around, reviewed posters, then collaborated/elaborated on new knowledge switching among personal knowledge, life skills and experience to create concrete examples they wanted to address in their proposal
- communicated discipline based learning; information moved beyond a single source as participants were well versed, for example in history, math, science, writing, technology, business, and non-profits
- shared personal experiences and stories from other charrettes and/or field experiences
- shared discipline knowledge and concepts implemented as solutions to the problem
- shared knowledge allowed participants to clearly define each team's vision, document it, and present it during final presentations
- utilized new knowledge, debated, addressed issues, then applied it to the problem and moved from the current situation to desired findings

I concluded participant discipline knowledge contributed information integrated into final

project proposals. This study confirmed TDM charrettes advanced TDL supported by observable

contributions from diverse teams. Teams supported this environment and incorporated

information in the form of hypothesis tested to unravel, address, and problem solve. Findings

indicated TDL defined multiple aspects of participant experiences supported by a TDM charrette

as participants:

- were involved in creating and integrating new/different knowledge acquired   from disciplines and/or experiences and identified linkages to problem solving,
- accepted responsibility for project outcomes and by degree of involvement in and by shared knowledge sources,
- gathered and identified specific impacts, outputs, and findings culled from resources thatled to sharing new knowledge, and
- coordinated and negotiated findings that contributed to project proposal's combined with their willingness to shape the impact of their findings on project success.

Team Interactions

Chapter IV discussed team interactions. Findings identified challenges that addressed

evolving ideas leading to action. I watched and listened for instances of how teams were driven

by multiple knowledge base's or as individuals. Findings from team interactions indicated this

was exhibited as participants:

- initiated prior knowledge and shared new knowledge as each team discussed findings from field trip activities that resembled "think, pair, share."
- organized ideas individually (sticky notes) then discussed their thinking, concepts, and ideas within teams.
- placed sticky notes on poster paper, ideas resembled a jigsaw puzzle, then one by one team's discussed and organized combined data and sourced the binder, POs, content experts, FO's, and GIS maps, then placed data into sections.
- teams addressed overall information and asked questions such as, "What do you think this idea means and how do we apply it to the project?", "What is the big picture and how does this information fit into the project?"

Post-charrette findings concluded that newly formed teams implemented TDL. They communicated in a complex environment driven by members ability to cyclically revolve through a learning process that combined cognitive, motivational, behavioral, and academic knowledge and skills to problem solve and develop a proposal.

Transformative Learning (TL) and Transformation – Observations and Impressions

In Chapter three I identified three questions that PO/FOs used to evaluate TL among participants/teams. Findings based on observations and impressions indicated:

1) As new questions emerged did you observe participants cycling between TDL/TDM phases?

Findings: PO/FOs initially noted impressions of participants' interactions, expanded throughout charrette experiences. Observations showed that individuals and teams developed and addressed new questions as they cycled among phases. This was evidenced and supported during presentations.

2) Did you observe participants asking for, needing, or wanting information from educators, industry experts?

Findings: PO/FOs observed T1, T2 and T3 making these requests most often; T4 appeared to have a comfortable blend of knowledge and life skills combined with extensive PO property knowledge. POs shared current and future site plans with T4,

and this allowed the team to formulate their plans without making requests for new information. This did not translate into a more thorough proposal being developed by T4.

3) Did participants need or want information from disciplines not included on their team or that they were unable to obtain from educators, industry, and/or content experts?

Findings: PO/FOs noted that participants, and themselves at times, required knowledge lacking from teams' current knowledge base. Participants made suggestions and discussed their desire to have additional discipline knowledge on each team. Identified as business, agriculture, landscape, and animal sciences being most prevalent, followed by architecture, history (land and community), the site staff, and archeology. While the internet provided much needed information, I noted that locating large amounts of data required time and without experts available to discuss/share/translate discipline jargon participants were unable to connect all information beyond basics. Teams tabled some of their more innovative ideas, settling for the known, comfortable, familiar, and convenient path of implementing existing knowledge.

Discussion of Transdisciplinary Learning (TDL)Transformative Learning (TL) Activities

This section shares interpretations and conclusions from literature, charrette activities and post-charrette review. Any discussion of transdisciplinarity involves interactions among individuals and teams as TD provided the method to explore and identify relationships during charrette activities. TDL was employed to integrate observational elements and to improve understandings of how different parts of the study related to one another. These elements were integrated into an iterative process leading to participants' TL. This study focused on

relationships among categories that were subject to change during the research process. The

closeness of working among teams led to unexpected events, leading to new directions, helpful

for future researchers.

I explored TDL from the participants' perspective when examining data; discovery was

fluid, evolving and dynamic. Data collection provided a sequence of events and captured

information in the form of words, images, observations, and from participant created documents.

I identified four themes that emerged from the evidence as:

- synthesis: students moved beyond readymade procedures and standardized answers to solve problems. Each question and answer was tackled using personal contributions shared in group discussions involving all team members/PO/FOs.

- integration: students increased understanding of the site and cooperation among differing disciplines to create a working hypothesis. They explored the interpretation of new knowledge unfamiliar to their specific discipline then combined two disciplines into a theoretical framework using recursive Q & A discussions to incorporate knowledge from multiple perspectives.

- similarities and differences: students realized they needed new eyes, dispositions, and behaviors to cooperatively solve the problem accepting opinions of individuals from differing cultural, educational, and personal backgrounds.

- transformation: historically, drawn boundaries among differing disciplines were reexamined to advance integration of new knowledge. Problems were initially addressed narrowly by disciplines, overcome by dialogue after several assumptions surfaced from segmented fields. Students questioned assumptions from different aspects of the same subject across disciplines then incorporated non-academic knowledge and expertise from PO/FOs causing a disorienting dilemma that enhanced TL.

Data collected allowed me to discover and identify how and if participants achieved TDL

and TL. Findings detected six TDL themes exhibited by participants, recognized among six

activities and behaviors that supported TDM characteristics as:

1. creative solutions (collaborative processes, and innovation-challenges of individuals and teams)
2. communication (listening, transparency, relationships, understanding, shared success, telling the truth)

3. flexibility (the speed and ease in which one can move from idea to concept with the least number of obstacles)
4. commitment (responsible for tasks and required knowledge to design/develop solutions)
5. trust/respect (sense of trust among individuals when a participant contributes an idea or knowledge that is safe from ridicule and/or belittlement, and is respected)
6. agreements (consensus among participants resulting in project delivery)

Findings confirmed participants meet these characteristics and achieved TDL. Teams clearly understood expectations and imagined outcomes of the charrette. Participants' appeared clear about the need for individual/team contributions and the framework of the project. This was exhibited as participants navigated the four phases of TDL. Participants cooperated in a social process among individuals to produce new understandings, both individually and within teams. They developed a shared understanding of new vocabulary implemented to comprehend differing discipline knowledge. Teams explored, collaborated, and contributed to the development of shared knowledge to address identified problems, and worked among TDL phases. For example, when teams conceptualized ideas, they synthesized and translated information among differing areas of expertise. Individuals adapted as required to advance a shared mission and vision, then created a shared mental model. This resulted in translational opportunities. Individuals successfully navigated conflicts resulting in the development of a new awareness external to individual preferences. Teams developed a TDM ethic and environment that promoted personal and individual TDL and TL.

As teams emerged POs/FOs repeatedly sourced team discussions that explored relationships among disciplines, personal knowledge, and shared experiences. TDL required individuals to exchange information while being able to comprehend and articulate, then reflect on individual contributions. Participants found a comfortable flow of verbal exchanges, problem solving, and decision making that rapidly and enthusiastically advanced a project plan. Interior

Design participants showed acute visual skills. Conceptual models supported problem solving. Each team developed a collective memory of who had what skill set and knowledge. This advanced and supported participants as they shared values, attitudes, and ideas. They moved from solo patterns to a team mode.

Once teams moved from conceptualization to implementation, they had established a rhythm that brought them together. This supported team collaboration as they refined and enhanced earlier concepts; supported by identified and finalized shared goals. When team discipline knowledge was lacking, they came together to foster expanded inter team based collaborations. They worked together and identified necessary information that moved ideation ahead. This advanced TDL that supported collective sharing of new knowledge that further enhanced collaboration.

In the final phase (translation) participants had advanced to provide solutions. This phased proved the most challenging environment for TDL. The study confirmed what I believed was the most difficult area to identify and examine innovation. I believed this challenge arose when POs failed to utilize and collect data from multiple time periods and/or forms. Missing data resulted in identification of ideation phases that moved to implementation without tangible results. Predicting and identifying innovations among student experiences was subjective by POs/FOs.

Post-charrette I had a discussion with three POs who indicated that innovation should be defined by students, their experiences, and preferences among teams. Two of three believed innovation should be assessed as a separate layer, supported by input from students as in post-charrette surveys. I agreed the concept was a good idea and future studies/researchers might have a section or open-ended essay that allowed students to identify innovative ideas, shared among

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team interactions and final presentations. Another option was to include a question doorpost presentation for each team that allowed participants to focus on tools and literature utilized to develop ideation translating to innovation. For example, one could ask the team to identify their innovative ideas and how they formulated them for the project. Another question would ask individuals to identify and share their collaborative problem solving and what they learned. Responses would support PO/FO observations with assessing how and/or if TL occurred.

Post-charrette I concluded this study supported the how and why of using TDL based projects to foster place-based learning. It supported broader approaches to problem solving. It contributed to the body of knowledge of several disciplines by preparing participants, on even a small scale, to further develop integration of knowledge derived from societal needs supplemented by newly structured and prioritized approaches. I concluded, from charrette activity and literature reviews, this study identified seven areas that implemented shared criteria for designing and evaluating TD identified as it:

- advanced scientific knowledge on how to assess TDL, knowledge sharing, and linked the research process, its products, and contributions to TL/change.
- was a researcher and stakeholder collaboration; it identified how charrette participants advanced collaboration resulting in actionable knowledge.
- implemented a TDM charrette that required different measures of problem-solving aimed at the integration of varied types of knowledge and life experiences, which were reflective, relevant, and negotiated.
- added to the body of knowledge on how using PBL helped participants develop skills employers' need and value.

Researcher Experiences and Observations

> The purpose of a storyteller is not to tell you how to think, but to give you questions to think upon. (Brandon Sanderson, fantasy, and science fiction writer)

The charrette was an action event that placed participants in a disorienting dilemma. This was evidenced by adding challenges to the XQ study and by removing a 'check list' of requirements for the Cherokee study. To clarify, challenges required participants to rethink,

review, and reassess prior beliefs and solutions; this activity simulated a life world environment as projects are always changing. This aspect proved disorienting for participants who were accustomed to following a check list identified as project goals, defined, or outlined by a specific assignment. Post-charrette findings indicated field trip experiences helped participants break from past mindsets and open up to new avenues of study. Framing the construction of a new mental model provided team members a way to understand and consider co-creation of knowledge as preferable to part and parcel.

The decision to implement visual narrative was purposeful. I implemented reflective and active processes for participants. This method supported participants as they explored the site. Findings built on literature in *The contemporary transdisciplinary approach as a methodology to aid students of Humanities and Social Sciences* (2013). The author cited Guyotte (2014) who based remarks on personal intuitive interpretations. He described how charrette involvement generated interactions, communication, and knowledge sharing/integration among participants and how TDL influenced knowledge integration and TL. The charrette environment and storytelling supported participants when making meaning of their experiences and as they shared data among disciplines (Given, 2008).

I selected narrative as the means to share findings and interpretations; not making this decision lightly I wanted to share reasons for this choice. First, charrettes are interactive experiences (professional, personal, and individual). They are a partnership with other participants; operating within a space of co-creators whose lone connection might be the desire to solve a problem. After reading a dissertation by Guyotte (2014), I found myself connecting with her study. She explored TD using visual-verbal analysis in Art education, stating "(visual–verbal journaling) seeks to place emphasis on visual and verbal data while also attending to the

relationship between these two expressive modes" (p. 3). Sharing "Through this analytic process, the researcher attends to the various texts through a rigorous yet flexible process which equitably addresses visual-verbal representations of experience" (p. 3). I also read a narrative novel by Patricia Leavy titled *SPARK* (2019*).* Ms. Leavy's journey began with a letter from the Goodright Foundation; an invitation to attend a project, a journey into the unknown among a group of unrelated co-participants among varied disciplines. She chronicled her journey into finding the answer to one question posed by Ms. Goodright, the foundations director, who opened the event with the following: "As you know, we have divided you into seven groups of seven. You will work in your group to answer one question. Your question is as follows: What is the answer?" (Leavy, 2019, p. 20).

Reading this I wondered given a four word question how I would approach such a challenge. What would I want to know and from whom among the team would I solicit ideas and hopefully answers? This problem and research *sparked* my ongoing desire to expand beyond the silos of my institution. Coupled with a passion for design, construction, education, and wildlife rehabilitation, I often felt I did not fit in any one department. Literature informed opinions and decisions and I now understood the challenges and time required to conduct a charrette with co-creators.

Once I completed reviews, I knew I had found my approach. I utilized numerical comparisons when they best depicted findings. I collected data through observations, surveys, and participant interactions shared findings described in narrative. I finalized my decision and began writing. I knew I had entered into the unknown but now I was armed with a new-found passion.

I added an analogy to clarify my process, TD research and cooking. Cooking involves different steps, it begins with an idea of what you want to make, it requires a shopping list and planning. Sometimes I work without a recipe and rely on experience and knowledge. Other times cooking suggests adaptability within the frame of a recipe, still other times it evolves, working with substitutions or what's on hand. Sometimes you are chopping things up or combining ingredients to get to the next step. At times you are heating, other times you are cooling; it involves mixing, tearing it apart and occasionally it involves combining everything.

Experiences' and passions' often dictate choices I make. My appetite for exploration and knowledge sharing were the recipe for choosing how to present what I discovered from literature and the XQ case study. My experiences as an impassioned construction, design, education, and sustainability professional facilitated my ability to work within an ever-changing environment to develop and maintain personal connections, invaluable skills during this study. My recipe for presenting findings and results required experience; rethinking individuals' participation, the challenges of collaborating with stakeholders and POs. I better understood how experiential experiences evolve and adapt alongside field work…my recipe required advanced observational skills, tools, and abilities learned from personal experiences and academic training.
I compile a list generated from personal charrette experiences and video notes, reviewed and supplementary to PO reviews and comments. Blended are outcomes among teams, identified as areas having the most impact to the site and project's success. I shared team outcomes with the understanding that had additional disciplines been represented many of these areas might have been considered during early collaboration.

Most notable during presentations was the lack of questions posed to presenters. I found this unusual at the time, later attributed to exhaustion and a pending snowstorm that required POs

to leave as soon as possible to avoid hazardous travel. Had decision makers, stakeholders, and

community members attended presentations, I believe questions would have been asked.

Identified/noted were topics that could enhance, derail or impact project planning such as the

understanding of carrying capacity. For example, during the field trip I discussed carrying

capacity and human impact on sites; I shared:

> When you are working with your team consider how many people 300+ acres can
> sustainably support on a working cattle ranch shared with wildlife. Remember Tweets
> mission identified the land be used for educational purposes and as a wildlife sanctuary.
> Think about how you might connect these two.

> We briefly talked about human impact, cattle paths, non-human species/interactions,

historic artifacts, and water availability/usage. I shared that NE had open land, accessible and

plentiful water resources and they had an existing educational program in place. Their facility

included flight cages for demonstrations. I shared aerial images that depicted large open spaces. I

asked participants to explore carrying capacity. T4 was the team that briefly addressed carrying

capacity.

> Participants identified areas they believed would enhance existing programs identified as:

- community collaborations
- community gardens (proposed on open land closest to highway to avoid random site
access afterhours)
a) collaboration with area schools and colleges – cooperation with CR Science
Institute and NE
b) IREA collaboration-sustainability
c) County collaboration (renew easement, expired 2005)
d) implementation of technology to advance ranch history and activities: interactive
museum such as milking stations (robotic animals)
e) onsite kitchen to eliminate catering costs at castle events/field site(s)
f) cooperation with cattle associations, wildlife, and community programs to support
existing and proposed programs (educational/financial support)

Areas of proposals that could impact the ranch's mission or historic renovation, included long-

term environmental objectives identified as:

a) building an amphitheater/outdoors concerts away from the castle grounds
b) adding wedding venues, corporate retreats, and long-term on-site educational research/programs
c) on-site kitchen to eliminate catering costs at castle events and on-site supporting researcher/volunteer food supplies
d) hunting events (pay to play events)
e) family field days
f) middle land activities (not defined by presenters, but I identified them as the caves and Mountain Man Trail)
g) summer camps (girl scouts, boy scouts, etc.)
h) demolition-renovation versus restoration, including original homestead usage and historic significance[17]

Areas not identified:

1. Waste-collection, removal, and impact on water, land, and biodiversity-none addressed biophilia, few addressed basic tenets of sustainability

- liquid, solid, toxic, and recyclable/non-recyclable
- domestic waste (household products such as cleaning, chemical, cooking, plastics)
- agricultural (poultry, harvest, pesticides)
- commercial (castle, education programs, office plastics, paper, Styrofoam, etc.)

2. Biodiversity pollution (dangers caused by human activities) such as habitat fragmentation, ecosystem degradation, water, and waste management to name a few. For example, what consequences might proposed ideas have on water consumption, soil loss from intensive agriculture, noise/light pollution? How could such damage be mitigated on private lands and within wildlife corridors?

3. Volunteerism – Sparks (2018) article *Volunteerism Declined Among Young People* showed that "high school and college students are less likely to volunteer or give to charity today than they were 15 years ago, even as young adults expressed the most interest in community engagement in a half-century"(para. 1).

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[17] If the property itself is not of historic significance the district (property) where it is located may be, consideration must be given before any renovation/demolition begins at the site.

The majority of Cherokees volunteer staff are retired individuals' or those who have experienced long term associations with the property; questions I anticipated might have been asked or discussed included:

a) how does one develop and support proposed programs?
b) how does one ascertain renovation priorities, needs, and proposals?
c) how does one recruit volunteers across multiple generations, academic arenas, and community/stakeholders?
d) who does CR & CF envision as the next stewards of the property/site and what roles will they play/support moving forward?
e) how does the mission plan intermingle with proposals and current programs when addressing future plans?
f) how does the foundation address hidden/personal agendas of staff, volunteers and the community while addressing the mission?
g) what and how does the current labor/volunteer pool support programs, what are future hiring/training needs to support proposals? and last,
h) how does the foundation budget and implement new programs proposed; by committee, by funding sources and how will funding be implemented to support the mission and proposals?

Participants rarely embraced the POs ideation/proposed expansion, beyond the Castle property for weddings, corporate events, and retreats, including an annual elk hunt (permitted by the state). For example, I listened to T4 develop their mission statement and heard participants questioning adding a wedding venue to the Wauhatchie site. A lengthy discussion evolved around simply using the castle as a wedding venue. POs redirected participants' stating this was the property's main source of funding, saying it would not be eliminated; participants did not pursue this further. During lunch I joined their conversation and listened as participants asked each other how weddings support the mission or property utilized as an educational venue and wildlife preserve. I later overheard interactions as participants questioned POs about wedding venues and events currently offered at the castle with two teams electing to expand social and art events to Wauhatchie. Once the concept was agreed upon by T2 and T3, discussions glossed past increased crowds and site impact, focusing instead on revenue generation in support of new programs and wedding venue expansion.

Missing in presentations but discussed among teams were reflections and ideas on ways to utilize internships to advance/enhance learning. Each team discussed areas missed in presentations. For example, while T2 was developing their presentation #45 shared information about her positive internship experiences and how programs could collaborate with universities to develop shared, onsite learning and/or programs supporting/offering educational credit. Participant #10 shared how internships are part of the design program and how (she believed) they increased and built job skills. She shared this event could be viewed as a resume builder. #10 communicated and stressed that the ability to function in a TDL environment was an experience/skill highly sought after by potential employers in her field.

Shared earlier was how TD inquiry boundaries were tested, moved, realigned, or reduced becoming an organizational principle rather than a way to create new knowledge (Jantsch, 1972). This study demonstrated three critical tasks and key challenges identified by Serrao-Neumann et al. (2015) as participants 1) coordinated discipline and sector investigation and analysis, 2) cross-fertilized data and findings among disciplines and sectors, and 3) synthesized outputs, especially adaptation options across disciplines and sectors. This study explored how TDM contributed to and shaped the perception of relevance, credibility, and legitimacy of the results to identify and assess student learning. Quality and relevance were gauged through survey assessment, charrette participation, and project presentations. It is important to note that relevance, credibility, and legitimacy are closely connected in that these qualities share attention to how different types of knowledge and expertise are valued and used in a TD process.

Transdisciplinary Study Challenges

I developed and utilized criteria and measures to ascertain individual and team learning. I selected this method to support multiple areas of data collection, while I believed it prevented

PO/FOs from becoming bored and/or complacent as they repeatedly utilized similar observation forms. Post-charrette I concluded this became a challenge as POs shared they became so engrossed in the charrette they forgot to collect data at one point or another. I believe that had I condensed observation forms POs would have addressed specific areas of the study, provided necessary data to correlate findings.

This study used images to support the narrative, as TD and charrettes weave in and out of storytelling. Findings lacked a plot line or characterization rather written in response to research questions. Conclusions were built on decisions to share what mattered in some stories while others were passed over. I concluded this can become difficult and dangerous to a study. I asked myself how does one determine the relationship between the narrative and reality? Challenges surfaced as I determined what text was inside and what was outside the study framework. Findings indicated this study experienced several challenges; identified as:

1) recruitment-I used non-probability sampling and recruited participants using convenience and snowball sampling. This method was appropriate to support the study. Challenges arose as POs and content experts were unable to commit to a 2-day charrette. Students experienced funding issues to travel to the site and/or charrette, while few educators responded to requests to meet. Attrition played a part to actual charrette attendance, coupled with weather issues that prevented safe travel outside the Fort Collins area.
2) data collection-My desire to implement multiple sources for data proved challenging to POs. This e proved to be a study limitation.
3) team presentations-Challenges were not evidenced by participant presentations as all were well developed and presented. What was lacking was questions to each team on their proposals by reviewers, post presentation.
4) audio/videotaping-The charrette was audio/video taped using 5 cameras and post charrette film was mixed into one version. This compacted the file for sharing however post charrette review became difficult as I experienced participant over speak. Compacting film required me to stop/start over and over to document interactions. Post charrette review proved daunting and involved approximately 6.5 months' time, logged as 960 hours. This could have been resolved using OWL technology.

As stated earlier developing, and implementing multiple observation forms to assess collaboration, TD, and transformative activities was grueling and at times difficult. Problematic

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areas identified proposals lacked innovative ideas and solutions. Challenges arose when POs failed to collect data implementing all forms, responding to some areas while ignoring others, and at times responding to incorrect questions. This created a time-consuming process as before assessments could be made, I had to contact POs and attempt to extrapolate meaning from documented responses. This resulted in documentation that lacked supporting data in several areas such as when identifying ideation phases transforming to implementation resulting in tangible results. Predicting and identifying innovation among student experiences was subjective by PO/FOs.

Gaps in Literature

Researchers have worked across disciplines for decades; and most colleges require undergrads to take at least one multidisciplinary course. Literature was plentiful on TD research but lacked extensive studies that addressed how to design, assess, and implement a TDL environment using a TDM charrette. Findings built on Pearce et al., as the authors shared, "Transdisciplinary learning refers to both the condition of learning in a transdisciplinary setting and learning about transdisciplinarity, including the methods and assumptions that researchers take on when carrying out transdisciplinary research" (p. 167). I learned that while there has been a shift toward TD both within academia and beyond, most literature discussed the shift from knowledge compartmentalization, to thinking that moved from traditional use of space to more flexible learning space design. A shift from ontology and epistemology to embracing a more diverse, inclusive world view (Gibbs et al., 2015). Literature reviews created a gap between traditional and disciplinary foundations and those that shifted to problem focused TDL. Findings indicated a gap existed on how to define, identify, and implement storytelling as a tool to support TDL. In Palmer's (2016) article the author stated, "Storytelling ethnography is a valuable tool if

your research traverses several disciplines and aims for insights that transcend all of them" (para.

1). The author identified two parallels between TD and storytelling ethnography as:

> 1) transdisciplinary researchers work at the border between academic inquiry and
> community knowledges, and
> 2) the power of stories lies in their capacity to act as a bridge between these different
> knowledges and help us to make sense of time and complexity at the scale of a
> community or an individual's life (para. 7).

Interpretations from literature and charrette activities confirmed this study filled TD research gaps by addressing the HOW to implement TDL using a TDM as it incorporated different interactions among disciplines that might affect TL. Post-charrette interpretation from participant experiences revealed varying student takeaways. Most prominent was student recognition that the experience had expanded their perspectives of other disciplines. Post charrette I concluded this study:

- built trust & mutual recognition among disciplines.
- supports wider implications for other disciplines.
- showed commitment & continuity among problems.
- advanced funding opportunities & support, and
- identified institutional challenges & support.

Study Limitations

This study departed from more conventional methodology; it used a holistic approach with sustained participant contact in a naturalistic setting. The study focused and included a high level of PO/FO and participant involvement that produced descriptive and visual data. Findings were built on PO/FO observations during a charrette. Themes developed from participant narratives to understand TDL relationships among TDM teams leading to TL rather than analyzing content. All this led me to conclude that the study had potential limitations. I implemented multiple instruments for data collection. Interpretation from charrette activity found that when engaged and collaborating with POs findings indicated the study was:

- time consuming during data collection, reflection, coding, and post event reviews,
- non-participant and participant observers might not have been content experts; thus selective perceptions of observers may have affected and/or biased data.

While not a limitation I believe it is important to share how storytelling can impact a study. I had to keep in mind how interpretations by PO/FOs and self may have impacted study findings. There can be ethical implications on how stories are acknowledged and how the conclusions form among storytellers and listeners; considerations were given to how each were told, shared, then repeated as narrative. This tool supported project development in innovative ways.

The study confirmed there was a difference between participants and teams as participants struggled completing the LSI, so team development was unevenly aligned. This limited statistical data collection and findings. I concluded that observations collected by POs presented knowledge transfer and gaps as observations were sporadic at times. PO/NPOs might seldom be content experts thus selective perceptions of observations might have affected and or biased data. Video review showed that selective memory and possible embellishments of events and telescoping may have occurred. Data collection, reflection, coding, and post event review was divided across multiple iterations to allow myself to look with fresh eyes. This became daunting and frustrating as I continually observed new behavior's and or actions. To verify POs observations against mine took almost 6 weeks additional time.

This study involved a strong regional and distinct property; these findings may not translate to other historic ranches, educational programs, or wildlife sites as Cherokee provided a unique setting with assets that might prevent study replication. Site accessibility was contingent upon weather; field trip participants were granted full physical site and structure(s) access; non field trip charrette participants had varying experiences using Galaxy Maps, so it was harder to

identify experiences. Statistical and data limitations arose from study population availability and participant willingness to attend FTF; there was also a difference between participants, as teams were aligned with different content experts among disciplines. Findings from the sample cannot be generalized to the population.

By planning to combine undergraduate and graduate students with industry professionals, stakeholders, community members, and educators from K-12 and higher education team knowledge and experience levels varied. Possible limitations for this study arose when presenting knowledge transfer and gaps from observations collected by participant observers and facilitators, consisting of 1) selective memory of events, 2) participants recalling events that occurred at one time as if it occurred at another time (telescoping), 3) exaggeration and/or embellishing events by participants in a more positive light than what occurred, or 4) Hawthorne effects.

XQ and Cherokee Cross-Case Study Review

The XQ challenge invited participants across the U.S. asking, "How would you rethink high school?" XQ's website summarized the response to the challenge stating, "It was the largest open call in history to rethink the century-old public high school system and better prepare our students for the future. More than 45,000 people signed up to join the movement and nearly 700 teams submitted full design applications" (Emerson Collective, 2016, para. 2).

Eliminations occurred post submittal review by education experts, over the course of a year at each phase of the project, narrowing the field culminating with five initial grants later adding five additional awards. Teams were challenged to envision education through a new lens; expected to design, develop, and if selected to implement their vision of what future schools

would look like. Challenge awards supported proposal development with a $10 M grant, allocated over five years.

Teams were required to progress through three development phases. Having progressed through earlier stages, on May 15, 2016 our team met in a blended environment to address questions released 10 minutes prior to a timed challenge, see Figure 5.3. We collaborated to develop creative yet feasible solutions, similar conceptually to a charrette using all of the four-hour time frame. The team applied Dewey's six-step process of inquiry, used Kolb's four-stage experiential learning cycle that included concrete experiences, reflection, abstract conceptualization, and active experimentation. This approach allowed people from diverse backgrounds, demographics, skill sets, and education with differing learning styles to develop and integrate their knowledge while drafting a solution.

Figure 5.3
XQ Founding Team TD Blended Environment Challenge

Similarities and Differences between XQ and Cherokee Wauhatchie Charrettes

This section provides a brief overview of the exploratory case study and charrette, followed by the Cherokee study. XQ and Cherokee timeline of events, activities and findings explored how individuals approached the charrette process using TDL activities. XQ findings advanced and informed my path forward from what was initially designed. This process identified tenets central to addressing research problems such as how to approach those problems, and the methods I needed to implement to develop this study. Categories were pre-defined and planned investigations were interwoven when deciding on what areas to focus on next. This study was process oriented; numbers and observation forms were utilized and implemented to collect data. Similar patterns developed between the two case studies. While the XQ project evolved over a 10-month challenge, similar execution methods were developed for Cherokee. The XQ project required community partnerships, collaboration, and shared resources to serve a large diverse community home to undocumented residents and/or multi-generational households. The school served a lower socio-economic community in a NE urban area of Denver, known as Montebello, CO. This area can be challenged by high crime rates, especially among youth. It was plagued by food deserts and lacked readily accessible medical/dental care, offered few employment opportunities, especially for youth, or advanced education preparation. Participants were asked to address community cultural wealth and gentrification. Community engagement shared a long history of mistrust among non-Hispanic or Black residents; a large percentage of the community were non-English speakers. The XQ charrette required one 8-hour day, ending with students' teams returning to the classroom to complete their designs and presentations over the next two weeks. Interior design students added the XQ project in their portfolios; both projects offered students letters of reference and certificates of attendance.

Similarities between the two studies were TDM charrette processes, PO/FO involvement, and use of a life-world problem as the basis for TDL and TL. Neither XQ nor Cherokee participants were provided check lists of what to do or how to address the problem; all charrette participants were pre-assigned teams. XQ differed as each team was assigned a POD to develop/design the day of the charrette, whereas Cherokee teams worked on a plot of land utilizing existing structures. They had the option to build one new building replacing a demolished pole barn at Wauhatchie. The single restriction was that the new structure could not enlarge the original footprint, however, to maximize space a second story/loft space could be added. They were permitted an expansion into natural spaces using non-permanent structures, such as decking.

Looking back, I pondered why XQ was seamless to implement and supported by many while Cherokee struggled with participant recruitment among disciplines. Reflecting on both studies I found timing was everything during the XQ challenge. Differences with the XQ outcome were supported by time for students to complete up front work/research to advance ideation and framework development before the charrette. XQ had eight university and community members roaming among all participants to support teams. POs offered a multitude of options and differing opinions to spark ideation, while participants had to remain focused amidst technological problems. XQ study confirmed discipline silo disagreements supported TL among students. I documented XQ construction management students saying they had no idea interior designers knew so much about construction, further supporting this study's need for TDL programs on campuses.

Reflecting on XQ, time and recruitment were my biggest take away; both supported early methodologies driven by the XQ timeline, backed by XQ staff and teammates. Proposal development was built upon XQs early concepts supported by ideation and research among the

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founding team. While I led the team, we all survived the challenges of competing time commitments, we didn't miss a deadline, individuals completed tasks as agreed, and we bounced ideas off each other, communicating across time and space.

A positive aspect of XQ was having international students involved added interest and allowed Colorado students to explore differing cultures. Participants adapted and addressed language barriers while overcoming technological challenges, time zone differences and cultural approaches; everyone adapted and embraced the opportunity to work globally. Colorado students shared how different, and unexpected it was to hear Ghana 'kids' needed simple things in their school such as lights, computers versus chalk board, and basic tools for doing homework (paper, pens, pencils and textbooks for each student). Adding high school students to XQ, acting as the "client" to the charrette, supported the changes many 3rd and 4th year college students had forgotten yet were close enough in age to relate to how each differed. Looking back I would keep this aspect, even working among local communities. For example, Denver is a multi-cultural community, and many cities have a refugee center. Post-charrette I had time to reflect on adding a global component to a study. I concluded this would be an interesting addition and challenge for students to address local, multicultural issues, such as discussed in Chapter II charrette case studies. In conclusion, participants were information they would be working among TDM teams, challenged to create educational programs using a specific site, Cherokee participants had pre-read materials, that XQ teams did not. XQ was supported by grant funds and Cherokee was self-funded. Differences framed modifications recommended for future studies as similar patterns developed between both studies, see Table 5.4. A principal difference between the two charrettes was the upfront time participants had to prepare for and become familiar with the project pre-charrette.

Table 5.4

XQ and Cherokee Cross Case Study Timeline of Events, Activities and Findings

Time and Event	Aim	Stakeholders	Activities	Outputs
2015 - 2016 XQ team recruitment & formation, grant development & Charrette planning Spring 2016	Address 1-year XQ challenge to design and develop education programs for high schools of the future	Group of local researchers, community members and Colorado League of Charter Schools (CLCS)	Shared potential of project founding team formation grant, XQ training, writing development & semester long Interior Design course including a 1-day charette Grant application to Colorado League of Charter schools (CLCS)	Integrated into a semester course in INTD 376 with Dr. Leigh to utilize XQ as a TD service-learning project. Key principles: Grant applications XQ & CLCS. Education H.S. program developed Community development Charrette development Survey development Challenge completion
Fall semester 2016	Team formation and collaboration with INTD376 junior/senior level students to address XQ challenge Preliminary meeting with Board of Education staff to ascertain project viability	XQ founding team CLCS Students, community members, stakeholders, and supporters	Shared potential of project with a $10 million grant possible Semester long course research & development toward project creation-worked with 24 senior and 6 junior college students to create the school of the future-planning	Work toward & develop TDL skill required for charrette participation Address semester projects Received Colorado League of Charter School Founder Grant to support charrette process

Time and Event	Aim	Stakeholders	Activities	Outputs
Spring 2016	XQ TD Charrette planning	Educators, TD team development stakeholders and community members	Instructional delivery to architectural interior design students scaffolding knowledge and skill sets to participate in a TD charrette	Key Outputs: Deliverables of research exploring – a Sustainability Lens, Net zero campus, year-round program, Living Building Challenge, and community cultural wealth theories when designing centers of education
XQ Challenge Charrette	Develop community based high school (Montbello, CO) An innovative conceptual multi-generational educational program using a 10-acre site in an underserved urban location northeast of Denver, CO	1 graduate student. 8 high school students, 4 undergraduate Construction Management students, 24 Undergraduate Interior Design students, 8 professors, community members & industry experts (approximately 47 participants) Virtual participants from Uganda Outspan School (12 high school students) and Amy Rubinson, PhD Candidate (Berkeley, CA)	Kick off, presentations by researcher project overview, expert presentations Activities, PODs assigned to predetermined teams for development	1 Day event 8:30 a.m. to 5:30 p.m.

Time and Event	Aim	Stakeholders	Activities	Outputs
XQ Founding Team Challenge Spring 2016	Respond to a timed challenge the final phase of the process	XQ Founding team, community members, educators & 1 senior level college student	Virtual timed TD team challenge answering specific questions by XQ Grant team, TD team development & challenges	Ideation & grant responses developed Completion of XQ Grant final phase (10 hours overall including preparation/set up and travel time)
Spring 2016 Case study Research Development	Site selection, visit/introduction to James Holmes, Executive Director	CR & CF staff, The Researcher and Daniel Raggi, Ecological Consultant	Initial site tour of 3,400 acres visit and introduction to Natures Educators site	Data collection for proposal development using the site for the researcher's study To collect data and develop a presentation for the CR & CF Board of Directors and invited stakeholders to share the research concept and project proposal (8 hours)
Fall Semester 2016	Project Proposal CR & CF Board of Director, staff & marketing team (outside firm)	Researcher was joined by CR & CF Board and education director, ranch manager, event director CEO, and Daniel Raggi, as co-presenter (14 participants)	Power Point Presentation, poster share followed by a question and answer session	Secure permission and create a MOU to conduct research using the Wauhatchie site for a TD charrette (40 hours preparation time-2 hours delivery and Q/A time)
Cherokee February 14, 2016	Share and inform observational training exercises and secure volunteers to attend the charrette as observers	CR & CF The researcher	Complete two PO training exercises Review and train POs using observational form	Participant Observer training

Time and Event	Aim	Stakeholders	Activities	Outputs
February 14 & 15, 2018 CSU students & Participant Observers (PO) educators Site visit Cherokee Wauhatchie	Provided participants with personal experiences shared independent observations and associations among multiple sites with team	Charrette participants, POs/FOs	Field exercises-sensory and mapping exercises	Data/knowledge collected for project development and TD team development/cooperation/negotiation
February 17 & 18, 2018 CR & CF Charrette		CR& CF	2-day charrette culminating with stakeholder presentations	Project proposals by four teams shared with stakeholders describing their vision for fulfilling Cherokees mission to create an educational and wildlife preserve using 355 acres at the Wauhatchie homestead

PO/FO skill sets were utilized for both charrettes and often acted as content experts among teams; Cherokee POs were assigned a team while XQ POs roamed among individuals/teams. Drop in content experts attended XQ throughout the day while Cherokee had one drop in professor who participated among teams both days.

The most notable difference between the two charrettes was that XQ development was team driven, as a cooperative project developed over its entirety. Another notable difference developed from program/course driven charrettes, with participants receiving a grade or extra credit for participation versus an entirely volunteer commitment. Interior design participants were offered extra credit for attending the Cherokee charrette, using it as a service project. XQ involved a portion of a graded class, volunteer high school students were familiar with the project and construction management students were not involved in latter phases of the XQ charrette. I noted preparation was similar, but the difference was the time of year (October vs February), and length of the charrettes; XQ lasted one day while Cherokee was two days.

Weather conditions and distance from Colorado while planning this study proved, in hindsight, to be a detriment to recruitment. I discovered extended face to face recruitment was advantageous to gain participants' buy in and commitment. I arrived in Colorado 14 days before the Cherokee charrette thus recruitment was hindered by time and location. What I did not perceive as problematic was students' and stakeholders' interests as they shared early enthusiasm for the project. During recruitment, participants exhibited curiosity and interest for both charrettes and viewed the process as stimulating, motivating, and advantageous, yet when it came time to attend the Cherokee charrette, unlike XQ, participants failed to show. Many reasons were explored, and I credited attrition as time commitment and not seeing rewards for participation.

Dissimilar was academic and community support between charrettes, XQ was nationally supported versus Cherokee which was locally supported. CSU professors were joined by community members and staff from the Colorado League of Charter Schools attending XQ as content experts; POs were not obligated to observe or document interactions. Similar support was unavailable for the Cherokee charrette, and the absence of this expertise and experience was noticed by participants. I noticed Cherokee volunteers supported the event, but some came prepared to advance vested agendas; some came to garner ideas furthering their own roles at the ranch, others came with their visions of what the ranch should become. Either way, the absence of educators and private sector individuals, not associated with Cherokee had influence on team development, ideation, and interaction.

Another major difference between XQ and Cherokee was development of a global team for the XQ project; we all came with distinct skill sets and backgrounds. Each team member addressed areas of proposal development and I planned/developed the charrette. XQ provided a "ready-made" participant pool, which made planning easier to coordinate and invited high school participants and industry/content experts. XQ charrette took place during the late spring semester, so weather and travel restrictions were not a problem. XQ provided a 5-week window for students to explore and conduct research prior to attending the charrette as part of a course assignment.

XQ attendance included high school, undergraduate and graduate students joined by community activists, private sector professionals, and educators. The XQ project created a K-12 school, using experiential learning programs for students of the future. XQ began with one question, "What do you envision the high school of the future will look like?" I predetermined the POD concepts and each team was given a POD to develop; participants were instructed to

identify a function and were responsible for developing their POD's role. Participants final

challenge was to create an overall campus footprint integrating each PODs' purpose, function,

and role within the framework of a school including ways to involve community members within

programs. Established safety protocols were required as the campus was open to community

members linked to adult learning, with high school students assuming the role of "teachers"

among learners. Programs were designed to support technical training curricula such as medical

and veterinary assistants providing students who desired alternatives to college with diverse post-

secondary opportunities. PODs were developed to provide students and community members

collaboration opportunities with industry/education experts from each field. For example,

students might study/work in a campus neighborhood garden or medical center as campus design

planned community shared services. XQ teams were to create a specific space based on

function/utilizations, and to craft an acronym for their POD. Teams worked from an aerial map

of the location as full demolition was proposed, the site footprint remained; there was no field

trip.

        Both events experienced technological issues and XQ international participants were

unable to participate. The decision to eliminate Cherokee's online/virtual participation was

viewed by participants as a deterrent for Denver professionals and university students. After

careful review this was the correct decision, while the loss of 27 participants impacted TDM

teaming. Coordinating interactions among online and FTF participants can be challenging and

create problematic working relationships among teams when technology fails. Study participants

completed pre and post-charrette surveys, again technology issues were experienced by

participants. Participants signed video/audio recording, non-disclosure/non-compete and

photographic releases; Cherokee participants completed additional releases for field trip participation.

XQ participants received a Service-Learning award from Colorado State's Institute for Learning and Teaching (TILT), and I invited one team to join Dr. Leigh, a graduate student and me to present their course project at the Colorado League of Charter School Conference (2016). XQ food and materials were funded using a Phase One Planning Grant I received from the Colorado League of Charter Schools; subsidized by community members and volunteers. Cherokee lacked this support and was self-funded. I concluded the biggest factor for success with XQ was physical presence in Colorado, which supported readily accessible participants and support among all parties and the campus.

I offer my own assessment and understanding of the two charrettes and experiences by visually summarizing, comparing and contrasting XQ and Cherokee depicted in Figure 5.4. I adapted the figure based upon the Sustainability Journal article, *Evaluating the Practice and Outcomes of Applying Regenerative Development to a Large-Scale Project in Vitoria, Australia* (Hes et al., 2018).

Tasks	XQ School of the Future (1-day charrette)	Cherokee Ranch & Castle (2-day charrette)	Total times and final costs	
			XQ	Cherokee
Pre-charrette prep	(Concept development, budgeting, coordination recruitment, delivery, and post charrette writing – all aspects of developing a charrette post research development)-itemized below			
Development of recruitment materials	36 hrs.	46 hrs. each x 2 people	Expenditures included food, printing, travel, parking, photographs, supplies and the researchers RT travel from Chicago, IL to Fort Collins, CO	
Coordination & set up of facility (includes travel time)	16 hrs. (team of 2 people x 8 hrs. person)	4 hrs. (site set up provided by university facilities team)		

Site visit(s)	N/A	46 hrs.
Team coordination	6 months	NA
Proposal & funding grant writing	12 months	NA
GIS development & mapping	14 hrs.	8 hrs. meeting as info created by GIS lab at CSU (2 campus trips for Cherokee staff)

Recruitment	10 months	2 months

All means expended-in person, internet, telephone, email, university blast system, video conferencing, texting

Team formation	1 week	1 month
Private Sector	6 months	40 hrs.
Educators	1 month	40 hrs.
Participants (high school students)	24 hrs.	NA
Participants (college students)	3 months	1 month
Participant Observers & Community Members	12 hrs.	1month (45 hrs.)
Industry professionals/speakers	21 hrs.	24 hrs.
Location/event space	Colorado State University	Colorado State University and CR & CF field trip
Food/snacks	$1,400.00	$700.00
Site visits (Travel & on-site time time)	4h travel driving (for Denver participants -travel to CSU campus)	4h travel driving to Denver ranch/3 hours on-site-students 10 h travel/4h onsite POs round trip travel to CSU campus x 2 days, travel site to ranch

Technology/video tools	24 hrs.	46 hrs.
Speakers/content experts	16 hrs.	9 hrs.
Budgeting	48 hrs.	36 hrs.
Pre-charrette binders/printing (does not include research time)	28 hrs.	20 hrs.
Parking	Weekend-no charge	$12.00 day per non-student person x 2 days – carpooling recommended

Charrette Preparation and Overall Costs		14 months $2500 grant funding $4200 personal funding	9 months-personal funding
		$6,700	$10,000

Figure 5.4
Comparison XQ and Cherokee Cross Case Study Costs and Development Findings

Post-charrette Interpretations and Conclusions

Findings indicated this study aligned with the literature regarding the importance of TD and charrette models implemented for TDL and TL. I concluded PO bias may have undermined charrette proposals. I learned that POs were accustomed to working with statistical data as evidenced in the need to identify and assign points. I concluded the inclusion of quantitative methods as subsequent analysis may offer additional evidence to strengthen validity.

This research was original in scope and contributed to TD studies as it explored inherent challenges of working among disciplines; especially when visioning the role of academic discipline boundaries. Rather than provide participants a 'check list' of what to do and a predefined framework for problem solving this study challenged participants to conceptualize the kinds and types of outcomes they believe possible through collaboration, using disciplinary knowledge, experience, and life skills. Briefly this study was:

- Action oriented
- Inquiry-driven vs. discipline-driven
- Based on knowledge co-creation,
- Focused on interrelationships, and
- Explored knowledge transfer, it
- Investigated 4 components of TL

Post charrette interpretations concluded that participants created new knowledge from among disciplines and envisioned how various disciplines may constructively overlap to generate innovation and new understating of a specific problem.

I elaborate on areas of the study that could be challenging and need further discussion identified in questions shared as note to self.

1) How did this study have wider implications for other disciplines in my field? Interpretations from literature support methods used in this study. Findings are beneficial to both charrette participants, educators, policy makers, stakeholders, and private sector actors. Post

charrette follow up with stakeholders and PO/FOs shared how the charrette and TDM teaming advanced current programs at Cherokee. Participants shared how attending the charrette and working on a TDL team revealed new opportunities that support personal interests, with four students adding a minor study area to their discipline or as one student shared, they "switched" disciplines.

2) How did conclusions support existing literature? This was my so what question. Hardon and colleagues (2008) assert TD research deals with problem fields in such a way that it can: "a) grasp the complexity of problems, b) consider the diversity of life-world and scientific perceptions of problems, c) link abstract and case-specific knowledge, and d) develop knowledge and practices that promote what is perceived to be the common good" (p. 20). I concluded this study confirmed findings and supported TD as it addressed aspects identified by Hardon et al.

As I completed the final chapters of this study, I kept asking myself this question reframed as - how does this study relate to existing theories on TD? Reviewing chapters 1 through 3 I revisited Gibbons, Piaget, Lewin and Leavy's understanding of TD as integrated problem-centered methodologies, explored questions that bridged academic disciplines with community needs. Interpretation from this review was supported as attendees exhibited participatory decision making and commitment to improve the situation as they used discipline viewpoints to teach and conduct research among teams. Participants established and coordinated knowledge and skills then bridged discipline concepts to advance the co-creation of solution-oriented transferable knowledge. Findings indicated the process supported and advanced synthesis of information to problem solve identified as:

- an important contribution to knowledge from this study is the application for private sector actors to apply this study to community-based problem solving using the tools and observation forms designed. Each could be easily adapted to specific problems.

- dealing with participant attrition was challenging and required me and the other FO to scramble at the charrette. Charrette dates were revised to accommodate additional participants as the study lost a large participant group when I removed the virtual aspect. I recommend adding a virtual option to FTF studies. Getting people to show up without incentives is always going to be problematic, yet I don't believe they should be paid rather I recommend adding the charrette as a course project, similar to the XQ Challenge. I also believe the time of year played a factor in both the field trip and charrette…try for early spring or fall is my recommendation.

Charrette activities supported participants as they:

- engaged in TDL and TDM that supported a TL process
- reflected on interaction and collaboration
- provided opportunities for ongoing assessment (formative & summative)
- reinforced service-learning
- built trust and mutual recognition of discipline knowledge and skills

Post charrette I concluded:

- students used an inductive process of learning as they:
  a) gathered information
  b) analyzed possible solutions and, implemented
  c) critical reflection (compared/contrasted ideas/decisions)

Interpretations from this study concluded it:

- encouraged buy in commitment to support a continuity when solving community-based problems
- advanced wider implications for other disciplines
- identified researchers/educators a means to secure funding and support, and
- identified institutional challenges and support for TD.

A disorienting dilemma triggered reflection based on one's beliefs. For example, problem solving required participants to reflect on problem content, the process of problem solving and the premise of the problem. By reflecting on the content and process relevant to solving the problem individuals had to communicate and resolve differences in points of view. Self-examination, TDL and TL were exhibited as participants cycled through reflective actions to overcome situational, discipline knowledge or emotional constraints; they integrated understanding of their individual experiences as a guide to action. Critical assessment of

assumptions was exhibited as participants gave, justified, and received reasons that supported

beliefs. They examined evidence for and against differing viewpoints, and were able to share,

debate and support their assumptions.

Planning a course of action was exhibited in participants' recursive discussions and

debates; this advanced and supported TDL by including new evidence leading to consensus.

Acquisition of new knowledge or skills required participants to review site data, published texts,

and information received from PO/FOs. Participants acquired knowledge and skills through

ongoing discussions with their teams. They explored and tried new roles triggered by reflection-

based beliefs. For example, problem solving required participants to reflect on problem content,

the process of problem solving and the premise of the problem. By reflecting on the content and

process relevant to solving the problem individuals explored options for new roles, built new

relationships and implemented actions that advanced and resolved different points of view

leading to TL.

Participants' built self-efficacy in new roles and relationships. This was exhibited as

participants' gained confidence in their ability to respectfully assist and/or disagree with others.

Displayed most often by T3 as students challenged POs, often viewed as the source for

knowledge and ideas based on age and position. Data included participant interactions',

continuity, and situation identified as:

- physical setting(s)
- actively involved in the inquiry as it unfolded
- collaboration with others captured shared discipline knowledge to inform new knowledge
- created a story about participants experiences-focused on knowledge transfer and transformative learning

Recruiting strategic key-players in the community, and across the university combined

with non-academic experts in multiple fields was critical to team development. Numerous

discussions with people who knew the local context helped me pre-select possible content experts; recruitment was about inviting a diverse group of participants rather than about quantity alone. I concluded distance from the site/university prevented many FTF interactions, which proved to be deferential to the recruitment process for the Cherokee charrette. I presented several FTF events two weeks pre-charrette; some were held in Denver others on campus.

The impact of a well-designed, active learning space is well documented in literature. Interpretation was that participants used the space to advance ideation and garner buy-in from team members and POs. To further illustrate charrettes were developed, designed, and arranged to advance the learner experience so that it was authentic and relevant. Interpretation from charrette activities revealed PO observations collected objective data about the observable representations that learners performed during the field trip and charrette. This data was combined with audio/video recordings to reveal sequential interactions among participants that showed team dynamics as individuals shared challenges that contributed to TL. I concluded this was the appropriate method to use to understand complex relationships within and between individuals and teams, and while adapting to the fast paced, often chaotic atmosphere of a charrette. The charrette supported collaboration and problem solving as it took place in a relaxed but serious environment so that participants could interact among each other and across teams. It supported knowledge sharing and workflow among participants.

Post-charrette conclusions showed student presentations explored, identified, and investigated a limited number of conditions and their relationships to possible problem solving. Ideation involved issues and conflicts that required multiple assessments of the same situation. Each team developed differing and equally plausible conclusions; each shared different implications for action leading to problem resolution.

CHAPTER VI – REFLECTIONS, RECOMMENDATIONS, AND EPILOGUE

> The complexity of life world problems demands an integrated approach to finding solutions, one that incorporates knowledge and skills from a variety of disciplines. Upon leaving the classroom, our students will be asked to resolve both personal and social conflicts in a changing world, a world in a state of economic, social, and political flux. They must know not only content but how to use that content in conjunction with other disciplines to solve wicked problems (Glenn, 2003, p. 145).

This case study evolved as both a process and a project. It was a successful exploration of imperfection; like a road it experienced twists and turns, ups and downs, dead ends, and detours, yet it arrived at the destination. This study's model was modified, and supported projections made from data obtained from a small number of participants. This challenge was viewed not as a limitation but shared as findings. This assumption was supported by Anderson and Vingrys (2001), as they argued study results allowed for inferences to be made regarding the proportion of the population expected to show similarities.

Researcher Key Points

In Chapter I, I identified study goals, framework, and study objectives. To recap the goal of the study was to develop and support collaboration protocols and communication exercises that enhanced TDL, and TDM teaming. The objective of this study was to explore and identify how TD is fundamentally different in its approach and how participants organize, share, transfer, and establish new knowledge and life skills that influence TL. Study objectives were supported and identified as students displayed, utilized, and implemented design thinking, organizational knowledge, and shared positive relationships among intra/inter team interactions. Participants excelled at exploring various resources and were able to locate relevant information to solve the problem as they approached the complete project.

Video review documented far more intra/inter team interactions, solutions, and positive interactions than what PO data shared. The study confirmed teams successfully explored the four major components of TL identified as 1) experience, 2) critical reflection, 3) reflective discord, and 4) actions taken (doing) by studying the construction of knowledge sharing. Findings indicated that the study supported collaboration and communication by 1) field trip exercises implemented as a think, pair, share activity, 2) developing, implementing, and supporting instruction on implementing Google Liquid Galaxy and GIS, 3) property tour that aided participants as they developed a sense of place, and 4) implementing participant presentations to stakeholders.

The framework was intended to produce information and aspects of TDM teaming and TL to advance student scholarship. The study confirmed it did so by using experiential, correctional, and causal-comparative methodology exhibited during mapping exercises, problem ideation as individuals negotiated outcomes that created a proposal which supported/addressed the problem and advanced the CR & CF mission. TL required individuals to successful adopt and address societal relationships to ranching, sustainability, natural environments, habitats, renovation, history, and education. Participants reinterpreted the identified problem using discipline knowledge to formulate applicable solutions. They refocused to identify and share new knowledge during the charrette. The study confirmed participants did not fully develop innovative concepts and solutions including social, cultural, environmental, intergenerational, and technical aspects that can affect TL.

The study confirmed and supported conclusions that participants shared stories that integrated knowledge. Shared stories effected the way people acted and implemented new and available knowledge to solve the problem. It supported TDL as participants' narratives used oral,

visual, written, and digital storytelling. POs utilized storytelling to share relationships, identify impact and cultural similarities from Cherokees history and to preserve the cultural heritage of the different sites. For example, participants appeared nonjudgmental as they shared a story to gain new insights to problem solving. Findings indicated and supported comparing and contrasting different elements of earlier communities among the Mountain Man Trail, historic roads, castle architectural history including archeological and Taos pottery finds at the property used storytelling. The study confirmed shared stories improved participants TL as it supported reflexivity. This study used narrative analysis to understand how the story conveyed meaning to participants. Findings indicated and POs noted that participant's shared stories to solve disagreements rather than argued to advance ideation. This interaction added a higher level of engagement as participants related to each other and shared experiences such as from attending the field trip. I concluded that shared stories advanced curiosity, imagination and communication which supported TDL and knowledge integration. Story telling advanced participants' willingness to express ideas.

Reflections and Lesson Learned

As the saying goes if you ask 10 people the same question you are going to get 10 different answers. Post charrette I plunged headfirst into project evaluations. I revisited charrette outcomes supported by conversations among professors and ranch staff each offering additional insights while championing future plans. Central ideas and reflections garnered are shared as I believe they offer information and insights to others pursuing TD research leading to TDL, TDM teaming and TL or when implementing charrettes in similar studies.

> Contemplation is not the opposite of thinking, but its complement. It is not the emptying of the mind of thoughts but the cultivation of awareness of thoughts within the mind. (Barbezat & Bush, 2014, p. 123)

Pre-charrette I concluded ways for participants to make meaning from their experiences. Post-charrette I had time to reflect and review how the study was designed. I began this study with the view that charrettes are a unique feature of TD collaboration and the charrette process is an intense interdepartmental partnership. I understood that TD and charrettes go beyond the customary pedagogical and assessment techniques utilized in individual courses. I believed that to implement TDL using a charrette model would require the understanding of a common language, bridge building, and development of beneficial connections among departments and disciplines. I learned that TDL requires universities to acknowledge and address roadblocks that TD research challenges for those in academic careers.

Post-charrette findings indicated at various points in time participants appeared lost and frustrated when receiving/sharing ideas among disciplines. Challenges surfaced when participants swam in unchartered waters of non-discipline knowledge and life skills. I concluded that this study identified aspects of how participants interacted. Video review was most interesting as I watched how participants revamped and regrouped repeatedly to be able to discuss how they might reframe an idea to solve a problem. Conversations moved from frustrated to excited; at times participants appeared surprised by some ideas believing others simply would not work.

I observed teams challenge one another's ideas and looked to the "experienced" for answers. I noted T3 called upon T4 POs to settle disputes perceived by other teams as the most knowledgeable. This observation supported pre-charrette survey responses and made me

question what participants might perceive as psychological safety associated with life skills and knowledge between the two POs, supported by T4 students. Participants had choices to their approach and how that approach affected their attitudes when working among differing disciplines. I observed early on T4 POs set ground rules for sharing ideas. They build mutual respect, trust, and interest within their team. One participant appeared to become annoyed and physically left T4, later rejoining and sharing new and supportive ideas that challenged the team to further innovation. I watched as no one verbally attacked or belittled the student who left rather supported their desire to do so and actively questioned/supported their return versus being shut out. This atmosphere of psychology safety was addressed and defined by the POs early Day 1. This behavior and expectation supported the student by openly listening to newly discovered knowledge; TL occurred as this individual shared information advancing the team through a recursive phase. The team revisited, collaborated, then updated each other on what transpired during part and parcel periods.

Despite applying what I believed was the appropriate sampling plan for participants, the study was impacted by the inability to control the environment, and to secure content expert contributions due to conflicting obligations. This study experienced a significant loss when injury changed the health status of a key participant prohibiting attendance; the loss of this key stakeholder snowballed into loss of volunteers, as their involvement correlated to his contribution. In other cases, participants failed to show while others were impacted by finances, the loss of the option to attend virtually, a two-day snowstorm along the Front Range impeded travel and contributed to this study's challenges.

Reflecting on charrette activities I discovered one of the most important utilizations for this tool was the shifting from teacher driven to student driven learning. Findings indicated teams

had a clear understanding of expectations and abstract outcomes of the project. Participants appeared positive about personal and team contributions including the project framework. I found individuals, teams and PO personal interactions and knowledge transfer/integration fit within TDL and supported the team's mission, vision, and values. POs early observations indicated teams were involved in the collaboration process with each participant clear and able to define tasks. Participants communicated honestly with each other; individuals appeared excited about the project. I perceived teams to be interested in change and each undertook creative thinking and problem-solving, bantering, and posing possible solutions. Participants were competent and all teams shared appropriate skill levels and discipline knowledge to have informed conversations with each other, PO/FOs.

TDM teaming provided numerous opportunities for participants to identify and bridge new knowledge with existing skills and experiences; this advanced participants TDL to get the most from shared experiences. Beginning with the field trip, the TDM provided participants a safe environment to collaborate and discuss the project. Identified were differences between "picture" and "letter" language and how individuals observed and connected with their surroundings. TDL environments focused on the exploration of reading, writing, translating, communicating, investigating, and exploring prior experiences and skill sets; it placed individuals in the role of teacher among team participants. Participants experienced an uncommon approach to knowledge acquisition and learning and were able to synthesize new information by interactions. As Moss (2003) described collaboration, citing Dewey as "collaboration is an attempt to create learning environments that reflect learning as it exists in the real world and to create in the classroom a place where the student lives" (p. 20).

Reflecting on the Cherokee study I concluded this study lacked leadership and organization by absence. I determined this was the biggest factor that affected non-participation among additional disciplines and attrition. I believe additional higher education collaborators, and non-academic professionals are required for future studies; this also demands other planning/recruiting by the researcher. Ongoing relationship building among diverse colleges, disciplines, educators, and community members/stakeholders is critical to TD development and charrettes especially when implementing community development aspects. My recommendation would be to allow 6-8 months for development and recruitment in the study proposal. With that in mind it is imperative that researchers implementing TD and/or TDM charrettes who desire/require participation among educators, industry experts, students, and stakeholders, all with competing time commitments and challenges need to be aware of conflicting obligations such as student competitions and/or semester travel. I concluded this was a required courtesy to afford colleagues, non-academic professionals and communities planning time.

Looking back, I found it interesting that participants believed, and proposed, K-12 educators and college professors needed to develop their own programs, course work, and assessments using the site. I concluded that Cherokees education director, or someone in a similar role, needs to conduct a needs analysis among educational and private sector professionals then interview individuals to solicit needs. Interpretations made this the jumping off point to develop programs and study materials, including assessment metrics to support needs for use by potential clients. This would be similar to the process completed by TwHP or other public educational programs, such as zoos, art museums or live/learn labs. Having an TD project and presentation ready before approaching professors and universities was invaluable for both studies.

Lessons Learned

At the highest level of learning sits TD, described by Meeth in *Beyond the Boundaries* as, "Whereas interdisciplinary programs start with the discipline, transdisciplinary programs start with the issue or problem and, through the process of problem solving, brings to bear the knowledge of those disciplines that contributes to a solution or resolution" (as cited in Moss, 2003, p. 6). Researchers have worked across disciplines for decades; and most colleges require undergrads to take at least one community development or sustainability course. I read numerous books and articles on TD and what I learned was that while there has been a shift toward TD both within academia and beyond, little has been done to address how to model research design strategies.

Looking ahead from the rear-view mirror I would adapt and recommend future researchers consider several modifications before tackling TD research. Consideration needs to be given to areas of communication, especially training and ways to support participants as TD teams experienced and were required to deal with tensions, disagreement, and confrontation at different times. Disagreements advanced discovery often leading to solutions. Research revealed numerous methods and programs for navigating conflict and confrontation, and I recommend future studies address ways to handle such prior to TD work with students, PO/FOs, and stakeholders. Teaching and learning ways to address these areas are important life skills/lessons. I learned TD and charrettes are invaluable methods to practice these lessons.

TD required ongoing learning adaptation and recursive actions as both were required to deal with unplanned situations and findings. I realized that TDM teaming to effect TL is at times a difficult process to implement. Similar to charrettes, TD projects require a wide variety of communication approaches often using websites, social media, virtual environments/meetings,

conference calls and numerous on-site or FTF team meetings. Both the XQ and Cherokee charrettes showed that participants were asked/expected to learn and implement new technologies to be successful. TL required participants to communicate and share individual knowledge and skill sets among transdisciplinarians while working in an uncertain, unpredictable and at times on an unfamiliar project in an ever-changing environment.

What I learned is that TD research can be costly resulting in one's decision to avoid this methodology. It can be time consuming, however knowledge learned from collaborative processes using a charrette model can provide particular strengths in capturing differing insights from participants. I concluded what proved beneficial to teams was data collected during the field trip. This information was utilized to address site needs. Implementation of Google Maps to advance visual associations and support among independent sites, offered options to explore the whole property in a 'big picture' view. I developed Galaxy Maps to support participants and POs as they openly sharing opinions and recalled information, which often conflicted with information from data sources; this tool resolved more conflicts than words along could have done.

This study implemented technology as resources and tools, such as Google Galaxy Maps, which optimized learning and blending unknown technology with traditional collaborative models. Hybrid learning when combined with traditional and TD methods allowed participants to increase content knowledge aligned to project goals. At times participants received contradictory information. A hybrid learning environment worked well for participants and proved to be a valuable tool for locating conceptual and plan information. I watched participants using the binder information connecting site plans to field trip notes and when sharing experiences from outside university classes. Not completing the pre-charrette read delayed early

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ideation and collaboration as finding, sharing, and analyzing this data needed to be completed during the charrette. Having access to technology teams employed multiple search engines for data; I concluded this access was beneficial to team success. I watched as participants questioned POs and listened as team communication developed among participants. Individuals moved inter-team and I observed POs collaborated, searched for answers, and shared life skills. Having 'insiders' proved both challenging and beneficial as depicted when T2 PO (DS) accessed to ranch archives to locate updated information, then willingly shared data with all teams.

Participants were able to pursue individual goals as they implemented a recursive framework to fill knowledge gaps. Both models expanded and reshaped learning experiences. This study placed participants front and center, responsible for their own learning and knowledge acquisition when solving an unknown problem. It placed the onus on individuals to describe, summarize, apply, and analyze information. As guardians of new knowledge, they had to share and transfer ideas and findings, often negotiating personal perspectives. Hybrid learning forced participants to adapt, integrate, modify, and prepare information through interactions. Participants intersected individual and discipline content development, then implemented newfound knowledge to compare ideas, assess and make choices from collective evidence. It often required looping back and rewriting, merging new information with existing.

Differences, both in learning and communication styles, among participants between Cherokee and XQ were not observed as significantly dissimilar, rather timing and length of preparation and development of both were judged to have played major roles in outcomes. Aspects considered included pre-charrette preparation, recruitment, event duration, and time provided outside charrette for research, team development, and presentation proposal development. I conclude not all charrettes should be graded experiences rather implemented to

advance TDL, knowledge transfer shared to advance TL could be realized. When implemented

for a course TDM charrette's students could earn a Pass/Fail assessment, with participants

evaluating self and each other within their teams. Research showed that allowing participants to

self-assess their own and team members work/contributions (mastery and performance goals),

students could increase content knowledge outcomes and improve collaboration while teaching

cooperation and negotiation skills; all necessary for 21st century learning, and professional

development (Demore, 2017; McMillian, 2008). Demore stated:

> Research shows that student self-assessment can be a valuable tool in increasing student metacognition (e.g., Flavell, 1979; Lambert, 2000; Lifford, Byron, & Ziemian, 2000; Peverly et al., 2002), and gaining assessment skills seems to directly correlate to an increase in metacognition skills (Vacca, 2002). (p. 26)

I walked away with was an understanding that we all think, learn, and transfer ideas,

share experiences/knowledge and make observations in different ways. Participants utilized skill

sets and "big picture" thinking differently, yet when placed in unfamiliar surroundings with

unknown individual's each approached the project in similar ways. Early on I learned that for

architectural design and construction students' lists create personal learning roadmaps. As

participants navigated through project ideation using design thinking skills, I observed teams had

trouble working outside academic norms, without a set of predefined instructions and projected

outcomes. I learned that check lists are perceived as providing participants a safety net, but they

support and serve as a basis for students to develop early discipline knowledge, moving from an

often-isolated single-discipline perspective to crossing boundaries with conversations that

advance learning. I did not observe the same struggles from other discipline participants when

presented without specific directions. For example, I discussed the implementation of

"biomimicry" during the field trip, post-charrette I asked 3 design students why they did not

mention or consider this approach; each responded "it was not on the 'list' you mentioned during

the charrette. This further supported a need for learning in TDM teams as other disciplines may

have been more familiar with this concept and shared it. Sue McGregor (2013) aptly described

the need for TD and Biomimicry defined by nine principles of the characteristics of ecosystems,

relevant and adaptable to most TD projects,

1) Rewards cooperation and integration and makes symbiotic relationships work because nature is all about connections between relationships. Always fits form to function…the shape something takes depends upon what it is intended to do…nature's designs are organic and only as big as they need to be to fit their function, rather than being linear (squares and blocks), and oversized, with a focus on form.

2) Always fits form to function…the shape something takes depends upon what it is intended to do…nature's designs are organic and only as big as they need to be to fit their function, rather than being linear (squares and blocks), and oversized, with a focus on form.

3) Depends on and develops diversity of possibilities to find the best solution(s) (rather than a one-size fits all, homogeneous approach).

4) Recycles and finds uses for everything…a system must be as diverse as its environment in order to remain viable. Systems represent regional, cultural, and material uniqueness of a place.

5) Requires local expertise and resources…natural ecosystems are tied to the local land; hence, sustainability requires reliance on local expertise and indigenous knowledge.

6) Avoids internal excess and "overbuilding" by curbing excesses from within. Nature has no ego to drive it.

7) Taps into the power of limits and manages not to exceed them…Nature teaches us to flourish within boundaries.

8) Runs on natural sunlight and other 'natural resources" of energy, such as the wind.

9) Uses only the energy and resources that it needs. Nature draws on the interest rather than the entire natural capital at its disposal. (pp 59-60)

Future Research and Recommendations

I concluded that both XQ and Cherokee studies identified and provided steps toward

improvement for future research. For example, pre- and post-charrette surveys allowed

participants to move ahead without answering a question, this created missing data, limiting

results. Of the participants who attended the Cherokee charrette three completed responses to all

questions on either of the pre and/or post-charrette surveys; I realized this choice/option impeded a thorough analysis of findings.

Post charrette I concluded when using the LSI, it is best completed during class times when permitted. My interpretation from literature and charrette activity identified 3 possible future research questions, followed by future study recommendations. Questions were:

1) What experiences are most likely to identify discipline knowledge sharing and project contributions for students from other disciplines?
2) How do students articulate discipline knowledge and identify the value of such knowledge, adding life skills and personal experiences?
3) What experiences, evidence and factors supported TD teams as participants shared discipline knowledge and developed project proposals relative to what single disciplines might have produced?

Findings, and personal experiences, indicated if using a charrette model, individuals who know each other prefer to work and sit together in class or at events. By allowing participants to self-select I concluded ideation and creativity can be impacted, by group think. To eliminate this as much as possible I recommend FOs pre-select teams either using the LSI or strictly by disciplines. A week before the charrette I would hold a kickoff event, each table would be assigned a number. Upon arrival attendees would be given an envelope, they could sit wherever they wished. After sharing the project overview, I would ask attendees to open the envelope then to move to identified tables. None would know why or the reasoning behind this change, but this I would be a fun way to introduce teams and could start early team development. This process and event would be video/audio taped and shared at the post charrette event and reception to share how teams are formed and trust was developed.

This study provided a starting point in the explorations of transdisciplinarity and transformation using TD charrettes. Several areas not explored in this study could be addressed in response to the findings such as a comparison between FTF and online TD teaming challenges coupled with a deeper exploration of TDL in relationship to TL. Specifically, participants had no

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initial perceptions that their participation would/could be transformative. An examination of TL and how that transformation affected individual academic and/or personal pursuits using firsthand experiences could advance future research. Similarly, it would be informative to assess PO/FO, educators, and non-academic stakeholders and how their engagement can advance/influence TDL, TDM teaming and TL, including exploring more deeply the challenges of building relationships and bridging knowledge gaps.

McGregor and Volckmann (2011) discussed TD research concepts at length and highlight the need for university wide support, especially during recruitment. Post-charrette findings confirmed that future research requires expanding the option for participants to attend virtually. This supports findings that this approach opens the door to a larger sample from among diverse disciplines. It further supports busy content experts the option to attend and still work; hopefully providing new and different perspectives among FTF participants. The loss of participants from different disciplines hindered the study from achieving fully the desired aim and objectives for data collection from team formation. The lack of representation limited the outcomes of the charrette; thus, the findings of the study cannot be generalized. Each of these limitations could be overcome by spending additional upfront time building TD relationships among colleges/disciplines. A larger budget secured with grant or research funds might have helped defray participants costs for parking and travel or in my opinion by moving such studies to a campus TD course where students address one problem over the entirety, of no less than 6-8 weeks of a semester load. Additional support from among disciplines and departments (community, private sector, and professors/graduate students) and incorporation of multiple campus/universities including via online environments might have increased recruitment and retention. I listened as each team spoke of the need and desire to express individual ideas and

points of view; 4/8 students bemoaned missing discipline knowledge outside their own, while they continued to develop ideas, using technology and the binder materials coupled with oral histories or assistance from PO/FOs. Ideation did not stop, rather adapted to what was known to participants versus expanding innovative concepts.

Looking back, I concluded I would adapt the study by expanding the number of participant and non-participant observers for each team, maintaining 2 Facilitators. I would use the same number of observation forms but change how and who collected data. POs would become active participants roaming among all teams versus being assigned a single team. This method would support NPOs in data collection by not being required to be active participants. Their focus would be solely on data collection and they would not be permitted to interact, ask questions, or offer input/feedback to teams. I believe this revision would make participation more interesting for observers. I would meet 1 hour each day with NPOs after the charrette ends to collect data, answer questions, and formulate possible questions for team presentations. This would provide a review of possible questions to be finalized while teams prepared to present. By not asking questions I believe this study missed an opportunity to close the circle on assessments and experiences.

I recommend, and this research supports, another study with a larger and more diverse groups among disciplines as this may give new insights into the development of using regionally sited historic properties, community development, and charrettes. Further exploration has the potential to lend additional resources for others comparing TL among TDM teams, POs, and stakeholders. Most importantly securing university wide support among departments and professors might offer additional insights into TD and how each discipline approaches TL and transformation.

To this I would add and strongly recommend expanding a study to include and support the adaption among virtual and FTF transdisciplinary environments as I truly believe the outcomes may far outweigh the challenges. This I believe would lead to new findings and opportunities as educators could utilize TD to advance 21st century skills, cooperation, collaboration, and understanding among diverse environments, cultures, and projects.

Epilogue

Post-charrette interpretations and reflections of this experience supported my beliefs this study was a successful exploration of imperfection; like a road it experienced twists and turns, ups and downs, dead ends, and detours. It survived challenges and disappointments, success, and failure, yet it and I arrived unscathed at the destination. My roller-coaster holds tears and laughter, at times ready to chuck it all and walk away; other times screaming from the roof tops how exciting this experience was. Through it all I remained focused; determined to complete this journey.

I approached research using issue or problem centered methodology. This approach transcended disciplinary borders and led me to TD; it opened an entirely new research pathway to produce knowledge-building practices among charrette participants. Working among disciplines and non-academic stakeholders I was better able to visualize and understand how each related to the other. I explored and created an environment for students to start communicating among disciplines; it supported how they used new skills and knowledge, coupled with personal experiences to expand deeper collaboration. This led them to transformative learning. I learned that TD supported my desire to work outside disciplinary tools alone. Using a charrette fostered resources and a holistic approach to knowledge building developed because of an emphasis on idea generation. By sharing knowledge among disciplinary

borders and as I developed research framework, I was able to move forward in multiple ways. By working outside a disciplinary silo, I was able to learn and use additional tools and resources, such as GIS and Liquid Galaxy. I learned new ways to apply personal and life skills knowledge to teaching. By using additional tools, such as field trip and Liquid Galaxy, I was able to explore research from more diverse perspectives, and as research collaboration shifted, I was able to re-assess tools as well as criteria for evaluating results.

There were challenges when working with TD and charrettes. First, was how to move from more traditional quantitative methodology to executing narrative to support the studies creditability. Even more challenging was trying to finalize a means to share findings from multiple approaches. Having collected a large data base from among multiple forms that covered all areas of observations I struggled with what to include, what to let go and how to cover it all. Every twist and turn of this study opened a new avenue of exploration. I struggled with the many different approaches available to expand topics and questions rather than limiting them. I was challenged to make choices and while some agreed others did not, so the struggle to adapt work to the voices of many varied to a large degree. I was compelled to consolidate and generalize. I found the problem with generalizations are they don't apply to specifics. Each discipline offered unique but limited perspectives to the problems posed by research questions. I discovered this approach embraced differences among disciplines rather than limit them.

The upside for me was that by merging different perspectives among discipline practioner's I was able to forge coalitions and collaborations across disciplinary and geographic borders. Participating in the XQ School of the future challenge, which is now being planned, was topped by meeting, and working with Fritof Capra, convinced to join XQ by dear friend and fellow bubble thinker Fu-Tung Cheng. I was left humbled by their enthusiasm and support.

Being invited and joined by Dr. Rubinson to present TD to a group of graduate students and professionals at ASU in Tempe, was the SPARK I needed to support belief this study was on the right track. I experienced the passion and knowledge shared among this group as Day 2 we joined a team and shared our discipline perspectives to a cohort; none with my professional background and among few bubble thinkers. They welcomed my vision and listened as I jumped from topic to topic moving sticky notes from one box to another. I am sure I frustrated the engineers as they shared ideas and solutions in a linear model; a way of seeing that has always challenged me. By participating in shared events, I was better able to address my own research while acquiring new perspectives from other educators, participants, and stakeholders. Many PhD candidates, and newly hooded PhDs I've spoken with say they wonder if their work will make a difference; many of us will not know how or if our efforts changed approaches or even see the fruits of our labors come to fruition.

Findings from this research supported TD project models and shared how TD can enhance students' and stakeholders' abilities to gain and integrate new knowledge and effect TL. I share this journey as a roadmap to support other researchers and educational practitioners planning to implement TD and assessments using charrettes, students, and multiple stakeholders. Many of these resources provided jumping off points for exploration. I learned the wheels are always moving in the TD world and much has occurred since I began this study, a brief overview and project/program updates are below.

1) XQ announced team winners of the Super Schools, adding three additional partial awards for exceptional projects; sadly, out team did not win.

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2) Montbello High School is an ongoing venture with Denver Public schools currently holding open invitations to present ideas for revamping the site, either renovation or new construction.

3) The XQ bus continues to travel across the states; adding new ventures to their existing programs; this researcher was interviewed in Denver, CO by the XQ team on educational ideas and our project.

4) I presented a poster at the Colorado State University School of Veterinarian Medicine Conference, Consortium of West Region CVM (July 12th – $14^{th,}$ 2017); sharing a short communication presentation titled: *Transdisciplinarity (TD): Dissolving Boundaries Between Conventional Disciplines – Learning Around the Construction of Real-world Problems.*

5) Ongoing collaboration with CR & CF; early project planning and collaboration with Temple Grandin, PhD, to implement her cattle handling system onsite at the ranch (opened Spring 2020). I attended a cattle handling lecture and hands on session by Grandin and Curt Pate.

Over this journey mentors and colleagues showed me how to merge global perspectives in a rapidly changing world. All have supported my belief that TD is a promising research methodology and way of producing knowledge and decision making to advance personal and professional transformation. These experiences were vital to research and supported many challenges, from moving out of state to tackling health issues. I rarely felt I was standing alone. I leave this journey with an appreciation for everyone's viewpoints and learned that roadblocks led to bridges, that TD and transformation are not in or out, yes or no propositions in academia, business, or life.

I recently read an article by newly minted PhDs on their dissertation experience; I found myself laughing, nodding, and at times screaming in agreement. The authors shared frustrations of the ongoing technological learning curves, tables, lists, fonts, references, spelling, editing, double checking. They discussed 'A Road Less Travelled' as both were 100 miles away from campus, I completed this journey 1200 miles east of Colorado. Others took jobs ABD and put their dissertation on hold for 18 months or more, losing interest and momentum. Reflecting on the late nights, early mornings, events, and holidays missed, family and friends put on hold. I related to their journey and have experienced all of these challenges along the way. Onofrey and Day (2004) talked about balancing obligations, juggling relationships, and working with your advisor to be accountable, while organization was touted as the key to success; all of this was true for me.

My personal journey continues here…I have come full circle. I concluded this experience with hope and excitement that time to utilize this knowledge, research, and build upon findings, and when the ink is finally dry, and all the papers signed off I can start a different journey. With a laugh, smile and hope I am checking out of what friends and family call *The are you ever going to be done Hotel*; returning to my beloved wildlife, forests, and mountains to reflect and rest momentarily as I search once again for that *SPARK* to ignite and inspire. Final thoughts come from something I share with every student and fellow learner. Every journey begins with a spark and continues with determination, peppered with fear, supported by love; these words live in my head, spoken to me in the voices of mentors …

"Come to the edge," he said.

"We can't, we're afraid!" they responded.

"Come to the edge," he said.

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"We can't, We will fall!" they responded.

"Come to the edge," he said.

And so they came.

And he pushed them.

And they flew."

Christopher Logue (1969, p. 65)

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APPENDICES

XQ School of the Future Challenge – Student survey

Q1.12 I have _____ students are in my class. (Fill in the blank)

Q1.13 Have you ever repeated a grade?
           Yes, If yes type what grade below (1)

           No (2)

Q1.14 I attend the following type of school. Choose all that apply.
           Public School (1)
           Charter School (2)
           Innovation School (3)
           Faith based school (4)
           Green and/or Sustainability School (5)
           Magnet School (6)
           Arts School (7)
           Technology School (8)
           Other (9) _____
           Do not know (10)

Q1.15 How many students are in your school_____ (fill in the blank).

Q1.16 My school has _____ (fill in the blank).
           Kindergarten to high school students (K-12) (1)
           Middle school students (6th to 9th grade) (2)
           High school students (10th to 12th grade). (3)
           Other (4) _____

Q1.18 What do you wear to school? (check one)
           Uniforms with my own shoes, of any color and style (1)
           Uniforms with only black or brown shoes (2)
           We don't' have uniforms at my school (3)

Q1.19 I start school at _____time every day (am is in the morning).
           7:30am (1)
           8:00am (2)
           8:45am (3)
           Other (4) _____

Q1.20 I end school at _____time every day. (pm is in the afternoon. noon is 12:00pm and midnight is 12:00am)

        3:15pm (1)
        3:30pm (2)
        3:45pm (3)
        Other (4) _____

Q1.21 If I were the principal of my school, we would start school at_____ and end school at_____. Complete and explain why.

        at 9:00am and end at 5:00pm (1)
        at 9:30am and end at 5:30pm (2)
        10:00am and end at 6:00pm (3)
        Other (4) _____

Q1.22 I think my teachers like their job?

        Strongly Disagree (1)
        Disagree (2)
        Neither Agree nor Disagree (3)
        Agree (4)
        Strongly Agree (5)

Q1.23 I like school?

        Strongly Disagree (1)
        Disagree (2)
        Neither Agree nor Disagree (3)
        Agree (4)
        Strongly Agree (5)

Q1.24 School is a place to hang out with my friends.

        Yes (1)
        No (2)

Q1.25 School is a place to make new friends.

        Yes (1)
        No (2)

Q1.26 School is helping me be a better person.

        Yes (1)
        No (2)

Q1.27 I get bullied at school.

        Yes (1)
        No (2)

Q1.28 School is a safe place for me.
        Yes (1)
        No (2)

Q1.29 School helps me learn about others who are not like me.
        Yes (1)
        No (2)

Q1.30 School helps me develop and expand my interests.
        Yes (1)
        No (2)

Q1.31 School helps me learn about myself.
        Yes (1)
        No (2)

Q1.32 School helps me be creative.
        Yes (1)
        No (2)

Q1.33 School helps me be curious.
        Yes (1)
        No (2)

Q1.34 School helps me make decisions and choices.
        Yes (1)
        No (2)

Q1.35 My school has community service as a requirement.
        Yes (1)
        No (2)
        Do not know (3)

Q1.36 My expectations for school are_____ (Complete the sentence).

Q1.37 My teachers take the time to get to me know as a person.
        Strongly Disagree (1)
        Disagree (2)
        Neither Agree nor Disagree (3)
        Agree (4)
        Strongly Agree (5)

Q1.38 People, other than my teachers, who work at my school know who I am and call me by name. Choose all that apply.

Other teachers (Identify) (1)

_____

Principal, assistant principal (2)
Secretary (3)
Coaches (4)
Counselors (5)
Dean of students (6)
Librarians, paraprofessionals, etc. (Identify) (7)

_____

Cafeteria and maintenance staff (8)

Q1.39 School is _____. Complete the sentence
Not at all Important (1)
Very Unimportant (2)
Somewhat Unimportant (3)
Neither Important nor Unimportant (4)
Somewhat Important (5)
Very Important (6)
Extremely Important (7)

Q1.40 My school is _____. Complete the sentence. Check all that apply.
Interesting (1)
Fun (2)
Challenging (3)
Boring (4)
Meaningful (5)
A positive environment (6)
A negative environment (7)

Q1.41 My favorite things about school are_____ (complete the sentence).

Q1.42 I prefer to learn_____. Complete the sentence
Alone (1)
In a team (2)
A combination of both (3)

Q1.43 I have _____homework to do daily
30 minutes to 60 minutes (1)
61 minutes to 90 minutes (2)
More than 91 minutes (3)

Q1.44 Homework assignments help me better understand my class work
          Strongly Disagree (1)
          Disagree (2)
          Neither Agree nor Disagree (3)
          Agree (4)
          Strongly Agree (5)

Q1.45 I earn money by _____ (complete the sentence).

Q1.46 I work outside of school and home_____ (finish the sentence)
          Weeknights, after school only (1)
          Only weekends (2)
          After school and on weekends (3)

Q1.47 What are the average number of hours a week you spend earning money
_____.
          0-10 hours a week (1)
          11 to 15 hours a week (2)
          16 to 20 hours per week (3)
          21 to 30 hours a week (4)
          more than 31 hours a week (5)

Q1.48 If I had the opportunity to work at my school, I would choose to do that rather than work somewhere else.
          Yes (1)
          No (2)

Post-charrette Survey

Q1 I participated in the XQ School of the Future Charrette on Saturday, November 14, 2015 as_____ (Check all that apply).

        a High School Student (1)
        an Interior Design college student (2)
        a Construction Management college student (3)
        a XQ team member (4)
        an invited guest (Please identify your role below) (5)

_____

Q2 I participated as a team member with Pod_____.

        Pod 1: Entry/Lobby (1)
        Pod 2: Live/Learn Lab (2)
        Pod 3: Cafeteria and Test Kitchen (3)
        Pod 4: Green House and Community Gardens (4)
        Pod 5: Library and Hollow Deck (Technology Center) (5)
        Pod 6: Amphitheater and Arts Lab (6)
        Pod 7: Life Skills and Restorative Justice Center (7)
        Pod 8: Temporary Student Housing (8)
        Pod 9: Service and Animal Assisted Therapy Center (9)
        Pod 10: Medical Center (10)
        Other (Please identify your role) (11)

_____

Q3 I have participated in a charrette before. If yes, please specify when, where, the focus of the charrette and what role you played as an attendee).

        Yes (1) _____
        No (2)

Q4 What was the most positive aspect of the charrette in your opinion (Check all that apply)?

        Learning to work in a team (1)
        Working with high school students (2)
        Working with college students outside of my discipline (3)
        Experiencing a real-life project (4)
        Learning about the design process and what a charrette is (5)
        Being able to use what I am learning in school (6)
        Being able to share my experiences about what I think schools should be like now and in the future (7)
        Other (8) _____

Q5 The most challenging part of the charrette for me was_____
(Check all that apply).

        explaining my concepts to others (1)

        understanding and answering the on-site Challenges given (there were 3
challenges given during the charrette) (2)

        working with others not in my field (3)

        not having enough information and/or content in my charrette binder to create a
school (4)

        technology problems (5)

        not being able to get enough time with the XQ team or other experts when I had
questions (6)

        working on a team (7)

        Other (8) _____

Q6 There was enough time allowed for meals, breaks and collaboration? (If other, please
explain)

        enough time (1)

        not enough time (2)

        too much time (3)

        Other (Please explain) (4)

_____

Q7 If this charrette were to be held again, what three changes would you suggest making it
more effective?

Q8 The charrette proved to be a valuable learning experience for me. (Choose one)

        Strongly Disagree (1)

        Disagree (2)

        Neither Agree nor Disagree (3)

        Agree (4)

        Strongly Agree (5)

Q9 The time for the charrette was _____ (Complete the sentence).

        too short (1)

        too long (2)

        exactly right (3)

Q10 I am interested in joining the XQ Team and continuing with this project as: Check all
that apply

        a collaborator, this position requires approximately 1-2 hour monthly, to share
ideas designs, concepts and/or review of documents; requires Internet (1)

        a team member, this position requires the largest time commitment,
approximately 4-8 hours monthly to meet with other team members to finalize our proposal and
to assist in writing some of the proposal; may attend via SKY PE etc. (2) an outside expert, this

position requires approximately 1- 4 hours monthly to review specific aspects related to your expertise while the final proposal is being written; requires Internet (3) Other (Please specify your life skills and what you wish to do) (4)

_____

Q11 Other feedback that you would like to share:

_____

The XQ School of the Future Team wishes to thank you all for your time, commitment, and participation in this charrette. It would not have been possible to move this challenge and contest forward without your assistance. Below is a copy of the XQ Team approved resume description for your use. Our recommendation for use on a resume is to create a heading titled "Leadership Positions" or "Conference Attendance" or "Skills". We believe any of these areas would high lite your participation.

 Resume: Montbello Conservatory of Expeditionary Learning: Design Charrette Participant Saturday, November 14, 2015 Aylesworth Hall, "d Lab" at Colorado State University.

 I _____participated as a _____ (fill in your role, i.e. Interior Design Student) member of a design charrette; a day long working design and development project about the challenges and opportunities faced when creating a new kind of school located in the under-served, minority community of Montbello, Colorado. The purpose of the charrette was to solicit input for the design and development of physical learning spaces that includes community members, health services, and experiential learning for a K-12 school of the future. The charrette focused on innovative, expeditionary, and experiential education programs, including design and construction concepts for a 10 Pod campus facility that would improve the quality of life, education and employment for K-12 students, educators, community members and stakeholders.

Letter of Introduction

September 27, 2016

Cherokee Ranch and Castle Board of Directors

6113 N. Daniels Park Road

Sedalia, CO 80135

Phone: 303.688.555

Fax: 303.688.1170

Dear Ms. Clark, Mr. Holmes, and Board Members,

Please allow me to introduce myself, Debra Domres and my associate, Daniel Raggi. It is with great pleasure that we have been invited to Cherokee Ranch to share and review a promising collaboration. A few weeks ago, we met, quite by accident, your amazing staff and Mr. James Holmes, your Executive Director. Our conversations revealed mutual interest in the property and today we wish to share with you a vision. We began with the following statement:

> *"At Cherokee Ranch & Castle we change lives by taking you from*
>
> *the here and now to the long ago and far away…one project, one habitat, one*
>
> *experience at a time."*

I am a PhD Candidate in the School of Education at Colorado State University, with a specialization in Learning, Teaching and Culture. I hold a MS in Sustainable Construction Management and bachelor's in communication and Public Affairs. My current research is interdisciplinary crossing the fields of education, historic preservation, sustainability, and ecology. I am currently collaborating with Daniel Raggi, who serves as my field expert and research associate. Daniel is an ISA Certified Arborist and has extensive landscape and horticultural experience.

My background includes K-12 Charter School development, most recently building a team to participate in the Lauren Jobs, 10 million dollar, XQ School of the Future Contest; placing in the top fifty. While our efforts and scope were too massive for this arena, we

discovered that K-12 transformation comes slowly, however our yearlong grant writing afforded us the skill set necessary to pursue additional curricula and program development following closely to Tweets original mission. This is where James and we met…a passion for all things Cherokee!

While talking with James we hit upon my construction background coupled with my Interior Design instruction at CSU. The conversation quickly moved from historic restoration to touring the property whereby Daniels passion for ecology and landscapes became apparent. A follow up visit and tour allowed us to ascertain opportunities for a mutually beneficial collaboration.

Subsequent conversations with James spurred us to pursue interest on campus from professors, students, and ancillary staff. To date we have interviewed Directors, Professors and internship developers while seeking support for proposed first steps, including painting the barn, hosting a spring break design charrette, and collaborating on a potential summer internship program whereby a team of interdisciplinary students would have the opportunity to live on site at Cherokee while restoring the Homestead assets. In fact, Monday afternoon Daniel and I presented to graduate students in the Construction Management program; our presentation was well received while generating interest in Cherokee Ranch. Professors from education, landscape and urban design, historic restoration and construction management have expressed enthusiasm in supporting us while we create a Cherokee partnership. It is in this sprit that we come to you today.

Moving forward we wish to address a number of action items and to craft a Memorandum of Understating (MOU). I am currently crafting an Institutional Review Board (IRB) protocol and MOU with Colorado State University and my graduate committee to further advance our mutual interests. Action items and dates for projects need to be established rapidly addressing the following areas:

1) MOU to be finalized no later than October 23, 2016 for submission to IRB
2) Immediately develop timeline and budgets to prep, repair and paint the barn as soon as possible, while seeking volunteer support
3) Develop a 2-day onsite charrette between March 11-18, 2017
4) Create and develop a possible internship for summer students between May and July 2017 for Homestead renovation, including budgets and timelines

As the Principal Investigator (PI) I will be acting as the main point of contract, however, should I be unreachable please contact Daniel, contact information below. Action items and timelines will be further discussed during our presentation, resumes and references will be forwarded under separate copy. We wish to thank you in advance for your time, assistance, and consideration. Please feel free to contact us with any questions you may have. At this time please sit back and allow us to take you from the here and now to the long ago and far away…

Sincerely,

Deb Domres

Deb Domres, PhD Candidate

Colorado State University

<u>Contact Information</u>

Deb Domres

900 S. Harrison Street, #3

Denver, Co 80209

Cell: 303.520.1153

debradomres@comcast.net or deb.domres@colostate.edu

Daniel Raggi

Cell: 631.745.8923

danieljraggi@comcast.net or danieljraggi@gmail.com

CHEROKEE RANCH AND CASTLE

BOARD PRESENTATION
SEPTEMBER 21, 2016

PRESENTERS
DEB DOMRES & DANIEL RAGGI

AT CHEROKEE RANCH & CASTLE WE CHANGE LIVES BY TAKING YOU FROM THE HERE AND NOW TO THE LONG AGO AND FAR AWAY…ONE PROJECT, ONE HABITAT, ONE EXPERIENCE AT A TIME

CHATFIELD BASIN CONSERVATION NETWORK

- IDENTIFIED CONSERVATION, WILDLIFE AND HABITAT CONNECTIONS AS:
  1) URBANIZING/SENSE OF PLACE-ARCHEOLOGICAL, LOCAL HISTORY, STEWARDSHIP, AND RESPITE FROM DEVELOPMENT
  2) ECOLOGICAL, GEOLOGICAL, AND CULTURAL IMPORTANCE OF THE BASIN
  3) RECREATION-CHEROKEE RANCH AND THE BACKCOUNTRY WILDERNESS (PROTECTED AREAS)
  4) INFRASTRUCTURE AND LAND USE
  5) SENSORY EXPERIENCES – TOUCH, SIGHT, SOUND, SMELLING, AND TASTE

WE PROPOSE TO

- DEVELOP PLACE-BASED EDUCATIONAL PROGRAMS FOR K-12, HIGHER EDUCATION AND COMMUNITY GROUPS

- ORGANIZE STUDENTS AND PARTICIPANTS IN A COLLABORATIVE INITIATIVE WHICH FOSTERS SOCIAL CAPITAL WHILE PREPARING THEM TO BECOME ACTIVE PARTICIPANTS IN THEIR FUTURE.

CHARRETTE OPPORTUNITY

CHARRETTE – SPRING 2017 - "THE BARN"

INTEGRATED, OR 'WHOLE BUILDING', CHARRETTES ESTABLISH A CREATIVE ENVIRONMENT FOR IDENTIFYING AND INCORPORATING STRATEGIES THAT RESULT IN PROJECTS THAT ARE DESIGNED AND BUILT TO MINIMIZE RESOURCE CONSUMPTION, REDUCE LIFE-CYCLE COSTS, AND MAXIMIZE HEALTH AND ENVIRONMENTAL PERFORMANCE ACROSS A WIDE RANGE OF MEASURES—FROM ECOLOGICAL RESTORATION TO HABITAT PROTECTION—WHILE ALSO MEETING EXPECTATIONS FOR SECURITY, ACCESSIBILITY, HISTORIC PRESERVATION AND DESIGN OBJECTIVES.

WE WILL COORDINATE A MULTIDISCIPLINARY TEAM CONSISTING OF STUDENTS, EDUCATORS, COMMUNITY MEMBERS, INDUSTRY EXPERTS AND SPEAKERS.

HISTORIC RENOVATION CHARRETTE

Colorado State University and University of Colorado

Historic Restoration of Existing Structures
A Spring Charrette at Johnson Homestead – "The Barn"

Potential Participants
a) College students-graduate and undergraduate
b) College faculty
c) Content Experts
d) Community Members
e) K-12 Educators

POTENTIAL COLLABORATORS
COLORADO STATE UNIVERSITY

- ANIMAL SCIENCES — TEMPLE GRANDIN, PhD
- EDUCATION — CAROLE MAKELA, PhD
- CONSTRUCTION MANAGEMENT — JOHN KILLINGSWORTH, PhD & MEHMET OZBEK, PhD & RON HOLT, ENDOWED PHELPS CHAIR, CERTIFICATE PROGRAM AND STUDENT COMPETITION COORDINATOR
- DEPARTMENT OF FISH, WILDLIFE, AND CONSERVATION BIOLOGY — DELWIN BENSON, PhD
- LANDSCAPE ARCHITECTURE — BRAD GOETZ, MASTER LANDSCAPE ARCHITECTURE
- NATURAL RESOURCE ECOLOGY LAB — GILLIAN BOWSER, PhD
- CULTURAL ANTHROPOLOGY — KATHERINE PICKERING, PhD

POTENTIAL COLLABORATORS
UNIVERSITY OF COLORADO

- ECOLOGY AND EVOLUTIONARY BIOLOGY — MARC BECKOFF, PhD PROFESSOR EMERITUS
- CONSTRUCTION ENGINEERING AND MANAGEMENT — CAROLINE CLEVENGER, PhD
- LANDSCAPE ARCHITECTURE & URBAN DESIGN- ANN KOMORA
- HISTORIC PRESERVATION PROGRAM- CHRISTOPHER KOZIOL, PhD

STRATEGIC PARTNERSHIPS

- National Endowment for the Humanities
- Nature's Educators - Educational Wildlife Programs
- National Trust for Historic Preservation
- The Advisory Council on Historic Preservation
- National Park Service, Heritage Preservation Services
- Colorado Preservation – Endangered Places Program
- Denver Museum of Nature and Science
- US Fish and Wildlife

SERVING THE TRUST

UNDERSTANDING RESOURCES

THE VOYAGE OF DISCOVERY IS NOT IN SEEKING NEW LANDSCAPES BUT IN HAVING NEW EYES.
-MARCEL PROUST

BY BUILDING UPON CHEROKEE'S LEGACY AND SHARING RESOURCES FROM PREVIOUS PARTNERSHIPS THE RANCH WILL BECOME A LEADER AT CONNECTING PEOPLE TO EDUCATION, PRESERVATION AND THE NATURAL WORLD THROUGH INNOVATIVE AND STRATEGIC COLLABORATIONS.

PREVIOUS CONCEPTS & LOW IMPACT ADAPTIONS

PREVIOUS CONCEPTS

A. BUILD NEW EDUCATIONAL CENTER
B. THREE MEETING ROOMS-NEW BUILDING
C. UTILIZE BARN AS BIRD OF PREY CENTER
D. SOUVENIR SHOP & RESTAURANT - NEW BUILDING
E. BUILD A GAME MANAGERS HOUSE

LOW IMPACT ADAPTATIONS

A. ONSITE OUTDOOR LIVE LEARN LAB — ALTERNATIVE STRUCTURES (SAFARI STYLE TENTS — MOVEABLE)
B. UTILIZE REHABILITATED JOHNSON FARM HOME
C. UTILIZE BARN AS CONFERENCE CENTER
D. FARM TO TABLE DINING ONSITE-BARN
E. UTILIZE REHABILITATED JOHNSON FARM HOME AND BARN

POTENTIAL FUNDING

A COMBINATION OF TRADITIONAL CAPITOL RAISING AND NON-TRADITIONAL METHODS SUCH AS CURRICULA BASED SITE IMPROVEMENTS, AND COLLABORATIVE PLANNING AND RESTORATION CAN ALLOW FOR GOAL BASED IMPROVEMENTS AT A LOWER PERSONAL OUTPUT TO THE TRUST.

- GRANTS

- EPA REGION 8 GRANT PROGRAM
- U.S. FISH AND WILDLIFE SERVICE PRIVATE STEWARDSHIP PROGRAM
- LOIS WEBSTER FUND
- COLORADO CONSERVATION TRUST
- GREAT OUTDOORS COLORADO
- DOUGLAS COUNTY SALES AND USE TAX

NEXT STEPS

1) BARN CLOSE UP & PAINTING - PLANNING
2) MEMORANDUM OF UNDERSTANDING (MOU)
3) PRESENTATIONS AT UNIVERSITIES AND COORDINATION OF INTEREST
4) CHARRETTE PLANNING AND DATES

CONCLUSION

A NEW APPROACH BASED LESS ON THE IDEA OF PERMANENT STRUCTURES, AND MORE ON ADAPTABILITY IN FORM AND FUNCTION IS A MORE EFFICIENT AND ECONOMICAL ROUTE TO REACHING THE GOALS OF THE TRUST. LONGSTANDING OBJECTIVES MAY BE LOOKED AT UNDER THE LENS OF PROFITABLE RESOURCES INSTEAD OF AS POTENTIAL EXPENSES. THE FORMATION OF A FORMAL EDUCATIONAL PROGRAM AT CHEROKEE RANCH WILL NOT ONLY FULFILL A CONCEPT PUT FORTH BY TWEET HERSELF, BUT CAN ALSO BE AN INTERESTING AND DYNAMIC RESOURCE IN ATTAINING OTHER IMPROVEMENTS.

QUESTIONS

CONTACT INFORMATION

Deb Domres, PhD
Candidate
Colorado State
University
Deb.domres@colostate.edu
303.520.01153

Daniel Raggi, ISA
Certified Arborist
daniel.jraggi@gmail.com
631.745.8923

THANK YOU

RESOURCES

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Memorandum of Understanding

for

RESEARCH, EDUCATIONAL DEVELOPMENT, LANDSCAPES and HISTORIC RENOVATION

Between

Debra L. Domres, PhD Candidate

and

Cherokee Ranch and Castle Foundation

IN WITNESS WHEREOF, the Parties have executed this Memorandum of Understanding as of the day and year of the last signature indicated below.

By: _____Executive Director

Date: _____

By: _____Researcher #1

Date: _____

By: _____Researcher #2

Date: _____

INTRODUCTION WHEREAS, Debra L. Domres, PhD Candidate ("Deb Domres"), residing at 900 S. Harrison St. #3, Denver, CO, has expertise in Educational Design, Curricula Development/ Delivery, Construction/Project Management, and Interior Design and research associates (2) of her choosing with expertise and experience in architecture, construction, education, ecology, landscapes and horticultural; are interested in developing a partnership with Cherokee Ranch and Castle, a 501c3 nonprofit, located at 6113 N. Daniels Park Road, Sedalia, CO 80135, for the purpose of research, education and ongoing development of educational programs; and WHEREAS, Cherokee Ranch and Castle is an institution with mutual interests to Education, Historic Preservation, Ecology, Landscapes, Habitat Restoration and Wildlife; and WHEREAS, this Memorandum of Understanding ("MOU") will establish a mechanism for the Parties to plan cooperative research and educational activities; and WHEREAS, each Party to this MOU recognizes the unique expertise of the other; and NOW THEREFORE, the undersigned Parties agree as follows:

I. AUTHORITIES

The Parties represent that they are each authorized under Federal and Colorado State Laws to enter into an MOU where such MOU promotes its objectives and mission.

II. STATEMENT OF OBJECTIVES

The objectives of this MOU are:

1. To allow for and to plan collaborative research, educational, and program development activities on the Cherokee Ranch and Castle complex and/or properties and to allow Deb Domres and her research associates access to the grounds and homestead sites, castle and all properties connected to Cherokee Ranch and Castle Complex for program development and/or renovation activities.

2. To allow development of curricula based towards the achievement of long-standing goals of the Cherokee Ranch Trust, which may act as an ongoing and alternative revenue stream.

3. To allow for renovation and/or restoration of protected ecologies, and coordination with regional conservation efforts.

4. To advance and oversee the development of non-permanent and existing structures for use towards educational and research opportunities while addressing the goals of the stated partners (safari style tents).

5. Where appropriate and as mutually agreed upon, too jointly and or individual seek sources of external support to fund planned collaborative efforts.

6. To make available to the Board President, and Executive Director, selected statements of work, those facts, methods, and new findings that are discovered through that research; pending any embargoed information during and until post publication/submissions are completed.

7. To allow the Parties to plan collaborative research, educational, and training activities of mutual interest.

8. To make available to the public, other researchers, and staff those facts, methods and new findings that are discovered through that research, and to share specialized equipment, physical facilities and support services in ways that will expand and provide more cost-effective research and education for the Parties.

III.   STATEMENT OF WORK

Program(s) of Study: Education, Sustainability, Habitat Restoration, Landscapes, and Historic Renovation/Construction.

Purpose of Study: To conduct ongoing research and academic studies which explore opportunities that might contribute to the development of Cherokee Ranch and Castle as an educational setting and wildlife refuge which offer and possibly generates sustainable revenue sources for the Trust while addressing the Mission and Vision.

Research Design: We plan to utilize a case study approach permitting us to collect historic data and to observe habitats/landscapes whereby allowing for the creation, development and execution of educational programs and historic restoration while generating a potential for a new positive revenue stream for the Trust.

A clear definition of the proposed scientific objectives, methodologies, and approaches to be developed by and between Cherokee Ranch and Castle, including clear definitions of the roles and expected contributions of all involved parties. The Statement of Work to be developed over the following weeks and finalized no later than November 5, 2016 and adapted to suit all parties; attached herein as an Addendum.

IV. GENERAL PROVISIONS

Legal definitions and restrictions for both parties regarding operations, to include but not limited to the following:

1. Publications – Includes publishing and or disclosing research results, in any form including but not limited to articles, abstracts, poster sessions, both informal and formal seminars, talks, lectures, information posted on the Internet, and grant applications. Both parties reserve the right to review and comment on all public disclosure by the other party within a 30-day time frame for review. This includes embargoed information until post defense and /or publication and /or patent preparation for exclusive use by Deb Domres within the context of dissertation and or Journal article submission.

2. This agreement includes any information, presentations and or documents contributing to the research and or shared with Cherokee Ranch and Castle employees, consultants and or Broad Members, preceding the project and or MOU, shall be owned by the party who contributed its use to the project.

3. Confidentiality and Non-Disclosure- Includes all information created, shared and or delivered to Cherokee Ranch and Castle prior to or outside of the scope of the agreement and created/developed by Deb Domres and/or her specified research associates', shall be kept confidential for a period of 5 years.

V. ACTIVITIES

In furtherance of the above objectives, the Parties agree that each will do the following:

1. Cherokee Ranch and Castle will appoint a Coordinator to assist in developing and planning collaborative research, educational, and training projects; and Cherokee Ranch and Castle will identify the name and contact information for its Coordinator. Deb Domres will act as the first point of contact in the role of Coordinator and will work in conjunction with her selected research associate(s) to oversee these aspects.

      Cherokee Ranch and Castle(s) Coordinator will review all aspects of the project

with Deb Domres during development and planning of collaborative research, educational, and training projects.

2. As specific collaborative research, educational and training activities are identified and the roles of each Party are agreed upon, those collaborative efforts will be reduced to writing as contracts and signed by the Parties. Any collaborative research agreements arising from this MOU will include, but not be limited to, provisions setting forth the approved budget, specific financial and administrative arrangements, and a description of the scope of work to be performed. All rights to intellectual property arising from the collaborative research effort and the right to publish will remain the property of Deb Domres.

4. This MOU does not necessarily anticipate any present exchange of monies between Parties or guarantee specific funding, however researchers shall be reimbursed for normal expenses to include copies, printed materials and out of pocket expenses on behalf of the Trust.

VI. NONDISCRIMINATION IN EMPLOYMENT

In connection with the performance of work under this MOU, the Parties agree not to discriminate against any employee, student, or applicant for employment because of sex, race, religion, color, handicap, or national origin.

VII. AMENDMENTS AND REVIEW

The terms of this MOU may be amended only by written mutual agreement, effective when signed by the Parties.

VIII. TERM AND TERMINATION

This MOU shall be in effect and automatically renew annually unless any Party, at any time, provides written notice of its intent to withdraw from it, with a 90-day written notice delivered to the parties as listed in Section VII Notice, below.

X. ABANDONMENT

It shall be considered abandonment of this MOU should any of the following conditions occur:

a) When the MOU holder voluntarily gives up the MOU with permission of the Trust (surrender),

b) When the MOU holder ceases to make use of it for a length of time where a reasonable person may have concluded it will no longer be used (abandonment), or

c) When one of the parties in the MOU becomes deceased or non-competent; at this point it shall be the option of the surviving members to renew and/or develop a new agreement

XI. NOTICE

Any notice required to be given under this MOU shall be in writing and deemed to have

been given at the earlier of when actually received if delivered by hand or if sent by mail to the party's address given below, five (5) days after mailing. A party may change the address for notice purposes by sending a notice of change of address in conformity with this paragraph.

Notice to Debra L. Domres, 900 S. Harrison Street #3, Denver, CO 80209

Notice to Cherokee Ranch and Trust: 6113 N. Daniels Park Road, Sedalia, CO 80135; Attn: James Holmes, Executive Director

XII. USE OF NAME The Parties agree not to use each other's names in any advertising or other form of publicity without the prior written consent of that Party. However, the Parties agree in advance that each may use the name of the other in announcing this MOU.

XIII. LIABILITY

Neither Party nor its personnel shall be considered as an official, agent, employee, representative or joint partner of the other Party. Neither Party shall enter into any contract or commitment on behalf of the other Party. Each party is fully responsible for the performance of the Project activities and shall not accept any liability arising out of any acts or omissions, its officials, employees, agents, or sub-contractors under this MOU, or arising in connection with the Project.

XIV. LEGAL COMPLIANCE (IRB Member Training-Debra Domres CITI/Colorado State University) Transcript Report attached or available at https://www.citiprogram.org/verify/?429b03db-b0cb-4cc2-93ce-d8fad25680cf

This MOU applies to collaborative human and non-human subjects research efforts between the parties as defined by federal regulation and state law that are determined to be exempt, that are eligible for expedited review, or require review of the convened IRB and that:

a) Involve obtaining personally identifiable data from the research site, and

b) Involve obtaining samples, which are providing oversight of the research.

c) Human Research Protections' (OHRP) guidance, Terms of the Federal Wide Assurance.

Definitions

a) Human Subjects Research - The definition of human subjects' research is that set forth in 45 Code of Federal Regulations (CFR) §46.102 and 21CFR §50.3(g), §103(e), §312.3(b) and §812.3(p).

b) Exempt Human Subject Research - The definition of exempt human subject research is that set forth in 45 Code of Federal Regulations §46.1 01 (b).

c) Expedited Human Subject Research - The definition of expedited human subject research is that set forth in 45 CFR §46.11 0 and 21 CFR §56.11 0 and OHRP guidance, Categories of Research That May Be Reviewed by the Institutional Review Board (IRB) through an Expedited Review Procedure, and Guidance on the Use of Expedited Review Procedures,

d) Compliance with Federal and State Law - A determination of exemption or review of human subject research under this agreement shall be conducted in accordance with all relevant federal and state statutes and regulations governing the protection of human subjects, and with all relevant policies and procedures pertaining to the protection of human subjects participating in research conducted at or by employees of those organizations or their affiliated organizations.

e) Informed Consent Form - Research subject to this agreement shall employ a consent process set forth in 45 CFR §46.116 and §46.117, including documentation of informed consent, a waiver of documentation of informed consent, and a waiver or alteration of informed consent that meets all federal and state requirements.

XV. Confidentiality Agreement – For the purpose of this agreement Confidential Information shall mean any and all information, which is supplied or disclosed, directly or indirectly, in writing or in any other means, by each Party to the other including, but not limited to any documents, drawings, sketches, designs, materials, samples, prototypes, data, know - how, and which at the time of its disclosure or supply is identified as confidential. The Party disclosing it within fifteen (15) days after disclosure shall record oral information in writing, and the resulting document shall specifically state the date of disclosure and designate the information as confidential.

- For the purpose of this agreement the Recipient shall mean the Party receiving the Confidential Information disclosed by the other Party.

- Each Party intends to disclose Confidential Information to the other Party in the framework of the MOU for

  (a) The preparation and submission of a proposal and

  (b) Negotiation and conclusion of any Grant Agreement and Research Agreement. Nothing in this agreement shall be regarded as compelling a Party to disclose any Confidential Information.

  (c) The Recipient shall: undertake to keep the Confidential Information confidential and not to disclose it nor to permit the disclosure of it to any third party and not to make it available to the public or accessible in any way, except with the prior written consent of the Party disclosing it; undertake to use the Confidential Information solely for the Purpose of this agreement and not to make any other use, whether commercial or non-commercial, without the prior written consent of the Party disclosing it.

  (d) The obligations specified in clauses above shall not apply in the following cases: the Confidential Information was known to the Recipient prior to the time of its receipt pursuant to this agreement otherwise than as a result of the Recipient's breach of any legal obligation; or the Confidential Information is in the public domain at the time of disclosure by the Party to the Recipient or thereafter enters the public domain without any breach of the terms of this agreement; or the Confidential Information becomes known to the Recipient through disclosure by sources, other than the Party disclosing it, having the legal right to disclose such Confidential Information; or the Recipient proves the Confidential Information has been developed independently by its employees, who had no access to any of the Confidential Information disclosed by the Party disclosing it to the Recipient.

  (e) The Recipient shall limit and control any copies and reproductions of the Confidential Information. The Recipient shall return all records or copies of the Confidential Information at the request of the other Party and at the latest on termination of this agreement. This shall not apply to Confidential Information or copies thereof which must be stored by the Recipient according to mandatory law, provided that such Confidentiality Information or copies thereof shall be subject to an indefinite confidentiality obligation.

(f) The Recipient undertakes to disclose the Confidential Information only to its employees who: reasonably need to receive the Confidential Information for the Purpose of the present agreement; and have been informed by the Recipient of the confidential nature of the Confidential Information and of the terms of the present agreement; and have been advised of and agree to be bound by equivalent obligations to those in the present agreement. The Parties agree that this agreement and the disclosure of the Confidential Information do not grant or imply any license, interest or right to the Recipient in respect to any intellectual property right of the other Party.

XVI. RECORDS AND CONSULTATIONS

Each party shall designate an associate or compliance officer. Designees shall be qualified to handle confidential materials, applications and any confidential information provided during the research. Each party must coordination a site of safe keeping for all records, releases, insurance records and release of liability for all researchers, participants, employees, and others working on or connected with the research. Each party will make sure that all designated employees have adequate training as to Institutional Review Board Training (IRB).

NOTIFY: Each party must/shall notify all its participants be they students, associates and/or employees of the name, office address and telephone number of the appointed coordinators.

XVII. CONCLUSION

This MOU shall be construed in accordance with the laws of the State of Colorado.

(Signed copies on file in the researcher's office and onsite at CR & CF office in Sedalia, CO)

November 9, 2016

Dr. Carole Makela, Ph.D.
105J Education
Colorado State University
Fort Collins, CO 80523-1588

RE: Cherokee Ranch Project MOU

Dear Dr. Makela —

Attached please find an executed Memorandum of Understanding between Cherokee Ranch & Castle Foundation and the Colorado State University in association with Ms. Deb Domres for project(s) at the Wauhatchie Farm also known as the Johnson Dairy Farm located on Cherokee Ranch.

I wish to express how pleased we are to continue our longstanding relationship with Colorado State University as we enter into a new direction with this exciting project.

Please feel free to contact me directly with any questions you may have and I am looking forward to meeting you in the near future.

Thank you for your consideration.

Sincerely.

James Holmes

James A. Holmes
Executive Director
Cherokee Ranch & Castle Foundation

Appendix D: Cherokee Recruitment Materials and Results

In-class recruitment verbal script:

Hello, my name is Deb Domres and I am a graduate student in the School of Education. We are conducting a two-day charrette on a working ranch in Sedalia, CO. Our study is titled:

Cherokee Ranch & Castle: Using a Historic Homestead, a Castle, and a Working Cattle Ranch to Teach

The goal of this study is to develop a concept for an educational center that provides programs delivered through a STEAM lens while providing service-based learning opportunities. During the charrette, you will be asked to create innovative ways to use this property as an educational center. Tis site is a working cattle ranch and home to an elk herd, a pair of brown bear, bobcats, and lynx. It has a historic castle and numerous archeological finds such as the pottery traded 1300 yrs. ago from Taos, NM Indians. The challenge for participants will be to create a proposed educational venue using site attributes. By using the findings of this study, we hope to find answers for ways to communicate knowledge sharing and collaboration among disciplines.

If you volunteer as a participant in this study, you will be asked to do the following:

- Join a team of students representing these disciplines: architecture, agriculture, animal sciences, construction management, education, ecology, sustainability, interior design, and landscape architecture, among others,

- Complete a pre-charrette read that familiarizes you with the ranch and similar projects (approximately 40 minutes) and present a 3-5-minute overview of your selected reading during the charrette,

- Complete 1 pre-and 1 post-charrette survey (approximately 20 minutes each),

- Attend a 2-day charrette (Friday, **XX** and Saturday, **XX**, 2017) at one of two locations

---

Department:

_____

Preferred Location (Check one) On-site (Cherokee Ranch)   Off-site (CSU) X

Circle Preferred phone call day & time: M T W T F S Sun   Time: _____   AM   PM

---

and,

- Present your team findings and recommendations to an invited group of stakeholders during the last day of charrette, lasting approximately 2 hours.

The entire project should take approximately 20 hours of your time.

If you are interested in participating, please fill out one of the individual confidential recruitment cards (sample below) and I will be in touch with you. Alternatively, you can come to the School of Education, 209 Education Building located at 450 W. Pitkin, Room **XX** for a full presentation including a question and answer session during one of the following dates and times:

Monday XX, 2017	10:00 AM, 12:00PM, 2:00PM or 4:00PM
Wednesday XX, 2017	1:00PM, 3:00PM, 5:00PM or 7:00PM

Individual Confidential recruitment cards:

SAMPLE Recruitment Cards: Individual Confidential recruitment cards request the following information (completed by potential participants). Recruitment cards will be printed on 3" x 5" index stock, are color coded to identify location and discipline/department. For example, blue cards represent a member of the off-site group of participants, identified as VB-blue (Below).

Name	Discipline	Email	Phone
John Doe	Ecology	john.doe@colostate.edu	970.555.2315

Recruitment Poster

Request for Professor Participation

Dear Professor _____

My name is Deb Domres and I am a PhD candidate in the School of Education at Colorado

State University. I am conducting a study titled:

Transdisciplinarity (TD): Dissolving Boundaries among Applied Disciplines

The study explores the process of knowledge transfer using a transdisciplinary model approach by observing and documenting TD teams. It seeks to explore and describe knowledge transfer across multiple domains and the abilities of participants to think critically while communicating across disciplinary boundaries; disciplines include - architecture, agriculture and animal sciences, construction management, education, ecology and sustainability, interior design, and landscape architecture, however it is open to participants from other fields who wish to attend.

I am writing to request your participation as either a) a consulting expert or b) a participant observer. Consulting experts will be asked to attend the charrette remotely from a location of their choice using *Blue Jeans* and Google Maps. Your assistance requires availability on either a Friday or Saturday (**ADD DATES**) to answer participants' questions relevant to your expertise during a two-hour window. Specific hours for participation can be arranged to accommodate your schedule.

Participant observers will attend a two-day charrette either at the Cherokee Ranch & Castle in Sedalia, CO or at the Colorado State University, Morgan Library. Four student teams of eight will participant from each location, and you will be asked to observe interactions among transdisciplinary teams. If you have any questions about the study or participation, please feel to contact me either by cell at 303.520.1153 or by email at deb.domres@colostate.edu. Thanking you in advance for your time and consideration.

Sincerely,

Deb Domres, PhD Candidate

Colorado State University

Request to Professor for Course Participation with/without Students

Dear Professor _____

   My name is Deb Domres and I am a PhD candidate in the School of Education at Colorado State University. I am conducting a study titled:

Transdisciplinarity (TD): Dissolving Boundaries among Applied Disciplines

The study explores the process of knowledge transfer using a transdisciplinary model approach by observing and documenting TD teams. It seeks to explore and describe knowledge transfer across multiple domains and the abilities of participants to think critically while communicating across disciplinary boundaries; disciplines include - architecture, agriculture and animal sciences, construction management, education, ecology and sustainability, interior design, and landscape architecture, however it is open to participants from other fields who wish to attend.

   I am writing to request your permission and assistance to recruit students from your class(es) for participation in a two-day charrette. Student participation in this research requires completing a pre-charrette read requiring approximately 40 minutes of time, completing a pre-and post-charrette survey requiring 20 minutes each. Participants may select articles to read from a pre-defined list of case studies like our research coupled with a summarized history of Cherokee Ranch & Castle. Students will explore transdisciplinary teaming and knowledge transfer among disciplines using experiential learning models.

   During the first day participants will share a 3-5-minute synopsis of what they learned from the pre-charrette read (time to develop the synopsis is included in the hour period). Participants will be expected to attend a two-day charrette, on Friday **XX** and Saturday **XX**, 2017, in one of the two predetermined locations. Four teams of eight students will participate remotely from CSU in Morgan Library using *Blue Jeans* and Google Liquid Galaxy/Maps joined by four teams participating on-site at Cherokee Ranch & Castel in Sedalia, CO approximately 25 miles south of Denver, CO. Students may select their participation site in advance. The last activity for students occurs during the second day of the charrette whereby each team will be given 10 - 15 minutes to present their work to invited stakeholders. Student total time commitment will be approximately 18 hours.

To avoid using course time I ask that you invite students to stay a few minutes after class or come early to the next class to learn more about the study. I will present a 10-minute overview at that time and distribute a contact card that students can complete if they are interested in hearing more about the research; copies attached for your review. I will email or telephone students with more information, or alternatively students may meet with me in the School of Education, Room **XX** for overview Q & A session.

If you wish to offer extra credit for participation in the study, please advise me prior to meeting with your class; or if there is an offer for alternative comparable methods of earning extra credit please advise. I wish to thank you in advance for your time and consideration and welcome any questions you might have for me. I may be contacted at deb.domres@colostate.edu or by cell at 303.520.1153. If you have any questions about the study or student participation, please feel to contact me either by cell at 303.520.1153 or by email at deb.domres@colostate.edu. Thanking you in advance for your time and consideration. Sincerely,

Deb Domres, PhD Candidate

Colorado State University

Phone and Email Recruitment

Recruiting Script - phone/email

Hello, my name (this) is Deb Domres I am calling/email to follow up on your request for more information about participating in a study at Cherokee Ranch & Castle. We are conducting a 2-day charrette where your insights, experience, and knowledge will be shared with other student teams. Opportunities are available to participate on-site at Cherokee Ranch & Castle in Sedalia, CO or off-site in Fort Collins, CO at CSU.

You will be assigned a team consisting of many of the following disciplines: architecture, agriculture and animal sciences, construction management, education, ecology and sustainability, interior design, and landscape architecture. Participation in this research includes completing a

pre-charrette read requiring approximately 40 minutes of time and later presenting a synopsis of what you learned during the charrette. You will take a pre-and post-charrette survey requiring approximately 20 minutes each. You will attend a 2-day charrette in a selected location. Your final charrette task will be to present, with your team, your proposal to a panel of invited stakeholders during a coffee and dessert reception. Your total time commitment will be approximately 18-20 hours. While no compensation is offered for your participation, meals and snacks will be provided along with a sample resume excerpt. Your professor will indicate how and if participation relates to your course, a grade, or extra credit.

(Answer any questions they have) If emailed – Add If you have any questions or would like to participate in the research, I can be reached at *303.520.1153* or deb.domres@colostate.edu.

Private Sector Recruitment

<div align="center">LETTERHEAD</div>

Dear _____

My name is Deb Domres and I am a PhD candidate in the School of Education at Colorado State University. Your name was given to me by _____, as someone who might be interested in participating in research a study titled:

<div align="center">*XXXX*</div>

The study explores the process of knowledge transfer using a multi - disciplinary model while documenting and observing TD teams. Participants include students from: architecture, agriculture and animal sciences, construction management, education, ecology and sustainability,

interior design, and landscape architecture and is open to participants from other fields who wish to attend.

I am writing to invite your participation in one or two roles: 1) as a consulting expert including acting as a participant observer, or 2) as a juror during student presentations at the end of the second day. As a consulting expert, you will be asked to 1) attend the charrette from one of the following: 1) CSU - the main hall of Morgan Library (Liquid Galaxy Room), or 2) on-site at the Ranch in Sedalia, CO. You will be asked answer participants questions relevant to your expertise and to complete provided observation forms of participant interactions. Data will be collected during a two-day charrette at one of two locations, 1) Cherokee Ranch & Castle, in Sedalia, CO or 2) CSU Morgan Library, Fort Collins, CO. I attached an overview of the project for your consideration. If you wish to participate as a juror, you will be reviewed student projects during presentations lasting approximately 3 hours.

Participant Observer (PO) Recruitment

LETTERHEAD

Dear Community Member,

My name is Deb Domres and I am a PhD Candidate and researcher from Colorado State University, College of Health and Human Sciences in the School of Education. The Principal Investigator is Dr. Carole Makela (PI), and I am the Co-Principal Investigator (Co-PI).

We are conducting a research study at Cherokee Ranch & Castle in Sedalia, Colorado revolving around the historic renovation of Homesteads while examining how teams' function during a charrette. This case study examines the relationships of TL to TDM teams. The working title of our project is:

XXXX

We wish to share and seek feedback from students participating in this research as they lead final presentations on Saturday, XX, 2017, at Cherokee Ranch Castle Main Hall beginning at 4:00 PM until 7:30 PM. Evaluation forms and comment cards will be provided for your use while evaluating student projects. We respectfully ask that guests hold questions until all presentations are final. Student participant teams are presenting both in off-site and on-site environments, so feedback is valuable to students, Cherokee staff, and the research team.

The event is being photographed, audio and video taped, and you will be required to sign releases giving permission to use your images and comments. We will not be collecting personal information or identifiers to share with others; the collection of your name and contact information is for our use and will not be shared. When we report, and share our research with others, we will combine the findings from all participants. Your identifying information will be kept in a locked file cabinet in the office of the Co-PI; available only to the research team and destroyed after the research is concluded.

While there are no direct benefits to you, we hope to gain new insights and information on developing educational programs using historic sites while looking at possible impacts on areas such as agriculture, endangered species, renovation of historic properties, and landscapes. There is no compensation for attendance and participation. There are no known risks to you for attending or participating in this study. While it is not possible to identify all potential risks in research procedures, the researcher(s) have taken reasonable safeguards to minimize any known and potential (but unknown) risks. Completing and signing the attached releases is your consent to participate; releases must be completed, returned, and/or received by the researcher to gain admittance.

If you have any questions about the research, please contact Deb Domres at

deb.domres@colostate.edu or by cell 303.520.1153. If you have any questions about your rights

as a volunteer in this research, contact the CSU IRB at: RICRO_IRB@mail.colostate.edu; 970-

491-1553. We wish to thank you in advance for your time and consideration and hope to share

the exciting project findings with you.

Sincerely,

Deb Domres, PhD Candidate

Colorado State University

School of Education
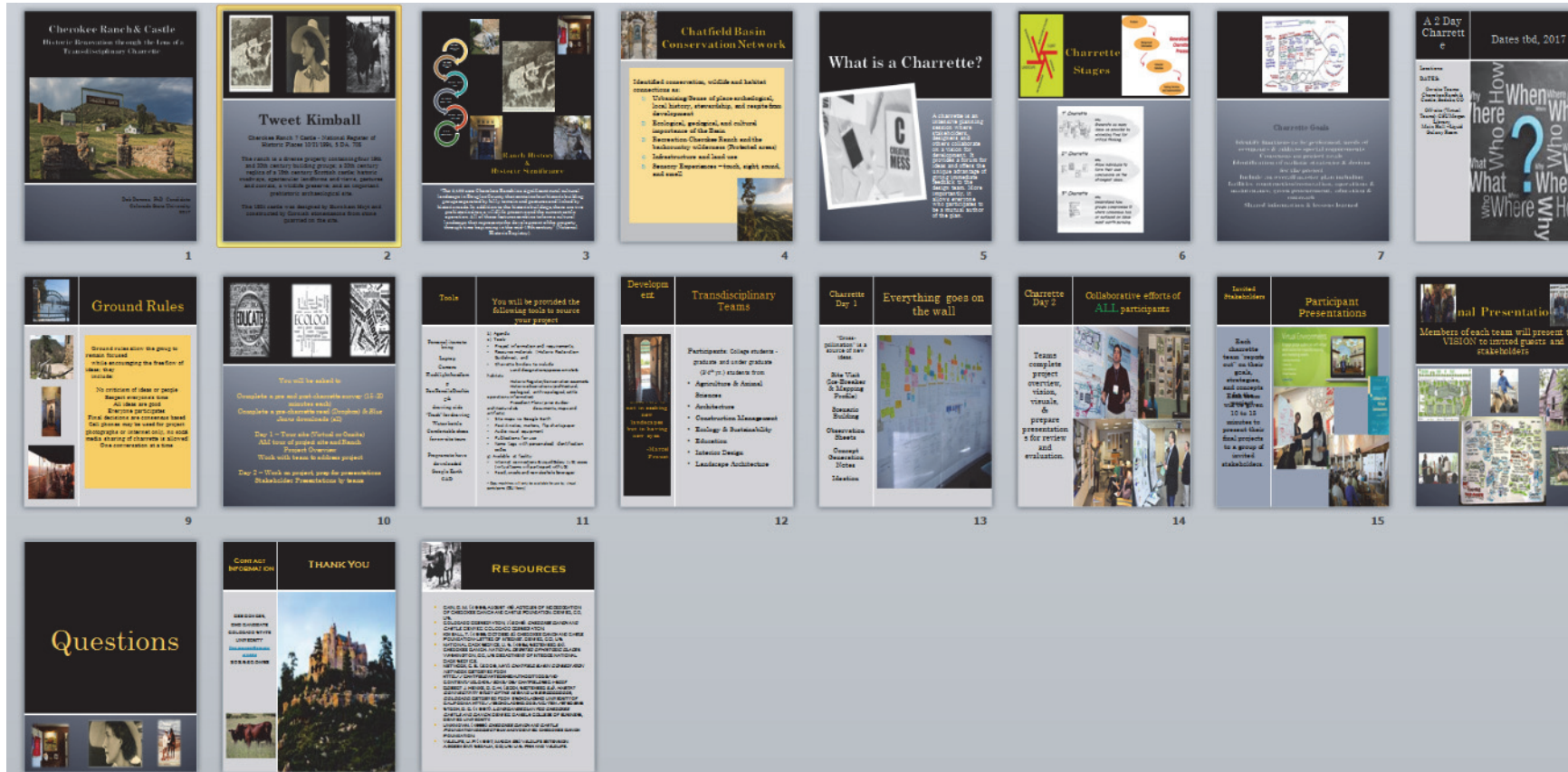
Recruitment Presentation – Power Point

Participant Consent Forms

Consent to Participate in a Research Study
Colorado State University

TITLE OF STUDY: XXXX

PRINCIPAL INVESTIGATOR: Dr. Carole Makela, Colorado State University, School of Education, Professor

CO-PRINCIPAL INVESTIGATOR:

Deb Domres, PhD Candidate, Colorado State University, School of Education, email: deb.domres@colostate.edu or cell 303.520.1153

WHY AM I BEING INVITED TO TAKE PART IN THIS RESEARCH? You are being asked to participate in this study as you an adult over 18 years of age and have an interest in one or more of the study areas including: agriculture, architecture, construction management, ecology, education, environmental and/or sustainability studies, interior design and/or landscape architecture.

WHO IS DOING THE STUDY? The research team consists of graduate students, and professors. There is no funding for this research.

WHAT IS THE PURPOSE OF THIS STUDY? The purpose of this study is to understand the impact of transdisciplinarity[18] among virtual and face-to-face teaming. I explored the effects of virtual and face-to-face teaming and how its effects project outcomes using a charrette model.

WHERE IS THE STUDY GOING TO TAKE PLACE AND HOW LONG WILL IT LAST? The study is taking place at two locations. You may participate at one of two locations:

---

[18] A transdisciplinary team allows members to contribute their own knowledge and expertise, but efforts are collective in determining best ideas or approaches. When transdisciplinary teams are used participants from multiple disciplines collaborate and share ideas to create a plan that covers all aspects of a project.

Team 1 participants will attend from the CSU campus in Fort Collins and Team 2 participants will meet at the Cherokee Ranch and Castle in Sedalia, CO. This included attendance at a two-day charrette. On the first day participants will begin at 830 AM and end at 500 PM; on day 2 participants will begin at 830 AM and present their final work to a jury panel of invited stakeholders between 430 PM and 700 PM. A charrette overview with exact locations, maps, and instructions will be available at the end of the survey.

WHAT WILL I BE ASKED TO DO? You will be asked to attend a two-day charrette on Friday, XX, 2017 and Saturday XX, 2017. You will complete a pre-charrette read and create a 3-5-minute review to share with others at the charrette; this requires 1 to 1.5 hours of time. You will complete both a pre-and post-charrette survey, each requiring about 15 -20 minutes time. You have two days to work with your team create an educational and research site using existing historic structures, and lastly your team will present your concept to a group of invited stakeholders.

ARE THERE REASONS WHY I SHOULD NOT TAKE PART IN THIS STUDY? There are no known reasons why you should not participate.

WHAT ARE THE POSSIBLE RISKS AND DISCOMFORTS?

The study will take place in both a virtual and on-site environment. Participants will be in one of two locations for this study. It is not possible to identify all potential risks in research procedures, but the researcher(s) have taken reasonable safeguards to minimize any known and potential, but unknown, risks.

ARE THERE ANY BENEFITS FROM TAKING PART IN THIS STUDY? There are no direct benefits to you for participating in this study. We hope to gain insights into how people transfer knowledge among team members.

DO I HAVE TO TAKE PART IN THE STUDY? Your participation in this research is voluntary. If you decide to participate in the study, you may withdraw your consent and stop participating at any time without penalty or loss of benefits to which you are otherwise entitled.

WHO WILL SEE THE INFORMATION THAT I GIVE? We will keep private all research records that identify you, to the extent allowed by law. When we write about the study to share with other researchers, we will write about the combined information we have gathered. We may publish the findings of this study and we will keep your name and other identifying information private.

WILL I RECEIVE ANY COMPENSATION FOR TAKING PART IN THIS STUDY? There is no compensation for taking part in this research.

WHAT IF I HAVE QUESTIONS?

If you have questions about the study, you can contact the investigator, Deb Domres at 303.520.1153 or deb.domres@colostate.edu. If you have any questions about your rights as a volunteer in this research, contact the IRB Coordinator at: the CSU IRB at: RICRO_IRB@mail.colostate.edu; 970-491-1553. Please print a copy of this consent form for your files.

WHAT ELSE DO I NEED TO KNOW? The charrette, presentations, and all activities will be audio and video taped and photographed.

Participant confirms participation in multiple activities

Please initial by each research activity listed below that you are volunteering to

participate in.

☐ Researchers and participant observers can observe me during the Cherokee Ranch
tour, mapping profile exercise and the two-day charrette ____(initials)

☐ Researchers and participant observers may take photos of me at any time during the
charrette____ (initials)

Permission to audiotape/videotape:

The researchers plan to audio/video tape your participation during the on-site
exercises and during the charrette to be sure that your comments are accurately recorded.
Our research team will have access to the audiotapes, and they will be destroyed once the
research is completed or within 5 years.

Do you give the researchers permission to audio/video tape you during the
charrette? Please initial next to your choice below.

☐ Yes, I agree to be digitally (audio/video) recorded _____ (initials)

☐ No, do not audio/video tape me during the charrette or exercises _____ (initials)

Permission to use direct quotes:

Please let us know if you would like your comments to remain confidential or be
attributed to you. Please initial next to your choice below.

☐ I give permission for comments I have made to be shared using my exact words
   and to include my personal ID _____ (initials)
☐ You can use my data for research and publishing, but do NOT associate my
   personal ID with direct quotes. _____ (initials)

Your signature acknowledges that you have read the information stated and willingly sign this
consent form. Your signature also acknowledges that you have printed, on the date signed, a
copy of this document containing XX_ pages.

Signature of person agreeing to take part in the study   Date: _____

_____ Discipline_____

Signature

_____ Personal ID _____

Printed name of person agreeing to take part in the study and ID (ID = Last four digits of cell or
home
telephone number)

Debra Domres, PhD Candidate   _____

Name of person providing information to participant   Date

Deb Domres (digitally signed)

Signature of Research Staff

PART 2 – Release of Liability Forms for Participants while ON-SITE at *Cherokee Ranch & Castle, a Working Cattle Ranch*

READ THIS DOCUMENT COMPLETELY BEFORE SIGNING. ITS EFFECT IS TO RELEASE COLORADO STATE UNIVERSITY, ITS GOVERNING BOARD, CHEROKEE RANCH & CASTLE, AND THE STATE OF COLORADO FROM LIABILITY RESULTING FROM YOUR PARTICIPATION IN THE ACTIVITIES DESCRIBED BELOW, AND TO WAIVE ALL CLAIMS FOR DAMAGES OR LOSES AGAINST THE UNIVERSITY, WHICH MAY ARISE FROM SUCH ACTIVITIES EVEN IF THEY RESULT FROM NEGLIGENCE.

<u>RELEASE FROM RESPONSIBILITY, ASSUMPTION OF RISK, AND WAIVER</u>

PARTICIPANTS FULL NAME: _____

DATE OF BIRTH (MO/DAY/YEAR): _____

ADDRESS: _____

DATES OF ACTIVITIES: START DATE: _____ END DATE: _____

Check one: ___CSU Student ___Other student at _____(School) ___Non-student

DESCRIPTION OF ACTIVITIES:

_____

_____

INSURANCE INFORMATION:

IF STUDENT: I am aware that as a student of Colorado State University or of _____ (Fill in name of your school), I can purchase accident insurance, either through Colorado State University or my home University (if available) or through another insurance carrier or agent, and (*check one*) ___have ___have not exercised my right to do so.

NAME OF INSURANCE CARRIER: _____

POLICY NUMBER: _____

I, the undersigned participant, exercising my own free choice to participate voluntarily in the activities described above, and promising to take due care during such participation, hereby acknowledge that I have been informed of the nature of the activities and that I am aware of the hazards, and risks which may be associated with my participation in the above-named activities, including the risks of bodily injury, death or damage to property which may occur from known or unknown causes. I understand, accept, and assume all such hazards and risks, and waive all claims against the State of Colorado, The Board of Governors of the Colorado State University System, The Cherokee Ranch & Castle Foundation, and other persons as set forth above. I understand that I am solely responsible for any costs arising out of any bodily injury or property damage that I may sustain through my participation in normal or unusual acts associated with the above-named activities, regardless of whose fault may be the cause of my injuries or damages, EVEN IF CAUSED BY CARELESSNESS OR NEGLIGENCE, so long as the conduct which caused the injuries or damages was not grossly negligent, or willful and wanton.

Further, I hereby indemnify and hold harmless The Board of Governors of the Colorado State University System and Colorado State University, and their members, officers, agents, employees, and any other persons or entities acting on their behalf, and the successors and assigns for any and all of the aforementioned persons and entities, against any and all claims, demands, and causes of action whatsoever, whether presently known or unknown, of any person who suffers any injury, disability, death or other harm, to person or property or both, as a result of my participation in and/or presence at the above listed activities.

I have had sufficient time to review and seek explanation of the provisions contained above, have carefully read them, understand them fully, and agree to be bound by them. After careful deliberation, I voluntarily give my consent and agree to this Release from Responsibility, Assumption of Risk, and Waiver.

I HAVE READ, UNDERSTOOD AND AGREED TO THE ABOVE TERMS THIS ___DAY OF _____, 20__.

Signature of Participant whose printed name appears above:

_____   _____

Signature   Witness over 18 years of age (Participant

                                                                   must sign in the presence of the Witness)

CR & CF Pre-charrette Survey –

Q1 This section asks for personal information and instructs you how to create a personal identifier used when writing about the charrette; it is known to you and the research team. To create your identifier below please use the last four digits of your home or cell phone number, followed by a M or F (gender) and then add one special character either a ! or * (exclamation or star mark). For example, if you phone number is 303.333.5531, you identify as female, and your special character is a * your code would look like this: 5531F* Please write your code in the space below.

Q2 I am
    Male
    Female

Q3 I am _____(age)

Q4 I live in (select one)
    Denver/ Metro area
    Fort Collins
    Other _____

Q5 I attend
    Colorado State University
    University of Colorado, Denver
    Other, please identify _____

Q6 I am a _____
    Freshman
    Sophomore
    Junior
    Senior
    Masters student
    PhD student

Q7 I attend the college of _____and my major is _____and my minor is _____. (complete the sentence for all that

apply). For example, you might say, "I attend the College of Business, my major is Global Social & Sustainable Enterprises; my minor is in environmental sustainability.

INSERT: I plan to attend the charrette _____Check one option

____On-site at Cherokee Ranch in Sedalia, CO

____Virtually, from the Colorado State University Morgan Library (We will be using Google Maps, Liquid Galaxy and KUBI robots.

Q8 This section asks about your experience(s) participating in charrettes.

Q9 I am clear about what a charrette is and what you do when participating in one?
Extremely clear
Moderately clear
Slightly clear
Neither clear nor unclear
Slightly unclear
Moderately unclear
Extremely unclear

Q10 Have you ever participated in a charrette?
Yes
No

Q11 The charrette I participated in was for _____ (complete the sentence). For example, I participated in a design build charrette and we designed a school.

Q12 The charrette I participated in was part of a class, mandatory and graded.
Yes
No

Q13 I think charrettes are valuable learning experiences
    Definitely yes
    Probably yes
    Might or might not
    Probably not
    Definitely not

Q14 The following questions ask you about working on a team. Answer all questions by completing the following sentence I think team members should_____

Q15 engage in ongoing collaboration to share information and exchange ideas
    Strongly agree
    Agree
    Somewhat agree
    Neither agree nor disagree
    Somewhat disagree
    Disagree
    Strongly disagree

Q16 equally share and generate ideas through brainstorming
    Strongly agree
    Agree
    Somewhat agree
    Neither agree nor disagree
    Somewhat disagree
    Disagree
    Strongly disagree

Q17 be accepting of other ideas
    Strongly agree
    Agree
    Somewhat agree
    Neither agree nor disagree
    Somewhat disagree
    Disagree
    Strongly disagree

Q18 ask questions to clarified information they are unfamiliar with
Strongly agree
Agree
Somewhat agree
Neither agree nor disagree
Somewhat disagree
Disagree
Strongly disagree

Q19 collect data and present findings to team members not in their field of study
Strongly agree
Agree
Somewhat agree
Neither agree nor disagree
Somewhat disagree
Disagree
Strongly disagree

Q20 know what other team members are working on and be able to explain it to others within their field
Strongly agree
Agree
Somewhat agree
Neither agree nor disagree
Somewhat disagree
Disagree
Strongly disagree

Q21 This next section asks you about collaborating on team projects. It addresses your feelings about teamwork and collaboration.

Q22 Given my schedule (work or studies) collaboration with other students is not practical
Strongly agree
Agree
Somewhat agree
Neither agree nor disagree
Somewhat disagree
Disagree
Strongly disagree

Q23 It is easier for me to figure out solutions to problems rather than rely on input and opinions of others
    Strongly agree
    Agree
    Somewhat agree
    Neither agree nor disagree
    Somewhat disagree
    Disagree
    Strongly disagree

Q24 I do not understand the collaborative teaming process and how it can benefit me in class, at work or in my future
    Strongly agree
    Agree
    Somewhat agree
    Neither agree nor disagree
    Somewhat disagree
    Disagree
    Strongly disagree

Q25 When collaborating with others I will probably be required to agree with them or use their ideas, when I may disagree
    Strongly agree
    Agree
    Somewhat agree
    Neither agree nor disagree
    Somewhat disagree
    Disagree
    Strongly disagree

Q26 I do not feel that I have enough experience, knowledge, or new ideas to be a successful collaborator
    Strongly agree
    Agree
    Somewhat agree
    Neither agree nor disagree
    Somewhat disagree
    Disagree
    Strongly disagree

Q27 Collaborating is too time consuming and I end up doing most the work alone
Strongly agree
Agree
Somewhat agree
Neither agree nor disagree
Somewhat disagree
Disagree
Strongly disagree

Q28 This section addresses attitudes. It asks how you feel toward the teaming process.

Q29 When working in a team I think we should develop a project overview, starting with goals everyone agrees on
Strongly agree
Agree
Somewhat agree
Neither agree nor disagree
Somewhat disagree
Disagree
Strongly disagree

Q30 I encourage and help team members when they do not understand or have concerns
Strongly agree
Agree
Somewhat agree
Neither agree nor disagree
Somewhat disagree
Disagree
Strongly disagree

Q31 I think my instructor/professor should intervene when teams are struggling or not getting along
Strongly agree
Agree
Somewhat agree
Neither agree nor disagree
Somewhat disagree
Disagree
Strongly disagree

Q32 When working on teams in the past we divided the project up and worked independently
  Strongly agree
  Agree
  Somewhat agree
  Neither agree nor disagree
  Somewhat disagree
  Disagree
  Strongly disagree

Q33 I think teamwork is productive and I learned more than working alone
  Strongly agree
  Agree
  Somewhat agree
  Neither agree nor disagree
  Somewhat disagree
  Disagree
  Strongly disagree

Q34 This next section addresses communication; it asks about how you prefer to communicate with others. Communication styles are our patterns of behaviors that are observable to others. There are no right or wrong answers. Keep in mind that the communication model describes your preferences, not your life skills or abilities. Dominance can be defined as the tendency to display a "take-charge" attitude. Every person falls somewhere on the dominance continuum. For example, if you tend to be cooperative and eager to assist others, then you would place yourself at the low end of the scale (zero). If you tend to give advice freely and frequently initiate demands, then you would place yourself toward the high end of the scale (100). Zero (0) represents low dominance and one hundred (100) represents high dominance. Move the slide to the preferred location for how you perceive yourself.

Q35
_____ I perceive myself as somewhat   cooperative/competitive

Q36
_____ I perceive myself as somewhat   submissive/authoritative

Q37
_____ I perceive myself as somewhat   domineering/accommodating

Q38

_____ I perceive myself as somewhat   outgoing/reserved

Q39

_____ I perceive myself as somewhat   insistent/compromising

Q40

_____ I perceive myself as somewhat   risk taking/cautious

Q41

_____ I perceive myself as somewhat   hurried/patient

Q42

_____ I perceive myself as somewhat   influential/passive

Q43

_____ I perceive myself as somewhat   quiet/talkative

Q44

_____ I perceive myself as somewhat   shy/bold

Q45

_____ I perceive myself as somewhat   supportive/demanding

Q46

_____ I perceive myself as somewhat   relaxed/intense

Q47

_____ I perceive myself as somewhat   restrained/assertive

Q48

_____ I perceive myself as somewhat   hesitant/decisive

Q49 Almost done! This is the last section of the survey. It addresses sociability; it asks about your perceptions of how you prefer to socialize. There are no right or wrong answers. Sociability is the tendency to seek and enjoy social relationships; it can measure whether you tend to control or express your feelings. Keep in mind that the sociability model describes your preferences, not your life skills or abilities. For example, if you perceive yourself as a no-nonsense kind of person you would place yourself toward the left end of the scale (zero); if you perceive yourself as easy to get to know and you express your

feelings easily you would place yourself toward the high end of the scale (100). Zero (0) represents low in sociability, while one hundred (100) represents high in sociability

Q50

_____ I perceive myself as somewhat   disciplined/easygoing

Q51

_____ I perceive myself as somewhat   controlled/expressive

Q52

_____ I perceive myself as somewhat   serious/lighthearted

Q53

_____ I perceive myself as somewhat   unstructured/methodical

Q54

_____ I perceive myself as somewhat   calculating/spontaneous

Q55

_____ I perceive myself as somewhat   guarded/open

Q56

_____ I perceive myself as somewhat   introverted/extroverted

Q57

_____ I perceive myself as somewhat   aloof/friendly

Q58

_____ I perceive myself as somewhat   formal/casual

Q59

_____ I perceive myself as somewhat   reserved/provocative

Q60

_____ I perceive myself as somewhat   cautious/carefree

Q61

_____ I perceive myself as somewhat   conforming/unconventional

Q62

_____ I perceive myself as somewhat   self-controlled/dramatic

Q63

_____ I perceive myself as somewhat   restrained/impulsive

You have now finished the pre-charrette survey. To better prepare yourself for the charrette please review the following documents; available online in Dropbox (identify this later) If you have any questions please email me for assistance at deb.domres@colostate.edu; or call my cell at 303.520.1153 and leave a message. I will get back with you ASAP!

Important Information for Participants attending the charrette virtually: please download the free version of ZOOM and test it before the charrette (verify with as with this many users how to do this-discuss with Don Quick. Or do I have one person from each team use ZOOM in the library Galaxy space? We will have the program download there for 1 whole room visual. It would be preferable for me to have 1 application per team and then the room set up on the larger screen in the library. Hope to use the KUBI robots with Dons assistance. Thoughts?

Thank you for your time to complete this pre-charrette survey! Without you this research would not be possible. We look forward to seeing you at the charrette.

Appendix F: Cherokee Participant Observer Pre-charrette Survey

CRCF Pre-charrette Participant and Non-Participant Observers

Q1 Demographics: This section asks for personal information and instructs you how to create a personal identifier used when making observations during the charrette; only you and the research team know it. To create your identifier below please use the last four digits of your home or cell phone number, and then add PO (participant observer) or NPO (non-participant observer). For example, if you phone number is 303.333.5531, and you are a participant observer your code would look like this: 5531- PO. Please write your code in the space below.

Q2 I am _____years old (complete the sentence).

Q3 I am
    Male (1)
    Female (2)

Q4 I live in (select one)
    Denver/ Metro area (1)
    Fort Collins (2)
    Other (3) _____

Q5 I am associated with
    Colorado State University (1)
    University of Colorado, Denver (2)
    Other, please identify (3) _____

Q6 I am a _____
    Professor (1)
    Instructor (2)
    K-12 educator (3)
    Masters student (5)
    PhD student (6)

Q7 I am a teacher/instructor in _____(department, grade, etc.) and I teach _____(complete the sentence and list all courses you teach)

Q8 This section asks about your experience(s) leading service-learning projects and charrettes.

Q9 Have you ever developed a service-learning project for students?
     Yes (1)
     No (2)

Q10 My service-learning project(s) were designed for _____ (project, subject and student level) complete the sentence.

Q11 The service-learning project was part of a class and students were graded.
     True (3)
     False (4)

Q12 Have you ever participated in a charrette?
     Yes (1)
     No (2)

Q13 The charrette I participated in was _____ to _____(complete the sentence). For example, I participated in a charrette designed to develop a new student lab.

Q14 The charrette I participated in was_____.
     Extremely useful (33)
     Moderately useful (34)
     Slightly useful (35)
     Neither useful nor useless (36)
     Slightly useless (37)
     Moderately useless (38)
     Extremely useless (39)

Q15 I use charrettes in my class(es) for_____ to teach_____ (complete the sentence). If not applicable, please add N/A

Q16 The charrette was part of my class course work and graded.
     True (1)
     False (2)

Q17 I think charrettes and service-learning projects are effective learning experiences for students.
     Extremely effective (21)
     Very effective (22)
     Moderately effective (23)
     Slightly effective (24)
     Not effective at all (25)

Q18 For each teacher activity listed check the response that indicates how often you use it with your class and then identify how much time you typically spend when you do.

	Frequency of Use					Time per Typical Use		
	Not once (1)	1 or 2 periods per semester (2)	1 or 2 periods per month (3)	One period per week (4)	> 1 period per week (5)	< 10 minutes (1)	< half period (2)	> half period (3)
work in small groups (1)								
do lab or field work (2)								
evaluate other students work (3)								
respond to questions testing recall (4)								
respond to open-ended questions (5)								
explain to the class solutions developed individually (6)								
explain to class solutions developed in teams (7)								
participate in structured learning activities (8)								

Q19 For each teacher activity listed check the response that indicates how often you use it with your class and then identify how much time you typically spend when you do.

	Frequency of Use					Time per Typical Use				
	Rarely(1)	1 or 2 periods per semester (2)	1 or 2 periods a month (3)	One period a week (4)	> 1 period a week (5)	< 10 minutes (1)	< 1/2 period (2)	> 1/2 period (3)	1/2 semester (4)	Whole semester (5)
Lecture using smart board, soliciting student input (1)										
Demonstrate a concept, using 2-dimensional graphics (2)										
Demonstrate a concept using 3-dimensional graphics (3)										
Lead student sin Q & A sessions (4)										
Observe or monitor student-led whole class discussions (5)										
Observe student-lead presentations (6)										
Administer a test/quiz (7)										

	set up & monitor cooperative learning activities (8)										
Design and lead service-learning projects (9)											
Design or lead internships (10)											
Design or lead charrettes (11)											

Q20 Indicate the extent to which the materials and equipment listed below are available and the frequency you use them when teaching your class.

	Availability			Frequency of Use					
	0 Not available (1)	1 Available limited supply (2)	2 Available in adequate supply (3)	Rarely (1)	1 or 2 periods per semester (2)	1 or 2 periods per month (3)	One period per week (4)	> 1 period a week (5)	Daily (6)
black board/white board (1)									
smart board (2)									
overhead projector (3)									
film or video (4)									

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computer (5)								
computer programs (6)								
models or other objects (7)								
paper, graph paper, etc. (8)								
artifacts (maps, pictures, etc.) (9)								
textbooks (hard copies) (10)								

Q21 Rank the teaching strategies you use with students and the frequency of use.

	Importance			Frequency of use				
	Not necessary (1)	Helpful (2)	Essential (3)	Rarely (1)	One period per week (2)	One period per month (3)	1/2 semester (4)	Semester long (5)
Collaboration/collaborating learning (1)								
Games, experiments, simulators (2)								
Inquiry guided learning (3)								

Interdisciplinary teaching (4)							
Learner-centered teaching (5)							
Mobile learning (when students are not in a fixed location) (6)							
Service learning (7)							
Social networking (8)							
Online/hybrid learning (9)							
Transdisciplinary (10)							
Multidisciplinary teaching (11)							
Problem based learning (12)							

Q22 Indicate the extent to which your school offers the following and how much you use them when teaching your class. When addressing frequency check all that apply.

	Availability		Frequency of use				
	Yes (1)	No (2)	Rarely (1)	1/2 time (2)	Daily (3)	Weekly (4)	1x month (5)
Recycling (1)							
Sustainability signs in school (classrooms, corridors, etc.) (2)							
Community Gardens (3)							
Service animals or classroom pets (4)							

Field trips off campus (5)						
Adult volunteers or classroom assistants (6)						
Composting (7)						
Alternative energy on campus (8)						
Living walls, wetlands, observation tunnels, etc. (9)						

Q23 If I could add anything to my campus to aid me in teaching students I would add_____(complete the sentence).

Q24 Is there anything else you wish to share, if so, please do so here.

NOTE: Before the attending the Participant/Non-Participant Observer organizational session please review the Participant Observation Article available online at:
http://www.allenbrizee.com/Obs_Int_Surveys.pdf

Participants may attend training session in person at CSU in the School of Education, on Friday, March 3rd, at 330PM or via ZOOM, a free download program during two sessions. Please select one of the following training sessions:

_____ Friday, March 3, 2017   3:30PM – 5:00PM School of Education – CSU campus
    Room, TBD (Light Refreshments will be provided)

_____Wednesday March 1, 2017   600PM – 7:30PM / ZOOM (virtual)
_____Saturday March 4, 2017   10AM -11:30AM / ZOOM (virtual)

Appendix G: Charrette Welcome Letter, Information, Agendas and Consent Forms

Within one week of signing up to join the study participants received the following letter; via email or by phone notification.

<p align="center">CSU Stationary/letterhead</p>

Date XX, 2017

Dear _____,

I am pleased to welcome you to the Cherokee Ranch & Castle study. I wish to express our sincerest appreciation for agreeing to attend and share your knowledge and experiences with other participants. Without people like you, this research would not be possible.

It is important that you take the time to complete the pre-charrette survey, as this will provide you with a schedule and access to the Dropbox site, containing pre-charrette reading materials and information. Within one week of completing the pre-charrette survey, you will be notified by _____ (phone or email) of your team assignment. As teams are formed, you will be introduced to your teammates and allowed to set up additional Dropbox accounts for collaborating pre-charrette.

If you should have any questions or need assistance, please feel to text me at 303.520.1153 or email me at deb.domres@colostate.edu. Please be patient, as I will attempt to respond within 24 hours. Again, thank you for your commitment to education and research and I look forward to meeting you soon.

Best,

Deb Domres

Charrette Instructions

Arrival: Upon arrival, at your preselected site, you will need to register and pick up your identification badge. You created a personal identifier when you took the pre-charrette survey, and this was used to create your ID; your badge number now includes **the first and last digit of your cell or home phone number;** please verify that this is correct, it is the single identifier we

have for you as a participant. If you have not completed the pre-charrette survey and signed all applicable release, you will not be allowed to attend the charrette.

Registration & Materials:

The following procedures will be in place during the charrette:

- Numeric nametags will be divided for pick up by the first digit of you cell number. For example, if you created an id that was 1153 (last four digits of your phone number) your id will be 13. ID's will be grouped by disciplines and first digits, so find the line for your discipline then 1 thru 4 or 5 thru 9. Your will not be asked for or identified by your name!

- Each site will have access to a printed copy of the online charrette binder. Your IDs will be written on the table tents and each team is color-coded; all materials will match your color code.

- Internet and Wi-Fi passwords will be included in your Dropbox information.

- Guards and gate keeps will be aware of participants; you will not need special codes to enter the Ranch Castle, or CSU Main Hall for Liquid Galaxy.

- There will be facilitators at each site to aid participants with materials and resources; please bring your laptop/tablets and any tools you would normally use in your daily work and or research. We will provide flip charts, hi-lighters, masking/painters tape and post it notes.

Food, snacks, & beverages:

As this is a sustainable event please bring your own water bottle; all plates, napkins and flatware are compostable so please be sure to dispose of items in the proper containers.

We will provide participants with meals and snacks both days:

- Lite breakfast (bagels, fruit, and various jams/spreads) coffee, tea, and juice.
- AM snacks

- Lunch; please be advised meals will be buffet style and we will do our best to offer a variety of foods; we will try to accommodate dietary needs/preferences however, we cannot guarantee or provide special meals.
- PM snacks

Agenda (On-site Participants)

Sunday, November 12, 2017 Location: Cherokee Ranch & Castle	
Check in begins at 8:00 AM 8:30 AM – 9:00 AM Breakfast	Check in and ID pick up (Castle). Continental breakfast & beverages
9:00 AM to 10:00 AM	**Charrette Opening** Welcome: Deb Domres Participant pre-charrette read presentations
10:00 AM – 11:30 AM (Includes 15 minutes' drive time to Wauhatchie)	Charrette exercises (Icebreaker & Mapping profile exercises)
11:30 AM – 12:30 PM Lunch at locations - Working with breaks	Breaks as needed by participants
12:45 PM - 5:00 PM	Develop a preliminary problem statement and set of questions. *Everything on the Wall* Teams will determine what to include for further development & framework for tomorrow's session. Begin project planning.
Monday, November 13, 2017 Location: Ranch	
8:30 AM – 9:00 AM	Continental breakfast & beverages (Castle)
9:00 AM – 12:00 AM	Project planning and development
12:00 PM to 1:00 PM Lunch at locations - Working	Breaks as needed by participants
1:00 PM – 4:00 PM (30-minute break before presentation)	Complete final preparation for presentations to stakeholders.
4:30 PM – 7:00 PM	Coffee & dessert: Stakeholder presentations - student final project delivery

Agenda (Off-site Participants) Attendees will complete field exercises and charrette participation using Goggle Maps & Liquid Galaxy from CSU campus

Sunday, November 12, 2017 Location: CSU Campus, Main Hall - Google Liquid Galaxy – Morgan Library 1st floor

Check in begins at 8:00 AM 8:30 AM – 9:00 AM Breakfast	Facilitators will be at the off-site location with participants. Dr. Amy Rubinson will be online to assist using Kubi robots. She will be joined by Youssef our site IT expert. Check in and ID pick up. Continental breakfast & beverages
9:00 AM – 10:00 AM	**Charrette Opening** Welcome: Deb Domres & Participant pre-read report presentations
10:00 AM – 11:30 AM	Charrette exercises (Icebreaker & Mapping profile exercises)
11:30 AM – 12:30 PM Lunch at locations - Working with breaks	Breaks as needed by participants
12:45 PM - 5:00 PM	Develop a preliminary problem statement and set of questions. *Everything on the Wall* Teams will determine what to include for further development & framework for tomorrow's session. Begin project planning.
Saturday, XX, 2017 Location: CSU Campus, Main Hall - Google Liquid Galaxy – **Morgan Library 1st floor and Presentations in Aylesworth Hall** **"d-Lab" Code for entry will be provided**	
8:30 AM – 9:00 AM	Continental breakfast & beverages
9:00 AM – 12:00 PM	Project planning and development
Lunch at Aylesworth Hall- Working	Lunch provided
12:45 PM – 4:00 PM (30-minute break to move from Morgan Library to Aylesworth d-lab)	Complete final preparation for presentations to stakeholders
4:30 PM – 7:00 PM	Coffee & dessert: Stakeholder presentations - student final project delivery (off-site will present in the d- lab Aylesworth Hall)

Charrette Day 1 Overview: Everything goes on the Wall

"Cross Pollination is a source of new ideas"

Site visit – On-site & Off-site – 2 Individual exercises (Ice Breaker Sensory & Mapping Profile)

Observation Sheets
Scenario Building
Concept Generation Notes
Ideation

Charrette Day 2 Overview: Collaborative efforts of ALL participants

Part 1: Teams complete project overview, vision, visuals, and narratives and prepare for review

and evaluation

Part 2: Participant presentations with invited stakeholders

Teams (participants will be able to communicate with partner team from the opposite

locations), will "report out" on the goals, strategies, and concepts for their project.

- Teams will be given 10 minutes to deliver a final presentation to a group of invited stakeholders. Stakeholders, facilitators, and participant observers will evaluate presentations.

Cherokee Ranch & Castle Foundation (CR & CF) Mission

To preserve the natural environment, heritage and history of Cherokee Ranch & Castle and provide education opportunities.

Vision

At Cherokee Ranch & Castle we change lives by taking you from the here and now to the long ago and far away…one project, one habitat, one EXPERIENCE at a time.

-Deb Domres and Gayle Forester

Charrette Ground Rules

Ground rules allow the groups to remain focused while encouraging the free flow of ideas;

they include:

- No criticism of ideas or people

- Respect everyone's time
- All ideas are jumping off points and adaptable
- Everyone participates
- Final decisions are consensus based
- One conversation at a time

Cell phones may be used for site photographs to aid ideation or for recall; cells may be used for internet access.

No social media sharing of charrette participants or projects is allowed!

Charrette Challenge

The challenge is to develop and design an educational research venue/site for varied learners and researchers using a planned historic renovation on a working cattle ranch in Sedalia, Colorado.

Charrette Strategy

Charrettes establish a creative integrated environment for identifying and incorporating strategies that result in projects that are designed and built to minimize resource consumption, reduce life-cycle costs, and maximize health and environmental performance across a wide range of measures - from ecological restorations to habitat protection - while also meeting expectations for security, accessibility, historic preservation, and design objectives.

Charrettes Process

Stage 1: Generate as many ideas as possible by minimizing time for critical thinking,

Stage 2: Allow individuals to form their own conclusions on the stronger ideas

Stage 3: Understand how teams compromise and where consensus has or surfaced on ideas, most worth pursuing

Charrette Stages

Charrette Instrument/
Tool kit Toolkit
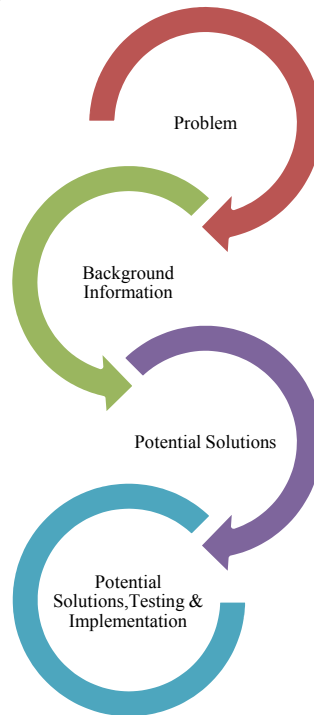
Team Assignments

You will be assigned to a team comprised of various disciplines; participating either off-site (from the CSU campus) or on-site in Sedalia, CO. Teams will be comprised of members from disciplines identified below. Final presentations developed by each team will be independent of other teams, presented to an invited group of stakeholders. The following diagram depicts disciplines represented at the charrette.

Agriculture Animal Sciences

Ecology & Sustainability Professionals

Architecture

Charrette Team Disciplines

Landscape Architecture

Construction Management

Interior Design

Education

Others

Facilitation and Participant Observers- Overview

All teams will be observed by facilitators and participant observers. Teams will have a list of professional educators and/or industry experts availed (schedule of each expert and field/discipline will be in your binder.) Facilitators and POs will direct participants to 'content experts' such as Ranch personnel, via video conferencing using Blue Jeans, or email, text or phone, to ask for assistance with questions from participants. Volunteers will be allowed to interact and assist with participants when their historic knowledge of the site would be helpful. All interactions will be noted, and notes will be shared with facilitators post charrette. POs are either educators or private sector practitioners/professionals and each has an abundance of talent, experience, and industry knowledge; if needed they can assist with project specifics.

POs are tasked with observing participants during the charrette process; each has been provided access to the pre-charrette read. Cherokee staff and Ranch personnel are available to

answer site-specific questions regarding background information, the ranch and of course the cattle operation.

The charrette will be photographed, audio and video taped for research purposes, and reviewed by participant observers, and facilitators to ensure and attribute quotes, ideas, and concepts to team participants. Images and/or recording will not be used for commercial purposes, and will be saved for five years, locked in the home office of the Co-PI. All images will be destroyed at that time. The research team does reserve the right to use images for research presentations.

Objectives

Transdisciplinary team members commit to teach, learn, and work across disciplinary boundaries to plan and provide integrated services resulting in outcomes that could not be provided by single practitioners in a single field during a charrette addressing a historic renovation[19].

Teams will accomplish objectives by scenario building as they:

- Engage within a transdisciplinary team to address infrastructure & land use problem(s),
- Develop integrative methods for problem solving across TD teams in two environments,
- Understand TD team collaboration while researching and developing a "Next Steps" plan for renovation to accommodate an educational program,
- Identify opportunities and barriers related to historic renovation on a working cattle ranch,
- Acquire practical, workable, and valid options for utilizing historic properties for wildlife and education plans

To reduce problem(s) complexity teams will:

- Focus their efforts on one Ranch site: The Johnson Dairy Farm also known as Wauhatchie and the 344 acres as identified on Google Earth/GIS maps provided.
- Use/negotiate disciplinary language across natural and social boundaries for developing a plan, problem statement, and deliverables for a final team presentation.

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[19] http://www.arj.no/2012/03/12/disciplinarities-2/

- Describe in non-academic language (narratives, drawings, pictures, mapping) the complexity of the challenge problem at hand, addressing non-academic community members and stakeholders. Presentations should be delivered using familiar, every-day language to non-academics.

- Decide what will be included/excluded from the challenge problem faced by the ranch, its inhabitants, and for future renovations.

- Decide on appropriate combination of existing qualitative and quantitative methods/approaches for use during the project development and presentations; if these prove to be too limited or inappropriate for the task, teams will proceed with designing innovative approaches that might not have been used before (transformative in nature and resulting in innovation).

<div align="center">Core Values to Consider while Planning</div>

1) Stewardship
2) Sustainability
3) Education
4) Wildlife/Endangered species (habitat protection/restoration)
5) Ranching & cattle operations
6) Historic Homestead(s) & Landscapes
7) Infrastructure, land & water use
8) Ecological, geological, and cultural importance of the site
9) Historic preservation/renovation

<div align="center">**Project Considerations and Goals**</div>

- Identify functions to be performed, needs of occupants & address special requirements
- Consensus on project goals
- Identification of realistic strategies & designs for the project
- Include an overall master plan including facilities construction/restoration, operations & maintenance, green procurement, education & outreach, and,
- Shared information and lessons learned
- Visuals and concept sketches must be included

Researcher Field Log/Notes:

Joined by Daniel Raggi I completed a site visit and created a field log utilized to created charrettes and presentations posters for participant use. I continued my site research with James Holmes, travelling to area sites who had created educational aspects to their programs; we learned about programs already being addressed and what was still in need of development, discussing the challenges and concerns their encountered during development. Case studies were collected for the Teaching with Historic properties (TwHP) site, I reviewed each section in search of appropriate studies to include for participant use; those that supported educational use of historic properties. Once all data was collected it was digitally archived in a folder and added to the Qualtrics site for participants. An example of historic data collected included structures now gone and early images with Tweet Kimball during the appraisal circa 1992, Wauhatchie Appraisal Forms – Site Structures (Accessed and copied then placed in the charrette binder.

Cherokee Ranch – Attn: James Holmes, Executive Director

Deb Domres & Daniel Raggi Field Log notes from onsite observations and findings - collected August 18, 2016 Attn: James Holmes
1) Historical restoration of existing structures
    a. Ascertain easement & exemptions
    b. Standards for historic restoration vs renovation
    c. Prioritize structures
        (1) Barn (Johnson Dairy Farm)
        (2) House (Johnson Dairy Farm)
        (3) Blunt Homestead Residence
2) Compile ecological report & plan further ecological observations
    a. Endangered species – location and existing habitats
    b. Human/eco impact assessment
    c. Human impact reduction plan/recommendations
    d. Reintroduction of native species – fauna & flora
3) Tent-clearance areas
    a. Scrub oak grove development

        b.   Curricula
- Archeological
- Geological
- Ecological
- Historical
- Political
- Wildlife rehabilitation
- Botanical
    1. Apple grove
    2. Grafting
    3. Historical trees (cuttings historical trees)
    4. Rare plant garden
    5. Hybridization & species monetization

4) Charrette

    a)   Selection of date and site- Proposed charrette held in barn with lunch served at the Castle
1. Clean up and prep with lighting, port a potty, generators
2. Technology needs ascertained
3. Poster board sheets-supplies for participants
4. Expert speakers - possible
    - James Holmes-property history overview of project
    - Historic preservation
    - Tim White (Construction)– rehab of residences and barn
    - Deb Domres and Daniel Raggi – Concepts for education, wildlife, and flora rehabilitation, including visiting researcher programs, education fellowships, etc.

    b)   Students participants-CSU (5 to 8 students per team divided into 7 or 8 teams)
- Construction Management
- Architecture
- Natural Resources
- Veterinarian School
- Interior Design
- Education
- Agriculture
- Consideration/Invitations: Content experts/professors/ private sector experts & industry professionals
    1. Deb Domres, Carole Makela & Daniel Raggi (PO) – charrette facilitators
    2. Tim White (CR & CF Board – private sector developer)
    3. John Killingsworth & Ron Holt (CSU CM professor &senior capstone)
    4. Bill Timpson
    5. Temple Grandin
    6. Delwin Benson

       7.   Gillian Bowser

    c)   Birds of Prey demonstration-lunch

5)   Sources of funding and lecture series

    a)   Monetization

    b)   Fees

    c)   Scheduling/hours

    d)   Demographics

6)   Reinstate Events-fundraising

    a)   Douglas County Republican Caucus – last held 2011

    b)   Waterloo Party

    c)   Tweets Birthday Celebration

Training involved a single session, before the charrette. Once acceptance by participants was received training was organized between two available days and times. Teams were formed by convenience sampling with each team collaborating with another team to complete "fishbowl" exercises.

For example, Teams A and B went first completing the Mountain Plane Crash Scenario while Teams C and D observed those team's interactions; Teams C and D traded places and completing the Lost at Sea Scenario; both teams compiled a report and shared their observations. Teams were pre- assigned when possible and late arrivers or additional participant teams were formed by asking individuals to count off. Each training session was different, depending on the number of attendees, when possible teams were comprised of an odd number of participants to avoid a stalemate. This process was explained further through demonstration during training.

Observing Teams

Facilitators and participant observers began by intruding themselves to the other team, but thereafter they cannot interrupt the meeting or ask questions while recording data.

PO/FOs collected data among team members by tracking interactions between individuals and recording when they spoke; asked questions, responded to others, and invited comments. Observing team members monitored active listening behaviors, described in Descriptors for Scored Discussants, such as paying attention, holding judgement, reflecting, clarifying, summarizing, and sharing. Once participants had completed the scenario exercise, teams trading places and completed the next exercise. Once both teams have completed the exercises teams broke out to collaborate and draft a report for the team they observed. This was done to help individuals and members strengthen their observational and communication skills.

Add directions here SAME FORMS WERE USED FOR THE SCENARIO EXERCISE

Assignment

Each team wrote an informal, analytical report in memo format using an **indirect approach** to the team they observed. Using individual Group Discussion Score Sheets, Group Discussion Score Cards and individual Assessment of Listening Skills forms, each team created a composite

score sheet from each form to share with the other teams. Memos included composite scores sheets in their memos; not to exceed four pages. Included in the memo were the following:

- organized facts and findings from composite observations
- assessments of team communication skills (strengths and challenges) for team members participating, and,
- provided observed teams with recommendations for strengthening individual skill sets, as these forms were used during the charrette.

Facts and Analysis

This section included facts based on each team's observations of the other team's exercise. Teams provided evidence, such as the dialogue diagram or the table summarizing activities, to explain team members' roles and describe ways they interacted. Included in the memo was any information necessary to provide context for the reader and adequately draw conclusions to support recommendations. All members of a team submitted individual reports/forms with one member either elected or volunteering to add each team's final report/memo to trainers/facilitators as a WORD document; sent via email.

PO Two Scenario Exercises – Practice Observational Skills

Scenario 1) - Survival Exercise Score Card – Plane Crash

Team Members _____

(Print)

Items	Step 1 Team Ranking	Step 2 Expert Ranking	Step 3 Difference Ranking [1- 3]
A ball of steel wool			
A small ax			
A loaded .45 caliber pistol			
Can of Crisco Shortening			
Newspapers (one per person)			
Cigarette Lighter (without fluid)			
Extra Shirt & pants for each survivor			
20 x 20 ft. piece of heavy-duty canvas			
A sectional air map made of plastic			
One quart of 100-proof whiskey			
A compass			

Family-sized chocolate bars (one per person)			
Total from Step 3			

Survival Exercise Score Card – Lost at Sea Scenario

Team Members _____

<div align="right">(Print)</div>

Items	Step 1 Team Ranking	Step 2 Expert Ranking	Step 3 Difference Ranking [1- 3]
A shaving mirror			
A quantity of mosquito netting			
Five-gallon can of water			
One case of U.S. Army C rations			
Maps of the Pacific Ocean			
A floating sea cushion			
2 gallons can of oil / petroleum mixture			
A small transistor radio			
Twenty sq. ft. of opaque plastic			
Shark repellant			
One quart of 160 proof Puerto Rican Rum			
Fifteen ft. of nylon rope			
Two boxes of chocolate bars			
Total from Step 3			

Exercise Scenarios

Instructions

Props/Prep: Yes
Time: 25-45 min
Audience: Any (teams)
Physical: No

Activity: This exercise can be used in many different settings and training programs. It is designed to work mainly to develop team building, cooperation, and leadership. A great activity to do with newly formed groups to 'break the ice'.

Time Requirements: approximately 25-45 minutes

Materials needed: *Mountain Plane Crash* and *Lost at Sea* scenarios, scoring sheets one- sheet per person for individual exercise and 1 sheet per team for individual responses, 1 sheet per team for part 2 team answers

Procedure:

Part 1
Participants should divide into teams of 5 (or as many as possible, keeping an odd number). Hand out one scenario sheet with 14 items listed, to each participant. Give 10 minutes to individually rank the 14 items.

Part 2
Team members should then confer for an additional 10 minutes and decide on the team's priority ranking each of the 14 items. Have the team re-rank item on one sheet of paper.

Part 3
Team members should then compare their individual rankings with those determined by the group, and discuss why the scores differ, if applicable. Or, if individuals would re-rank items based on the group discussion, what changed their minds? How did the group influence them?

Part 4
Facilitator reads out the correct order of contents. There is no reason to do this except that group answers will certainly differ from the correct order. It creates many smiles.

Function in Training:
Focus on teamwork, collaboration, concession, thinking outside the box.

Facilitator's Notes

Aim   This exercise may be used as an icebreaker, but it will also enable student groups to discover how they work together; their strengths and how they need to improve.

Time   Thirty minutes as an icebreaker, one to one and a half hours with debriefing,
required   depending on the number of groups.

Resources   A room where small groups can form; flip chart plus pens.

Procedure 1 Give participants the handout of the scenario and make clear the 30-minute time limit imposed.

2 Explain that each group will have five minutes in which to report and justify their decision. Reporting is not essential but gives participants the opportunity to explain their decisions. If there are many groups, an alternative would be to record their choices on paper for display.

3 Carry out a debriefing of how the group had functioned. The questions you ask will depend upon the learning you want to achieve from the exercise but should encourage reflection on their experience.

Examples -
How did they reach their decision?
What roles did group members adopt?
Did they listen to each other?
What have they learned about the functions of a group?
What would they do next time?

Mountain Plane Crash – Scenario I Activity

You and your companions have just survived the crash of a small plane. Both the pilot and co-pilot were killed in the crash. It is mid-January and you are in Northern Canada. The daily temperature is zero and the nighttime temperature is below zero. There is snow on the ground and the countryside contains several creeks crisscrossing the area. The nearest town is 35 kilometers away. You are all dressed in city clothes appropriate for a business meeting. Your group of survivors managed to salvage the following items:

- A ball of steel wool
- A small axe
- A loaded pistol
- Can of vegetable oil
- Newspapers (one per person)
- Cigarette lighter (without fluid)
- Extra shirt and pants for each survivor
- 20 x 20 ft. piece of heavy-duty canvas
- An air map made of plastic
- Some whiskey
- A compass
  - Family-size chocolate bars (one per person)

Your task as a group is to list the above 12 items in order of importance for your survival. List the uses for each. You will be required to come to agreement as a group.

Plane Crash Scenario Answers

1. Cigarette lighter (without fluid).
   The gravest danger facing the group is exposure to cold. The greatest need is for a source of warmth and the second greatest need is for signaling devices. This makes building a fire the first order of business. Without matches, something is needed to produce sparks, and even without fluid, a cigarette lighter can do that.
2. Ball of steel wool
   To make a fire, the survivors need a means of catching he sparks made by the cigarette lighter. This is the best substance for catching a spark and supporting a flame, even if the steel wool is a little wet.
3. Extra shirt and pants for each survivor
   Besides adding warmth to the body, clothes can also be used for shelter, signaling, bedding, bandages, string (when unraveled) and fuel for the fire.
4. Can of vegetable oil
   This has many uses. A mirror-like signaling device can be made from the lid. After shining the lid with steel wool, it will reflect sunlight. While this could be limited somewhat by the trees, a member of the group could climb a tree and use the mirrored lid to signal search planes. It can be rubbed on exposed skin for protection against the cold. The empty can be useful in melting snow for drinking water. It is much safer to drink warmed water than to eat snow, since warm water will help retain body heat. The can is also useful as a cup.
5. 20 x 20 ft. piece of heavy-duty canvas
   The cold makes shelter necessary, and canvas would protect against wind and snow (canvas is used in making tents). Spread on a frame made of trees, it could be used as a tent or a wind screen. It might also be used as a ground cover to keep the survivors dry.
6. Small axe
   Survivors need a constant supply of wood to maintain the fire. The axe could be used for this as well as for clearing a sheltered campsite, cutting tree branches for ground insulation, and constructing a frame for the canvas tent.
7. Family-size chocolate bars (one per person)
   Chocolate will provide some food energy. Since it contains mostly carbohydrates, it supplies the energy without making digestive demands on the body.
8. Newspapers (one per person)
   These are useful in starting a fire. They can also be used as insulation under clothing when rolled up and placed around a person's arms and legs. A newspaper can also be used as a verbal signaling device when rolled up in a megaphone-shape. It could also provide reading material for recreation.
9. A loaded pistol The pistol provides a sound-signaling device. (The international distress signal is 3 shots fired in rapid succession). There have been numerous cases of survivors going undetected because they were too weak to make a loud enough noise to attract attention. The butt of the pistol could be used as a hammer, and the powder from the shells will assist in fire building. By placing a small bit of cloth in a cartridge emptied of its bullet, one can start a fire by firing the gun at dry wood on the ground. The pistol also has some serious disadvantages. Anger, frustration, impatience, irritability, and lapses of

rationality may increase as the group awaits rescue. The availability of a lethal weapon is a danger to the group under these conditions. Although a pistol could be used in hunting, it would take an expert marksman to kill an animal with it. Then the animal would have to be transported to the crash site, which could prove difficult to impossible depending on when its shot.

10. Some whiskey

   The only uses of whiskey are as an aid in fire building and as a fuel for a torch (made by soaking a piece of clothing in the whiskey and attaching it to a tree branch). The empty bottle could be used for storing water. The danger of whiskey is that someone might drink it, thinking it would bring warmth. Alcohol takes on the temperature it is exposed to and a drink near freezing whiskey would freeze a person's esophagus and stomach. Alcohol also dilates the blood vessels in the skin, resulting in chilled blood belong carried back to the heart, resulting in a rapid loss of body heat. Thus, a drunk person is more likely to get hypothermia than a sober person is.

11. A compass

   Because a compass might encourage someone to try to walk to the nearest town, it is a dangerous item. The only redeeming feature is that it could be used as a reflector of sunlight (due to its glass top).

12. An air map made of plastic

   This is also among the least desirable of the items because it will encourage individuals to try to walk to the nearest town. Its only useful feature is as a ground cover to keep someone dry.

Lost at Sea– Scenario II Activity

Lost at Sea Exercise

Scenario: You and your team have chartered a yacht. None of you have any previous sailing experience, so you have hired an experienced skipper and a two-person crew. As you sail through the Southern Pacific Ocean, a fire breaks out and much of the yacht and its contents are destroyed. The yacht is slowly sinking. Your location is unclear because vital navigational and radio equipment have been damaged. The yacht skipper and crew have been lost to the fire. Your best guess is that you are approximately 1,000 miles southwest of the nearest landfall.

You and your friends have managed to save the following items:

- A sextant
- A shaving mirror
- A quantity of mosquito netting
- Five-gallon can of water
- One case of U.S. Army C- rations
- Maps of the Pacific Ocean
- A floating sea cushion

- A 2 gallon can of oil-gas mixture
- A small transistor radio
- Twenty sq. ft. of opaque plastic
- Shark repellant
- One quart of 160 proof Puerto Rican Rum
- Fifteen ft. of nylon rope
- Two boxes of chocolate bars (one per person)

In addition to the above, you have salvaged a rubber life raft. The total contents of your team's pants pockets amount to one package of cigarettes, three boxes of matches, and three pieces of paper currency.

YOUR CHANCES OF SURVIVAL WILL DEPEND UPON YOUR ABILITY TO RANK THE ABOVE ITEMS IN THEIR RELATIVE ORDER OF IMPORTANCE. GOOD LUCK!

Plane Crash Scenario Answers
Lost at Sea Individual Worksheet[*]

Calculating Scores

Using the answer sheet, the score is the difference between the actual answer and the

individual/group ranking. The lower the score the better. Calculate the score for each item and

add them to find the total score. (These are the official answers as given by the U.S. Merchant

Marines in their recruit training)

Your task is to rank the items below in terms of their importance to your survival. Place the

number *1* by the **most** important item, the number *2* by second most important, and so on through

number 12, the least important.

   __   Sextant
   __   Shaving Mirror
   __   Five-gallon can of water
   __   One case of U.S. Army C- rations
   __   Maps of the Pacific Ocean
   __   A floating seat cushion
   __   A two-gallon can of oil-gas mixture
   __   **A s**mall transistor radio

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[*] Above exercises were copied and adapted respectively from *The 1975 Annual Handbook for Group Facilitators available online at Pfeiffer's Classic Activities for Building Better Teams/@ 2003 John Wiley & Sons, Inc.*

___ Shark repellent
___ One quart of 160 proof Puerto Rican Rum
___ Fifteen ft. of nylon rope
___ Two boxes of chocolate bars (one per person)

Instructions

This is an exercise in group decision making. Your group is to employ the group consensus method in reaching its decision. This means that the ranking, for each of the twelve survival items, **must** be agreed upon by each group member before it becomes the group decision. Consensus can be difficult to reach; therefore, not every ranking will meet with everyone's approval. As a group, try to make each ranking one with which **all** group members can at least **partially** agree with. Here are some guidelines to use in reaching consensus:

1. Avoid arguing for your own individual judgments. Approach the task based on logic.

2. Avoid changing your mind if it is only to reach agreement and avoid conflict. Support only solutions with which you can agree at least somewhat.

3. Avoid "conflict-reducing" techniques such as majority vote, averaging, or trading in reaching your decision.

4. View differences of opinion as a help, rather than a hindrance in decision-making.

___ Sextant
___ Shaving Mirror
___ Five-gallon can of water
___ Mosquito netting
___ One case of U.S. Army C rations
___ Maps of the Pacific Ocean
___ Seat Cushion (flotation device approved by the Coast Guard)
___ Two-gallon can of oil-gas mixture
___ Small transistor radio
___ Shark repellent
___ Twenty square feet of opaque plastic
___ One quart of 160-proof Puerto Rican rum
___ Fifteen feet of nylon rope
___ Two boxes of chocolate bars
___ Fishing kit

Lost at Sea – Answers

According to the experts (United States Coastguard), the basic supplies needed when a person is stranded mid-ocean are articles to attract attention and articles to aid survival until rescue arrives. Without signaling devices there is almost no chance of being spotted and ultimately rescued. Furthermore, most rescues occur within the first 36 hours and a person can survive with only a minimum of food and water during that period.

So, the following is the order of ranking the items in their importance to your survival:

1. Shaving Mirror
   The shaving mirror would be critical for signaling air-sea rescue.
2. Two-gallon can of oil-gas mixture
   The oil –gas mixture would also be critical for signaling. The mixture will float on water and could be ignited with one of the pieces of paper currency and a match.
3. Five-gallon can of water
   The water would be necessary to replenish fluids lost through perspiration.
4. Once case of sea rations
   One case of army rations would provide basic food intake.
5. Twenty sq. ft. of opaque plastic
   The opaque plastic could be used to collect rainwater and provide shelter from the elements.
6. Two boxes of chocolate bars
   The chocolate bars could provide reserve food supply
7. Fifteen ft. of nylon rope
   The nylon rope could be used to secure people or equipment to prevent them from being washed overboard.
8. Floating sea cushion
   The floating seat cushion could serve as a life preserver if someone fell overboard.
9. Shark repellent
   Obvious
10. One quart of 160-proof Puerto Rican rum
    The 160 per cent proof rum contains 80% alcohol, which is enough to be used as an antiseptic for any injuries; otherwise, it is of little value.
11. Small transistor radio
    The small transistor radio would be of no use without a transmitter. You would also be out of range of any radio station.
12. Maps of the Pacific Ocean
    Maps of the Pacific Ocean would be worthless without navigation equipment.
13. Mosquito netting

The mosquito netting would not be necessary, as there are NO mosquitoes in the mid-Pacific Ocean, and the fishing kit would be more effective for catching fish.

14. Sextant

Without tables and a chronometer, relatively useless

The basic rationale for ranking signaling devices above life-sustaining items (food and water) is that without signaling devices there is almost no chance of being spotted and rescued. Furthermore, most rescues occur during the first thirty-six hours, and one can survive without food and water during this period.

Appendix I: Individual and Team Assessment Forms and Findings

The study utilized eight forms for data collection by PO/FOs; identified below; not all

POs completed each observation form. The researcher and PO/FOs used the table below to

'score' participants levels of TD teaming. The researcher used the following tables to measure

participant interactions and levels of TD teaming during the charrette and when reviewing

audio/video recordings. Level descriptors were implemented to establish standards for student

learning. Depicted below.

Level	Descriptors
5	Is a proactive participant showing a balance between listening, initiating, and focusing discussions? Displays a proactive use of the full range of discussion skills to keep discussion going and to involve everyone in the group. Understands the purpose of the discussion and keeps the discussion focused and on topic. Applies skills with confidence, showing leadership and sensitivity.
4	Is an active participant showing a balance between listening, initiating, and focusing discussion? Keeps the discussion going Tries to involve everyone in the group. Understands the purpose behind the discussion but is more focused on the discussion than on the people involved. Applies skills with confidence but lacks leadership and sensitivity.
3	Demonstrates all the elements of discussion skills but uses them less frequently and with less confidence than the above level. Is **aggressive** rather than **assertive** to keep the discussion going and tends to dominate the group to involve everyone or to keep the discussion going. Keeps the discussion going but as a supporter rather than a leader; tens to move n and out of the discussion as a supporter. Demonstrates many skills but lacks the confidence to pursue them so that the group takes longer than necessary to reach consensus. Demonstrates a positive approach but is more focused on getting done than on having a positive discussion.
2	Is an active listener but defers easily to others and lacks confidence to pursue personal point of view even when it is right? Participates but does not use skills such as summarizing and clarifying often enough to show confidence.

	Limits discussion skills to asking questions, summarizing, and staying on topic.
	Lacks balance between discussion and analytical skills. Either displays good analysis skills and poor discussion skills or good discussion skills and poor analytical skills.
	Rarely demonstrates analysis skills because does not understand the purpose of the discussion, and as a result, offers little evidence to support any point of view.
1	Shows effort and is willing to be involved in the discussion but lacks the skills to get involved.
	Is an inconsistently active participant showing an imbalance between listening, initiating, and focusing discussion.
	Fails to offer enough factual information or stay on topic.
	Asks clarifying questions as the main discussion skill but fails to summarize and clarify often enough to show confidence.
	Passively tried to find e.g. flipping through notes. Lacks participation, resulting in little evidence with which to assess skills.
0	Demonstrates no participation or effort.
	Participates when prompted by facilitator.
	Simply responds to others and initiates nothing.
	Provides limited responses that are often off topic.
	Participates minimally so that is impossible to assess skills or understanding of the issues.

PO/FO **O**bservations were collected, reviewed for completion; points earned by participants were based on identified measures in the Observation Forms; composite scores were accumulated by teams completing all charrette exercises and activities. POs and FOs observation forms we used for differing activities and the researcher implemented the same standards when completing audio/video observations; the researcher watched the videos three times to identify measures among all the forms supplied POs. To better ascertain transdisciplinarity teaming three-point rubrics were developed to identify mastery based on levels, below is the first which shares criteria among differing point values.

Criteria and Measures - Rubric

Criteria	Exemplary (5 points)	Accomplished (4 points)	Developing (3 points)	Beginning (2 points)	Did not answer but mentioned (1) or did not address category (Zero points)
Descriptive observation and field log (5 points)	Detailed description of day. Field log included 6 or more drawings of structures (interior /exteriors), site maps, landscape maps, paths, connections, artifacts	Includes some details and descriptions but elaboration was needed, field logs included 4 or 5 drawings	Descriptions lacked clarity in areas and needed elaboration, field log included 2 or 3 drawings	Description not clear, needs extensive elaboration, field log included1 drawing or were missing	No descriptions or drawings exercises not attempted or completed
Background of problem: Statement of the issues identified discipline knowledge and problems focused on and explained how each relates to project objectives. (5 points)	Identified 5 to 7 issues with considerable detail, explained problems, relationships and how they relate to project objectives, utilized 3 or more sources outside case study alone.	Identified 3 to 4 issues with adequate detail, explained the relationship between problems and offered support from multiple case studies.	Identified 1 or 2 issues with some detail, briefly explained relationships but failed to offer clear support from case studies.	Identified a single issue and provided unclear or non-existing explanations to support relationships between issues, utilized single case study.	No discussion or identification to project objectives
Academic disciplines - statements addressing potential benefits and negative impacts	Critical thinking is exhibited in responses and notes; four or more benefits and	Critical thinking is exhibited in responses and notes; three benefits and negative	Critical thinking is exhibited in responses and notes; two benefits and negative	Critical thinking is slightly exhibited in responses and notes; one positive	Did not attempt or make notes/filed log

Criteria	Exemplary (5 points)	Accomplished (4 points)	Developing (3 points)	Beginning (2 points)	Did not answer but mentioned (1) or did not address category (Zero points)
of implementations from observations and field logs (5 points)	negative impacts are presented.	impacts are presented.	impacts are presented.	and one negative impact are presented.	
Full explanation of the problem identified from observations and field logs (5 points)	Project problem is full explored, explained using evidence from all-past, present & future - concepts supported with case studies, site evidence & observations	Project problem is fully explored, explained with two of the following evidence from (past, present & future) with site evidence & observations	Project problem fully explored, explained using 1 of the following (past, present & future) evidence and observations	Project problem is not fully explained with any of the following (past, present & future) site evidence & observations	Observations not used to address project problem, did not use past present or future evidence
Academic representation, expressions, and observations (5 points)	Proposed solution reflected individuals' academic discipline and skills, and other academic disciplines in the college	Proposed solution reflected individuals' academic discipline and skills	Proposed solution reflected 51% to 75% of academic disciplines and skills represented in the team	Proposed solution reflected 25% to 50% of the academic disciplines and skills represented in the team	Proposed solution reflected none of the academic disciplines and skills represented in the group

Observation form 1 with results. PO/FOs addressed student learning during the charrette using the below observation form identified as Objectives and Measures. Individuals were watched and listened to during charrette interactions. Teams earned points based on measures in the follow manner as observations addressed eight questions: 1) Yes, 5 points 2) Partial, 3 points and 3) No, zero points;

criteria addressed if the team fully, partially or did not complete each objective each of eight questions. Findings were collected and averaged among each team; shared in below by team, questions, and measure. Tables include the researcher's observations using audio/video recordings. Documented differences existed among the different PO/FOs and when using video recordings, which supported capturing richer details.

Red T1 PO/FO Observations Identifying Student Objectives & Measures

Objectives	Measures Students will be able to:	Yes	Partial	No	Video FO 1 Observation – post-charrette		
					Yes	Partial	No
O1) Did participant(s) complete the pre-charrette research & analyze the ranch site?	Identify/analyze readings, understanding early homestead development/ranching		X		X		
O2) Did each participant prepare a 3-5-minute presentation to share with their team & during the charrette	Identify & analyze social & cultural evidence-used historic renovation guidelines - culminating in renovation plan		X				X
O3) Did participant projects include a writing component & presentation within a TD team?	Identify, define & analyze the ranch as an educational center		X		X		
O4) Did participants address issues through a negotiated action research project during a charrette?	Identify & interpret maps, historic artifacts, GIS, wildlife & cattle operation.		X				X
O5) Were participants able to identify & describe what is going on at the site?	Identify & analyze presentations formulating a team vision		X		X		
O6) The project will include writing & presentation of findings & recommendations by TD teams? Did each team include input from each discipline?	Identify & demonstrate risk-taking, independence; accept challenges and assume new roles	X			X		

Objectives	Measures	Yes	Partial	No	Video	
O7) Did the charrette appear to improve participants awareness of individual strengths, change preconceived ideas, and expose participants to options and points of views other than their own? Did the team appear to respect and appreciate different perspectives & disciplines while identifying similarities and relationships?	Demonstrate autonomy & assertiveness, responsible for one's own actions-preserving in the face of conflict/difficulties	X			X	
O8) Did participants develop oral and/or written communication skills, while learning to collaborate & negotiate to resolve conflict? Did the team come to understand relationships among disciplines/fields?	Demonstrate autonomy & assertiveness while taking responsibility for one's own actions while preserving in the face of conflict/difficulties.	X			X	
	TOTAL	15	15		30	6

Green T2 PO/FO Observations Identifying Student Objectives & Measures

Objectives	Measures Students will be able to…	Yes	Partial	No	Video FO 1 Observation – post-charrette		
					Yes	Partial	No
O1) Did participant(s) complete the pre-charrette research & analyze the ranch site?	Identify/analyze readings, understanding early homestead development/ranching		X			X	
O2) Did each participant prepare a 3-5-minute presentation to share with their team & during the charrette	Identify & analyze social & cultural evidence-used historic renovation guidelines - culminating in renovation plan		X			X	
O3) Did participant projects include a writing component & presentation within a TD team?	Identify, define & analyze the ranch as an educational center		X		X		
O4) Did participants address issues through a negotiated action research project during a charrette?	Identify & interpret maps, historic artifacts, GIS, wildlife & cattle operation.		X			X	

Objective	Measure				
O5) Were participants able to identify & describe what is going on at the site?	Identify & analyze presentations formulating a team vision		X	X	
O6) The project will include writing & presentation of findings & recommendations by TD teams? Did each team include input from each discipline?	Identify & demonstrate risk-taking, independence; accept challenges and assume new roles	X		X	
O7) Did the charrette appear to improve participants awareness of individual strengths, change preconceived ideas, and expose participants to options and points of views other than their own? Did the team appear to respect and appreciate different perspectives & disciplines while identifying similarities and relationships?	Demonstrate autonomy & assertiveness, responsible for one's own actions-preserving in the face of conflict/difficulties	X		X	
O8) Did participants develop oral and/or written communication skills, while learning to collaborate & negotiate to resolve conflict? Did the team come to understand relationships among disciplines/fields?	Demonstrate autonomy & assertiveness while taking responsibility for one's own actions while persevering in the face of conflict/difficulties.				
	TOTAL	10	15	20	9

Blue T3 FO/PO – Researcher Observations from Charrette & Videos

Objective #91 & #89 (#91 was no active Day 1 – work conflict)	Measure Students will be able to…	Yes	Partial	No	Video FO 1 Observation – post-charrette		
					Yes	Partial	No
O1) Did participant(s) complete the pre-charrette research & analyze the ranch site?	Identify/analyze readings, understanding early homestead development/ranching			X			X
O2) Did each participant prepare a 3-5-minute presentation to share with	Identify & analyze social & cultural evidence-used historic renovation guidelines - culminating in renovation plan			X		X	

their team & during the charrette							
O3) Did participant projects include a writing component & presentation within a TD team?	Identify, define & analyze the ranch as an educational center	X			X		
O4) Did participants address issues through a negotiated action research project during a charrette?	Identify & interpret maps, historic artifacts, GIS, wildlife & cattle operation.	X			X		
O5) Were participants able to identify & describe what is going on at the site?	Identify & analyze presentations formulating a team vision	X				X	
O6) The project will include writing & presentation of findings & recommendations by TD teams? Did each team include input from each discipline?	Identify & demonstrate risk-taking, independence; accept challenges and assume new roles	X				X	
O7) Did the charrette appear to improve participants awareness of individual strengths, change preconceived ideas, and expose participants to options and points of views other than their own? Did the team appear to respect and appreciate different perspectives & disciplines while identifying similarities and relationships?	Demonstrate autonomy & assertiveness, responsible for one's own actions-preserving in the face of conflict/difficulties	X			X		
O8) Did participants develop oral and/or written communication skills, while learning to collaborate & negotiate to resolve conflict? Did the team come to understand relationships among disciplines/fields?	Demonstrate autonomy & assertiveness while taking responsibility for one's own actions while persevere in the face of conflict/difficulties.	X			X		
	TOTALS	30	0	0	20	9	0

T4 PO/FO Observations Identifying Student Objectives & Measures

Objectives	Measures Students will be able to:	Yes	Partial	No	Video FO 1 Observation – post-charrette		
					Yes	Partial	No
O1) Did participant(s) complete the pre-charrette research & analyze the ranch site?	Identify/analyze readings, understanding early homestead development/ranching		X			X	
O2) Did each participant prepare a 3-5-minute presentation to share with their team & during the charrette	Identify & analyze social & cultural evidence-used historic renovation guidelines - culminating in renovation plan		X			X	
O3) Did participant projects include a writing component & presentation within a TD team?	Identify, define & analyze the ranch as an educational center		X		X		
O4) Did participants address issues through a negotiated action research project during a charrette?	Identify & interpret maps, historic artifacts, GIS, wildlife & cattle operation.	X			X		
O5) Were participants able to identify & describe what is going on at the site?	Identify & analyze presentations formulating a team vision	X			X		
O6) The project will include writing & presentation of findings & recommendations by TD teams? Did each team include input from each discipline?	Identify & demonstrate risk-taking, independence; accept challenges and assume new roles	X			X		
O7) Did the charrette appear to improve participants awareness of individual strengths, change preconceived ideas, and expose participants to options and points of views other than their own? Did the team appear to respect and appreciate different perspectives & disciplines while identifying similarities and relationships?	Demonstrate autonomy & assertiveness, responsible for one's own actions-preserving in the face of conflict/difficulties			X		X	

O8) Did participants develop oral and/or written communication skills, while learning to collaborate & negotiate to resolve conflict? Did the team come to understand relationships among disciplines/fields?	Demonstrate autonomy & assertiveness while taking responsibility for one's own actions while preserving in the face of conflict/difficulties.	X			X		
	TOTAL	20	9	0	25	9	0

Observation Form 2 – inter/intra team discussion) POs were provided a Team Discussion form, but none collected data

1) Team Discussion Score Sheet

Group Discussion Score Card				
Team # ___ Team Color: _____ Place 2-digit participant ID # across top row				
Use hash tags or check marks to denote interactions	ID #	ID #	ID #	ID #
Questions to all				
Questions to one				
Responding				
Initiating/Inviting				
Total				
Rank in Group				
Level of Performance				

Observation Form 3 with results) Academic and Discipline Knowledge; findings by team

Team academic and discipline knowledge skill scores

Different disciplines use specific terminologies and technical language; each use specific research methods according to discipline research requirements. The researcher's framework included observations collected by watching and listening as participants communicated and interacted using artifacts and resources, during self-directed and team-based challenges experienced during a charrette. Four observation forms were used to collect data addressing these attributes; assessments focused on measures of individual and team skills, knowledge, creativity, personal learning, and problem solving. Measures were based on 5-point scale identified as: exemplary (5), accomplished (4), developing (3), beginning (2), or attempted (1) but did not address (0). Tables were adapted from prior charrette studies and from literature (Transdisciplinary Team Observations- Knowledge (Relationships of Transformative Learning to Transdisciplinary Team Actions and Key Tasks/Academic and Discipline Skills and in Krishnan (2009). Krishnan identified 6 characteristics of an academic discipline.

A. Six attributes of Academic Discipline Knowledge (DK)

Attribute DK	T1 Red	T2 Green	Blue T3	Yellow T4
1.1 Communication	4	4	4	5
1.2 Planning	3	4	4	4
1.3 Writing evaluation/proposal notes	3	3	3	3
1.4 Data collection & analysis	3	4	4	4
1.5 Technology (21st century Skills Software /Technology Word, Excel, Project, CAD, Visual basics, or PowerPoint)	3	3	4	5
1.6 Presentation	3	3	3	3

Totals	19/30	21/30	22/30	24/30

B. Six attributes of Character for success (CS) (Skills not directly measured by standardized tests) – these skills address individuals disposition to think feel and act in ways that help one's self and others (copied from https://www.huffpost.com/entry/teaching-character-versus_b_6508710)

Attribute CS	T1 Red	T2 Green	Blue T3	Green T4
2.1 Character – ethics/trustworthy	5	5	5	5
2.2 Social Emotional Skills (social situations- showing up on time, firm handshake, etc.)	5	5	5	5
2.3 Growth Mindset	3	3	3	3
42.4 Non-cogitative traits & habits (Self-control, persistence, conscientiousness)	4	4	4	5
2.5 Soft Skills (Manners & social convention)	5	5	5	5
2.6 Curiosity, optimism, social intelligence	5	5	5	5
Totals	27/30	27/30	27/30	28/30

C. Six Life Skills (LS) for problem solving – these skills revolve around how individuals use what they know to achieve goals copied from https://www.huffpost.com/entry/teaching-character-versus_b_6508710

Attributes - LS	T1 Red	T2 Green	Blue T3	Yellow T4
3.1 Focus when problem solving	4	4	4	5

3.2 Perspective taking	4	4	4	4
3.3 Communicating	5	4	5	4
3.4 Critical thinking	4	4	4	5
3.5 Taking on challenges	5	5	5	5
3.6 Self-directed engaged learning	4	4	4	4
Totals	26/30	25/30	26/30	27/30

D. Ten attributes of successful teamwork – PO/FOs

Adapted and revised from researcher previous activities and charrettes combined with
https://medium.com/@mikeschoultz/10-team-characteristics-for-effective-teamwork-e0429b362ddd

Attribute - TW	T1 Red	T2 Green	Blue T3	Green T4
4.1 Cooperation-listens, shares ideas, supports team	5	5	3	5
4.2 Contributions- ideas & assistance	4	5	4	5
4.3 Problem-solving-discussed, compromised & made changes/reliable and responsive	5	5	4	5
4.4 Task/Assignment- who will do what, keeps others informed	5	4	3	4
4.5 Responsibility – understands & completes agreed tasks	4	4	4	4
4.6 Self-assessment- Discussed team problems & agreed on a solution, remained flexible	5	5	3	5
4.7 Agrees on goals and outcomes-gives clear directions	4	3	3	4
4.8 Supports risk taking and change	5	5	4	5
4.9 Defined roles: Big picture thinker, taskmaster, organizer	3	4	4	4
4.10 Mutually accountable-accepts team and individual responsibility	5	5	5	5
Totals	45/50	45/50	37/50	46/50

(Madill et al., 2018).

Observation Form 4) Field trip observations PO/FOs did not complete the observations; the researcher completed the form, shared results, when testing and during the second field trip with one student.

Field trip Observation Form

Participant ID	See			Hear			Smell			Touch		
	5 pts.	3 pts	0 pts DNC	5 pts	3 pts	O pts DNC	5 points	3points	Zero points	5 points	3 points	Zero points
# 16												
#10												
#45												
#91												
#89												
#22												
#18												
FO/ researcher	White fence, house, barn, pump house, chicken coup, trees, grasses, dirt road, cars, gate entry, barb wire fence, manure, mountains, highway, dirt in house animal droppings, in house, old carpet, stone & metal			Cars, cattle, people talking, feet on ground, birds, voices, laughter, whispering, highway noises, feet on hard surfaces, ground brush blowing in wind			Musty and skunk in house, manure, fresh air, people/perfume, dirt, and grasses,			Cold propane tank, cars, rough barn wood, barbed wire fence, stone cistern, tree bark, dirt, snow, carpet in house, brick fireplace, metal fireplace, glass windows,		

	fireplace, chipped paint inside house, garden, pastures, people in different color clothes, cattle paths, partially covered snow on ground								wood floors		
#89 Drop Out Anthony	Wooden barn on concrete, chicken coop, pump house, homestead house, concrete cistern				Breeze in trees, clunking of boots on ground, cars in distance, birds		Soil, brush, manure, fresh air			Rough wood, soft soil, splintered fencing, chipped paint on rustic siding		

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Observation Form 5) Participant Interactions and Exchanges (PO/FOs did not utilize this form)

| | 5. Interactions/ Exchanges   Team _____ PO ID _____ | | | | | | | |
ID	5.1 Discussion among team (Group)	5.2 Discussion 1 x 1 among team	5.3 Discussion 1 x 1 between 2 teams	5.4 Discussion 1 x 1 between 3 teams	5.5 Discussion among POs & team	5.6 Discussion 1 x 1 among POs & team	5.7 Discussion among Disciplines 1 x 1	5.8 Discussion among disciplines w/team (Group)
Day 1 a.m.								
16								
JL								
MFP								
CM 43								
16								
JL								
MFP								
CM 43								
Day 1 PM (2)								
16								
JL								
MFP								
CM 43								
16								
JL								
MFP								
CM 43								

Observation Form 6) Measures of Listening Skills: PO/FOs were instructed to collect observations using the following rubric: G represented Good and NI represented Needs Improvement; by implemented this 'scoring' method the researcher was supported when measuring behaviors among teams then make comparisons among all teams . (Team findings communication skills by actions (Table 39) p. 367 MOVE HERE, below)

Team ID	Names (IDs) (Adjust columns to meet number of participants per team)							
Behavior (good or * Needs Improvement	Good	NI*	Good	NI*	Good	NI*	Good	NI*
Makes eye contact; is engaged								
Provides encouragement								
Clarifies for understanding								
Asks relevant questions Reflects what they said								
Does not interrupt								
Validates other's feelings								

Observation Form 7) Team Performance (Interactions by dimensions and attributes. Findings

follow by teams. Measures were based on a 5-point scale, identified as:

Exemplary (5 points)	Accomplished (4 points)	Developing (3 points)	Beginning (2 points)	None or Low (1 point)

Team performance (Interactions) by dimensions/attributes

Attribute	T1	T2	T3	T4
Dimension: Peer Interaction				
Monitors tasks/project with team	4	5	4	4
Negotiates roles within group	4	4	4	4
Divided tasks working individually to toward project development/completion	0	0	0	-5[20]
Did not divide tasks worked jointly toward project development/ completion	5	5	5	3
Articulated for understanding regarding process and/or content	5	4	3	5
Provided individual/team feedback, asked for assistance and/or redirection	5	3	4	5
Dimension: Positive Communication				
Respected others' ideas, participated and offered ideas/input	5	5	5	5
Used socially appropriate language and behavior/avoided discipline jargon	4	4	4	4
Listened, took turns speaking and was open to other ideas	5	4	4	4
Dimension: Inquiry Rich/Multiple paths				
Developed and asked appropriate questions to relevant knowledge	3	3	3	4

---

[20] Team participants part and parceled all work Day 1, a process outside of TDM so the researcher deducted points for this aspect. T1, T2, and T3 worked as a team both days so each received a 0 representing not applicable.

Verified information and sources to support inquiry (binder, maps, internet, PO/FOs)	3	5	5	5
Dimensions Authentic Approach and Tasks				
Shares connections to relevant knowledge; discipline and skills knowledge	3	4	4	5
Negotiates methods or materials relevant to address/solve the problem	3	4	4	5
Uses tools collaboratively to approach tasks	4	5	3	4
Developed new and innovative ways to address education and site management/addressed Cr & CF mission	3	3	3	3[21]
Dimension: TD Thinking				
Discusses approaching task, activity, or problem using multiple disciplines	3	3	3	3
Co-creates processes/products by incorporating multiple disciplines and players Stakeholders (PO/FOS)	4	4	4	4
Sought research including communicating with experts	5	3	3	5
Totals (Possible overall 80) Culminative	68	67	65	67

Observation Form 8) Observation Classification System by Team Knowledge

Exemplary (5 points)	**Accomplished (4 points)**	**Developing (3 points)**	**Beginning (2 points)**	**None or Low (1 point)**

A) Team Intra and Inter Team Observation Levels- measures and scores

Team Discussion Levels
Place 2-digit participant ID # across top row

---

[21] FOs scored this attribute as zero

Use hash tags or check marks to denote interactions	T1	T2	T3	T4
Questions to all	4	4	4	5
Questions to one	5	5	4	5
Responding	2	4	5	5
Initiating/Inviting	4	5	4	5
Sought inter team collaboration	4	4	4	0
Total				
Rank in Group	19/25	22/25	21/25	20/25
Level of Performance	3+	4	4	5

B) Team Discussion Measures and Scores

Actions	Red T1 #16		Green T2 #10/#45		Blue T3 #89/#91		Yellow T4 #22/#18	
	G	NI	G	NI	G	NI	G	NI
Makes eye contact; is engaged	X		X		X		X	
Provides encouragement	X		X		X		X	
Clarifies for understanding	X		X		X	2/4	X	2/4
Asks relevant questions	X	1/4	X		X		X	
Reflects back what they heard/said	X		X		X	2/4	X	
Does not interrupt	X		X		X		X	
Validates other feelings	X		X		X	2/4	X	2/4
Notes	1/4 POs noted T1 required improvement when asking relevant questions		Day 2 1 PO failed to collect any observations except does not interrupt equated to G		2 POs noted 2 - students required improvement in 3 actions resulting in a disagreement as to actions		2 POs noted #18 needed improvement in 2 actions, resulting in a disagreement among POs as to actions	

Appendix J: Post-charrette Survey (Students)

Enter the personalized identifier you created for the
 during your pre-charrette survey _____ and I was a member of the
_____team. I participated at _____(location).
Q1 I reviewed pre-charrette read materials, created a 3-5-minute synopsis, and shared it during the charrette.
> Yes
> No

IF NO please share why not _____.

Q2 Having information about the project before the charrette was helpful and saved time during the charrette.
> Strongly agree
> Somewhat agree
> Neither agree nor disagree
> Somewhat disagree
> Strongly disagree

Q3 Being assigned a team was helpful as it allowed me to share experiences with people outside my field.
> Strongly agree
> Somewhat agree
> Neither agree nor disagree
> Somewhat disagree
> Strongly disagree

Q4 Did attending the charrette make you more comfortable when working on a team with other disciplines?
> Definitely yes
> Probably yes
> Might or might not
> Probably not
> Definitely not

Q5 Do you feel your team valued your opinions?
> Yes
> Maybe
> No

Q6 Did working with people from other disciplines help you value views of others?
　　　　Strongly agree
　　　　Somewhat agree
　　　　Neither agree nor disagree
　　　　Somewhat disagree
　　　　Strongly disagree

Q7 Did you offer feedback to teammates during the development of your project?
　　　　Definitely yes
　　　　Probably yes
　　　　Might or might not
　　　　Probably not
　　　　Definitely not

Q8 My specific discipline knowledge was valued during the charrette.
　　　　Strongly agree
　　　　Somewhat agree
　　　　Neither agree nor disagree
　　　　Somewhat disagree
　　　　Strongly disagree

Q9 I was an active participant during the charrette and carried my weight with my team.
　　　　Strongly agree
　　　　Somewhat agree
　　　　Neither agree nor disagree
　　　　Somewhat disagree
　　　　Strongly disagree

Q10 My team experienced differing opinions during project planning.
　　　　Strongly agree
　　　　Agree
　　　　Somewhat agree
　　　　Neither agree nor disagree
　　　　Somewhat disagree

Q11 My team experienced tense moments during the charrette.
        Strongly agree
        Somewhat agree
        Neither agree nor disagree
        Somewhat disagree
        Strongly disagree

Q12 The charrette experience made me more confident when sharing knowledge from my discipline with others outside my field.
        Strongly agree
        Somewhat agree
        Neither agree nor disagree
        Somewhat disagree
        Disagree

Q13 My team helped me understand concepts and ideas outside of my discipline/field?
        Strongly agree
        Somewhat agree
        Neither agree nor disagree
        Somewhat disagree
        Strongly disagree

Q14 My team could make connections among disciplines.
        Strongly agree
        Somewhat agree
        Neither agree nor disagree
        Somewhat disagree
        Strongly disagree

This section asks about your communicating with teams from another location, called your counterpart team (on-site or off-site). Specify how you participated, for example I participated <u>virtually </u>with the<u> Blue </u>team in Fort Collins.

        I participated _____ with the_____ team (fill in the blank).

Q15 I could relate to my counterpart team (on-site or off-site), when discussing ideas outside those of my team.

        Strongly agree
        Somewhat agree
        Neither agree nor disagree
        Somewhat disagree
        Strongly disagree

Q16 I could relate to participants from another location (virtual team or on-site team) easily and found it helpful to be able to share my ideas.

        Definitely yes
        Probably yes
        Might or might not
        Probably not
        Definitely not

Q17 I learned new terminology/vocabulary, not jargon, useful to connect future work from charrette participants outside my discipline.

        Definitely yes
        Probably yes
        Might or might not
        Probably not
        Definitely not

Q18 My team could focus on creating our plan once we reached a consensus of what was needed to create an educational program while incorporating site elements and characteristics.

        Strongly agree
        Agree
        Somewhat agree
        Neither agree nor disagree
        Somewhat disagree

Q19 My team shared knowledge from their respective fields that enhanced our project.
 Strongly agree
 Somewhat agree
 Neither agree nor disagree
 Somewhat disagree
 Strongly disagree

Q20 Describe how the individual ice-breaker exercise helped you experience the site by identifying three areas. If it did not help, please say, "didn't help".

Q21 Describe how the mapping profile exercises (3) helped you share your observations among teams; if they did not help, say "didn't help".

Q22 I believe my observations from the icebreaker and mapping profile exercises helped my team better understand my point of view when addressing the project.
 Strongly agree
 Somewhat agree
 Neither agree nor disagree
 Somewhat disagree
 Strongly disagree

Q23 The charrette helped me better understand how to work in a team and share knowledge among others outside my field.
 Strongly agree
 Somewhat agree
 Neither agree nor disagree
 Somewhat disagree
 Strongly disagree

Q24 I changed the way I look at how I communicate because of working on a transdisciplinary team.
 Strongly agree
 Somewhat agree
 Neither agree nor disagree
 Somewhat disagree
 Strongly disagree

Q25 My team helped me change the way I shared ideas with other participants.
 Strongly agree
 Somewhat agree
 Neither agree nor disagree
 Somewhat disagree
 Strongly disagree

Q26 Working with others outside of my discipline changed how I will do things in the future
        Strongly agree
        Somewhat agree
        Neither agree nor disagree
        Somewhat disagree
        Strongly disagree

Q27 During team collaboration we discovered oversights in what we previously believed to be true from our individual disciplines.
        Strongly agree
        Somewhat agree
        Neither agree nor disagree
        Somewhat disagree
        Strongly disagree

The following section asks your opinion about collaboration, goals, and strategies within your team. Answer each question by completing the following sentence: During the charrette, my team _____
Q28 helped me to better understand concepts outside of my field.
        Strongly agree
        Somewhat agree
        Neither agree nor disagree
        Somewhat disagree
        Strongly disagree

Q29 helped me learn how to collect, compare, and see our project in a unique way?
        Strongly agree
        Somewhat agree
        Neither agree nor disagree
        Somewhat disagree
        Strongly disagree

Q30 helped me to understand and solve problems while creating innovative solutions I was unfamiliar with prior to the charrette.

> Strongly agree
> Somewhat agree
> Neither agree nor disagree
> Somewhat disagree
> Strongly disagree

Q31 helped me experience ways to see links among disciplines.

> Strongly agree
> Somewhat agree
> Neither agree nor disagree
> Somewhat disagree
> Strongly disagree

The following section asks your opinion about collaboration, goals, and strategies within your team. Answer each question by completing the following sentence:

As a team member during the charrette I_____.

Q32 shared new ways to look at a problem while sharing ways we approach problems in my discipline.

> Strongly agree
> Somewhat agree
> Neither agree nor disagree
> Somewhat disagree
> Strongly disagree

Q33 collaborated and shared options for ways to share new ways to teach others.

> Strongly agree
> Somewhat agree
> Neither agree nor disagree
> Somewhat disagree
> Strongly disagree

Q34 found ways to share my previous experiences and was can link the knowledge I learned with my team.

> Strongly agree
> Somewhat agree
> Neither agree nor disagree
> Somewhat disagree
> Strongly disagree

Q35 I discovered that by doing _____ I will make better decisions on future projects (fill in the blank).

Q36 The charrette helped me share my ideas and knowledge with my team when giving feedback in a respectful way.

     Strongly agree
     Somewhat agree
     Neither agree nor disagree
     Somewhat disagree
     Strongly disagree

Q37 I changed my perception about team projects and how to work with participants from differing fields with different perspectives.

     Strongly agree
     Somewhat agree
     Neither agree nor disagree
     Somewhat disagree
     Strongly disagree

Q38 I learned that there is more than one way to do things without feeling I am giving in or being forced to change; I did not have to agree to get along.

     Strongly agree
     Somewhat agree
     Neither agree nor disagree
     Somewhat disagree
     Strongly disagree

Q39 During the charrette I did not have to work alone while others made minimal contributions.

     Strongly agree
     Somewhat agree
     Neither agree nor disagree
     Somewhat disagree
     Strongly disagree

Q40 My team shared the workload and rational to come up with solutions for the project.

     Strongly agree
     Somewhat agree
     Neither agree nor disagree
     Somewhat disagree
     Strongly disagree

Q41 By attending the charrette I gained a better understanding of the interconnections and relationships among fields/disciplines.

- Strongly agree
- Somewhat agree
- Neither agree nor disagree
- Somewhat disagree
- Strongly disagree

Q42 The charrette helped me gain an understanding of links between historic properties and education.

- Strongly agree
- Somewhat agree
- Neither agree nor disagree
- Somewhat disagree
- Strongly disagree

Q43 By attending the charrette I gained an understanding of links to the overall property and how it could be used for future research and education opportunities.

- Strongly agree
- Somewhat agree
- Neither agree nor disagree
- Somewhat disagree
- Strongly disagree

Q44 During charrette planning I gained an understanding of the wider issues facing renovation at the Ranch.

- Strongly agree
- Somewhat agree
- Neither agree nor disagree
- Somewhat disagree
- Strongly disagree

This section asks your opinion about team members and teamwork. Place a check in the box that best fits your opinion; 1 represents not at all or low and 5 extremely or very.

Q45 How accepting were team members of ideas offered by different disciplines.

	1	2	3	4	5	
	1	2	3	4	5	
Not accepting at all						Extremely accepting

Q46 How constructively was tension utilized within the team to stimulate knowledge transfer.

	1	2	3	4	5	

	1	2	3	4	5	
Not constructive at all						Very constructive

Q47 How challenged were you by being assigned to a team of mostly unknown individuals.

	1	2	3	4	5	
	1	2	3	4	5	
Not challenged at all						Extremely challenged

Q48 Overall, the level of collaboration among team members was_____.

	1	2	3	4	5	
	1	2	3	4	5	
Very weak						Very strong

Q49 Rate how much you agree or disagree with each of the following statements concerning your team. The members of our team_____

	Strongly agree	Agree	Some what agree	Neither agree nor disagree	Some what disagree	Disagree	Strongly disagree
shared information among disciplines effectively							
communicated, shared ideas, and expressed intended messages to one another easily							
shared and developed ideas between on-site and off-site teams							
utilized specific techniques between on-site and off-site teams in pursuit of solutions, such as brain storming, or comparison							

Q50 Rate how much you agree or disagree with each of the following statements concerning your team. How effective was or were_____

	Extremely effective	Very effective	Moderately effective	Slightly effective	Not effective at all
the tools selected by your team to communicate and convey intended messages to one another					
the process of assigning roles and responsibilities to team members					
ideas, terminology, and concepts transferred across disciplines					

Q51 Rank the following tools/methods for your preferred method to communicate, when working with a team. Rank 1 being the most preferred and 10 the least preferred.

_____ Telephone not texting
_____ Texting
_____ Online
_____ Shared databases (example lotus notes)
_____ E-mail
_____ Face-to-face
_____ Video conferencing (example Skype, ZOOM, Blue Jeans)
_____ Audio conferencing
_____ Voice mail
_____ Chat rooms and/or bulletin boards

Q52 Behaviors that make it difficult for me to communicate virtually are_____ (Check all that apply)

time zones differ
contact information is constantly changing
available work hours, off hours availability
check in frequency
response time from others

Q53 Did you work with others from your same discipline during the charrette?
        yes, most of the time
        yes, about half of the time
        yes, about a quarter of the time
        no, not at all

Q54 Please describe a positive and/or negative experience associated with the charrette.

Q55 What do you perceive to be the biggest barriers/challenges while working with a transdisciplinary team.

Q56 How comfortable are you in working on a transdisciplinary team again.
        Extremely comfortable
        Somewhat comfortable
        Neither comfortable nor uncomfortable
        Somewhat uncomfortable
        Extremely uncomfortable

Q57 How confident are you that you will continue working with transdisciplinary teams in the future.
        Much more
        Somewhat more
        About the same
        Somewhat less
        Much less

Q58 Is there anything else you would like us to know about the charrette, your experience or recommendations for future charrettes and working with multidisciplinary teams? Please write as much or as little as you wish.

Thank you for your time, hard work and participation in this research. Our work is not possible without you!
Thank you from the Research Team and all of those from Cherokee Ranch & Castle!

Appendix K: PO Post-charrette Survey

CRCF Post-charrette Survey Community members & volunteers dld/cm 1.16.2016

Q1 This section asks for personal information and instructs you how to create a personal identifier. This identifier allows the research team to keep you anonymous when writing about the charrette; it is known to you and the research team. To create your identifier below please use the last four digits of your home or cell phone number, followed by either a C (community member), S (Cherokee staff) or V (Volunteer) and a # symbol. For example, if your phone number is 303.333.5531, and you are a community member, non-staff, or volunteer) your code would look like this: 5531C#. Please write your code in the space below.

Q2 I am_____
    Male (1)
    Female (2)
    Trans gender (3)
    Prefer not to say (4)

Q3 I am _____ years old (complete the sentence).

Q4 I am_____ (check the correct box)
    Employed full time (1)
    Employed part time (2)
    Unemployed looking for work (3)
    Unemployed not looking for work (4)
    Retired (5)
    Student (6)
    Disabled (7)
    Stay at home parent (9)
    Prefer not to say (8)

Q5 If employed, please enter your job title and field in the box below.

Q6 My highest level of education is _____(high school, associates, bachelors, masters, PhD, etc.) and my studies were in _____ or I work in_____(for example you might say, " I have a MS in construction management and my studies were in sustainability; I work for a general contractor as a project manager"). Complete the sentence in the space below; if retired or other please specify.

Q7 I participated in the charrette as a_____ from Cherokee Ranch & Castle.

    volunteer (1)
    employee (2)
    Board member (3)
    Business associate (4)
    Nature educators' employee/educator (5)
    Community member-not a volunteer from Cherokee Ranch (6)
    Other (7)

Q8 During the charrette I was an_____ (complete the sentence).

    Invited speaker (1)
    Auxiliary support (meals, check in, etc.) (2)
    Tour guide at the Castle (3)
    Property/site tour guide (4)
    Interested community member (5)
    Other (6)

Q9 Please identify your role and identify the task you facilitated during the charrette. For example, it might look like one of the following: I was a guide at _____ for 3 hours during the mapping profile exercise, or I was an invited speaker at _____ (add name of location- headquarters, castle, etc.) for 3 hours; virtual facilitator, etc.

Q10 I have either worked or volunteered at the Ranch for_____ (length of time).

    less than 6 months (1)
    6-12 months (2)
    13-24 months (3)
    25-60 months (11)
    more than 61 months (12)
    None of the above (13)

Q11 During the charrette I observed participants using the following materials. (select all that apply)

    black or white board (1)
    cameras (2)
    cell phones (3)
    tablet or laptop computer (4)
    paper, graph paper, rulers, etc. (5)
    artifacts (maps, pictures, etc.) (6)
    Charrette binder (8)
    Goggle maps (7)

Q12 During the charrette I observed participants _____.

	Most of the time (30)	About half the time (31)	Rarely (32)
collaborating within their team (1)			
seeking assistance from other teams (2)			
going outside or virtually to review the site (3)			
asking for help from team lead and/or educators (4)			
talking to the facilitators for answers and/or project clarification (5)			
talking to volunteers and staff for assistance (6)			
evaluating other teams or participants work (12)			
assisting with the final presentation preparation (13)			
using the charrette binder (14)			

Q13 I observed_____.

	Most of the time (16)	About half the time (17)	Rarely (18)
one or more participants taking over the discussion (1)			
one or more participants appearing intimidated or not participating (2)			

one or more participants appearing bored or disinterested (3)			

Q14 I observed participants _____.

	Most of the time (16)	About half the time (17)	Rarely (18)
recycling materials in the correct bins (1)			
placing proper items in the compost bins (2)			
bring respectful of the site and land (3)			

Q15 I observed participants _____.

	Always (24)	Most of the time (25)	About half the time (26)	Sometimes (27)	Rarely (28)
discussing a range of solutions for the problem (1)					
discussing all ideas presented with respect (2)					
sharing knowledge from their area of study (3)					
exploring real-world solutions to the problems (4)					
sharing real-world experiences relating to the problems (5)					

identifying real-world ways and/or methods to solve the problems (6)					

Q16 During the icebreaker exercise I observed participants _____ (complete the sentence).

Q17 During the mapping profile exercise I observed participants _____ (complete the sentence).

Q18 This section asks you to rate the overall charrette experience from both your observations and as a participant.

Q19 From my observations I found participants completing or participating in the following activities (check all that apply).

	Strongly agree (13)	Somewhat agree (14)	Neither agree nor disagree (15)	Somewhat disagree (16)	Strongly disagree (17)
cooperatively working in sub-groups within teams (1)					
doing field work (2)					
responding to questions orally (3)					
taking notes (4)					
recording original data/information (5)					
analyzing and interpreting information from speakers (6)					

analyzing and interpreting information provided by teammates (7)					
generating original ideas (8)					
reviewing the previous day's work (9)					
engaging in on-task discussions primarily with other participants (10)					
solving problems from which there are several appropriate approaches (12)					
organized data into a presentation that addressed the problems (13)					
giving a final presentation that addressed the problem (11)					

Q20 From my observations the physical site_____.

	Strongly agree (18)	Somewhat agree (19)	Neither agree nor disagree (20)	Somewhat disagree (21)	Strongly disagree (22)
was perfect for this event and size of participants (1)					

tour was helpful when looking for ways to solve the problems (2)					
was easily navigated (3)					
parking was convenient (11)					
technology was appropriate (14)					
Internet was available when needed (12)					
workspaces were large enough to accomplish tasks (13)					
length of time to accomplish each task was appropriate (9)					
speakers provided needed information to complete tasks/answer questions (10)					
the facilitator(s) was prepared (21)					

Q21 From my observations the planning team_____(logistics).

	Strongly agree (13)	Somewhat agree (14)	Neither agree nor disagree (15)	Somewhat disagree (16)	Strongly disagree (17)
provided enough flip charts, pens, etc. to complete tasks (1)					
provided participants enough time to accomplish each task (2)					
provided speakers with needed equipment and allowed enough time for them to share needed information for participants to complete tasks (3)					
and facilitator(s) were well prepared for the event (4)					
and facilitator(s) supported participants when asked or needed (5)					
provided needed technology (8)					

provided enough tables to work comfortably (9)					
provided a well thought out and planned event (10)					

Q22 In my opinion_____ (asks your opinion about teams/participants).

	Strongly agree (23)	Somewhat agree (24)	Neither agree nor disagree (25)	Somewhat disagree (26)	Strongly disagree (27)
there was not enough time to do each task and/or exercise (1)					
the teams were the right size (17)					
think teams were balanced with diverse participants, interests and fields represented (2)					
there were to many participants (include students, observers, speakers, staff & volunteers) (3)					
the charrette was well planned (16)					

participants were prepared, and valuable (18)					
that the non-participant observers were necessary (19)					
I would be interested in being a participant observer for a charrette (20)					
the facilitator(s) were prepared (21)					
the charrette was a valuable experience for participants (23)					

Q23 Please add anything else here that you wish us to know...ideas, changes, and areas we did not ask you about that you feel should be included.