

DISSERTATION
EFFECTIVENESS OF A DECISION MAKING UNIT: AGRICULTURE EDUCATION
AT THE HIGH SCHOOL LEVEL

Submitted by
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In partial fulfillment of the requirements
For the Degree of Doctor of Philosophy
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ABSTRACT OF DISSERTATION
EFFECTIVENESS OF A DECISION MAKING UNIT: AGRICULTURE EDUCATION
AT THE HIGH SCHOOL LEVEL

Many curriculums and instructors present information in a discipline-based format. In real-life situations, decisions made regarding one area have repercussions that are felt in multiple areas. The purpose of this study was to examine the impact a decision making unit taken from the Integrated Resource Management (IRM) High School Curriculum Aid Compact Disc had on the decision making approach of high school students.

Most studies assessing thought processes are based on self-report measures where students indicate their perceived skill level rather than completing tasks which provide evidence of their actual skill level. An objective instrument was developed to assess students' approach to problem solving by allowing them to display their own skills. Student approach to decision making was measured as the variance related to the level of importance students placed on items related to four domain areas (animal science, environment, financial, and human). Eighty-three high school students and 14 instructors participated in the project.

While significant interactions between pre and post test administrations were not detected, self report by students indicated their approach to decision making had changed as a result of completing the decision making unit. Student and instructor feedback

indicated there is not one right or best way to develop curriculum or deliver instruction. Within one class there are students with diverse learning styles, levels of skill, interests, and prior knowledge. Curriculum packages should be developed and delivered in a manner which addresses multiple learning styles simultaneously and provides instructors with a variety of materials to utilize.

Over 90% of responding students were from rural areas. As rural populations continue to decline and core credit requirements placed on high school students increases, agriculture education instructors need to increase the number of non-rural students in their classes in order to ensure the survival of their programs as well as maintain a level of the population that is agriculture literate.

While conceptually it makes sense to assess the level of importance students place on various domain areas when facing a decision, there may be better approaches to assess student approach to problem solving. Further research exploring objective approaches to assess thought processes including decision making is needed.

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CHAPTER I: INTRODUCTION

Background

Decision making skills are required of everyone in every area of life. However an effective decision making process is seldom formally taught (Hammond, Keeney, & Raiffa, 1999) at any educational level. It is often expected that students who comprehend content information will inherently have the ability to assimilate information and apply it in making decisions. According to Perkins (1984), “students function primarily as consumers of products of inquiry, not producers,” (p. 24). Ennis (1987) indicated that pilot curricula which teach thinking skills are necessary. “If students are challenged to critically evaluate, communicate, and defend their ideas, knowledge retention and understanding will increase even more,” (Peters, Smith, & Smith, 2002, p. 862).

The ability to assess a situation and make wise choices is a lifelong challenge.

Although it is important to develop strong component skills that students may draw upon when needed, a far more important skill is the ability to weigh various claims according to the available data, evidence, and examples, select the strongest claim, and arrange the supporting material in a way that builds a sound argument, such as an argument about what decision to make or how to solve a problem, (Yeh, 2001, p. 14).

Those who master decision-making skills will benefit both personally and professionally. Unfortunately, learners often are not presented with information in a way that is conducive to good decision making or guided through exercises that develop good decision making skills. Making informed decisions requires that decision makers be aware of all factors involved in and affected by a given situation. These factors often

cross traditional discipline boundaries. A multidisciplinary approach provides a broader framework, real life applications, and basis for learners to obtain and use knowledge as a foundation for further knowledge acquisition and decision making.

Agriculture encompasses many disciplines that traditionally have been taught as separate subjects, for example animal science, range science, and agriculture economics. Knowledge of one area alone leaves a decision maker or manager ill-equipped to make optimal decisions. An integrated approach, which considers all domain areas cooperatively, is reflective of real life and allows informed decisions to be made.

According to Williams and Dollisso, technological advances are changing the way in which food and fiber are produced (1998). Technical skill alone is not enough to address challenges faced by leaders in agriculture, quick and careful thinkers and communicators are needed who can dynamically address changes in market structure and demands of consumers (Grant, Field, Green, & Rollin, 2000). Today's agricultural leaders require content knowledge from multiple subject areas combined with higher order thinking skills to make informed decisions. The Integrated Resource Management (IRM) High School Curriculum Aid CD (Batchelder, Peel, & Niswender, 2003) was designed to present content knowledge integratively and build higher order thinking skills through questioning, content, practical scenarios, and problem solving activities.

Purpose of the Study

Many curriculums and instructors present information in a discipline-based format (Boccuti, 2000). In real-life situations, decisions made in regard to agricultural resources have repercussions that are felt in multiple domain areas of the system. The Integrated Resource Management (IRM) curriculum presented students with discipline

specific information but went beyond traditional discipline boundaries by connecting content to other closely related disciplines. It also challenged students to consider how decisions interact and interrelate with other resource areas. Decision makers who recognize all of the elements involved in and affected by their choices are better equipped to select the best alternative.

The purpose of this study was to examine what impact a decision making unit taken from the Integrated Resource Management (IRM) High School Curriculum Aid CD had on the decision making approach of high school students. In addition to decision making ability, students' attitudes toward the environment/range, animal science, and financial components were also evaluated. High school instructors in the study responded to questions regarding their demographics, delivery of course content, and their perceptions of students' decision making skills.

Objectives

The primary objective of this research was to explore the effectiveness of the IRM curriculum at improving students' abilities to make decisions from an integrated approach, considering information from multiple domain areas. There were two secondary objectives. One was to assess correlations between student decision making ability and attitudes toward environment/range, animal science, and financial considerations. The second was to determine if correlations existed between several instructor variables and student performance. Information obtained through this research was intended to provide valuable information for the development of future curriculum and learning activities designed to facilitate the teaching and learning of agriculture and decision making skills.

Research Questions

The primary purpose of the research was to assess trends in student decision making ability. Other variables relating to attitude and instructor background, experience, and perception were simultaneously examined. All variables were studied with the purpose of gaining information to be used in curriculum development. The study pursued three primary research questions:

1. Is there a significant change in students' domain integration scores between pre and post tests?
2. What domain area (animal science, environmental/range, financial, human) do students emphasize when making decisions?
3. Is there a correlation between decision making domain areas students mention in their open ended responses and domain areas they weigh most heavily on the Likert scale response items?

Delimitations

1. To get instructors and classes to participate in the research, they were only asked to participate for a short period of time. The treatment group participated for five class periods. One class period was required for the pretest, three periods of instruction, and one period for the posttest. The control group was only asked to participate for two class periods, a week to ten days apart. These schedules were based on 50 minute class periods. Schools that use different class lengths made appropriate adjustments. Due to the short amount of instruction time, exposure to the IRM curriculum may not be long enough to detect significant differences in

student decision-making ability as the experimental group will have been introduced without adequate time for application and practice.

2. Each high school class that participated was taught by a different instructor and in a different school. It was not possible to control for instructor variance in teaching styles and emphasis placed on developing decision-making skills either prior to or during the study.
3. Instructors and their students were divided into experimental and control groups by class. Instructors that were able to attend the July in service became the experimental group and those that were not able to attend participated in the control group. There may be notable differences between the instructors who chose to participate and were in the experimental group and those not attending and assigned to the control group.
4. Data was not collected regarding long-term learning. For example, no follow-up was done six months or a year after the study was completed.
5. The control group was composed of students of the same grade level (sophomore/junior/senior) enrolled in an agriculture class. They were not taught any decision making model. It was not possible to compare the IRM decision making unit to other decision making units as decision making skills are not a standard component of high school curriculums.

Assumption

The population for this study consisted of agriculture education students from 14 high school classes in Colorado. To assume similar results from other students, it must be assumed that those students are similar to those included in this study.

Definitions

Animal science attitude score – score indicated by student responses to items regarding their attitude toward animal science.

Current curriculum – what is currently being used in high school agriculture education classrooms in the state of Colorado, this is not a specific curriculum across the state but includes a variety of resources that are selected or created by individual instructors.

Domain integration score – score indicating the extent to which students' ranking of the four domain areas of environment/range, animal science, financial considerations, and human resource considerations is balanced. Scores range from zero to sixteen with zero being the most unbalanced and sixteen being most balanced.

Financial consideration attitude score – score indicated by student responses to items regarding their attitude toward financial considerations and their importance.

Environment/range attitude score – score indicated by student responses to items regarding their attitude toward the environment/range and its importance.

Instructors – high school agriculture education instructors.

Integrated – addresses multiple related content areas simultaneously, crosses traditional discipline boundaries, may also be called multi or interdisciplinary.

Integrated decision-making ability – capacity to incorporate information from multiple content areas when analyzing problems and making decisions.

Integrated Resource Management (IRM) High School Curriculum Aid – curriculum package developed at Colorado State University which presents content information on grazing animals and the grazing resource in an integrated manner.

Learning style – the way in which a student learns, factors that influence a person’s preferred learning style are amount of structure and order, spontaneity, setting, freedom to choose activities and assignments, sequence, impulse, analytic, logic, emotion, feeling, perception, input organization, processing, understanding, hands-on, self-motivated, interaction, group work preference, independent work, practicality and realistic approach.

Post test score – the scores that experimental group students receive on the test after they have been taught the decision-making unit and that the control group students receive on the second test.

Pre test score – the scores that experimental group students receive on the test prior to exposure to the decision-making unit and control group students receive on the first test.

Students – high school students, usually ages 13-18, in grades 9-12, enrolled in an agriculture education course.

Teaching style – the atmosphere and approach an instructor uses in a classroom to conduct themselves, deliver information, and interact with students. Factors that comprise a teaching style may include but are not limited to lecture, demonstration, question/answer format, hands-on exercises, spontaneity, welcome interruptions by students with questions, etc.

Significance

There is not a scientifically tested instrument available on the market that measures student decision making skills (Mincemoyer & Perkins, 2003). Research on students’ thought process and decision making ability has been conducted on individual steps within the decision making process such as defining goals, assessing options, selecting an alternative but there is not a comprehensive instrument that collects

information providing evidence of the thought process students followed to arrive at their decision. Additional thought process assessments ask participants to provide a self-report of their perceived increase in skill level (Mincemoyer & Perkins, 2003). A self-report instrument alone does not provide objective evidence of changes within participant thought process.

An increase in integrated approaches to instruction in agricultural education is occurring (Fields, Hoiberg, & Othman, 2003). Integrated approaches have more direct applications to real life than traditional discipline based approaches. However research linking thought process or approach to decision making is lacking. When decision making approach is combined with an integrated approach to agriculture education, supporting research is non-existent. Information gained through a study addressing the impact of an integrated approach on students' decision making ability would benefit educators, curriculum developers, and students. Fields, Hoiberg, & Othman (2003) found that associate deans of Land-Grant institutions strongly recommended, "finding new educational applications for technology and developing appropriate instruments for assessing technology's impact on learning" (p. 12).

CHAPTER II: LITERATURE REVIEW

The purpose of this chapter is to present an overview of recent literature on and interactions between learning and decision making ability. According to Novak and Gowin (1984):

We have come to recognize that questions of learning cannot be addressed comprehensively unless we consider simultaneously questions dealing with three other commonplaces involved in education: instructors and how they teach, the structure of the knowledge that shapes the curriculum and how it is produced, and the social matrix, or governance, of the educational setting, (p xii).

Three of the elements from Gowin's quote are included in this review of literature: instructors, how instructors teach, and curriculum design. Several other variables also interact with decision making ability: individual learning style, attitude, higher order thinking skills, method of synthesizing information, and mode and method of delivering of information.

Variables are categorized as internal or external to the learner throughout this review of literature. To understand how these categories interact and influence student learning, information on the brain and how it functions is presented first. The following sections address internal learner attributes, external learner attributes, facilitation of critical thinking, and Colorado's Agricultural Education. The literature review concludes with a summary.

The Brain

It is necessary to present information (via curriculum and instructor presentation) in a manner that is natural to the brain to have the greatest impact on student learning. A brain-friendly approach facilitates learning, retention, and the development of higher order thinking skills,

So what is brain-based learning? According to Perry (2000), all learning is brain-based. When learning occurs, the brain is changed. While this is true, instructors have the opportunity to increase the level of learning and retention while decreasing frustration when they deliver information in a manner conducive to learning. Utilizing “brain-friendly” practices results in a process that is low stress and often enjoyable while yielding desirable results. The following paragraphs examine what happens physiologically in the brain as learning occurs and how learning can be facilitated in a way natural to the brain.

Brain Function

According to Jensen (1998b), a human adult’s brain weighs approximately three pounds. Compared to other species, humans have a large brain in relation to body weight. The brain contains two types of cells: glia and neurons. Ninety percent of the cells are glia and 10% are neurons. The neurons are responsible for thinking and processing. Neurons are constantly firing, transferring information. They have the ability to move but usually remain in place and extend dendrites as new information is obtained (Jensen, 1998b). Dendrites have many branches and develop more branches in the process of thinking and transferring information (Jensen, 1998b). In addition to extending dendrites,

the neurons also extend single axons which connect to synapses that fire information to other dendrites (Jensen, 1998b).

When individuals acquire new information, dendrites within the brain grow. Connections within the brain become stronger and faster the more they are utilized (Buchel, Coull, & Friston, 1999). Utilization occurs when the same task is completed often or when the same information is called upon numerous times. As the brain is working, it “searches for common patterns and connections” (Caine & Caine, 1991, p. 119). “The brain is essentially curious, and it must be to survive. It constantly seeks connections between the new and the known,” (Wolfe & Brandt, 1998, p. 11). New connections are formed when information from one area of the brain is used in conjunction with that from another area.

Consider an example where students are presented with a calving date situation which requires them to use range information regarding spring forage growth, business information related to markets at weaning, and animal science knowledge to decide the best time to calve. Information related to each content area may have been taught separately and stored separately but the process of using information together causes connections to be constructed within the brain.

If random bits of information are presented that the brain is unable to relate to or attach to existing knowledge, the brain has a difficult time storing and recalling that information. As a result, learning is best achieved when linked with the learner’s previous knowledge, experience, or understanding of a given subject or concept (Perry, 2000). Learning diagnostics, metaphors and analogies are a few approaches that allow instructors to identify students’ levels of knowledge and then attach new information to

something learners already know. Take for example, an instructor teaching a lesson on feeding cattle. Starting the lesson with a learning diagnostic where the instructor asks students what they know about major nutrients, their sources, their importance, and what students' prior experiences feeding cattle have been provides: 1) the instructor with an idea of how in-depth the lesson needs to be and 2) stimulates thought which locates areas of students' brains to which new information can be attached.

Metaphors and analogies are especially helpful tools to use when new content is being taught to the learner. If an association can be drawn between something that the learner is already familiar with and the new content, a connection is made within the brain rather than a deposit of random information to which the learner is unable to relate. "Authentic and significant learning occurs as new experiences are integrated into our scheme of meanings in such a way that those meanings are expanded and extended," (Beane, 1992, p. 49).

Stress and the Brain

Stress can be detrimental to optimal brain function as it causes the body to release cortisol, adrenaline, and vasopressin (Jensen, 1998a). These heighten senses initially but high levels of these chemicals over long periods of time impair the brain's ability to store and recall information properly (Jensen, 1998a). Students who are exposed to long term stressors will have a difficult time grasping, remembering, and synthesizing new information. While instructors cannot control situations outside the classroom, they can reduce stress in the classroom by modeling an attitude of acceptance and encouraging all students to adhere to that example in their classes (Hardiman, 2001). Stress is also

reduced or eliminated when “brain friendly” approaches are used in the classroom, making the learning process effective and enjoyable.

According to Caine and Caine (1991) not all stress is harmful or negative. Some individuals thrive under stress. Caine and Caine indicate that the difference lies in the attitude of the individual when facing a stressful situation. Those that see a potential solution are more likely to succeed and minimize stress. Those who see a situation as hopeless are more likely to fail and prolong stress. Guiding students through problem-solving activities and finding solutions on their own builds confidence and helps improve their attitude for the next stressful situation.

Emotion, Novelty, and Uniqueness

The brain is better able to recall details which are connected to emotion or are strangely unique (Jensen, 1998a). For example, individuals are able to recall events associated with strong emotion such as happiness, fear, or anger for a longer period of time than non-climactic events that occurred at relatively the same point in time. If the learner has a strong interest or emotional attachment to what is being taught, learning will occur at a more rapid rate (Leamson, 2000). Emotional connections help cement long-term memory (Hardiman, 2001, Wolfe & Brandt, 1998).

Instructors can create or attach strong emotion to course content by incorporating stories or examples that contain strong emotion and are relevant to what is being taught. Jensen (1998a) states, “great learning states include curiosity, anticipation, and challenge,” (p. 43). Including emotion maintains learner attention, solidifies content, and increases brain connections.

It is important to note that too much emotion may actually hinder brain function. If the emotion is too strong, learners may feel threatened. A threatened response can induce a stressful reaction from the brain, decreasing the level of learning (Wolfe & Brandt, 1998). As with any approach, instructors should monitor students' reaction and adjust their delivery and class activities as necessary.

Reflection

Reflection is an activity that aids in “cementing” information and experiences in learners' minds. A time for reflection after new information is presented allows learners to process and solidify new information. Reflection is not a recent discovery as John Dewey was writing about reflection in 1910. Dewey defines reflective thought as, “active, persistent, and careful consideration of any belief or supposed form of knowledge in the light of the grounds that support it, and the further conclusions to which it tends,” (p. 6).

According to Dewey's (1910) definition, the act of “reflecting” can take many forms. The term active indicates a response to information. The action of the response can be thinking, writing, discussing, or applying the material. Persistent means to continue - - keep coming back to the content on which the reflection is focused. The final phrase of the definition encourages reflectors to examine any and everything which may be related to the topic. During this process additional brain connections are developed and/or existing ones are strengthened (Jensen, 1998b).

The greater number of times a topic or content area is visited, the stronger brain connections become. According to Jensen (1998a), “to ensure that the brain maintains synaptic connections, we need elaboration to strengthen the original contact,” (p. 44).

During the reflection process learners may discover other areas of life to which new information is pertinent. This process personalizes and solidifies content.

Reflection is often an afterthought or a brief exercise at the end of a lesson. Jensen challenges this approach by stating, “Teachers ought to spend 55 to 80 percent of their time allowing students to process information,” (Jensen, p. 44). This sounds like a lot of time but McKeown and Beck (1999) stress the importance of ample time for processing and reflection, “for effective learning to occur, students must construct their own knowledge and instructors must orient their instructional practices toward teaching for understanding,” (p. 25). Reflection can be incorporated throughout a lesson by taking periodic breaks and allowing students to verbalize or write about their perceptions or participate in other activities which require them to reflect on content taught. Reflection is the primary purpose of many discussions.

Brain Summary

Applying brain-friendly practices to learning situations creates environments conducive to effective learning. According to Brandt (1999), the application of brain-based research would be most effective when combined with previously established frameworks for teaching and learning. Languis (1998) states, “it is possible to apply knowledge about the brain to strengthen education,” (p. 46). As more is learned about brain function, instructors and educational systems are able to take advantage of this new information by applying brain-friendly approaches in the classroom.

There are several important characteristics to consider in designing curriculum and learning environments that are brain-friendly. A brain friendly environment stimulates growth and connections within the brain, which increases learners’ abilities to

recall and utilize information. High levels of stress have no place in this environment. The characteristics that reinforce a brain-friendly environment are: 1) students' opinions, thoughts, and feelings are respected, 2) students feel safe to question and participate in the learning process, 3) new information is attached to something students already know through the use of metaphors or analogies, 4) emotion, novelty, and uniqueness are incorporated to reinforce content information, and 5) reflective time is included in lessons, which allows learners to further process and connect new information.

Internal Learner Attributes

Each individual has a unique set of internal attributes which influence the way in which they learn. Some of these characteristics are learning style, attitude, and level of content knowledge. These characteristics work together to influence an individual's ability to acquire and synthesize information, communicate with others, and make decisions.

Learning Styles

Learning styles are described as the way in which individuals prefer to take in information. How receptive individuals are to the way information is presented is influenced by their learning styles. The better one understands their own as well as others' learning styles, the better equipped they are to foster their own learning process and have positive interactions with others in the classroom, workplace, or home. The way information is presented is influenced by the learning environment, which is primarily determined by the instructor. There are elements of the environment, which are beyond the instructor's control such as influence of other students, facility conditions, unforeseen interruptions, etc.

Definitions and categories describing various learning styles have been developed by several different individuals. Learning style categories were developed based on the way in which individuals prefer to interact and take in information. Two of the most widely used and recognized systems for identifying learner types are the Myers-Briggs (1998) and the Gregorc (1982). Each of these uses an instrument to which participants respond to questions or statements. After completing the respective instrument, respondents are provided with an individual score referring to each category and category descriptions thereby identifying learner type.

The Myers-Briggs (1998) Type Indicator has four categories that indicate four different learner styles. Each category is divided into two levels (Table 1). The two levels of the first category are introvert or extrovert. The two levels of the second category are sensing and intuition. The third category is comprised of thinking and feeling and the fourth and final category is made up of judging and perceiving. Individuals are assigned one of two letters from each of the four categories which results in 16 possible types.

A second system that uses fewer categories is the Gregorc (1982) (see Table 2). In this approach, learners are grouped into two categories that each has two levels. The first category describes perceptual abilities or how individuals acquire or grasp information. The two levels of perceptual abilities are concrete and abstract. Concrete refers to more direct use of physical senses while abstract learners prefer an orientation toward the intangible.

Table 1

Myers-Briggs Categories

E Extraversion People who prefer extraversion tend to focus on the outer world of people and things.	I Introversion People who prefer introversion tend to focus on the inner world of ideas and impressions.
S Sensing People who prefer sensing tend to focus on the present and on concrete information gained from their senses.	N Intuition People who prefer intuition tend to focus on the future, with a view toward patterns and possibilities.
T Thinking People who prefer thinking tend to base their decisions primarily on logic and on objective analysis of cause and effect.	F Feeling People who prefer feeling tend to base their decisions primarily on values and on subjective evaluation of person-centered concerns.
J Judging People who prefer judging tend to like a planned and organized approach to life and prefer to have things settled.	P Perceiving People who prefer perceiving tend to like a flexible and spontaneous approach to life and prefer to keep their options open.

Table 2

Gregorc Categories

Gregorc Categories		Perceptual Abilities	
		Concrete (C)	Abstract (A)
Ordering Abilities	Sequential (S)	CS – prefer practical to the point learning, structure, order, neatness	AS – like the abstract, prefer time to think, rational, logical
	Random (R)	CR – investigate, experiment, enjoy options, are competitors	AR – social learners, make friends easily, ruled by emotions

The second category relates to ordering abilities or how learners arrange, systematize, reference, and dispose of information. The two levels of this category are sequential and random. Sequential learners prefer things to be linear and structured while random learners are tolerant of ambiguity. Combining a level from each category provides four possible composites: concrete sequential, concrete random, abstract sequential, and abstract random. Characteristics of each group are outlined in Table 2.

The first two categories of the Myers-Briggs (introvert/extrovert, sensing/intuition) are similar to the perceptual abilities categories of the Gregorc. They pertain to individuals' focus and way in which they take in information. The second two categories of the Myers-Briggs (thinking/feeling, judging/perceiving) are similar to the ordering abilities categories of the Gregorc. These categories address how an individual prefers to organize, process, and act on information.

Individuals categorized in each learning style have particular ways in which they communicate, prefer information to be delivered, and the type of projects in which they elect to participate. While differences seem daunting at first, there are practical ways to approach a class or audience of learners from each style. Group work allows each person to "shine" in their own respect if groups are well formed. Individuals that understand the strengths of each learning style are better equipped to respect others' approaches, delegate responsibilities accordingly, and have more positive group-work experiences. Classroom environments should be organized yet allow room for creativity and individual choice within the structure. This provides a stable environment for learners preferring structure and choice for more spontaneous personalities.

Information on learning styles is useful to students and instructors. If instructors are aware of the challenges different instructional approaches present to each learning style, and understand why individuals like or dislike certain styles, patience and cooperation can lead to including a variety of approaches that will pertain to each student. Students who are aware of how and why they learn best are able to adjust to various methods of instructional delivery by instructors. It is also beneficial to understand how others learn and how to present information in a way that is conducive to their learning styles.

While everyone has their own “best way” of learning, they are capable of learning outside of their primary style. Brain research shows that individual brain structure and organization differ but is specifically related to individual learning style (Languis, 1998). Curriculum and instruction that are designed and delivered in a way that are conducive to all learning styles will reach the most learners.

Affective Domain – Attitude

Linn and Gronlund (2000) define the affective domain as attitudes, interests, appreciation, and modes of adjustment while each of these characteristics influence students’ level of learning, this section focuses on attitude. Eagly (1992) defines attitude as, “a tendency or state internal to the person,” (p. 694). Attitude is an outer indicator of what is happening inside an individual. This is very important to educators desiring to have an impact on student learning.

Research shows that brain function and learning are affected by attitude. “Good problem solvers have a positive attitude toward problems, believing they can solve them by careful, persistent analysis,” (Elliot et al., 2000, p. 306). Robert Leamson (2000)

explains that the brain's emotional center, known as the limbic system, is connected via neural pathways to the site of learning, known as the frontal lobes. According to Jensen (1998a), the physiological state that an individual is in when learning takes place determines how much is comprehended. Eagly (1992) states, "the importance of attitudes thus lies in their presumed power to influence responding." (p. 694). Students with different attitudes will have different levels of comprehension, recall, and synthesis of information.

According to Marzano (1992) there are two types of student attitudes that influence learning: 1) attitudes toward the learning climate and 2) classroom tasks. While attitudes critical to creative thinking cannot be taught directly (Perkins, 1984), instructors can create classrooms favorable to positive attitudes by maintaining an environment where students opinions are respected and students are comfortable asking questions.

Kassem (2000) explained that along with critical thinking skills students need to be taught to be strong, independent, lifelong learners. Foundations are developed for lifelong learning in an environment where students are interested in what is being taught, are comfortable exploring and asking questions, and are presented with challenging practical problems.

Decision Making Skills – Higher Order Thinking

Multiple terms and definitions are used to describe the process that leads to making a decision. Some of these terms are: critical thinking, higher order thinking, cognitive ability, and decision making skills. For the purposes of this paper, critical thinking or higher order thinking skills are those required and exercised in the process

resulting in a decision being made. Thus decision-making ability is dependent on one's level of critical or higher order thinking.

The following sentences present how several authors have described and defined rational and critical thinking. According to Baron (1985), "rational thinking is thinking that follows a descriptive model," (p. 50). Critical thinking has been defined and described in the following ways, "seeing situations clearly, identifying problems, and exploring possible solutions" (Slavin, 1997, p. 8), "thinking about your thinking while you are thinking in order to make your thinking better" (Paul, 1993, p. 91), "reasonable and reflective thinking that is focused upon deciding what to believe or do" (Norris & Ennis, 1989, p. 1), "a form of higher-order thinking to the extent that it demands more than simply the ability to recall", (Tsui, 1999, p. 197), "reasonable reflective thinking that is focused on deciding what to believe or do," (Ennis, 1987, p. 10), "careful argumentation"(Yeh, 2001, p. 12), "critical thinking appears to stress the individual's ability to interpret, evaluate, and make informed judgments about the adequacy of arguments, data, and conclusions," (Pascarella and Terenzini, 1991, p. 118).

While various terms are used, critical thinking centers around five components: practicality, reflection, reasonable, belief, and action (Ennis, 1987). Decisions, beliefs, and goals are all considered in the rational thinking process. Rational thinking requires individuals to be metacognizant or take into account all that they know related to a situation and use that information to make a decision. Perkins, Jay, and Tishman (1993) describe metacognition as "the self-monitoring and self-adjusting of the ongoing thinking process by the thinker" (p. 69).

Self-monitoring and self-adjusting may be done through the reflection process. Reflecting allows a person to consider how they got where they are as well as how to get where they want to go. Many other aspects may be reviewed in the reflecting process but that varies from person to person and situation to situation. The underlying theme being that time is spent considering a current situation and its alternatives and outcomes. Thinking skills are required to determine what action(s) will be taken or decisions will be made to bring the decision maker closer to the desired outcome. According to Perkins et al. (1993), "how well thinking achieves its ends depends considerably on what repertoire of skills and strategies a person has and how well they work" (p. 70).

Importance

Critical thinking skills are called upon every day of life. While decisions may be large or small, they all have consequences. The ability to assess a situation, identify alternatives, weigh potential consequences, and then select the most feasible option is often what separates good decisions from bad ones. Granted, it is impossible to forecast all the results of each alternative but a well-thought through evaluation of options will yield a more desirable decision.

While students are often given content information, they are seldom taught how to synthesize information and knowledge into making informed decisions (Hammond, Keeney, & Raiffa, 1999) or given the chance to practice the process. Yeh (2001) stated, "students told me that they had never been explicitly taught to bridge gaps between their reasons and claims," (p. 16). "There is a need to actively show students how different subject areas influence their lives, and it is critical that students see the strength of each discipline perspective in a connected way" (Jacobs, 1989, p. 5).

Aids for Instructors

Taxonomies have been developed that categorize thinking skills and therefore aid instructors in utilizing different levels of thinking skills. A taxonomy is a set of standard classifications designed to create a common language or framework for those involved in education. One of the most widely known is Bloom's Taxonomy (1956). Bloom's taxonomy addresses six areas: knowledge, comprehension, application, analysis, synthesis, and evaluation. His taxonomy defines each area, provides terms that are used when performing tasks associated with each area, and gives examples for measuring learning in each area.

Educators benefit through the use of classifications or taxonomies to identify critical cognitive areas as well as which thinking skills their lessons and activities are addressing. The classifications discussed in this paper are those applied to the cognitive domain. This includes remembering and recalling knowledge, creating, thinking, and problem solving.

External Learner Attributes

External attributes are those in the learning environment and to a great extent beyond the learner's control. The learner may have the option to choose where to take a class or who to learn from but he/she does not determine the style, teaching philosophy, or approach of the instructor or the type of supporting materials, activities, and curriculum utilized. The external attributes that will be examined in this review of literature are instructor variables and curriculum design.

Instructor Approach

Each instructor is unique in their approach and delivery of content in the classroom. Likewise each instructor has their own unique way of delivering information. Tsui (1999) states that both instructor technique and content affect critical thinking.

Teachers tend to teach in the way that they learn best. This means that they are effective at reaching students with the same learning style but may be unconsciously neglecting students with differing learning styles. An awareness of the various learning styles and the way in which students learn best allows instructors to present information in a manner that will reach all learners. According to Marotz-Baden et al. (2000), use of all learning and teaching styles is necessary to motivate students to learn and retain knowledge as well as to incorporate appropriate instructional techniques and activities. Students with differing learning styles will approach these five areas differently: use of instructional time, the focus of their individual study, environment they prefer, approach to change, and their approach to thinking creatively. Instructors that are flexible and provide options for students in addition to using various approaches when delivering information are able to reach students with varying learning styles.

Some teachers are rigid and controlling. In this type of environment Biemans and Jongmans (1995) state, “the teacher initiates and fulfils the learning functions (taking over), leaving only few opportunities for the learner” (p. 42). Perkins (1984) is also critical of educational systems in his statement, “schooling generally presents knowledge as a given, rather than as the product of a creative effort to accomplish something...schooling generally poses to students tasks that do not exercise or even allow creative effort” (p. 22).

In contrast to the rigidly controlled environment, at the opposite end of that spectrum is an instructor that provides little structure. Students are free to do what they want when they want and are given little guidance or parameters. Most students perform optimally in between these two extremes.

There is a high degree of variability in the way instructors conduct their classes but educational experts have provided guidance for those interested in improving the classroom environment. According to Perkins (1984), courses should focus on creative thinking, address strategies, skills, and attitudes, offer plenty of time-on-task and foster creative thinking in all subjects.

It is important for instructors to include characteristics that are conducive to each learning style in their delivery methods, activities, assignments, and exam formats.

Marotz-Baden et al. (2000) explained that:

The exposure to different models of teaching/learning helps students become better able to present material in alternate ways. In addition, including a social interaction learning component where students are expected to problem solve increases the relevancy of the material and retention of knowledge learned. (p. 51)

While it may sound complicated or time consuming to teach to multiple learning styles simultaneously, a few changes or additions to current approaches and materials can make a significant difference. According to Kassem (2000), “many current lesson plans can be modified to change the language and the focus of the lesson without losing the specific content,” (p. 10). An example of addressing multiple learning styles in the same class is to provide structure and flexibility. Some learners prefer a structured environment which an instructor can provide by listing the day’s activities on the board, providing clear instructions for projects, and giving an outline of accompanying lessons. In this same class there will be learners who prefer flexibility. Their needs can be

addressed simultaneously by allowing them choices. The instructor creates feasible options and then allows students to select an option. This approach can be used in a variety of ways including how class time will be spent or what type of assignment to complete.

It is healthy for students' brains to participate in a number and variety of activities. As students participate in various activities, the number of connections within their brains' increase and become stronger (Buchel, Coull, & Friston, 1999). Activities should be geared toward applying content to real life. Linking content material with life applications provides benefits that are twofold. Linking creates more connections in the brain joining content and application, which may serve as a pathway for future connections. This interconnected framework also provides students with a model to refer to when applying material acquired in the future.

Curriculum Design

Traditional curriculum usually presented information in a discipline specific format. According to Boccuti (2000), "high schools primarily utilize discipline based curriculum," (p.1). In this approach, few if any connections are made to other related disciplines. This approach is contrary to what we now know about how the brain learns best. However, need for change is being recognized.

"More and more educators are coming to realize that one of the fundamental problems in schools is the "separate subject" approach to knowledge and skills...it has little, if any, support in curriculum research; it presents the world to young people in terms of the specialized interests of academic scholars," (Beane, 1992, p. 46).

Curriculum that is developed incorporating current brain research and is mindful of learner attributes is intended to reach a majority of students. This type of curriculum

contains many of the following components; learning diagnostic, outline/overview, variety, analogies, novelty, integration, active learning activities, review, and reflection.

Integrated Approach

What is an integrated approach? Is it the same as an interdisciplinary approach? According to Bailis (2001), “interdisciplinary instruction involves presenting a domain of knowledge in terms of its constituent disciplines and their relations, its connections to other domains, and its uses in the workaday world” (p. 4). Jacobs (1997) defines an interdisciplinary design as one where, “concepts, skills, and assessments from two or more disciplines are brought together in a formal investigation of a common organizing center” (p. 33). In other words, subject matter is presented in a way that is connected to related subjects, is practical, and applicable. Campbell and Harris (2001) use the terms integrated and interdisciplinary interchangeably which is how they are used in this review of literature.

Why is an integrated approach important?

When we are confronted with a problem or puzzling situation in life, we hardly stop to think about which part is science, which mathematics, which language arts, and so on. Instead, we bring to bear any knowledge or skill that is pertinent to the situation, or--if the situation is significant enough--we seek out that which we need to know or to do (Beane, 1992, p. 46).

Life is not divided into distinct subject categories, which is how most high school classes are taught. According to R. N. Caine and G. Caine (1991):

Currently literature, mathematics, history, and science are often seen as separate disciplines unrelated to the life of the learner. Brain-based learning, on the other hand, rests on the fact that the various disciplines relate to each other and share common information that the brain can recognize and organize (p. 4).

Integrated approaches deliver information in a practical and applicable way which is how the brain prefers to receive information.

Students complain that school does not prepare them for life outside of school (Jacobs, 1989). “There are numerous signs in recent subject association pronouncements and state curriculum recommendations that more and more people are coming to understand that school lacks meaning for young people, and that the separate subject approaches is a main culprit,” (Beane, 1992, p. 53). This problem of separate and impractical approaches to subject matter is decreased significantly through implementation of an interdisciplinary approach. Material that is delivered in an integrated manner is similar to “real life” situations.

Post et al. (1997) state that when an interdisciplinary approach is used, students construct their own knowledge through the processes of conceptualizing, developing, and implementing themes.

If we teach in a manner that isolates the various disciplines, then students learn that the disciplines are separate, unconnected, and discontinuous. If we teach them integrated approaches, that is what the students will learn. This latter perspective is much more likely to support the kind of intellectual understandings and knowledge structures necessary in the twenty-first century. (p. iv)

Agricultural education lends itself to an integrated approach due to the many related subject areas and disciplines it encompasses and builds upon. Integration of vocational and academic areas was emphasized by the Carl Perkins Act of 1990 (Gill & Stump, 2001). Going beyond the classroom to real life application, Engel and van den Bor (1995) state “joint problem-oriented inquiry and learning have become the backbone of the continuous practical and professional innovation required in rural development today,” (p. 2).

Much of the published literature on integrated curriculum approaches is geared toward disciplines taught by different instructors working in interdisciplinary teams to

teach their respective discipline relative to a central topic or theme. Jacobs (1997) states, “When teachers team on common content, skills, and assessments there is a dramatic increase in continuity,” (p. 35). For example, a team consisting of instructors in math, science, social studies, and English each teach their specific content but relate it to a central topic such as the Industrial Revolution. As an assignment students may complete a project that has components in each discipline area but all related to the Industrial Revolution.

Agriculture instructors may integrate much of the content they teach with or without other instructors. The opportunity to illustrate the importance of integration often occurs when basic discipline content is applied to practical situations. For example, an instructor may be teaching about an animal science topic such as reproduction. A particular lesson may be covering the importance of nutrition for the cow, which contributes to successful breeding, pregnancy and delivery, and also discusses changes in cows’ nutritional needs relative to where they are in their reproductive cycles. Following this lesson an instructor may ask their students to choose a calving date that will provide the best nutrition for the cow. This is an applied decision that involves the animal science lesson just taught but also requires students to consider range or pasture condition, cost of supplemental feed, and human resources. While agriculture instructors may integrate much of their material on their own, students will benefit further through integration with other instructors such as those that teach math, science, business, and English. As more areas are connected, more connections are developed within learners’ brains.

Facilitating Critical Thinking

This section applies data on internal and external learner characteristics to practical classroom approaches and activities. Awareness of various learner attributes allows curriculum developers, instructors, and students to present information and activities that are most conducive to the learning process. According to R. N. Caine and G. Caine (1991):

The key to being a more effective educator, therefore, is not simply to find a specific methodology or technique. It is to grasp what actually happens in the brain during learning and to appreciate how all the different components of experience work together to help the brain do its job. (p.125)

The following paragraphs outline brain-friendly activities. These approaches engage learners in actions that build on knowledge already obtained and increase connections within their brains.

Variety

Incorporating multiple methods of delivery, assignments, and activities keeps students fresh and excited about learning. “Kids quickly learn the routines embedded in their classes and develop sophisticated strategies for cutting to minimal effort,” (Wasley, 1999, p. 9). A stimulating environment does not remain the same. Change can occur on multiple levels: classroom and field learning, instructional delivery, type of assignment, posters on the wall, etc. As students receive information and are then required to apply it through a variety of avenues, existing connections within the brain are strengthened and additional connections are established. Teachers are able to prevent students from “checking out” by using a variety of educational strategies, (Wasley, 1999).

Metaphors

When metaphors are used, the instructor connects new information with familiar information. “Metaphors are intrinsic to the construction of new knowledge and are at the heart of the acquisition of felt meaning” (Caine & Caine, 1991, p. 114). When new information is connected to what the learner has previously learned, it builds understanding and confidence in addition to building and strengthening connections within the brain.

Modeling Decision Making

It is assumed that good students are also good decision-makers. Research conducted by Kassem (2000) found that “teachers said they had assumed their students already knew how to draw inferences or conclusions from required readings and were surprised to discover how many could not do so” (p. 8). Decision making skills are seldom taught and tests often require students to regurgitate information rather than synthesize and apply it. According to Perkins (1984), “students function primarily as consumers of products of inquiry, not producers, (p. 24). In contrast, Elliot et al. (2000) state, “good problem solvers know how to take problems apart. They break the problems down into manageable parts, analyze the parts, examine potential solutions, and select a course of action” (p. 306).

Baron (1985) claims that good problem solving is teachable and Bransford, Brown, and Cocking (2000) add that students need guidance from instructors in order to connect school subjects with everyday knowledge. Perkins (1984) model for creative thinking identifies characteristics and provides guidance for fostering their acquisition,

“one can view creative thinking as the process of designing something and provide advice on how to do so,” (p. 23).

One method for teaching students how to make decisions or be good problem solvers is to model that process. To move from factual information to more complex learning outcomes, a framework including knowledge, understanding, and application components should be utilized (Linn & Gronlund, 2000). This can be done by the instructor “thinking out loud”. “A classroom environment that elicits thinking must be one in which students feel safe enough to share their formative thoughts. One way that instructors can provide this environment is to model their own thinking process,” (McKeown & Beck, 1999, p. 27).

When thinking out loud, thoughts are expressed orally regarding the situation being faced, desired outcomes, influencing factors, feasible alternatives, potential results of implementing each alternative, and selection of an alternative. It is important to express that there is one more piece to this cycle--review and revision. While it may not take place immediately after alternative selection, it is crucial. What is observed or learned in this review step is used to make revisions. Additional questions or decisions may arise which takes the decision-maker back to the first step of clarifying the situation being faced. Thinking out loud is also a form of reflecting on the decision.

Scenarios

Students often question whether what they are learning is practical and applicable. Utilizing scenarios illustrates the practicality of what is being learned and requires students to go beyond memorizing theory and facts to application. “Scenarios or case studies require students to apply knowledge of a subject or subjects and to use decision-

making skills in determining the best action to take,” (Advancing students’ academic..., 1999, p.10).

The process of reviewing a situation, identifying alternatives, and selecting the most feasible alternative requires students to synthesize what they already know and transfer applicable knowledge from other subject areas. This is a complex process which will require instructor guidance, especially if students have not had the opportunity to work through scenarios in previous coursework. Instructor modeling is useful to introduce this approach. When possible, students can create their own scenarios or describe familiar situations related to the content they are learning for application.

Questioning

Instructors who ask questions that require a higher level of thinking are facilitating students’ higher order thinking processes (Elliot et al., 2000). Yeh (2001) states,

Teachers could teach students to think in terms of a series of mini-arguments as they collect evidence, to ask, “What claim, potentially, could this piece of evidence support? What are supporting reasons for that judgment? What claim is contradicted by that piece of evidence? What reasons support that conclusion?” In this way, students could be taught to think critically about the process of collecting evidence, (p. 13).

Connections are made as learners respond to questions requiring them to figure out what is occurring (McKeown & Beck, 1999). The use of leading questions allows instructors to guide students through self-discovery connecting disciplines and integrating material (Jacobs, 1997). Instructors may also use Bloom’s Taxonomy (1956) as a guide in asking questions requiring higher levels of thought. Instructors may also use re-voicing which is paraphrasing a student’s response and attaching another question, which builds on the previous statement (McKeown & Beck, 1999). Questioning exercises can be used as a

bridge to help students transfer knowledge from known or familiar applications to new areas.

Transfer

The term “transfer” refers to applying the thoughts, concepts, skills, or information learned in one area to another. According to Holyoak (1991), “abstract types of reasoning skills acquired through systematic training can be applied in contexts quite different from that in which training occurred,” (p. 307).

Many early attempts at process training did not work because investigators assumed that just teaching the processes necessary for task performance would result in improved performance on intellectual tasks. The problem was that students often did not learn when to use the processes or how to implement them in tasks differing even slightly from the ones on which they had been trained. In order to achieve durable and transferable learning, it is essential that students be taught not only how to perform tasks but also when to use the strategies they are taught and how to implement them in new situations, (Sternberg, 1984, p. 47).

In order for transfer to occur, learners must go beyond memorization to understanding (Bransford et al., 2000). Asking students to apply content information provides them with the opportunity to display their understanding. Analogies and scenarios illustrate the transfer process while creating or enhancing connections within the brain.

Feedback

Regardless of what approaches or activities are implemented, timely feedback is crucial. “Assessment without feedback merely serves as judgement,” (Costa & Kallick, 2000, p. 29). “It is well known that learning requires feedback in order to be effective. Hence, in environments with poor or even delayed feedback, learning may be slow or even nonexistent,” (Ericsson & Smith, 1991, p. 27). Students also need to receive

feedback (Tsui, 1999) on their performance in a timely manner so adjustments can be made to future assignments.

Correct thoughts or approaches need to be reinforced so they become routine and misdirected approaches need immediate redirection so they do not become habit. Perkins (2000) describes habits as, “not behaviors we pick up and lay down whimsically or arbitrarily. They are behaviors we exhibit reliably on appropriate occasions, and they are smoothly triggered without painstaking attention,” (p. viii). Habits are developed when appropriate actions and behaviors are taken repeatedly. “Habits are routine, but good use of the mind is not,” (Perkins, 2000, p. viii).

Colorado Agriculture Education – Background and Current State

Agricultural education began in 1917 with the passage of the Smith-Hughes Act. That Act provided federal funds for the hiring of secondary agriculture education instructors (Rasmussen, 1989). Since that time, significant changes have been made as fifteen different amendments or acts have been passed increasing the amount of funding and the variety of agricultural programs delivered (Gill & Stump, 2001). Currently there are agriculture education programs in 92 high schools in the state of Colorado.

While there is not a prescribed curriculum for the state, the Colorado Technical Prep committee has outlined recommended standards for high school instruction. This committee is not empowered or endorsed to require their guidelines. The committee was created through a grant and its members had the foresight to anticipate that standards may be required in the future. Represented on the committee are individuals from high schools, universities, industry, business, and community colleges. They created the Colorado Agriculture Education Tech Prep Curriculum Guide (2002).

Currently a consistent agriculture curriculum is not used in Colorado. Instructors create their own lessons, activities, and tests from multiple sources. Some of the sources they use include various textbooks, internet sources, personal knowledge, and experiences. Developing their own materials is a very time consuming process and does not provide consistent opportunities or experiences for students statewide. Instructors and students would benefit if a comprehensive resource, written to state standards, and specific to the types of agriculture and issues facing Colorado was available.

Summary

The literature reviewed describes the latest information regarding the teaching and learning process. Considerable effort has been made to present resources currently available for Colorado agriculture education instructors. There is an obvious void between what is available and what current literature describes as ideal. Students and instructors would benefit from a standardized statewide curriculum that delivers appropriate content in the most effective manner for learning.

Content and technical information is changing rapidly in many fields, therefore any institution desiring to influence student learning in the long term must show that it is impacting learning skills, (Terenzini, Springer, Pascarella, & Nora, 1995; Walsh & Paul, 1989). If a curriculum endeavored to address learning skills and the need for a long-term change, the curriculum would be required to include a unit to train students in effective decision-making. This unit would provide a model that guides students through an integrated approach to gather, analyze, then utilize information in order to make an informed decision. Students equipped with effective thinking and decision making skills are able to develop and adapt to change.

This “ideal” comprehensive curriculum would address the internal and external needs of the learners’ in a brain-friendly manner. A brain-friendly approach facilitates learning and retention by presenting ideas and concepts in a manner conducive to how the brain learns, stores, and recalls information. Learning diagnostic activities would be used at the beginning of each unit to provide instructors with information regarding the current knowledge level of the students. Content delivery could then be adjusted to facilitate efficient teaching and learning. Learning diagnostics benefit students further as they respond to the questions, related areas within the brain are stimulated which provides a platform for new information to be attached.

Multiple tools would be included in the curriculum to deliver content through stimulating methods addressing various learning styles. Some tools would provide emotional, novel, and unique (Jensen, 1998a) components to illustrate concepts. Emotion, novelty, and uniqueness capture learners’ attention and cements content in long-term memory (Hardiman, 2001). Additional instructional resources that capture learners’ attention such as metaphors and analogies would also be provided. Using metaphors (Caine & Caine, 1991) and analogies to present new information allows students to draw associations between current knowledge and new content.

Delivering content that is integrated in nature allows additional connections to be established within the brain of the student. The world we live in and situations we face deal with multiple disciplines simultaneously (Beane, 1992, Caine & Caine, 1991). “Today’s agricultural students are well versed but often lack the skill and knowledge required for cohesive thought and critical problem solving,” (Grant et al., 2000, p. 1684). When information is delivered in an integrated way, it is already linked to real life (Post

et al., 1997, Jacobs, 1989). When an interdisciplinary approach is used, students construct their own knowledge through the processes of conceptualizing, developing, and implementing themes (Post et al., 1997).

While a curriculum can provide tools developed using the latest brain research, the role of the instructor remains critical. In *Experience and Education* (1939), Dewey describes the importance of developing a positive attitude toward learning in the following way:

Perhaps the greatest of all pedagogical fallacies is the notion that a person learns only the particular thing he is studying at the time. Collateral learning in the way of formation of enduring attitudes, of likes and dislikes, may be and often is much more important...For these attitudes are fundamentally what count in the future. The most important attitude that can be formed is that of desire to go on learning. If impetus in this direction is weakened instead of being intensified, something much more than mere lack of preparation takes place. (p. 49)

Educators are challenged to ignite a spark that will burn long after students have left the classrooms.

A classroom conducive to student learning has several characteristics. It is a positive environment where learners are comfortable sharing, exploring, and expressing ideas (McKeown & Beck, 1999). Questioning stimulates deeper thought on the part of students (Elliot et al., 2000). Modeling processes such as decision making provides students with a framework to build upon (McKeown & Beck, 1999). Scenarios allow students to apply and integrate information (Advancing students' academic...,1999). There are many facets to knowledge acquisition and application. The more they are experienced, the more learners are prepared to use them outside the classroom.

CHAPTER III: METHODOLOGY

The primary purpose of this research was to determine if students taught the IRM Decision Making Unit utilized a more integrated approach to problem solving, than students of a similar level who were not exposed to the decision making unit. The extent of students' integrated approach was measured by the number of domain areas mentioned and emphasis placed on each domain area by students. Demographic variables and student attitudes relative to animal science, environmental stewardship, and financial considerations were also studied and compared with student responses to the decision making situations. Instructors were surveyed with regard to background, experience, use of curriculum, and their perceived importance of teaching decision-making skills.

This research followed a unique approach as the researcher was examining potential trends in student thought related to decision making. The researcher was interested in identifying which domain area(s) (animal science, environmental stewardship, and financial considerations) students placed the greatest importance on when making decisions and if weights were more balanced after students were exposed to the decision making unit. A "more balanced" score would indicate that students were using a more integrated approach when making decisions, considering multiple discipline areas simultaneously rather than making decisions based solely on one area. Prior research on decision making has primarily focused on respondents' self-concept of their decision making skills.

The purpose of the decision making unit was to teach students to process information and make decisions from an integrated perspective. Jacobs (1989) supports this approach by stating, “it is critical that students see the strength of each discipline perspective in a connected way” (p. 5). The challenge arises in quantifying how individuals make decisions. As single discipline programs focus primarily on one area and integrated programs highlight many discipline areas, it can be argued that one who is thinking more integratively considers elements from more discipline areas than an individual who has not been trained to make decisions from an integrated perspective.

The researcher was interested in examining was how domain area weights and number of domain areas identified changed after students were exposed to the decision making unit. It was assumed that if an individual was utilizing an integrated approach, considering more related areas, after exposure to the decision making unit, weights for the Likert scale statements would be more even across domain areas on the posttest than on the pretest for the same respondent.

Research Questions

1. Is there a significant change in students’ domain integration scores between pre and post tests?
2. What domain area (animal science, environmental/range, financial, human) do students emphasis when making decisions?
3. Is there a correlation between decision making domains students mention in their open ended responses and domains they weigh most heavily on the Likert scale response items?

Null Hypotheses

The following three null hypotheses were developed based on the research questions:

$H_{(0)1}$ There is not a significant difference in domain weights on the post tests between high school agriculture education students who complete the decision making unit and high school agriculture education students in the control group.

$H_{(0)2}$ All domain areas will be weighted equally on student pretests.

$H_{(0)3}$ There are no correlations between domain factors students mention in their open ended responses and domains they weigh most heavily on the Likert scale responses.

Research Design

This project followed a quasi experimental approach. The general purpose was to explore the relationship between the control and treatment groups. An experimental design was used with an active independent variable. The desired outcome was to examine causality.

Population

The target population was all agriculture education instructors and their high school level students in the state of Colorado. Recruitment followed several phases. A presentation outlining the research project was given to all instructors attending an FFA state contest held at Colorado State University in May 2003. On June 18, 2003 every vocational instructor in the state of Colorado was sent a letter describing the importance of decision making skills, the need to provide a framework for students to base their decisions, an outline of this project, requirements for participation, training that would be held at the summer institute, and benefits for participants (Appendix I). Included in the

letter to instructors was a draft response (Appendix II). Colorado State Regulatory Compliance required researchers to receive a letter from each school administrator indicating their approval to participate prior to any materials being sent to them. The draft response provided schools with a model to follow in composing their response letter. An email was sent to each instructor June 24 as a follow up to the letter. Another brief presentation was given in Lamar, CO at the summer institute in July for agriculture education instructors. This presentation extended an additional invitation for instructors to participate.

Ideally instructors choosing to participate would have been divided into experimental and control groups. Then the experimental instructors would be invited to attend the training. However instructors were slow to respond and not all respondents were able to attend the in service training. Therefore instructors that were able to attend the training were placed in the experimental group and instructors unable to attend the training were placed in the control group.

In exchange for their input and participation in the study, instructors received a copy of the complete curriculum. Additionally, participating instructors were eligible to receive one credit of continuing education.

Sample

All instructors in the state of Colorado were invited to participate in this project. Instructors that attended an in-service training were assigned to the experimental group. Instructors that wanted to participate but were unable to attend the in-service were placed in the control group. Students in both groups were given the option to participate by completing a pre and posttest. The actual sample consisted of n=14 high school

agriculture education programs. N=54 students from 9 schools were in the experimental group and n=29 students from 5 schools were in the control group.

Training

Training was conducted at the Colorado agriculture education instructor summer institute which was held in July, 2003 at Lamar Community College. The researcher delivered a program which outlined each element of the decision making curriculum. Included in this program was: the Authorware version of the unit, unit contents, lesson plans, worksheets, and assessment tools. The curriculum and supporting materials were distributed to instructors and the session concluded with a question and answer time.

The intent of the in-service was to prepare instructors to participate in the research by using the decision making unit with their students and administering the pre and post tests. Instructors were encouraged to start the semester using the one week decision making unit as a foundation for content they would present to students throughout the semester. It was the researcher's intent to have instructors teach the unit as soon as possible after they received instruction at the in-service. Also, the researcher recognized that schedules are very hectic and asking instructors to use the unit at the beginning of the semester would provide the greatest number of participants.

While instructors in the experiment group received the decision making curriculum at the summer institute, research materials were not sent to instructors until the researcher received a letter of agreement from each instructor's administrator. Colorado State University Office of Regulatory Compliance required that a signed letter of agreement be submitted prior to distribution of research materials. Upon receipt of the letters, instructors in both groups were sent a packet containing: instructions (Appendix

III), check list (Appendix IV), script (Appendix V), letter to parents (Appendix VI), consent forms (Appendix VII), pretests (Appendix VIII), envelopes, posttest (Appendix IX), instructor questionnaire (Appendix X), and an addressed return postage paid mailer.

Curriculum Package

The IRM curriculum package consisted of an interactive CD with presentations in Authorware, instructor materials including lesson plans, worksheets for each unit, and tests for each unit. Authorware® is a computer program which delivers information interactively, similar to a web-site interface. Instructors are able to utilize the curriculum as a class presentation or individual students could use the program to work at their own computers. Each of the 10 units in the curriculum illustrates linkages to relevant information from other topic or discipline areas. This facilitates and displays the integrated nature of agriculture.

The curriculum is designed to appear and respond similar to a web-site. Pull-down menus were located across the top of the screen that could be accessed at any time. Menus allow users to navigate between and within units. Menu options also made a glossary and page of industry links available to users at all times.

Each unit within the curriculum followed a similar format. Information and activities were designed to be interactive and reach all learner styles. Units start with a learning diagnostic which is an activity designed to initiate student thought about the topic and provide instructors with information on students' current level of knowledge. The learning diagnostics come in different formats but all include questions which require student response. To follow a brain friendly model and attach new information to

something the learner already knows, an instructor must be aware of what the students know relative to the topic.

Following the learning diagnostic, content information was delivered in an interactive format. Questions appeared on the screen to encourage interaction and reinforce content as well as to get students thinking beyond traditional discipline boundaries to other related topics. While pictures were included, video clips were also incorporated into each unit to further illustrate content material. Each unit concluded with interactive review exercises. While each unit contained the same components, they were delivered through a variety of methods. Interactive exercises, videos, and pictures were utilized to maintain student interest and to stimulate new avenues of thought.

In addition to the curriculum presentation, instructors received a manual on CD. The CD contained Word documents which included lesson plans, worksheets, and tests. Lesson plans were provided for each lesson within a unit. The lesson plans outlined unit objectives, suggested length, situation, motivation, questions, and related supporting materials. Worksheets containing various activities were provided for each unit. While the activities varied for each unit, each worksheet was designed to reinforce unit objectives. Each unit test followed the same format. They began with multiple choice questions, then true/false questions, and concluded with a matching items section.

Instrumentation

Data collection instruments were administered to both students and instructors. Students completed a pretest which asked for individual identification which was used to match their pre and posttests, attitudinal statements, and decision making scenarios (Appendix VIII). The post test (Appendix IX) contained the same individual

identification, demographic questions, and decision making scenarios as the pretest. Posttests administered to the experimental group also contained four questions regarding the IRM decision making unit. Instructors completed a questionnaire regarding their demographics, use, perception, and delivery of curriculum, and their perceived importance of decision making skills (Appendix X).

Decision Making Instrument

The decision making portion of pre and posttests was developed specifically for this research. While there are decision making instruments on the market, none were specific to the parameters of this study. The researcher was interested in identifying the domain areas which had the greatest impact on each students' decision making ability. Influencing domain areas that the research targeted were animal science, environmental stewardship, and financial considerations.

To measure the desired variables, six decision making scenarios were created, four were specific to agriculture and two addressed life decisions relevant to high school students. Each scenario consisted of information, a decision to be made, and potential decision options. Open ended questions followed the decision making options. Questions asked students which option they chose, what factors weighed most heavily in their selection, and why these factors were important. Open ended questions also allowed students to indicate domains not listed and provided an opportunity for further explanation.

Several Likert scale statements were listed on the page following the scenario and open ended questions. Respondents were asked to indicate how important each statement was in regards to the decision being made. The Likert scale next to each statement

contained nine options ranging from “extremely important” to “not at all important” (Appendices VIII, IX).

The six scenarios were divided into forms A and B. Each form consisted of two agriculture scenarios and one life scenario. Half of the pre and posttests contained Form A scenarios and the other half contained Form B scenarios. Tests containing Form A scenarios were printed on pink paper. Tests containing Form B scenarios were printed on blue paper. Students that took a pink pretest (Form A) took a blue posttest (Form B) and visa versa. The following table illustrates what components were included on the pre and posttests and what color paper was used.

Table 3

Pre and Posttest Contents

Form	Pre	Post (control group)	Post (treatment group)
Form A (pink paper)	Test matcher Attitude questions Scenarios A, B, C	Test matcher Demographic questions Scenarios A, B, C	Test matcher Demographic questions Scenarios A, B, C Questions regarding DM unit
Form B (blue paper)	Test matcher Attitude questions Scenarios D, E, F	Test matcher Demographic questions Scenarios D, E, F	Test matcher Demographic questions Scenarios D, E, F Questions regarding DM unit

Attitudinal Statements

The attitudinal portion of the instrument was developed specifically for this study. Again, there are attitudinal instruments available but none specific to the purposes of this project. The instrument targeted attitudes specific to the three previously mentioned domain areas: animal science, environmental stewardship, and financial considerations. Next to each statement was a Likert scale where respondents indicated their level of

agreement from one to nine. A one indicated the item was “extremely important” and a nine indicated “not important at all”.

Instructor Questionnaire

The purposes of the instructor questionnaires were to obtain information that would allow the researcher to improve the current decision making unit and develop further curriculum that would be useful to Colorado Vocational Agriculture instructors. Two instructor questionnaires were used, one for the experimental group and one for the control group (Appendix X). Both questionnaires were two pages and contained questions regarding demographic information, curriculum use, and delivery. Questions focused specifically on instructors’ perceptions of the need for a decision making unit, type of curriculum they were currently using, and the greatest challenges they faced as agriculture educators.

The experimental group questionnaire contained additional questions specific to the decision-making unit. Instructors were asked to rate the usefulness of each component of the curriculum: lesson plans, Authorware presentation, learning diagnostic, TILT (today I learned that...) review, and worksheet. Open-ended questions also asked what they liked about the curriculum, what they would change, and additional comments.

Validity

Validity was addressed to ensure a quality study. Measurement, internal, and external validity were examined. Evidence of face and content validity provided substantiation for measurement validity. Verification of face validity was illustrated in the types of scenarios provided. Scenarios included were relevant to high school junior and senior level agriculture students. Questions asked following the scenarios required

students to exercise their decision making skills and provide evidence of that process. High school instructors, research, and content experts provided content validity. They reviewed testing materials for accuracy, appropriateness for the sample, and ability to collect the desired data. Overall measurement validity was rated high.

Internal validity overall was rated medium (Gliner & Morgan, 2000).

Equivalence of groups, based on participant characteristics, was given a medium ranking. It was not possible to randomly assign participants to groups but efforts were made to equate groups and check group similarity. Control of extraneous experiences and environment variables was also given a medium rating. It was not possible to control all extraneous variables but attempts to reduce extraneous influences were taken. All treatment group instructors attended the same training, received the same curriculum and supporting materials, and followed the same research protocol. Control group instructors were given uniform materials, specific instructions, and a timeline to follow.

External validity, which considered population and ecological validity, was rated medium-high (Gliner & Morgan, 2000). Regarding population validity, successful attempts were made to obtain a sample consisting of schools representing the target population. Participating schools represented various geographic areas of Colorado. Instructors and students in both the control and treatment groups represented multiple demographic groups. Participating instructors included males and females, new and experienced instructors. Participating students from each of these schools include males and females between the ages of 14-18.

Table 4

Validity Substantiation

Validity Component	Basis/Assurances	Level Achieved/ Perceived
Measurement Validity		
face validity	- relevant scenarios - questions required students to exercise and provide evidence of their decision making skills	High
content validity	- materials used were reviewed by high school instructors, researchers, and content experts - materials were reviewed for accuracy, appropriateness, and ability to collect desired data	High
Internal Validity		
equivalence of groups	- not possible to used random assignment - efforts made to equate groups and assess group similarity	Medium
control of extraneous experiences and environment	- all treatment group instructors attended the same training - all instructors were given identical materials, instructions, and a timeline to follow	Medium
External Validity		
population	- participants were representative of actual population (gender, age, experience)	Medium
ecological	- research took place in students' actual classrooms - individual instructors delivered content and tests - regular task for high school students - appropriate time and length for unit and tests	High

Ecological validity measured the “naturalness” of the research procedures. It addressed the extent to which procedures used were representative of real-life activities for high school students. Research took place on students’ actual high school campus. The unit and tests were delivered by students regular agriculture education instructor.

Tasks completed as part of the project were regular activities for students in the classroom. Duration of the program was appropriate for the audience. Ecological validity was rated high.

Assumptions

1. The students that participated in this study represented a cross section of agriculture education students taking junior and senior level coursework in the state of Colorado.
2. The students were honest and accurate in their responses on the decision making instrument and attitudinal instrument.
3. If there was not a significant difference between the experimental and control groups' scores on the pretest, and there was a significant difference on their posttest scores, it may be assumed that the difference is due to the experimental group's exposure to the Integrated Decision Making unit of the IRM curriculum.

Pilot Test

The decision making unit was pilot tested twice. Kelly Coonrad, agriculture instructor at Valley High School, Gilcrest, Colorado, used the unit with two of her high school classes in May 2003. A total of 15 students participated in the first pilot study. After reviewing the completed instruments adjustments were made to the type of items students would respond to following each decision making scenario. The original instrument listed several statements following each scenario with a yes and no response. Students then indicated whether or not each statement would be included in their decision making process. On the revised instrument, the yes/no were replaced with a Likert scale so students could indicate the level of importance of each statement. Data collected from the Likert scale allowed for more statistical procedures to be completed. Open ended

questions were also added which allowed students to further explain their choices. An additional pilot test was conducted using the revised instruments. Five junior and senior level 4-Hers comprised the second pilot group. Feedback and data provided by the students were useful and positive.

Data Collection

Data were collected from both students and instructors. Student data were collected using pretest and posttest instruments. At the start of the research, instructors in both groups read students a script explaining the project. Instructors then sent students home with an informational letter for their parents and two consent forms. One consent form was to be signed and returned to school and the other was for parents to keep for their records. On the day instructors administered the pretest, students sealed their signed consent forms with their completed pretests in a business envelope and then returned them to their instructors. Experimental instructors then taught the decision making unit and administered the posttests. Control group instructors taught their regular curriculum and administered the posttest 5-10 days after the pretest had been administered. After students took the posttest and instructors completed their questionnaire, all materials were returned to the researcher in a postage paid mailer.

Sorting

Each school's packet and return mailer were coded with a number. The school number was used so the researcher knew which schools had returned their materials. Follow-up phone calls were made to instructors who had not returned their materials. School numbers were also used to group students that had been exposed to the same instruction.

Each student identified his or her self with a unique alpha numeric sequence on each test. The students' unique identifier corresponded to the first letter of their mother's first name, last two digits of their phone number, and day of birth. When students' pre and post tests were received, quantitative information was entered in Excel. Tests without a match or signed consent form were not entered in the database.

Data Analysis

Pre and post test instruments contained both open ended and Likert-scaled items. Responses to open ended questions following each scenario were coded, entered into the database, and analyzed as quantitative data. Open ended statements that treatment group students responded to were analyzed separately as were open-responses by instructors on their questionnaire.

Coding--Likert-scaled statements

Following each scenario were several Likert-scaled statements. Next to each statement was a one to nine point Likert scale where students indicated their perceived level of importance of the statement to the decision. A score of one indicated extreme importance and a score of nine indicated not important.

The Likert-scaled statements, that followed the scenarios, were each assigned a "domain area code." For example, statements referring to the animal science domain received an "a" code, statements referring to financial considerations received a "p" code, statements referring to environmental considerations received a "e" code, and statements referring to human considerations received an "h" code. Some statements received two domain area codes. Statements that referred to labor requirements received an "h" and "p" code because labor issues relate directly to availability of individuals to perform the

tasks and the price that will have to be paid for their services. Three statements received the double code “ph”. Three statements that referred to animals interacting with the environment received the double code “ae”. One statement received the double code “ap”. It referred to buying versus raising replacement females. Statements that did not clearly fall into one or two of the categories did not receive a code and were not included in any analysis.

Researcher Bias and Assumptions

The decision making unit being tested was created by the researcher. The researcher also analyzed student responses to open ended questions. Every effort was made to assess responses in an impartial manner. Third parties assisted in the development of codes and placement of responses into appropriate categories.

Coding—Open ended responses

Students’ responded to two open-ended questions following each scenario. The first question: “What factors weighed most heavily in your selection?” The second question: “Why are these factors important?” Responses were qualitatively analyzed, grouping similar responses together in order to arrange the responses into domain areas (Table 5). Once responses were grouped according to domain area, they were given a sub code within each domain code. Sub codes represented more specific areas within the domain area. Each sub code was also identified as addressing short or long term considerations. It was possible for a response to receive one or multiple codes. A greater number of codes assigned, represented a greater number of domain areas considered by the respondent in the decision making process.

Data Entry

After all Likert-scaled statements and open ended responses were coded, numbers were entered in the database referring to each item's code. The value label for each Likert-scaled statement contained a letter which referred to the domain area or areas that the statement represented. The domain area letter within each label was used to identify relevant statements to use in calculations specific to the domain areas.

Multiple codes were used for each open-ended question. In the database there were multiple columns for each question that referred to each domain area, code within domain area, and total domain areas mentioned. First researchers wanted to know which domain areas were mentioned. Secondly, which areas within a domain were mentioned. And then, how many total domains were considered in each response.

Domain Integration Scores

After the data was entered in Excel it was imported to SPSS. The first calculations were to create average domain scores from the Likert scale items from the pre and post tests. Average domain scores or means were calculated for each domain area (animal science, financial considerations, environment, and human). Separate means were calculated for the pre and post tests for each student.

Two methods were used to calculate integration scores (integration 1, integration 2). The "integration 1" approach calculated the variation among domains for the pre and post tests. Integration 1 provided a level of integration among domains. Students that had similar domain area averages would have a low level of variance, therefore a high degree of integration, which is desirable. A low level of variance would indicate that on average, students placed a similar level of importance on statements from all domain

areas. Likewise, students that had very diverse domain area averages would have a high level of variance, indicating less integration of the domain areas in their thought process.

The second method, or “integration 2” considered both variation within and variation among domain areas. When variation between is used alone, as in Integration 1, a student who gave the same response for every Likert-scaled item would have a perfect score. Using an approach that considers both types of variation would penalize a student who gave identical responses for every item. A student that gives identical answers is not responding to differences in scenarios and situations and is giving thoughtless responses. Integration 2 was calculated by dividing variation within domain areas by variation between domain areas. A higher score would indicate a low variation between each domain but a variety of responses within each domain area.

Table 5

Coding Used for Open Ended Responses to Agriculture Questions

Code	Description
Financial Considerations	
P1, short term	cost
P2, short term	revenue, yield, three cuttings, bushels, money, market preference
P3, short term	profit, both cost & revenue items mentioned, make money, cost efficient
P4, long term	long term, financial sustainability, LT costs & profits, save money
Environmental Elements	
E1, Characteristics, short term	Crop scenarios: short term, depletion, nitrogen, increase or decrease in soil, soil nutrients, utilize the land properly, enough forage Animal scenarios: physical location of operation, weather, altitude, growing season, condition
E2, long term	long term, sustainability, rotation
E3, both short & long term	both ST & LT, making land better to use in the future, keep soil in good condition, improve range
Animal Science	
A1, short term	number of animals, animal equivalents, AUMs
A2, short term	birth percentage, reproduction
A3, short term	maintenance, feeding requirements
A4, short term	able to handle environment, individual characteristics, weight, meat quality & yield,
A5, long term	long term, keep producing offspring, survival rate
Human	
H1, short term	personal preference, fun, interesting
H2, short term	personal knowledge and/or experience
H3, short term	labor, hours of work
Multiple Code	
A4 E1	heat tolerance, able to handle environment
H3 P1	hours of labor, labor required

Table 6

Coding Used for Open Ended Responses to Non-Agriculture Questions

Code	Description
Financial Considerations	
P1, Short term	cost (to get better gas mileage)
P2, Short term	revenue, money
P3, Short term	profit, both cost & revenue items mentioned, make money, cost efficient
P4, Long term	long term, financial sustainability, LT costs & profits, debt
Quality of Education/Vehicle	
Q1 Characteristics	Education: what is offered, size, classes, extra-curricular activities, opportunities, reputation. Car: Size, age, condition, dependability, reliability
Q2 Value of product	Education: degree, future opportunities, jobs, etc. Car: Usability, haul things
Human	
H1	personal preference, fun, interesting
H2	personal knowledge and/or experience
H3	labor, hours of work
H4	safety
Multiple Code	
H1 P1	transferring, hassle of transferring

CHAPTER IV: RESULTS AND DISCUSSION

Introduction

The purpose of this research was to assess the impact a decision making unit had on student approach to problem solving. The decision making unit, delivered to the treatment group, provided students with a framework or approach for making decisions. The unit showed students how to use an integrated approach which considered all factors influencing the situation as well as potential outcomes or impacts of the decision.

Most studies assessing thought processes and decision making are based on self-report measures where students indicate their perceived skill level rather than completing tasks which provide evidence of their actual skill level. An objective instrument was developed to accurately assess student approach to problem solving by allowing them to display their skills rather than respond to questions which may prompt answers.

In addition to the objective section, students responded to open ended questions where they provided explanations for their choices and provided individual feedback regarding the decision making unit. Instructors were given an opportunity to provide feedback regarding their instructional methods and perceptions of the decision making unit.

The three primary questions the analysis addressed were:

1. Is there a significant change in students' domain integration scores between pre and post tests?

2. What domain area (animal science, environmental/range, financial, human) do students emphasize when making decisions?
3. Is there a correlation between decision making domain areas students mention in their open ended responses and domain areas they weigh most heavily on the Likert scale response items?

Actual Sample

The actual sample consisted of 83 students and 14 instructors. Participants represented 13 schools as two instructors were from the same school. The treatment group was comprised of 9 instructors and 54 students. There were five instructors and 29 students in the control group. Treatment group instructors received training in the delivery of the decision making unit. The unit was taught through three days of instruction between the pre and post tests. Control instructors did not participate in training. They taught their planned curriculum between administrations of pre and posttests. One treatment group instructor submitted student data that was not used because he had his students take the same form of pre and post tests. His instructor questionnaire was included in the evaluation. Two additional instructors attended the training for the treatment group but chose not to participate in the project.

Student Demographics

Students in the treatment and control groups provided similar demographic information (see Table 7). Fifty-six percent of the treatment group were males and all of the treatment participants were ages 16-18. Fifty-two percent of the control group were males and 87% of the control group were 16-18 years old. The largest difference between treatment and control groups was in the "grade in school" category. One

hundred percent of the treatment group was in 11th or 12th grade while 51% of the control group participants were in the 11th or 12th grades. However, when 10th grade was added to the tally, the control group percentage increased to 96%.

Researchers requested that instructors participate with classes of students that had taken at least one agricultural education class prior to the one in which the research took place. This request was made to ensure agricultural knowledge and familiarity with the agricultural based scenarios presented on the pre and post tests. However, some of the students had not taken a prior agriculture course. Six percent of the treatment group and 7% of the control group had not completed an agriculture class prior to participation in the project. Both groups contained approximately the same proportion of students that had not taken a prior agriculture class, therefore their responses were included.

Students were asked if they had been in or were currently in 4-H and FFA. Sixty-six percent of the treatment group and 86% of the control group responded “yes” to 4-H while 96% of the treatment group and 100% of the control group were in or had been in FFA. Ninety-three percent of the treatment students and 100% of the control group students live in rural areas which included farm and rural non-farm residences.

Table 7

Student Demographics

Demographics	Treatment N (% of treatment group), (N=54)	Control N (% of control group), (N=29)
Gender		
Male	30 (56%)	15 (52%)
Female	24 (44%)	14 (48%)
Age (years)		
14	0 (0%)	1 (3%)
15	0 (0%)	3 (10%)
16	24 (44%)	17 (59%)
17	26 (48%)	6 (21%)
18	4 (7%)	2 (7%)
Grade in school		
9	0 (0%)	1 (3%)
10	0 (0%)	13 (45%)
11	32 (59%)	10 (34%)
12	22 (41%)	5 (17%)
Agricultural courses completed		
0	3 (6%)	2 (7%)
1-2	4 (7%)	13 (45%)
3-4	16 (30%)	8 (27%)
4+	31 (57%)	6 (21%)
Student in 4-H past or present		
yes	36 (66%)	25 (86%)
no	18 (33%)	4 (14%)
Student in FFA past or present		
Yes	52 (96%)	29 (100%)
No	2 (4%)	0 (0%)
Student lives		
rural farm	42 (78%)	25 (86%)
rural non-farm	8 (15%)	4 (14%)
suburban	1 (2%)	0 (0%)
urban	3 (5%)	0 (0%)

* Percentages may not equal 100 due to rounding.

Data Analysis

Means for each measure from the pre and post tests were compared using repeated measures analysis of variance. Subject variability was used for random error estimates rather than school or instructor variances as there were so few

instructors/schools. Significance was set at $p \leq .05$. Both groups completed both forms and approximately half of the students in each group took form A as a pre, with the other half taking form B, the form effect was ignored (see Table 8).

Table 8

Form of Test Taken at Pre and Post by Group

Group	Form of pretest taken		Total
	A	B	
Treatment	26 (48%)	28 (52%)	54 (100%)
Control	14 (48%)	15 (52%)	29 (100%)
Total	40	43	83

The distribution of “Integration Score 1”, which measured variation between domain areas (animal science, environment, financial, human) at pre and post was right skewed. Many of the scores were between zero and one. Low scores indicated a low level of variation between the average levels of importance placed on each domain area. The log of the variances, times 100 plus 1.0, was used to normalize the distribution as many of the values were less than one. “Integration Score 2”, divided the sum of the variations within each domain area by the variation between all domain areas. This score was also right skewed. A log transformation was completed to normalize the distribution of Integration Score 2.

Descriptives for Agriculture Likert Scaled Responses

Table 9 presents descriptive information for each calculation completed using student responses to Likert scaled statements that followed each decision scenario. A one to nine scale was used. A one indicated “extremely important” and a nine represented “not at all important”.

domain areas. Both groups showed less variation on the post test than the pretest for Integration Score 1.

Integration Score 2 measured total variation within domain areas divided by variation between domain areas. It was expected that student responses within a domain area should vary depending on the situation or decision being made while variation between domain areas would be similar if a student was using an integrated approach, considering all domain areas to be of similar importance.

In addition to Integration Scores 1 and 2, Table 9 displays total variation within domain areas, individual variation for each domain area, and average importance placed on statements in each domain area. Students placed the greatest level of importance (lowest mean) on statements referring to the environmental area, followed by animal science, then finances and the human domain area.

Results of Agriculture Likert Scaled Responses

No significant period by group interactions were found (see Table 10). Three significant period interactions were found which indicate there was a significant change between pre and post measures but both groups showed a change. The three areas with significant period effects were: variation within domain areas, variation within the human domain, and variation within the environmental domain. All three areas showed significantly less variation at the post test.

Three significant group interactions were also detected. These indicate there was a difference between the groups but it remained constant throughout the study. The three areas with significant group interactions between pre and post test were: environmental domain area, financial domain area, and animal science domain area.

Table 9

Descriptives for Agriculture Scaled Items

Score	Group	N	Mean	Std. Dev.
Integration Score 1 pre	treatment	54	1.60	.54
Log10(variation between*100+1)	control	29	1.59	.55
Integration Score 1 post	treatment	54	1.55	.48
Log 10(variation between*100+1)	control	29	1.51	.56
Integration Score 2 pre	treatment	54	1.27	.45
(variation within ÷ variation between)	control	28	1.26	.30
Integration Score 2 post	treatment	54	1.14	.41
(variation within ÷ variation between)	control	28	1.21	.38
Total Variation within Domain areas	treatment	54	8.71	5.44
Pre	control	29	10.13	7.86
Total Variation within Domain areas	treatment	54	6.65	6.19
Post	control	29	6.96	5.17
Variation within Human Domain	treatment	54	2.19	2.61
Pre	control	29	3.07	3.19
Variation within Human Domain	treatment	54	1.63	2.48
Post	control	29	1.45	1.54
Variation within Financial Domain	treatment	54	2.35	1.95
Pre	control	29	2.59	2.27
Variation within Financial Domain	treatment	54	1.76	1.89
Post	control	29	2.68	2.61
Variation within Environment Domain	treatment	54	1.47	1.35
Pre	control	29	1.42	1.51
Variation within Environment Domain	treatment	54	1.11	1.24
Post	control	29	.78	1.07
Variation within An Science Domain	treatment	54	1.74	2.17
Pre	control	29	2.00	2.37
Variation within Animal Science Domain	treatment	54	1.28	2.15
Post	control	29	1.21	2.20
Human Average Importance	treatment	54	3.68	1.34
Pre	control	29	3.52	1.31
Human Average Importance	treatment	54	3.83	1.50
Post	control	29	3.20	1.31
Environmental Average Importance	treatment	54	2.57	1.12
Pre	control	29	2.15	.81
Environmental Average Importance	treatment	54	2.70	1.44
Post	control	29	2.22	1.03
Financial Average Importance	treatment	54	3.47	1.08
Pre	control	29	2.87	1.08

Financial Average Importance	treatment	54	3.13	1.39
Post	control	29	2.86	.91
Animal Science Average Importance	treatment	54	2.84	1.13
Pre	control	29	2.47	.98
Animal Science Average Importance	treatment	54	2.87	1.32
Post	control	29	2.42	1.14

Table 10

Agriculture Likert Scaled Repeated Measures Analysis

Source	Measure	Degrees Freedom	Mean Square	Significance
Integration Score 1 at pre and post $\text{Log}^{10}(\text{variation between} \times 100 + 1)$	period	1	.170	.425
	error (period)	81	.264	
	period*group	1	.009	.852
	group	1	.018	.806
	error (group)	81	.289	
Integration Score 2 at pre and post $\text{Log}^{10}(\text{Variation within} \div \text{variation between})$	period	1	.349	.147
	error (period)	79*	.163	
	period*group	1	.056	.558
	group	1	.031	.667
	error (group)	79*	.166	
Variation within domain areas at pre and post	period	1	258.271	.002
	error (period)	81	24.871	
	period*group	1	11.561	.497
	group	1	28.260	.455
	error (group)	81	50.118	
Variation within human domain at pre and post	period	1	44.840	.007
	error (period)	81	5.848	
	period*group	1	10.586	.182
	group	1	4.539	.422
	error (group)	81	6.979	
Variation within financial domain at pre and post	period	1	2.339	.402
	error (period)	81	3.299	
	period*group	1	4.474	.248
	group	1	12.761	.137
	error (group)	81	5.645	
Variation within environmental domain at pre and post	period	1	9.531	.005
	error (period)	81	1.170	
	period*group	1	.742	.428
	group	1	.589	.445
	error (group)	81	2.208	
Variation within animal science at pre and post	period	1	14.645	.158
	error (period)	81	7.218	

	period*group	1	1.080	.700
	group	1	.147	.703
	error (group)	81	2.511	
Human domain area mentioned at pre and post	period	1	.255	.682
	error (period)	81	1.511	
	period*group	1	2.167	.235
	group	1	5.861	.116
	error (group)	81	2.319	
Environmental domain area mentioned at pre and post	period	1	.363	.586
	error (period)	81	1.215	
	period*group	1	.031	.873
	group	1	7.797	.028
	error (group)	81	1.566	
Financial domain area mentioned at pre and post	period	1	1.092	.317
	error (period)	81	1.076	
	period*group	1	1.052	.326
	group	1	6.983	.043
	error (group)	81	1.654	
Animal science domain area mentioned at pre and post	period	1	.004	.954
	error (period)	81	1.224	
	period*group	1	.057	.830
	group	1	6.309	.046
	error (group)	81	1.532	

*Two respondents had zero variation therefore it was not possible to calculate Integration Score 2.

Discussion of Agriculture Likert Scaled Item Results

Research question one asked, Is there a significant change in students' domain integration scores between pre and post tests? Results of repeated measures analysis on the Likert scaled agriculture scenarios did not indicate significant changes in student domain integration scores. Students showed a low level of variation between domain areas, which is desirable, but when a low level of variation was present on the pretests there was little room for improvement on the posttests.

It was not possible to control the actions of participating instructors. Treatment group instructors attended training and received specific instructions for their participation but it was not possible to monitor their actions. It is possible that treatment

group instructors did not teach the decision making unit in its entirety. Some instructors did not follow the documented research instructions and misinformed students which rendered their responses unusable.

If instructors did not follow the research instructions for the testing portion, it is questionable whether they followed the curriculum delivery instructions. Also, some of the student comments made reference to the examples only being agriculture related which is not indicative of the content of the decision making unit. If the complete decision making unit was taught students would have been exposed to both agriculture and non-agriculture scenarios. For groups that did receive three full class periods of instruction, it is possible that three classes is not long enough to detect significant changes in student approach to decision making not to present the content.

Descriptives for Open-Ended Items

Student responses to the open ended questions following each agriculture scenario were reviewed and then grouped first by domain area and then more specifically by sub codes within each domain area (see Table 5). Each code was also identified as relating to short or long term concerns. Table 11 presents the means and standard deviations for each group, period, and code.

Means of responses on the open ended questions show that students were most likely to discuss financial issues. Next, students were most likely to mention animal science items, then environmental statements and human concerns. This order of domain areas remained the same on pre and post tests.

Results of Agriculture Open-Ended Questions

Open ended responses were coded then evaluated quantitatively. There were no significant group by period interactions. One significant group interaction and one significant period interaction were found. There was a significant difference between treatment and control groups for the financial sub code three category (long term, financial sustainability, costs and profits, save money) which remained constant throughout the study. In the human sub code two category (personal knowledge and/or experience) significant changes occurred between the pre and post tests but both groups experienced these changes.

Research question two asked, “What domain area (animal science, environmental/range, financial, human) do students emphasize when making decisions?” Means of Likert scaled agriculture responses indicated that students placed a similar level of importance on items from all four domain areas (see Table 12). The mean range for all domain areas was 2.43 to 3.62. The Likert statements provided pieces of information for students to indicate their perceived level of importance of each. While students gave each domain area a similar level of importance on the Likert statements, when they were asked to explain their choice they were most likely to mention financial reasons. Financial reasons were mentioned in 65% of their responses. Approximately 50% of their responses mentioned animal science and environmental issues and 16-17% of their responses mentioned human issues.

Open ended responses may have provided a more accurate indication of the level of importance students placed on each domain area as students were not prompted in any way on their open ended responses. The two questions they responded to following each

Table 11

Descriptives for Agriculture Open-Ended Responses

Mentioned in opened responses	Group	N	Mean	Std. Dev.
Domain areas mentioned on open-ended pretest questions (number)	treatment	54	1.86	.44
	control	29	1.89	.40
Domain areas mentioned on open-ended posttest questions (number)	treatment	54	1.86	.49
	control	29	1.75	.48
Sub codes mentioned pre (number)	treatment	54	.13	.03
	control	29	.14	.04
Sub codes mentioned post (number)	treatment	54	.13	.04
	control	29	.12	.04
Animal Science Average Pre (averaged 8 questions on each form, 1 = mentioned, 0 = not mentioned)	treatment	54	.56	.38
	control	29	.53	.31
Animal Science Average Post (averaged 8 questions on each form, 1 = mentioned, 0 = not mentioned)	treatment	54	.51	.34
	control	29	.50	.28
Environment Average Pre (averaged 8 questions on each form, 1 = mentioned, 0 = not mentioned)	treatment	54	.50	.31
	control	29	.50	.28
Environment Average Post (averaged 8 questions on each form, 1 = mentioned, 0 = not mentioned)	treatment	54	.53	.35
	control	29	.44	.30
Financial Average Pre (averaged 8 questions on each form, 1 = mentioned, 0 = not mentioned)	treatment	54	.65	.33
	control	29	.66	.28
Financial Average Post (averaged 8 questions on each form, 1 = mentioned, 0 = not mentioned)	treatment	54	.66	.32
	control	29	.65	.37
Human Average Pre (averaged 8 questions on each form, 1 = mentioned, 0 = not mentioned)	treatment	54	.15	.20
	control	29	.19	.21
Human Average Post (averaged 8 questions on each form, 1 = mentioned, 0 = not mentioned)	treatment	54	.16	.21
	control	29	.16	.20
Short Term Pre	treatment	54	.16	.05
	control	29	.17	.05

Short Term Post	treatment	54	.16	.05
	control	29	.15	.05
Long Term Pre	treatment	54	.02	.04
	control	29	.03	.04
Long Term Post	treatment	54	.03	.05
	control	29	.02	.03
Animal science sub code 1 pretest avg	treatment	54	.08	.16
	control	29	.10	.16
Animal science sub code 1 posttest avg	treatment	54	.07	.14
	control	29	.11	.20
Animal science sub code 2 pretest avg	treatment	54	.02	.07
	control	29	.03	.08
Animal science sub code 2 posttest avg	treatment	54	.08	.17
	control	29	.03	.08
Animal science sub code 3 pretest avg	treatment	54	.12	.20
	control	29	.18	.22
Animal science sub code 3 posttest avg	treatment	54	.12	.16
	control	29	.10	.17
Animal science sub code 4 pretest avg	treatment	54	.45	.41
	control	29	.42	.39
Animal science sub code 4 posttest avg	treatment	54	.37	.41
	control	29	.34	.37
Animal science sub code 5 pretest avg	treatment	54	.02	.07
	control	29	.00	.00
Animal science sub code 5 posttest avg	treatment	54	.02	.07
	control	29	.01	.05
Environmental sub code 1 pretest avg	treatment	54	.47	.33
	control	29	.46	.28
Environmental sub code 1 posttest avg	treatment	54	.48	.37
	control	29	.41	.29
Environmental sub code 2 pretest avg	treatment	54	.00	.00
	control	29	.01	.05
Environmental sub code 2 posttest avg	treatment	54	.00	.03
	control	29	.00	.00
Environmental sub code 3 pretest avg	treatment	54	.04	.11
	control	29	.03	.09

Environmental sub code 3 posttest avg	treatment	54	.05	.12
	control	29	.03	.09
Financial sub code 1 pretest avg	treatment	54	.07	.15
	control	29	.09	.15
Financial sub code 1 posttest avg	treatment	54	.08	.16
	control	29	.16	.21
Financial sub code 2 pretest avg	treatment	54	.23	.22
	control	29	.26	.22
Financial sub code 2 posttest avg	treatment	54	.17	.20
	control	29	.20	.20
Financial sub code 3 pretest avg	treatment	54	.33	.28
	control	29	.28	.29
Financial sub code 3 posttest avg	treatment	54	.38	.34
	control	29	.26	.32
Financial sub code 4 pretest avg	treatment	54	.02	.07
	control	29	.06	.13
Financial sub code 4 posttest avg	treatment	54	.04	.12
	control	29	.03	.10
Human sub code 1 pretest avg	treatment	54	.03	.11
	control	29	.01	.05
Human sub code 1 posttest avg	treatment	54	.01	.08
	control	29	.00	.00
Human sub code 2 pretest avg	treatment	54	.06	.15
	control	29	.06	.14
Human sub code 2 posttest avg	treatment	54	.01	.08
	control	29	.01	.05
Human sub code 3 pretest avg	treatment	54	.06	.14
	control	29	.13	.20
Human sub code 3 posttest avg	treatment	54	.13	.19
	control	29	.16	.19

Table 12

Domain Area Rank for Open Ended and Likert Responses

Domain Area	Form of test	Likert Mean (1=extremely important 9=not important)	Likert Rank	Open Ended Mean (% of responses that mentioned domain)	Open Ended Rank
Animal Science	pre	2.71	2	55%	2
	post	2.71	2	51%	2
Environment	pre	2.43	1	51%	3
	post	2.53	1	50%	3
Financial	pre	3.26	3	65%	1
	post	3.25	3	66%	1
Human	pre	3.62	4	17%	4
	post	3.61	4	16%	4

scenario were, “what factors weighed most heavily in your selection?” and “why are these factors important?” Financial reasons were listed most often ($\approx 65\%$ of the time) followed by animal science and environmental reasons ($\approx 51\%$ of the time) and then human ($\approx 16\%$ of the time).

Table 13

Agriculture Open-Ended Repeated Measures Analysis

Source	Measure	Degrees Freedom	Mean Square	Significance
Average number of domain areas mentioned on pre and post	period	1	.179	.302
	error (period)	81	.166	
	period*group	1	.179	.302
	group	1	.067	.608
	error (group)	81	.253	
Average number of sub codes mentioned on pre and post	period	1	.003	.121
	error (period)	81	.001	
	period*group	1	.003	.097
	group	1	.000	.789
	error (group)	81	.002	
Animal Science Pre and Post test (averaged 8 questions on each form, 1 = mentioned, 0 = not mentioned)	period	1	.062	.561
	error (period)	81	.180	
	period*group	1	.001	.932
	group	1	.009	.669
	error (group)	81	.047	

Environment Pre and Post test (averaged 8 questions on each form, 1 = mentioned, 0 = not mentioned)	period	1	.010	.766
	error (period)	81	.112	
	period*group	1	.073	.421
	group	1	.089	.323
	error (group)	81	.090	
Financial Pre and Post test (averaged 8 questions on each form, 1 = mentioned, 0 = not mentioned)	period	1	.000	.979
	error (period)	81	.146	
	period*group	1	.009	.803
	group	1	.000	.998
	error (group)	81	.066	
Human Pre and Post test (averaged 8 questions on each form, 1 = mentioned, 0 = not mentioned)	period	1	.004	.768
	error (period)	81	.048	
	period*group	1	.009	.672
	group	1	.018	.494
	error (group)	81	.037	
Average number of short term responses mentioned on pre and post	period	1	.004	.166
	error (period)	81	.002	
	period*group	1	.003	.237
	group	1	.000	.786
	error (group)	81	.003	
Average number of long term responses mentioned on pre and post	period	1	.000	.905
	error (period)	81	.002	
	period*group	1	.003	.210
	group	1	.000	.722
	error (group)	81	.001	
Average number of statements in the animal science sub code 1 category for pre and post tests	period	1	.001	.891
	error (period)	81	.032	
	period*group	1	.007	.648
	group	1	.033	.203
	error (group)	81	.020	
Average number of statements in the animal science sub code 2 category for pre and post tests	period	1	.034	.120
	error (period)	81	.014	
	period*group	1	.034	.120
	group	1	.028	.134
	error (group)	81	.012	
Average number of statements in the animal science sub code 3 category for pre and post tests	period	1	.064	.246
	error (period)	81	.047	
	period*group	1	.050	.303
	group	1	.022	.341
	error (group)	81	.024	
Average number of statements in the animal science sub code 4 category for pre and post tests	period	1	.230	.374
	error (period)	81	.288	
	period*group	1	.000	.995
	group	1	.026	.399
	error (group)	81	.036	

Average number of statements in the animal science sub code 5 category for pre and post tests	period	1	.001	.654
	error (period)	81	.003	
	period*group	1	.001	.654
	group	1	.008	.115
	error (group)	81	.003	
Average number of statements in the environmental sub code 1 category for pre and post	period	1	.017	.732
	error (period)	81	.144	
	period*group	1	.035	.623
	group	1	.064	.353
	error (group)	81	.073	
Average number of statements in the environmental sub code 2 category for pre and post	period	1	.000	.656
	error (period)	81	.001	
	period*group	1	.002	.141
	group	1	.000	.656
	error (group)	81	.001	
Average number of statements in the environmental sub code 3 category for pre and post	period	1	.002	.714
	error (period)	81	.013	
	period*group	1	.002	.714
	group	1	.003	.563
	error (group)	81	.010	
Average number of statements in the financial sub code 1 category for pre and post	period	1	.071	.124
	error (period)	81	.029	
	period*group	1	.044	.224
	group	1	.098	.055
	error (group)	81	.026	
Average number of statements in the financial sub code 2 category for pre and post	period	1	.137	.070
	error (period)	81	.041	
	period*group	1	.000	.998
	group	1	.038	.382
	error (group)	81	.049	
Average number of statements in the financial sub code 3 category for pre and post	period	1	.002	.893
	error (period)	81	.129	
	period*group	1	.043	.565
	group	1	.258	.045
	error (group)	81	.062	
Average number of statements in the financial sub code 4 category for pre and post	period	1	.001	.747
	error (period)	81	.012	
	period*group	1	.031	.104
	group	1	.006	.413
	error (group)	81	.009	
Average number of statements in the human sub code 1 category for pre and post	period	1	.007	.302
	error (period)	81	.006	
	period*group	1	.001	.706
	group	1	.013	.134
	error (group)	81	.006	

Average number of statements in the human sub code 2 category for pre and post	period	1	.091	.007
	error (period)	81	.012	
	period*group	1	.000	.879
	group	1	.000	.893
	error (group)	81	.014	
Average number of statements in the human sub code 3 category for pre and post	period	1	.078	.145
	error (period)	81	.036	
	period*group	1	.014	.530
	group	1	.076	.098
	error (group)	81	.027	

Discussion of Agriculture Open-Ended Responses

While there were no significant changes in the four coded areas (animal science, environmental, financial, human) and sub codes that students mentioned on the pre and post tests, student responses do indicate which domain areas they thought were most important. Students mentioned financial reasons most often in their explanations followed by animal science, then environment, and human. Students mentioned more short-term items (16% of possible) than long-term items (2% of possible). When discussing animal science items, students mentioned the sub code 4 most often which pertained to individual animal characteristics. When discussing environmental issues, students mentioned sub code 1 which dealt with short term land issues most often. When students discussed financial concerns they were most likely to mention the sub code 3 which was short term costs and profits. When human issues were discussed students were most likely to mention the sub code 3 which dealt with labor concerns. Complete sub code descriptions are listed in Table 5. New curriculum should focus on increasing students' awareness in and importance of the areas represented in the subcode that were not discussed by the students.

Non-Agriculture Open-Ended Items

Pre and post tests each contained one non-agriculture decision scenario (Appendix VIII, IX). Responses to open ended questions following each scenario were grouped then coded in the same manner as the agriculture responses (see Table 6). On average, treatment group participants mentioned more domain areas on their post tests and control participants mentioned fewer, but significant interactions were not detected (see Table 14).

Table 14

Descriptives for Non-Agriculture Open-Ended Responses

Domain areas mentioned	Group	N	Mean	Std. Deviation
# domain areas mentioned pre	treatment	54	1.86	.578
	control	29	1.74	.592
# domain areas mentioned post	treatment	54	2.00	.607
	control	29	1.62	.703

Table 15

Non-Agriculture Open-Ended Item Results

Source	Measure	Degrees Freedom	Mean Square	Significance
Average number of domain areas mentioned for pre and post	period	1	.003	.91
	error (period)	81	.275	
	period*group	1	.636	.132
	group	1	2.349	.029
	error (group)	81	.476	

Opinions and Preferences

All students responded to opinion, preference, and information source statements on their pretests. On the opinion and preference scale, a one represented “completely agree” and a nine indicated, “completely disagree.” The two statements that received the strongest level of agreement mentioned the environment related to agricultural operations (see Table 16). The other two statements referred to financial issues. Student responses provided further evidence that at the time of the pretest, students were already considering the importance of domain area interactions such as agricultural operations and the environment.

Table 16

Opinions and Preferences

Statement	Group	N	Mean	Standard Deviation
Agricultural operations should promote increased quality of the environment.	treatment	54	3.37	1.81
	control	29	2.69	1.89
Success is determined by the amount of money an operation makes.	treatment	54	5.26	2.57
	control	29	5.90	2.47
It is important to match animals to their environment.	treatment	54	2.65	2.20
	control	29	2.24	1.88
The least cost option is always the best option.	treatment	54	6.48	1.91
	control	29	6.62	2.15

Use of Information Sources When Making Decisions

Students were asked how extensively they would rely on family, technology, and field experts for information when making decisions. Students responded on a Likert-type scale where one indicated, “extensive use” and nine represented, “no use”. Students in both groups placed the greatest level of importance on family, followed by technology,

and lastly experts in the field. Similar means for all three sources (2.83 to 3.48) indicate that students placed a similar level of use on all three sources (see Table 17).

Table 17

Information Sources for Making Decisions

Statement	Group	N	Mean	Standard Deviation
family	treatment	54	2.93	.28
	control	29	2.83	.35
technology	treatment	54	3.48	.30
	control	29	3.66	.43
experts in the field	treatment	54	2.94	.28
	control	29	2.97	.45

IRM Decision Making Unit Feedback

Feedback on the decision making unit provided by both students and instructors was clearly positive. Students and instructors in the treatment group provided feedback by completing questionnaires. Their feedback indicated that they thought the CD-based curriculum was useable, applicable, and challenging.

Student Feedback Regarding IRM Decision Making Unit

Students who completed the IRM decision making unit also responded to three questions regarding the unit:

1. What did you like about the decision making unit?
2. What would you change about the decision making unit?
3. How will you use the information from the decision making unit when making decisions in your own life?

Following the questions, students were to list any additional comments they had about the decision making unit.

Fifty-four students responded to the first question, “What did you like about the decision making unit?” Responses were reviewed and then grouped into four categories: learning, format/approach, applicability, and other. Statements that were placed in the “learning” category described something the students had learned or gained as a result of their participation in the decision making unit. The “format/approach” category was developed for statements that referred to the way the curriculum was designed and presented. The third category, “applicability” contained statements that described how students were able to apply the information presented in the unit.

Seven of the responses were included in two of the categories as respondents’ statements applied to two categories. Ninety-five percent of the students had a positive response to the format and content of the unit. These responses were placed in three main categories (see Table 18). The three responses (5%) that were included in the “other” category were, “it is okay”, “not a hole [sic] lot”, and “I think it is great to have different scenarios, but the questions might not make sense to someone who knows nothing about agriculture.”

Forty-three percent of the student responses indicated what they liked about the unit was that they had learned. An example of the responses included in this category were, “now I know and understand,” “it was challenging,” “it made you think,” “helped me make better decisions,” and “the knowledge it gave me.” A primary goal of the unit was to challenge students to think. Students’ frequent responses stating they had learned provide evidence that their thinking regarding decision making and the approaches they use had been impacted.

Table 18

Student Responses Indicating What They Liked About the Decision Making Unit

Number of responses (% of those responding)	Category & Description
26 (43%)	Learning: I learned, challenging, made me think, helped me, gave me knowledge
19 (31%)	Format/approach: liked computerized examples, liked the situations, liked the questions, simple, straightforward, provided way to consider options
13 (21%)	Applicability: applicable to me, useful, multi-disciplinary, agriculture & non-agriculture, helpful in future
3 (5%)	Other

Format/approach was the second category containing student responses to the question of what they liked about the decision making unit. Students listed that they liked the computerization, the examples, situations, and questions. They thought the unit was “simple and straightforward,” and indicated that it provided them with a way to consider options. These statements reinforce the claim that the unit reaches students effectively.

CD-based curricula are gaining popularity due to their versatility and sophistication of content and delivery. Instructors benefit from a computer-based approach since they can present materials to an entire class or individual students can work through materials on their own. Instructors and students gain from the utilization of computer technology which allows visual aids such as pictures and videos. Interactive activities help to maintain student focus while requiring them to be active participants in the learning process.

“Applicability” was the third category of responses. One of the goals of the curriculum team was that the materials would be applicable to high school students. In order to make a difference in the way students approach and address decisions, the presentation would have to be such that students could relate the steps and examples in the unit to issues they face in their lives. Student responses indicated that this goal was achieved. Some of the students’ responses included, “it can be used in everyday life,” “can be used for any decision...agriculture or not,” “it helped put me in a real situation,” and “the decision making unit will help me in the future.” Learning is best achieved when new information is linked to something already familiar to the learner (Beane, 1992, Perry, 2000).

Responses to, “What would you change about the decision making unit?” were more varied than those to the first question. The 54 responses did not fit easily into specific categories. Five categories were required to group the responses. Thirteen (24%) students wanted the unit tougher and/or longer while 6 (11%) wanted it shorter and/or easier, and 15 (28%) desired no change. Seven students (13%) stated they wanted more activities or interaction in the learning process. The last 13 (24%) provided responses that did not fit the previous categories. These responses included statements such as, “have it once a week,” “apply it more to agriculture,” “incorporate a little more non-agriculture situations.”

Student responses to the second question, “What would you change about the Decision Making Unit,” illustrated the challenges faced by curriculum writers and instructors. Student responses covered the spectrum from make it longer and harder to do not change it to make it shorter and easier. There is no one right or best way to develop

curriculum or deliver instruction. Within one class there are students with diverse learning styles, levels of skill, interests, and prior knowledge. It is challenging to capture and engage every student's attention.

In addition to presenting material that is conducive to multiple learning styles, group work provides an approach to challenge students with varying levels of skill and knowledge. Students who have already mastered a topic may be challenged by helping their group or teammates learn and apply the concepts. Group work mirrors everyday life for many adults that work with others. Learning how to communicate effectively and complete tasks as a team is a lifelong skill.

It is interesting to note that the unit contained both agriculture and non-agriculture examples. The Authorware presentation clearly stated that the concepts taught in the unit could be applied to any decision being faced, not just agricultural-type decisions. Responses stating the unit should include agriculture or non-agriculture examples indicate that it is very likely that some instructors did not teach the entire unit.

Seven (13%) of the respondents to the question asking what students would change about the unit indicated they wanted more interaction or activities. The unit contained a class review exercise, worksheet, Authorware review, and Authorware scenario for application. Again it is possible that some instructors did not complete/use all the activities or those students would prefer even more interactive exercises. When developing curriculum or lesson plans, it is a challenge to incorporate multiple activities to apply concepts without being perceived as repetitive or elementary and fit into available time. When instructors were asked how their class time was typically spent, group interactive activities was listed as the second most used, with 22% of the time for

the treatment group spent this way and 25% of the time for the control group spent doing interactive activities.

Some students' responses indicated that the concepts were "too elementary" or "below our level." While decision-making is not rocket science, many individuals do not take the time necessary to assess a situation and make an informed decision. Curriculum developers are challenged to present information in a straightforward and logical manner without appearing to be below students' learning levels while simultaneously not overwhelming students with too much information and detail.

Student responses to all three questions regarding the decision-making unit were positive but question three was unique in that it asked students specifically how they would use the information from the decision making unit. The 53 responses to the third question were extremely positive. Responses were reviewed and then grouped into three categories:

1. explanations of *how* the unit had impacted their decision making approach,
2. examples of decisions *where* they would apply the unit,
3. Other -- statements did not fit into the first two categories.

Eighty three percent of students' responses fell in to the first two categories which included *how* and *where* students would apply the information they had gained from the unit.

Although the objective measurements of integrated decision making did not provide evidence of a significant gain, students said they were giving more thought to their decisions. Students' positive responses provided evidence that if the instrument used had been based on self-report items only, the results would be overwhelmingly

Table 19

Student Responses Indicating How They Will Use the Decision Making Unit

Number of responses (% of those responding)	Category & Description
25 (47%)	Explained how the unit had impacted their decision making approach. Included phrases “I will think more,” “look at the big picture”, “consider all the factors/consequences”
19 (36%)	Provided examples of decisions where they would apply the unit such as college, investments, enterprise selection, etc.
9 (17%)	Other, did not fall into the first two categories. Examples include, “as much as possible,” “the same way I did here,” and “I will use the decision making circle.”

positive. It also provides evidence that the instrument may have been too easy or was not effective at detecting changes in students’ approach to decision-making.

Student responses explained how their thought processes had changed after completing the decision making unit. They said they would think more before making a hasty choice and consider the potential outcomes to the options being considered. Other students described where they would apply the concepts they had learned in the decision making unit. Students mentioned many types of decisions they were or would be facing where their newly learned decision making process could be applied ranging from enterprise selection to investments, jobs, and colleges. Direct student feedback illustrated that the unit was applicable to students’ lives and that they were going to or are using what they learned.

Following the three questions, an open-ended statement gave students the opportunity to list additional comments. Twenty-seven students provided responses. Twenty-three (85%) of their responses were positive. Positive statements included,

“I really liked it. It will help me make future decisions in life. It made me realize that I should think a lot of things through before I just make a choice like what are the positives, what the negatives and what are the consequences if I do this.”

“It is good and I think many people would get a lot of good out of it if they took it also.”

“I think this type of thing is awesome for students these days. This is actually useful, informative information that pertains to everyday life.”

“It provided a simple way to make hard decisions, or simple ones.”

“I liked the pictures.”

“It was well planned.”

“It was pretty fun.”

The four statements (15%) that were critical included it was elementary, boring, and too repetitive.

Again, it is difficult to facilitate learning that is interesting and engaging to every student. Through the usage of student feedback, it may be possible to develop curriculum which would relate to an even larger percentage of students. It is also possible that student interest was strongly influenced by their instructor’s enthusiasm and method(s) of delivery.

Likert Scaled and Open Ended Response Correlations

Research question three was, “Is there a correlation between decision making domain areas students mention in their open ended responses and domain areas they weigh most heavily on the Likert scale response items?” It was anticipated that students would discuss the domain areas they weighed most heavily on the Likert scaled statements in their responses to the open ended questions. Separate correlation analyses were conducted for the treatment and control groups at the time of pre and post tests.

The descriptive table displays the means and standard deviations for treatment and control groups on pre and post tests (see Table 20). All four group/period sections displayed similar means for their responses. On the scale for the Likert items, a one

represented “not at all important” and nine represented, “extremely important”. There were four open ended agriculture questions on each form of the test, two following each agriculture scenario. Therefore students had the opportunity to mention each domain area up to four times. Open ended scores indicate how many times (of four possible) students mentioned each domain area.

Table 20

Descriptives for Control and Treatment Groups at Pre and Post Test

Domain & Question Type	Control Pre		Control Post		Treatment Pre		Treatment Post	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Financial Likert	7.13	1.08	7.14	.91	6.53	1.08	6.87	1.39
An Sci Likert	7.53	.98	7.58	1.14	7.16	1.13	7.13	1.32
Env Likert	7.85	.81	7.78	1.03	7.43	1.12	7.30	1.44
Human Likert	6.48	1.31	6.80	1.31	6.32	1.34	6.17	1.50
Fin Open Ended	2.66	1.11	2.59	1.48	2.59	1.31	2.65	1.29
An Sci Open Ended	2.14	1.25	2.00	1.10	2.22	1.50	2.04	1.36
Env Open Ended	2.00	1.10	1.76	1.21	2.02	1.25	2.13	1.40
Human Open Ended	.76	.83	.66	.81	.61	.81	.63	.85

Same Domain Area Likert and Open Ended Correlations

The control group did not have any significant correlations between Likert responses and open ended responses for same domain areas on pre or post tests (see Tables 21 & 22). A negative correlation was detected on the pre test for the animal science domain for both the treatment and control groups (see Tables 21 & 23). The environmental domain had a significant positive correlation between Likert responses and open ended responses for the treatment group on both the pre and post test (see Tables 23 & 24).

Table 21

Correlations for Control Group Pre Tests

Domain	Question Type	Fin Likert	An Sci Likert	Env Likert	Human Likert	Fin OE	An Sci OE	Env OE	Human OE
Fin Likert	Pearson Correlation Sig. (2-tailed)	1							
An Sci Likert	Pearson Correlation Sig. (2-tailed)	.679** .000	1						
Env Likert	Pearson Correlation Sig. (2-tailed)	.434* .019	.167 .386	1					
Human Likert	Pearson Correlation Sig. (2-tailed)	.661** .000	.507** .005	.446* .015	1				
Fin OE	Pearson Correlation Sig. (2-tailed)	.360 .055	.422* .023	-.159 .410	-.073 .706	1			
An Sci OE	Pearson Correlation Sig. (2-tailed)	-.271 .155	.481** .008	.373* .046	-.203 .292	-.455* .013	1		
Env OE	Pearson Correlation Sig. (2-tailed)	-.095 .623	-.088 .649	.266 .164	.194 .313	-.379* .042	.572** .001	1	
Human OE	Pearson Correlation Sig. (2-tailed)	-.043 .826	.172 .372	-.306 .106	-.107 .582	.139 .473	-.415* .025	-.468* .010	1

** Correlation is significant at the 0.01 level (2-tailed).

* Correlation is significant at the 0.05 level (2-tailed).

a Listwise N=29

Table 22

Correlations for Control Group Post Tests

Domain Question Type		Fin Likert	An Sci Likert	Env Likert	Human Likert	Fin OE	An Sci OE	Env OE	Human OE
Fin Likert	Pearson Correlation Sig. (2-tailed)	1 .							
An Sci Likert	Pearson Correlation Sig. (2-tailed)	.639** .000	1 .						
Env Likert	Pearson Correlation Sig. (2-tailed)	.484** .008	.451* .014	1 .					
Human Likert	Pearson Correlation Sig. (2-tailed)	.528** .003	.225 .240	.398* .033	1 .				
Fin OE	Pearson Correlation Sig. (2-tailed)	.321 .090	.398* .032	-.130 .503	-.204 .288	1 .			
An Sci OE	Pearson Correlation Sig. (2-tailed)	-.221 .249	-.184 .340	.183 .343	.045 .816	.593** .001	1 .		
Env OE	Pearson Correlation Sig. (2-tailed)	-.369* .049	-.311 .101	-.086 .658	-.171 .374	-.277 .146	.507** .005	1 .	
Human OE	Pearson Correlation Sig. (2-tailed)	.185 .337	-.018 .925	-.130 .500	.242 .206	.144 .455	-.398* .032	.021 .913	1 .

** Correlation is significant at the 0.01 level (2-tailed).

* Correlation is significant at the 0.05 level (2-tailed).

a Listwise N=29

Table 23

Correlations for Treatment Group Pre Tests

Domain Question Type		Fin Likert	An Sci Likert	Env Likert	Human Likert	Fin OE	An Sci OE	Env OE	Human OE
Fin Likert	Pearson Correlation Sig. (2- tailed)	1 .							
An Sci Likert	Pearson Correlation Sig. (2- tailed)	.601** .000	1 .						
Env Likert	Pearson Correlation Sig. (2- tailed)	.472** .000	.424** .001	1 .					
Human Likert	Pearson Correlation Sig. (2- tailed)	.694** .000	.410** .002	.286* .036	1 .				
Fin OE	Pearson Correlation Sig. (2- tailed)	.178 .197	.283* .038	-.270* .048	-.003 .985	1 .			
An Sci OE	Pearson Correlation Sig. (2- tailed)	-.206 .134	.348** .010	.313* .021	-.101 .466	.615** .000	1 .		
Env OE	Pearson Correlation Sig. (2- tailed)	-.182 .187	-.032 .821	.402** .003	-.112 .422	.490** .000	.571** .000	1 .	
Human OE	Pearson Correlation Sig. (2- tailed)	.025 .859	.201 .144	-.121 .383	.118 .397	.310* .023	.470** .000	-.328* .016	1 .

** Correlation is significant at the 0.01 level (2-tailed).

* Correlation is significant at the 0.05 level (2-tailed).

a Listwise N=54

Table 24

Correlations for Treatment Group Post Tests

Domain Question Type		Fin Likert	An Sci Likert	Env Likert	Human Likert	Fin OE	An Sci OE	Env OE	Human OE
Fin Likert	Pearson Correlation Sig. (2- tailed)	1 .							
An Sci Likert	Pearson Correlation Sig. (2- tailed)	.805** .000	1 .						
Env Likert	Pearson Correlation Sig. (2- tailed)	.781** .000	.754** .000	1 .					
Human Likert	Pearson Correlation Sig. (2- tailed)	.795** .000	.666** .000	.599** .000	1 .				
Fin OE	Pearson Correlation Sig. (2- tailed)	.089 .523	.206 .134	-.186 .179	-.038 .787	1 .			
An Sci OE	Pearson Correlation Sig. (2- tailed)	-.139 .315	-.195 .158	.158 .253	-.147 .290	.605** .000	1 .		
Env OE	Pearson Correlation Sig. (2- tailed)	.029 .832	-.129 .351	.322* .018	.114 .412	.611** .000	.661** .000	1 .	
Human OE	Pearson Correlation Sig. (2- tailed)	-.096 .492	-.038 .787	-.170 .220	.130 .349	.068 .626	-.281* .040	-.038 .785	1 .

** Correlation is significant at the 0.01 level (2-tailed).

* Correlation is significant at the 0.05 level (2-tailed).

a Listwise N=54

Likert to Likert Correlations

Other significant correlations were present that crossed domain areas. There were six possible Likert to Likert and open ended to open ended correlations.

1. Financial to Animal Science
2. Financial to Environment
3. Financial to Human
4. Animal Science to Environment
5. Animal Science to Human
6. Environment to Human

Students that were using an integrated approach would place the same level of importance on items regarding each domain area. Therefore all domains would be positively correlated. Of the six possible Likert to Likert domain correlations both groups at both testing times had positive correlations on four and all of the group/period sections except one had positive correlations on the other two (see Table 25). These interactions indicate that students were using an integrated approach.

Likert means show that similar levels of importance were placed on all four domain areas (see Table 12). Since students were already placing a similar level of importance on items from all of the domain areas at the time of pretest, it is not possible to determine if the treatment would have had an impact on students that did not start the treatment with similar levels of importance for the domains.

Open Ended Correlations

Of the six possible open ended to open ended correlations, both groups at both testing intervals had a positive correlation for animal science and environment. Two of

Table 25

Treatment/period Sections with Significant Positive Correlations in Each Area

Domain & Type	Fin Likert	An Sci Likert	Env Likert	Human Likert	Fin OE	An Sci OE	Env OE	Human OE
Fin Likert								
An Sci Likert	CPre CPst TPre TPst							
Env Likert	CPre CPst TPre TPst	CPst TPre TPst						
Human Likert	CPre CPst TPre TPst	CPre TPre TPst	CPre CPst TPre TPst					
Fin OE		CPre CPst TPre						
An Sci OE			CPre TPre					
Env OE			TPre			CPre CPst TPre TPst		
Human OE								

CPre = Control group pre test
 CPst = Control group post test
 TPre = Treatment group pre test
 TPst = Treatment group post test

the scenarios presented students with situations where specie or breed of animal was being selected for a particular environment. Since an obvious animal/environment interaction was presented in these scenarios, it is not surprising that students' responses included reasons that related to both domain areas and therefore a significant positive correlation between the two domain areas was present.

Instructor Demographics

Fifteen instructors participated in the project with 14 returning useable student data. Twelve instructors completed the instructor questionnaire (see Table 26). Eight of the instructors were in the treatment group and four were in the control group. Both groups contained male and female instructors as well as a distribution of teaching experience. Seventy-five percent of the instructors in both groups had majored in agriculture education. Thirty-eight percent of the treatment group instructors had graduate degrees while 50% of the control group was currently working on advanced degrees. When instructors were asked what percentage of class time was spent on various activities, the most used was lecture, followed by interactive activities then independent student work, group work, and other. Less than half of the instructors specifically teach decision making skills but 75% or more of both groups said they would use a decision making unit.

Instructors were asked to indicate, on a one to five scale, how useful they found five components of the decision making unit (see Table 27). One on the scale indicated “very useful” and five indicated “not useful”. For five components, 76% or more of the instructors ranked each either a one or two.

The lesson plans (Appendix XI) provided a suggested timeline and format for instructors to follow for the three days of curriculum delivery. Lesson plans for each day followed the state format and contained: estimated time required, area description, job description, questions, situation description, motivation, and content description. Authorware is the program used to build and deliver each day’s content. A learning diagnostic activity was used at the beginning of the unit to stimulate thought about

Table 26

Participating Instructor Demographics

Instructor Profile	Treatment N (% of treatment group)	Control N (% of control group)
Gender		
Male	5 (63%)	3 (75%)
Female	3 (38%)	1 (25%)
Experience teaching agriculture education (years)		
2-3	2 (25%)	0 (0%)
4-5	0 (0%)	2 (50%)
6-7	2 (25%)	0 (0%)
8-9	1 (13%)	1 (25%)
10-19	0 (0%)	0 (0%)
20+	3 (38%)	1 (25%)
Undergraduate major		
Agriculture Education	6 (75%)	3 (75%)
Other	2 (25%)	1 (25%)
Graduate degree		
Yes	3 (38%)	0 (0%)
No	5 (63%)	2 (50%)
Currently pursuing	0 (0%)	2 (50%)
Class time spent on each activity (percent)		
lecture	30%	39%
interactive activities	22%	25%
group work	20%	13%
students work independently	20%	14%
other	7%	10%
Specifically teach decision making skills		
Yes	3 (38%)	1 (25%)
No	5 (63%)	3 (75%)
Would use a decision making unit		
Yes	7 (88%)	3 (75%)
No	0 (0%)	0 (0%)
possibly	1 (13%)	1 (25%)

*Percentages may not equal 100 due to rounding.

Table 27

Treatment Instructor Usefulness of Decision Making Unit Components

Unit Component	Usefulness Ranking N(%)					
	1=Very Useful	2	3	4	5=Not useful	6 Did not use
Lesson Plans	3 (38%)	4 (50%)	1(13%)	0(0%)	0(0%)	0(0%)
Authorware presentations	5 (63%)	3 (38%)	0(0%)	0(0%)	0(0%)	0(0%)
Learning diagnostic	3 (38%)	4 (50%)	1 (13%)	0(0%)	0(0%)	0(0%)
TILT review	1 (13%)	5 (63%)	1 (13%)	1 (13%)	0(0%)	0(0%)
Worksheet	2 (25%)	5(63%)	0(0%)	0(0%)	0(0%)	1 (13%)

*Percentages may not equal 100 due to rounding.

decision making and to provide instructors with information regarding students understanding relative to decision making. The “TILT” review was an exercise where students completed the sentence, “Today I learned that...” A worksheet (Appendix XII) provided a framework for students to apply a situation of their own to the decision making model.

Instructor Decision Making Unit Feedback

The instructor that gave the TILT review a “4” on a one to five scale wrote in that the “students felt belittled”. Unfortunately the researcher was not able to observe this instructor in the classroom to determine why students felt “belittled” when completing this exercise.

Treatment instructors were asked to rate the difficulty of the unit. Fifty percent of the instructors said the unit was appropriately difficult. Twenty-five percent said the unit was moderately easy and the remaining 25% said it was very easy. The purpose of the decision making unit was not to overwhelm students with difficulty. Instructor feedback indicates that the unit was not too difficult and could possibly be made more difficult.

Instructor Influence

It was clear that the instructors' attitude and enthusiasm in delivery of the decision making unit were reflected in their students' responses to the open-ended questions. Student feedback reflected that of their instructor. Instructors that provided positive and upbeat comments on the decision making unit had students that enjoyed the unit and provided similar comments. The same was true for instructors that were more critical of the decision making unit, their students used almost identical statements in their feedback. Student feedback was directly correlated to the attitude and enthusiasm of the instructor. This illustrates the influence instructors have on the interest level and acceptance of curriculum by their students.

Instructors with a high level of buy in will show that in the way they present information and interact with their students. Most instructors do not follow lesson plans, even their own, verbatim. If the instructor is passionate about a topic they will spend more time, be more interested, be more knowledgeable, and convey that in the classroom.

CHAPTER V: RECOMMENDATIONS

Introduction

Educators and curriculum developers desire to have an impact on the thought processes of the audiences they serve. As learning occurs, changes occur in the brain. Literature is available which explains what happens physiologically as learning takes place (Buchel, Coull, & Friston, 1999, Caine & Caine, 1991, Jensen, 1998b, Wolfe & Brandt, 1998) as well as how to facilitate physiological change (Beane, 1992, Jensen, 1998a, Brandt, 1999, Perry, 2000). However, an objective instrument which assesses thought process or decision making skills is not available (Mincemoyer & Perkins, 2003). While this research tested a new instrument designed to objectively measure decision making approach, that pursuit led to additional questions regarding the future of agricultural education and assessment of approaches to problem solving.

Summary

The purpose of this study was to examine the impact a decision making unit had on the decision making approach of high school students. Student approach to decision making was measured as the variance related to the level of importance students placed on items related to four domain areas (animal science, environment, financial, and human). While significant interactions between pre and post test administrations were not detected, self report by students indicated their approach to decision making had changed as a result of completing the decision making unit.

Student and instructor feedback regarding what they liked as well as what they would change about the decision making unit provided valuable information for instructors, curriculum writers, and researchers. Student responses ranged from make it longer and harder to do not change anything to make it shorter and easier. Likewise, individual instructors preferred different portions of the curriculum and instructor materials. There is not one right or best way to develop curriculum or deliver instruction. Within one class there are students with diverse learning styles, levels of skill, interests, and prior knowledge. Curriculum packages should be developed and delivered in a manner which addresses multiple learning styles simultaneously.

Recognition of the Limitations

The treatment period of three days was concise. In order to get high school instructors to participate with their classes, it was necessary to keep the treatment period brief. As a result, students may not have been exposed to enough content or had enough time to practice their skills to show a significant change from the pretest to the posttest.

Also, treatment instructors were only exposed to one training session which was approximately one hour in length. In addition to the training, treatment group instructors were also given explicit instructions. However, the researcher was unable to control instructor action. Instructors may not have delivered the entire unit to their students. Several students mentioned that the unit should have included non-agricultural examples. The unit did provide such examples so either those students did not recall the content they were exposed to or their instructors did not present portions of the unit.

A possible solution to the short training period and inability to monitor/control instructor delivery would be to train student teachers in the unit prior to their student

teaching field experience. It would be necessary to obtain permission from student teachers' respective schools for them to teach the selected unit. Once permission was granted, researchers could work with student teachers in training to familiarize them with the curriculum and give them the opportunity to practice and provide feedback.

Suggestions for Replication of Research

Even though the instrument was pilot tested and adjusted, further amendments are recommended prior to future use. Students performed so well, showing little variation, on the pretest that there was not room for significant improvement on the post test. The obvious solution is to make the instrument tougher; the less obvious solution is how to make the instrument tougher. Developing more complex decisions may be a feasible answer.

When the agriculture scenarios were developed, they were related to range, animal, and crop enterprises. The Likert statements following each scenario were created specifically for each scenario; therefore the statements following each scenario did not contain the same number of statements pertaining to each domain area. For example, the scenarios that did not directly relate to animals did not have many statements relating to animal science. It would have been cleaner to analyze and compare student scores if each scenario had the same number of statements, or a similar number of statements (3-4) relating to each domain area. The scenarios should be adjusted so the Likert statements following each scenario contain the same number of statements referring to each domain area.

In addition to using the objective approaches to measuring decision making, include open ended responses to collect additional information. Self-report items and

open ended responses will provide valuable information to help identify if the objective portion or the treatment needs to be adjusted. For example, if significant gains are not detected on the objective portion but students describe how their thought process has changed on open-ended responses, it is possible that the problem is with the objective instrument, not the treatment. Student feedback may provide insight as to how the objective portion may be adjusted to detect or more accurately assess changes taking place in respondents' thought process.

Recommendations for Additional Research

While this project set out to answer questions, throughout the research process two important additional questions surfaced. Will/how/can agricultural education continue when virtually all students participating in agricultural education are from rural areas and rural populations are declining in many areas? How can the objective portion of the instrument be improved or changed to provide an accurate assessment of student approach to decision making?

Recruiting Students to Agriculture Education

Almost all of the agriculture students who participated in this project were from rural areas. When students were asked where they live, 93% of the treatment students and 100% of the control group students lived in a rural area, which includes farm and rural non-farm residents. These numbers indicate that very few non-rural students participate in agriculture education courses. As rural populations continue to decline and core credit requirements placed on high school students increase, agriculture education instructors need to increase the number of non-rural students in their classes to ensure the survival of their programs as well as maintain a level of the population that is agriculture

literate. As agriculture education has changed in the past, it will continue to change to meet the needs of the current time, "Prosperity for agricultural education demands making adjustments" (Lee & Thomas, 1995, p.11).

If the rural population is declining the question arises, "Is agricultural education a needed program?" First of all, as populations continue to increase the need for food and fiber productions increases making it important that adequate training is available to individuals entering agricultural related jobs. Also, individuals outside of agriculture make decisions which impact agriculture and it is important that they be agriculture literate. Additionally, agricultural education provides valuable skills for students entering any profession. Several programs which integrate agriculture education with core class content have found agriculture education is a logical place to apply the theory taught in core content courses such as math, science, or business (Pritz 1989, Lankard 1993, Balschweid 2002). "Students have the opportunity to apply their academic knowledge to specific occupational tasks and to solving problems typically encountered in business and technical fields," (Lankard, 1993, p. 1). Research would be of value that explores the most effective manner to integrate core subject matter with agricultural education content and applications.

Improve Objective Assessment Instrument

The purpose of the objective portion of the instrument was to have students complete exercises that would demonstrate their approach to problem solving. Other instruments designed to assess thought process and decision making rely on self-report measures where students indicate their perceived skill level by responding to statements such as, "I consider all options before making a choice," or "I think about the results of

the choices I make before rushing into decisions.” Statements on self-report instruments may prompt respondents to provide a certain answer. For example, if a student was responding to the statement, “I consider all options before making a choice”, the student may think it sounds good to say they definitely do, whether they actually think that way or not.

While conceptually it makes sense to assess the level of importance students place on various domain areas when facing a decision, there may be better approaches to assess student approach to problem solving. Further research exploring objective approaches to assess thought processes including decision making is needed as well as the quality of decisions.

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APPENDIX

APPENDIX I
Letter to Instructors



Knowledge to Go Places
Fort Collins, CO 80523-1683

Dear Agriculture Instructor,

My name is Jen Batchelder. I am conducting my dissertation research entitled "Effectiveness of a Decision Making Unit" with Carole Makela, PhD, in the School of Education. While decision making skills are important to every area of life, decision making skills are seldom specifically taught to students. The purpose of this research is to study the decision making skills of vocational agriculture students' using their current curriculum and an Integrated Resource Management (IRM) Decision Making Unit. I am contacting you to request that you and your school participate in this research.

To participate, you must be offering a junior/senior level vocational agriculture class in the fall of 2003. The majority of the students in the class need to have already taken at least one vocational agriculture class. If your school chooses to participate, the instructor will be asked to explain the research project to their students, distribute consent forms to students, and administer a pretest and a posttest to the students. It should take students 30-45 minutes to complete each of the tests in two different class sessions.

You will be asked to complete a questionnaire regarding your use, perceptions, and delivery of curriculum. The questionnaire should take approximately 30 minutes to complete. Findings are confidential. Results will be reported as group findings only. Individual student, instructor, and school responses will not be revealed.

Schools agreeing to participate will be divided into two groups (treatment and control). The treatment group will use the IRM curriculum for the study and those instructors will be invited to participate in an in-service that will be held at the summer institute in July. These teachers will receive instruction on the IRM curriculum along with the curriculum package which includes lesson plans, interactive classroom exercises, homework assignments, a CD with interactive presentations, and student assessment tools. These instructors will be asked to teach the week-long Decision-Making Unit during August or September for the purposes of this research. Instructors in this group will be eligible for two credits of continuing education, one for the in-service training and one for their input and participation along with their class in the actual research.

Schools in the control group will use their current curriculum for the fall semester and receive the IRM curriculum at the conclusion of the semester. Control group schools will be asked to schedule time during August or September to administer the pre and posttest. Tests need to be administered a week to ten days apart. Instructors in the control group will be eligible to receive one credit of continuing education after their input in this project.

If your school is interested in participating please review the following requirements and contact me as soon as possible.

- Your school must be offering a junior/senior level vocational agriculture course in fall 2003. The majority of the students in this class need to have already taken at least one vocational agriculture class.
- The instructor will distribute and collect consent forms from students choosing to participate.
- The instructor will administer a pretest and posttest to the students.
- The instructor will complete a questionnaire.
- The instructor will return all materials in a pre-addressed postage paid mailer upon completion.
- Colorado State University Regulatory Compliance requires that we receive a letter of cooperation from your school with an original signature from an individual qualified to obligate your school (principal, superintendent, or another educational authority). This letter should be on school letterhead. (A draft letter is enclosed for your use).

If you have any questions or concerns please contact me at the earliest convenient date. If you are having or anticipating instructor turnover and are hesitant to commit the new one but are interested in participating please let me know and we can work out a plan.

I look forward to working with you and receiving your response as soon as possible.

Jen Batchelder MAg
jenbatch@lamar.colostate.edu
(970) 491-1610

Carole Makela, PhD
makela@cahs.colostate.edu
(970) 491-5141

APPENDIX II
Draft Response

*Draft Response - Sample letter of cooperation to participate
Please respond on your school's letterhead*

Jen Batchelder
Colorado State University
Western Center for Integrated Resource Management
E102 ARBL
Fort Collins, CO 80523-1683

Dear Jen Batchelder,

I have read the letter regarding your dissertation research project entitled, "Effectiveness of a Decision Making Unit." Our school is offering junior/senior level vocational agriculture course in the Fall 2003 and would like to participate in this project.

I understand we will either receive the Integrated Resource Management (IRM) Decision Making Unit and Grazing Resource/Grazing Animal curriculum to use for the week long study, or we will use our current curriculum and receive the IRM curriculum at the end of the study. As a participating school, our vocational agriculture instructor will explain the research project to the students, distribute consent forms and information to parents and to students, and administer a pretest and posttest to the students. Additionally, instructors will be asked to complete a questionnaire regarding their use, perceptions, and delivery of curriculum.

I am familiar with the project and am comfortable that participants are adequately protected. I am authorized to volunteer our school's participation in this study. We estimate that we will have _____ students participating.

Signature
Title

(please include the e-mail, mailing address, and phone # of instructor or contact person that instructions and research materials should be sent to, and dates on which your fall 2003 semester begins and ends).

APPENDIX III
Instructor Instructions



Dear Instructor,

Thank you for participating in the IRM Decision Making research project. Items included in this packet and their instructions are as follows:

- 1. Check-list – Provides brief instructions and an open timeline for you to use in determining when to complete each of the project steps.
- 2. Script – Read this to students when explaining the project.
- 3. Information sheets for parents/guardians – After reading the script to the students send one informational sheet and two copies of the consent form home with each student.
- 4. Consent form – Two copies have been included for each student to take home, one to sign and return with their pretest and one to keep for their records. Instructors are not supposed to see students' completed consent forms (their choice to participate or not participate by taking the pre & posttests should not have any influence on their grade for your class). If students have folders that stay in the classroom have them put their completed consent form there until the day of the pretest. On the day of the pretest they will enclose their consent form in an envelope with their pretest.
- 5. Pretests – Pretests are pink and blue. Please pass tests out in the order they are stacked so every other student has the same color test. Students that take a pink pretest need to take a blue posttest. Use the attached form to identify which color pretest students have taken. Test color refers to the decision making scenarios included on the test.
- 6. Envelopes – Distribute envelopes with the pretests. When students complete the pretest they will place their signed consent form and pretest in an envelope, seal it, and return it to you. Students choosing not to participate will also enclose their blank consent form and pretest in the envelope, seal it, and return it to you.
- 7. Posttests – Posttests are also pink and blue. Students that completed a pink pretest need to take a blue post test and visa versa.
- 8. Instructor questionnaire – Your feedback is important. Please take a few moments to complete the survey prior to returning your packet.
- 9. Stamped mailer – Return all survey materials in the pre-addressed stamped mailer.
- 10. I have included a few extras of everything. If you need additional materials please let me know and I will be happy to send you more.

Thank you again for your participation!

Jen Batchelder
(970) 491-1610
jenbatch@lamar.colostate.edu

APPENDIX IV
Check List

(treatment)

IRM Decision Making Unit Check-list

Check when completed	Date	Action
	August	Receive research packet from Jen Batchelder. Packet will contain: instructions for all materials in the packet, script to read to students (explains project), information sheet for parents/guardian, 2 copies of consent form for each student to take home (one to sign with parent/guardian and return with their pretest, one to keep for their records), pretest forms A (pink paper) and B (blue paper), envelopes for students to seal their pretest and consent form in prior to returning to instructor, posttest forms A (pink paper) and B (blue paper), instructor questionnaire, postage paid pre-addressed mailer.
		Read script to students, send instructional sheet and two copies of the consent form home with students. <i>(At the beginning of the school year, 1-2 weeks prior to teaching the decision making unit).</i>
		Remind students to sign their consent form with their parents and bring it back to school. <i>(Instructors are not to see students' consent forms. If students have folders that stay in the classroom have them put their completed consent form in their folder until the day of the pretest. On the day of the pretest they will enclose their consent form in an envelope with their completed pretest.)</i>
		Day 1 of decision making unit. Administer pre tests. <i>(Half the pre tests are pink (form A) and half are blue (form B), students that take a pink pretest need to take a blue post test, visa versa.)</i>
		Days 2-4 deliver content of the decision making unit.
		Day 5 Administer post test. <i>(Half the post tests are pink (form A) and half are blue (form B), students that took a pink pretest need to take a blue post test, visa versa.)</i>
		Complete instructor questionnaire.
		Return all survey materials pre-addressed stamped mailer.
	Will be sent after your research packet is received.	Receive complete IRM High School Grazing Animal and Grazing Resource Curriculum.

If you have any questions please feel free to contact me.

Jen Batchelder

(970) 491-1610

jenbatch@lamar.colostate.edu

control

IRM Decision Making Unit Check-list

Check when completed	Date	Action
	August	Receive research packet from Jen Batchelder. Packet will contain: instructions for all materials in the packet, script to read to students (explains project), information sheet for parents/guardian, 2 copies of consent form for each student to take home (one to sign with parent/guardian and return with their pretest, one to keep for their records), pretest forms A (pink paper) and B (blue paper), envelopes for students to seal their pretest and consent form in prior to returning to instructor, posttest forms A (pink paper) and B (blue paper), instructor questionnaire, postage paid pre-addressed mailer.
		Read script to students, send instructional sheet and two copies of the consent form home with students. <i>(At the beginning of the school year, 1-2 weeks prior to teaching the decision making unit).</i>
		Remind students to sign their consent form with their parents and bring it back to school. <i>(Instructors are not to see students' consent forms. If students have folders that stay in the classroom have them put their completed consent form in their folder until the day of the pretest. On the day of the pretest they will enclose their consent form in an envelope with their completed pretest.)</i>
		Day of pretest. Administer pretests. <i>(Half the pre tests are pink (form A) and half are blue (form B), students that take a pink pretest need to take a blue post test, visa versa.)</i>
		5-10 days after pretest, administer post test. <i>(Half the post tests are pink (form A) and half are blue (form B), students that took a pink pretest need to take a blue post test, visa versa.)</i>
		Complete instructor questionnaire.
		Return all survey materials pre-addressed stamped mailer.
	Will be sent after your research packet is received.	Receive complete IRM High School Grazing Animal and Grazing Resource Curriculum.

If you have any questions please feel free to contact me.

Jen Batchelder

(970) 491-1610

jenbatch@lamar.colostate.edu

APPENDIX V
Script

Script for instructors to use in explaining the study to their students

Dear students,

This class has chosen to participate in a study titled, "Effectiveness of a Decision-Making Unit." The purpose of this study is to evaluate your decision making skills. From this study, researchers will gain valuable information to help develop decision-making curriculum for the high school level. Your participation is very important.

Your participation is completely voluntary. Your response will have no effect on your grade for this course. If you choose to participate, you will be asked to complete a consent form, pretest, and a posttest. First, take the "letter to parents" and "consent form" home, review it, and sign it with one of your parents. Then, bring one copy of the signed consent form back to class and include it the provided envelope with your pretest on _____ (*instructor provide day and date*).

If you choose not to participate, you will still be asked to return your unsigned consent form with the blank pretest. After you have completed the pretest, you will place it in an envelope with your signed consent form and seal it before returning it to me. I will then send the sealed envelopes to Colorado State University where results will be compiled and analyzed. I will not see your forms or tests.

Your participation is very important so curriculum writers can develop course materials that are effective for students like you. If you choose to participate, please have your parents sign the consent form and return it with your completed pretest. (*Instructors, please inform the students of the date when the pretest will be administered. They will need to have their consent form completed and included with their pretest if they are going to participate.*)

Thank you very much on behalf of,
Jen Batchelder

APPENDIX VI
Letter to parent of Guardian



Dear Parent or Guardian,

Overview

Your teen's vocational agriculture class has chosen to participate in a research project titled, "Effectiveness of a Decision Making Unit." This project is being conducted by Jen Batchelder, a graduate student at Colorado State University. You are being contacted to inform you about this project and to request that you consent to your teen's participation in the research. Participation is completely voluntary.

Purpose

The purpose is to study teens' decision making skills related to vocational agriculture. Half of the high schools in the study will use a weeklong decision-making unit developed at Colorado State University and half of the schools will use their current curriculum. As a result of this research, information will be gained to help improve the decision-making unit as well as develop additional curriculum. Data collected during the study will be used in a dissertation for Jen's doctorate.

How

Students participating in the study will take a pretest and a posttest. The tests are designed to measure students' decision-making ability and attitudes toward agriculture, education, and decision making. Each of the two tests should take 30-45 minutes to complete and will be completed on two different days in the vocational agriculture class. Performance on the pretest and posttest will have no impact on the student's grade for the class. The tests are used to collect research data only.

Confidentiality

Responses are confidential. Results will be reported by group only. Individual students will be asked to place the first letter of their mother's first name, last two digits of their phone number, and the day of their birth on the pretest and posttest. This is done so it can be verified that each student has completed both a pretest and posttest. Tests without a match will be removed from the study.

On the day of the pretest, instructors will hand out the pretest with an envelope. Students who participate will return the completed test and a signed copy of the consent form in the envelope. Students who do not wish to participate will not complete the consent form or the survey, and will return them blank, sealed in the envelopes provided.

At the time of the posttest, instructors will again hand out the posttest with an envelope. Students who participate will complete the test, place it in the envelope, seal the envelope and return it to their teacher. Students without consent will return their un-completed posttest in the sealed envelope. Their teacher will then send the sealed envelopes to Jen at Colorado State University.

Response

Two copies of the consent form have been included so you can keep one for your records. If you are willing to have your teen participate, please initial the bottom of both pages, sign the second page along with your teen, and have your teen take it to class on the designated date. If you do not want your teen to participate, please return the consent form unsigned.

Thank you very much.

Contact

If you have any questions regarding you teen's participation in this research please contact your agriculture teacher or Jen Batchelder at (970) 491-1610.

APPENDIX VII
Consent Form

COLORADO STATE UNIVERSITY
INFORMED CONSENT TO PARTICIPATE IN A RESEARCH PROJECT

TITLE OF PROJECT: Effectiveness of a Decision Making Unit

NAME OF PRINCIPAL INVESTIGATOR: Carole Makela, PhD

NAME OF CO-INVESTIGATOR: Jen Batchelder, MAg

CONTACT NAME AND PHONE NUMBER FOR QUESTIONS/PROBLEMS: Jen Batchelder (970) 491-1610

PURPOSE OF THE RESEARCH:

The purpose is to compare the decision-making ability of high school students exposed to the Integrated Resource Management Decision Making Unit with students in current vocational agriculture classes.

PROCEDURES/METHODS TO BE USED:

Students will be asked to complete a pretest at the beginning of the unit and a posttest at the end of the unit. Scenarios will be followed by forced choice options. The instrument will also have questions in regards to their attitudes towards agriculture, education, and decision making. These will be in the form of statements with a scale to indicate their level of agreement. Each test will take approximately 30-45 minutes.

RISKS INHERENT IN THE PROCEDURES:

There are no known risks. 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.

BENEFITS:

This study has no direct benefit to you. However, future students may benefit from the results of this study. Research findings will aid curriculum writers in revising the Integrated Resource Management curriculum as well as in writing other curriculum.

CONFIDENTIALITY:

Your name will not be placed on the pretest or posttest. You will be asked to place the first letter of your mother's first name, last two digits of your phone number, and the day of your birth on the pretest and posttest. This is done so it can be verified that you have completed both. Tests without a match will be removed from the study.

When you return your consent form, you will include it in an envelope with your pretest. Returning the consent form and pretest together allows the researchers to verify that you have parental consent. You seal the envelope before you turn it in. The researchers and individuals authorized to protect human research participants are the only people who can see the consent form and tests. Once your pretest is marked as coming with a consent form, the consent form will be placed in a separate file so individual consent forms and pretests are not matched.

Questions about participants' rights may be directed to Celia S. Walker at (970) 491-1563.

Parent or Guardian's initials _____ Date _____ Page 1 of 2

LIABILITY:

The Colorado Governmental Immunity Act determines and may limit Colorado State University's legal responsibility if an injury happens because of this study. Claims against the University must be filed within 180 days of the injury.

PARTICIPATION:

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.

Your signature acknowledges that you have read the information stated and willingly sign this consent form. Your signature also acknowledges that you have received, on the date signed, a copy of this document containing 2 pages.

Participant (Student) name (printed)

Participant (Student) signature

Date

Investigator or co-investigator signature

Date

PARENTAL SIGNATURE FOR MINOR

As parent or guardian you authorize _____ (print student's name) to become a participant for the described research. The nature and general purpose of the project have been satisfactorily described on the letter to parent or guardian and consent form and you are satisfied that proper precautions will be observed.

Minor's (student) date of birth

Parent/Guardian name (printed)

Parent/Guardian signature

Date

(In addition to signing, please initial the bottom of this page and the previous page.)

Parent or Guardian's initials _____ Date _____ Page 2 of 2

APPENDIX VIII
Pretest Forms A & B

Part A: Test Matchers

The next few questions are designed to ask you things that are unique about you. We do not ask your name because we want you to remain anonymous; however we want to be able to match this pretest with the posttest you will take at the end of the program. The same test matcher questions will appear on the posttest and this information will be used to match your pre and posttests.

1. Circle the **first letter** of your **mother's first name** in the list below.
For example, if your mother's name is Mary, you would circle the M below.

A B C D E F G H I J K L M N O P Q R S T U V W X Y
Z

2. Please circle the **last two digits** of your **phone number** below.
For example, if your phone number is 123-4567, you would circle 6 in the first column and 7 in the second column.

second to the last digit of your phone number	last digit of your phone number
1	1
2	2
3	3
4	4
5	5
6	6
7	7
8	8
9	9
0	0

3. Please circle the **day of your birth** from the following numbers.
For example, if you were born on the 3rd of the month, you would circle 3.

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17
18 19 20 21 22 23 24 25 26 27 28 29 30 31

Part B: Opinions and preferences.

Please circle the number indicating how strongly you agree or disagree with each of the following statements.

Completely Agree										Completely Disagree	Statement
1	2	3	4	5	6	7	8	9			Agricultural operations should promote increased quality of the environment.
1	2	3	4	5	6	7	8	9			Success is determined by the amount of money an operation makes.
1	2	3	4	5	6	7	8	9			It is important to match animals to their environment.
1	2	3	4	5	6	7	8	9			The least cost option is always the best option.

In the following table please indicate how much you would use each source for information when making decisions.

Extensive Use										No Use	Source
1	2	3	4	5	6	7	8	9			family
1	2	3	4	5	6	7	8	9			technology
1	2	3	4	5	6	7	8	9			experts in the field

Part C: Decision Situations

There are three scenarios on the following pages. Please read each situation and decision statement carefully. Then respond to each question.

Scenario A:

You are managing an operation that farms 500 acres of irrigated land in Eastern Colorado. Irrigation costs are \$20/acre. It is the owner's goal to get as much out of the land as possible (obtain maximum profit) without compromising the ability of the land to produce in the future.

Decision to be made:

You are to decide what crop or crops would you recommend be planted on the land.

Facts about crops you might select:

Corn: Seed and fertilizer for one acre costs \$250. If the corn is harvested as silage it will yield 9 ton/acre and is worth \$25/ton. If it is harvested as shelled corn it will yield 160 bushels/acre and is worth \$2.25/bushel. Harvesting costs for both methods are \$25/acre. Corn depletes the soil of nitrogen.

Alfalfa: Alfalfa is seeded once very seven years. It costs \$55/acre for seed. On average you will get three cuttings per year. Those three cuttings together will yield 5 ton/acre. Each ton is worth \$75. Harvesting costs for all three cuttings are \$70/acre. Alfalfa replaces nitrogen in the soil.

Wheat: It costs \$15 to seed one acre of wheat. Wheat uses phosphorus and nitrogen. Fertilizer application costs \$50/acre. It costs \$20/acre to harvest wheat. It will yield 100 bushels/acre and each bushel is worth \$3.

Your Decision:

1. Which crop will you choose to plant?

Explain your choice:

2. What factors weighed most heavily in your selection?

3. Why are these factors important?

Decision Factors:

In the table below read each statement and indicate how important each would be relative to the decision described on the previous page. 1=extremely important, 9=of no importance.

4.

Extremely Important	Not at all Important	Statement
1 2 3 4 5 6 7 8 9		crops planted for the previous two years
1 2 3 4 5 6 7 8 9		forecasted market prices for each crop being considered
1 2 3 4 5 6 7 8 9		type of equipment required for each crop
1 2 3 4 5 6 7 8 9		soil sample results that indicate what nutrients need to be replenished
1 2 3 4 5 6 7 8 9		type of equipment owned by the ranch
1 2 3 4 5 6 7 8 9		estimated yield of each crop
1 2 3 4 5 6 7 8 9		crop with which you have the most experience
1 2 3 4 5 6 7 8 9		crop that you like the best
1 2 3 4 5 6 7 8 9		amount of labor required for each crop
1 2 3 4 5 6 7 8 9		weather forecast for the growing season
1 2 3 4 5 6 7 8 9		type of pests in the area

Scenario B:

You have just been hired to manage a 2,000 acre ranch in the Rocky Mountains. The average growing season is 90 days and average snowfall in the winter is 200 inches. The elevation is 6500 ft. Currently all of the land is used for grazing. It is possible to run 100 animal units on this ranch. The primary enterprise is livestock production.

Decision to be made:

Decide what specie(s) of animal(s) you will select for the ranch.

Facts about specie(s) you might select:

Cattle: Annual cow costs are \$230/head. Expected calving percentage is 85%. The average net return per calf sold is \$300. Winter feeding requires 6 hours of labor per day. At the ranch's high elevation pulmonary arterial pressures will determine the genetic type of cattle. One cow equals one animal unit.

Wildlife: The growing season allows enough forage for wildlife only if they are chosen as the primary enterprise. Labor is required for monitoring wildlife populations, animal condition, and to guide hunters. Hunters are charged \$8,000 per hunt. One elk equals .7 animal units. One mule deer equals .15 animal units.

Range Brood Mares: Annuals mare costs are \$270/head. Expected foaling percentage is 95%. Average return per weaned foal is \$300. Winter feeding requires 6 hours of labor per day. One horse equals 1.8 animal units.

Sheep: Annual ewe costs are \$9/head. Expected lambing percentage is 130%. Average return per weaned lamb is \$60. Wool income is \$20 per head per year. Winter feeding requires 4 hours of labor per day. One sheep equals .15 animal units.

Your Decision:

1. Which specie or species would you choose?

Explain your choice:

2. What factors weighed most heavily in your selection?

3. Why are these factors important?

Decision Factors:

In the table below read each statement and indicate how important each would be relative to the decision described on the previous page. 1=extremely important, 9=of no importance.

4.

Extremely Important	Not at all Important	Statement
1 2 3 4 5 6 7 8 9		type of specie you have experience/knowledge of
1 2 3 4 5 6 7 8 9		nutrient requirements for each specie
1 2 3 4 5 6 7 8 9		facilities and equipment necessary to handle each specie
1 2 3 4 5 6 7 8 9		forage requirements for each species
1 2 3 4 5 6 7 8 9		projected hours of labor required for each species being considered
1 2 3 4 5 6 7 8 9		cost for outside labor if necessary
1 2 3 4 5 6 7 8 9		potential profitability of guiding hunters on the ranch
1 2 3 4 5 6 7 8 9		initial cost for each species
1 2 3 4 5 6 7 8 9		cost of supplemental feed for each specie
1 2 3 4 5 6 7 8 9		expected profit for each species
1 2 3 4 5 6 7 8 9		current range condition
1 2 3 4 5 6 7 8 9		impact each species will have on the forage resource
1 2 3 4 5 6 7 8 9		forage availability at different times of the year
1 2 3 4 5 6 7 8 9		forage type
1 2 3 4 5 6 7 8 9		pasture terrain
1 2 3 4 5 6 7 8 9		species the previous manager chose
1 2 3 4 5 6 7 8 9		type of specie you like the best

Scenario C:

You have decided that you want to go to college and have narrowed your options to two schools. One is a junior college and the other is a state university. Both are similar distances from your home.. Your parents were not able to save money for your college, so you are on your own. You want to obtain the best possible education with the least cost

Decision to be made:

You must choose between the junior college the state university for at least your freshman year.

Facts about the school you might select:

Junior College:

Solid reputation but offers only an associates degree
Cheaper tuition costs
Smaller number of students, smaller class sizes
Rent is the same as the town with the State University
Some but most likely not all of the classes will transfer to the State University

State University:

One of the best for the course of study in which you are interested
Tuition is more expensive than the junior college
All classes taken will apply toward your degree
Don't have to deal with the hassle of transferring to the State University
Larger student body, larger class sizes
More opportunities than Junior College (rec. center, library, organizations)

Your Decision:

1. Which school would you choose?

Explain your choice:

2. What factors weighed most heavily in your selection?

3. Why are these factors important?

Decision Factors:

In the table below read each statement and indicate how important each would be relative to the decision described on the previous page. 1=extremely important, 9=of no importance.

4.

Extremely Important	Not at all Important	Statement
1 2 3 4 5 6 7 8 9		cost of tuition
1 2 3 4 5 6 7 8 9		number of students in each class
1 2 3 4 5 6 7 8 9		school's reputation
1 2 3 4 5 6 7 8 9		cost of living in each area
1 2 3 4 5 6 7 8 9		extra-curricular opportunities
1 2 3 4 5 6 7 8 9		toughness of classes (rigor)
1 2 3 4 5 6 7 8 9		availability of work-study jobs
1 2 3 4 5 6 7 8 9		condition of dorms/student housing

Part A: Test Matchers

The next few questions are designed to ask you things that are unique about you. We do not ask your name because we want you to remain anonymous; however we want to be able to match this pretest with the posttest you will take at the end of the program. The same test matcher questions will appear on the posttest and this information will be used to match your pre and posttests.

4. Circle the **first letter** of your **mother's first name** in the list below.
For example, if your mother's name is Mary, you would circle the M below.

A B C D E F G H I J K L M N O P Q R S T U V W X Y
Z

5. Please circle the **last two digits** of your **phone number** below.
For example, if your phone number is 123-4567, you would circle 6 in the first column and 7 in the second column.

second to the last digit of your phone number	last digit of your phone number
1	1
2	2
3	3
4	4
5	5
6	6
7	7
8	8
9	9
0	0

6. Please circle the **day of your birth** from the following numbers.
For example, if you were born on the 3rd of the month, you would circle 3.

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17

18 19 20 21 22 23 24 25 26 27 28 29 30 31

Part B: Opinions and preferences.

Please circle the number indicating how strongly you agree or disagree with each of the following statements.

Completely Agree										Completely Disagree	Statement
1	2	3	4	5	6	7	8	9			Agricultural operations should promote increased quality of the environment.
1	2	3	4	5	6	7	8	9			Success is determined by the amount of money an operation makes.
1	2	3	4	5	6	7	8	9			It is important to match animals to their environment.
1	2	3	4	5	6	7	8	9			The least cost option is always the best option.

In the following table please indicate how much you would use each source for information when making decisions.

Extensive Use										No Use	Source
1	2	3	4	5	6	7	8	9			family
1	2	3	4	5	6	7	8	9			technology
1	2	3	4	5	6	7	8	9			experts in the field

Part C: Decision Situations

There are three scenarios on the following pages. Please read each situation and decision statement carefully. Then respond to each question.

Scenario D:

You are managing Hell's Fire Ranch located in the desert of West Texas. The new owner is an investment banker from New York City who knows little about cattle. Your market is selling calves at weaning on a commodity market. The summer averages 50 – 60 days of above 100 degrees. Average annual rainfall is 18 inches.

Decision to be made:

You are to decide what breed of cattle to select for this environment.

Facts about breeds you might select:

Angus: Moderate maintenance requirements, low heat tolerance, high meat quality, and low meat yield.

Simmental: High maintenance requirements, low heat tolerance, moderate meat quality, and high meat yield.

Brahman: Low maintenance requirements, high heat tolerance, travel well, provide low quality meat, meat yield is low/mod.

Brangus: Low/moderate maintenance requirements, moderate heat tolerance, meat quality and yield are moderate.

Your Decision:

1. What breed of cattle will you select for the ranch?

Explain your choice:

2. What factors weighed most heavily in your selection?

3. Why are these factors important?

Decision Factors:

In the table below read each statement and indicate how important each would be relative to the decision described on the previous page. 1=extremely important, 9=of no importance.

4.

Extremely Important	Not at all Important	Statement
1 2 3 4 5 6 7 8 9		temperament of the breed
1 2 3 4 5 6 7 8 9		milking ability of the breed
1 2 3 4 5 6 7 8 9		nutrient requirements of the breed
1 2 3 4 5 6 7 8 9		heat tolerance of the breed
1 2 3 4 5 6 7 8 9		frame size of the breed
1 2 3 4 5 6 7 8 9		distance animals will have to travel to graze and obtain water
1 2 3 4 5 6 7 8 9		cost of each breed
1 2 3 4 5 6 7 8 9		maintenance requirements of each breed
1 2 3 4 5 6 7 8 9		marketability of each breed
1 2 3 4 5 6 7 8 9		breed you like best
1 2 3 4 5 6 7 8 9		breed most suited to the environment

Scenario E:

Your newest assignment is to manage the calving operation at Hefty Herefords. You are in the process of decided when you want your cows to start calving in the spring. This decision will determine when you turn the bulls out with the cows. The ranch is located in southeastern Wyoming. The elevation is 5,000 ft. Spring green-up occurs around April 15. Gestating (pregnant) cows require 25 lbs. of hay/day. Lactating (milking) cows require 35 lbs. of hay/day. Hefty Herefords sells all of their calves at weaning.

Decision to be made:

You are to decide when to turn the bulls out with the cows.

Facts about turn-out dates you might select:

May 15: turnout would provide for calving season from late February through April. These calves would be weaned October 1. Their average weaning weight would be around 500 pounds assuming normal rainfall. Average market price for 500 pound calves on October 1st is \$103.13/cwt.

June 15: turnout would provide for a calving season from late March through May. These calves would be weaned October 15. Their average weaning weight would be around 470 pounds assuming normal rainfall. Average market price for 470 pounds calves on October 15th is \$105.60/cwt.

July 15: turnout would provide for a calving season from late April through June. These calves would be weaned November 1st. Their average weaning weight would be around 440 pounds assuming normal rainfall. Average market price for 440 pound calves on November 1st is \$107.90/cwt.

Your Decision:

1. When will you turn the bulls in with the cows?

Explain your choice:

2. What factors weighed most heavily in your selection?

3. Why are these factors important?

Decision Factors:

In the table below read each statement and indicate how important each would be relative to the decision described on the previous page. 1=extremely important, 9=of no importance.

4.

Extremely Important	Not at all Important	Statement
1 2 3 4 5 6 7 8 9		time of year at which you have experience calving
1 2 3 4 5 6 7 8 9		nutrient requirements for gestating (pregnant) cows
1 2 3 4 5 6 7 8 9		forecasted market price for calves at various times next fall
1 2 3 4 5 6 7 8 9		forage availability at potential calving dates
1 2 3 4 5 6 7 8 9		weather conditions (temperature, amount of snow) at potential calving dates
1 2 3 4 5 6 7 8 9		cost of supplemental hay
1 2 3 4 5 6 7 8 9		availability of the right type of bull for purchase
1 2 3 4 5 6 7 8 9		date that the neighbors turn their bulls out
1 2 3 4 5 6 7 8 9		amount of hay left after previous winter
1 2 3 4 5 6 7 8 9		expected weight of calves at potential selling dates
1 2 3 4 5 6 7 8 9		nutrient requirements of lactating cows
1 2 3 4 5 6 7 8 9		alliance opportunities at the different calving options
1 2 3 4 5 6 7 8 9		projected space availability at the local feedlot
1 2 3 4 5 6 7 8 9		availability of seasonal labor for the times considered
1 2 3 4 5 6 7 8 9		family time commitments during various calving options
1 2 3 4 5 6 7 8 9		buying or raising replacement females
1 2 3 4 5 6 7 8 9		facility restrictions or availability at calving options

Scenario F:

You are tired of depending on your parents and your friends for rides. You have saved a few thousand dollars and are considering two different vehicles for purchase. One vehicle is an older pick-up that you have enough money to buy but it needs some fixing up. The other vehicle is a newer smaller vehicle that costs more than you have but your parents have agreed to co-sign a loan for you.

Decision to be made:

You are to decide which vehicle would be the best for your economic situation.

Facts about vehicles you might select:

Older pickup:

You will not have any debt

You will have to do some work to make it dependable

It is a safe, well made vehicle

Compact car:

You will have debt

If it does break down, you will not have money to fix it

Not as safe as the older pickup

Gets better gas mileage

Your Decision:

1. Which vehicle will you select?

Explain your choice:

2. What factors weighed most heavily in your selection?

3. Why are these factors important?

Decision Factors:

In the table below read each statement and indicate how important each would be relative to the decision described on the previous page. 1=extremely important, 9=of no importance.

4.

Extremely Important	Not at all Important	Statement
1 2 3 4 5 6 7 8 9		gas mileage of each vehicle
1 2 3 4 5 6 7 8 9		cost of each vehicle
1 2 3 4 5 6 7 8 9		cost of insurance for each vehicle
1 2 3 4 5 6 7 8 9		estimated maintenance costs for each vehicle
1 2 3 4 5 6 7 8 9		your level of knowledge about vehicles and common repairs
1 2 3 4 5 6 7 8 9		number of people that will fit in each vehicle
1 2 3 4 5 6 7 8 9		how much you like the appearance of each vehicle
1 2 3 4 5 6 7 8 9		if a loan was required to get the vehicle

APPENDIX IX
Posttest Forms A & B

Part A: Test Matchers

The next few questions are designed to ask you things that are unique about you. We do not ask your name because we want you to remain anonymous; however we want to be able to match this posttest with the pretest you took earlier.

7. Circle the **first letter** of your **mother's first name** in the list below.
For example, if your mother's name is Mary, you would circle the M below.

A B C D E F G H I J K L M N O P Q R S T U V W X Y
Z

8. Please circle the **last two digits** of your **phone number** below.
For example, if your phone number is 123-4567, you would circle 6 in the first column and 7 in the second column.

second to the last digit of your phone number	last digit of your phone number
1	1
2	2
3	3
4	4
5	5
6	6
7	7
8	8
9	9
0	0

9. Please circle the **day of your birth** from the following numbers.
For example, if you were born on the 3rd of the month, you would circle 3.

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17
18 19 20 21 22 23 24 25 26 27 28 29 30 31

Part B: Demographics

Please mark an "X" on the line next to your response for each of the following questions.

1. Gender

male

female

2. How old are you?

14

15

16

17

18

19

3. What grade are you in?

9th

10th

11th

12th

4. How many semester long vocational agriculture classes have you completed before this semester began?

0

1-2

3-4

4+

5. Are you or were you in 4-H?

yes

no

6. Are you or were you in FFA?

yes

no

7. Do you live in a rural, suburban or urban background? Please mark one.

Rural, farm or ranch

(rural = unincorporated community of less than 5,000 people)

Rural, non-farm

Suburban (incorporated community of less than 20,000)

Urban (incorporated community of 20,000 or more)

Part C: Decision Situations

There are three scenarios on the following pages. Please read each situation and decision statement carefully. Then respond to each question.

Scenario A:

You are managing an operation that farms 500 acres of irrigated land in Eastern Colorado. Irrigation costs are \$20/acre. It is the owner's goal to get as much out of the land as possible (obtain maximum profit) without compromising the ability of the land to produce in the future.

Decision to be made:

You are to decide what crop or crops would you recommend be planted on the land.

Facts about crops you might select:

Corn: Seed and fertilizer for one acre costs \$250. If the corn is harvested as silage it will yield 9 ton/acre and is worth \$25/ton. If it is harvested as shelled corn it will yield 160 bushels/acre and is worth \$2.25/bushel. Harvesting costs for both methods are \$25/acre. Corn depletes the soil of nitrogen.

Alfalfa: Alfalfa is seeded once every seven years. It costs \$55/acre for seed. On average you will get three cuttings per year. Those three cuttings together will yield 5 ton/acre. Each ton is worth \$75. Harvesting costs for all three cuttings are \$70/acre. Alfalfa replaces nitrogen in the soil.

Wheat: It costs \$15 to seed one acre of wheat. Wheat uses phosphorus and nitrogen. Fertilizer application costs \$50/acre. It costs \$20/acre to harvest wheat. It will yield 100 bushels/acre and each bushel is worth \$3.

Your Decision:

1. Which crop will you choose to plant?

Explain your choice:

2. What factors weighed most heavily in your selection?

3. Why are these factors important?

Decision Factors:

In the table below read each statement and indicate how important each would be relative to the decision described on the previous page. 1=extremely important, 9=of no importance.

4.

Extremely Important	Not at all Important	Statement
1 2 3 4 5 6 7 8 9		crops planted for the previous two years
1 2 3 4 5 6 7 8 9		forecasted market prices for each crop being considered
1 2 3 4 5 6 7 8 9		type of equipment required for each crop
1 2 3 4 5 6 7 8 9		soil sample results that indicate what nutrients need to be replenished
1 2 3 4 5 6 7 8 9		type of equipment owned by the ranch
1 2 3 4 5 6 7 8 9		estimated yield of each crop
1 2 3 4 5 6 7 8 9		crop with which you have the most experience
1 2 3 4 5 6 7 8 9		crop that you like the best
1 2 3 4 5 6 7 8 9		amount of labor required for each crop
1 2 3 4 5 6 7 8 9		weather forecast for the growing season
1 2 3 4 5 6 7 8 9		type of pests in the area

Scenario B:

You have just been hired to manage a 2,000 acre ranch in the Rocky Mountains. The average growing season is 90 days and average snowfall in the winter is 200 inches. The elevation is 6500 ft. Currently all of the land is used for grazing. It is possible to run 100 animal units on this ranch. The primary enterprise is livestock production.

Decision to be made:

Decide what specie(s) of animal(s) you will select for the ranch.

Facts about specie(s) you might select:

Cattle: Annual cow costs are \$230/head. Expected calving percentage is 85%. The average net return per calf sold is \$300. Winter feeding requires 6 hours of labor per day. At the ranch's high elevation pulmonary arterial pressures will determine the genetic type of cattle. One cow equals one animal unit.

Wildlife: The growing season allows enough forage for wildlife only if they are chosen as the primary enterprise. Labor is required for monitoring wildlife populations, animal condition, and to guide hunters. Hunters are charged \$8,000 per hunt. One elk equals .7 animal units. One mule deer equals .15 animal units.

Range Brood Mares: Annuals mare costs are \$270/head. Expected foaling percentage is 95%. Average return per weaned foal is \$300. Winter feeding requires 6 hours of labor per day. One horse equals 1.8 animal units.

Sheep: Annual ewe costs are \$9/head. Expected lambing percentage is 130%. Average return per weaned lamb is \$60. Wool income is \$20 per head per year. Winter feeding requires 4 hours of labor per day. One sheep equals .15 animal units.

Your Decision:

1. Which specie or species would you choose?

Explain your choice:

2. What factors weighed most heavily in your selection?

3. Why are these factors important?

Decision Factors:

In the table below read each statement and indicate how important each would be relative to the decision described on the previous page. 1=extremely important, 9=of no importance.

4.

Extremely Important	Not at all Important	Statement
1 2 3 4 5 6 7 8 9		type of specie you have experience/knowledge of
1 2 3 4 5 6 7 8 9		nutrient requirements for each specie
1 2 3 4 5 6 7 8 9		facilities and equipment necessary to handle each specie
1 2 3 4 5 6 7 8 9		forage requirements for each species
1 2 3 4 5 6 7 8 9		projected hours of labor required for each species being considered
1 2 3 4 5 6 7 8 9		cost for outside labor if necessary
1 2 3 4 5 6 7 8 9		potential profitability of guiding hunters on the ranch
1 2 3 4 5 6 7 8 9		initial cost for each species
1 2 3 4 5 6 7 8 9		cost of supplemental feed for each specie
1 2 3 4 5 6 7 8 9		expected profit for each species
1 2 3 4 5 6 7 8 9		current range condition
1 2 3 4 5 6 7 8 9		impact each species will have on the forage resource
1 2 3 4 5 6 7 8 9		forage availability at different times of the year
1 2 3 4 5 6 7 8 9		forage type
1 2 3 4 5 6 7 8 9		pasture terrain
1 2 3 4 5 6 7 8 9		species the previous manager chose
1 2 3 4 5 6 7 8 9		type of specie you like the best

Scenario C:

You have decided that you want to go to college and have narrowed your options to two schools. One is a junior college and the other is a state university. Both are similar distances from your home.. Your parents were not able to save money for your college, so you are on your own. You want to obtain the best possible education with the least cost

Decision to be made:

You must choose between the junior college the state university for at least your freshman year.

Facts about the school you might select:

Junior College:

Solid reputation but offers only an associates degree
Cheaper tuition costs
Smaller number of students, smaller class sizes
Rent is the same as the town with the State University
Some but most likely not all of the classes will transfer to the State University

State University:

One of the best for the course of study in which you are interested
Tuition is more expensive than the junior college
All classes taken will apply toward your degree
Don't have to deal with the hassle of transferring to the State University
Larger student body, larger class sizes
More opportunities than Junior College (rec. center, library, organizations)

Your Decision:

1. Which school would you choose?

Explain your choice:

2. What factors weighed most heavily in your selection?

3. Why are these factors important?

Decision Factors:

In the table below read each statement and indicate how important each would be relative to the decision described on the previous page. 1=extremely important, 9=of no importance.

4.

Extremely Important	Not at all Important	Statement
1 2 3 4 5 6 7 8 9		cost of tuition
1 2 3 4 5 6 7 8 9		number of students in each class
1 2 3 4 5 6 7 8 9		school's reputation
1 2 3 4 5 6 7 8 9		cost of living in each area
1 2 3 4 5 6 7 8 9		extra-curricular opportunities
1 2 3 4 5 6 7 8 9		toughness of classes (rigor)
1 2 3 4 5 6 7 8 9		availability of work-study jobs
1 2 3 4 5 6 7 8 9		condition of dorms/student housing

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The next few questions are designed to ask you things that are unique about you. We do not ask your name because we want you to remain anonymous; however we want to be able to match this posttest with the pretest you took earlier.

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Z

11. Please circle the **last two digits** of your **phone number** below.
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3	3
4	4
5	5
6	6
7	7
8	8
9	9
0	0

12. Please circle the **day of your birth** from the following numbers.
For example, if you were born on the 3rd of the month, you would circle 3.

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17
18 19 20 21 22 23 24 25 26 27 28 29 30 31

Part B: Demographics

Please mark an "X" on the line next to your response for each of the following questions.

8. Gender

- male
 female

9. How old are you?

- 14
 15
 16
 17
 18
 19

10. What grade are you in?

- 9th
 10th
 11th
 12th

11. How many semester long vocational agriculture classes have you completed before this semester began?

- 0
 1-2
 3-4
 4+

12. Are you or were you in 4-H?

- yes
 no

13. Are you or were you in FFA?

- yes
 no

14. Do you live in a rural, suburban or urban background? Please mark one.

- Rural, farm or ranch
(rural = unincorporated community of less than 5,000 people)
 Rural, non-farm
 Suburban (incorporated community of less than 20,000)
 Urban (incorporated community of 20,000 or more)

Part C: Decision Situations

There are three scenarios on the following pages. Please read each situation and decision statement carefully. Then respond to each question.

Scenario A:

You are managing an operation that farms 500 acres of irrigated land in Eastern Colorado. Irrigation costs are \$20/acre. It is the owner's goal to get as much out of the land as possible (obtain maximum profit) without compromising the ability of the land to produce in the future.

Decision to be made:

You are to decide what crop or crops would you recommend be planted on the land.

Facts about crops you might select:

Corn: Seed and fertilizer for one acre costs \$250. If the corn is harvested as silage it will yield 9 ton/acre and is worth \$25/ton. If it is harvested as shelled corn it will yield 160 bushels/acre and is worth \$2.25/bushel. Harvesting costs for both methods are \$25/acre. Corn depletes the soil of nitrogen.

Alfalfa: Alfalfa is seeded once every seven years. It costs \$55/acre for seed. On average you will get three cuttings per year. Those three cuttings together will yield 5 ton/acre. Each ton is worth \$75. Harvesting costs for all three cuttings are \$70/acre. Alfalfa replaces nitrogen in the soil.

Wheat: It costs \$15 to seed one acre of wheat. Wheat uses phosphorus and nitrogen. Fertilizer application costs \$50/acre. It costs \$20/acre to harvest wheat. It will yield 100 bushels/acre and each bushel is worth \$3.

Your Decision:

5. Which crop will you choose to plant?

Explain your choice:

6. What factors weighed most heavily in your selection?

7. Why are these factors important?

Decision Factors:

In the table below read each statement and indicate how important each would be relative to the decision described on the previous page. 1=extremely important, 9=of no importance.

8.

Extremely Important	Not at all Important	Statement
1 2 3 4 5 6 7 8 9		crops planted for the previous two years
1 2 3 4 5 6 7 8 9		forecasted market prices for each crop being considered
1 2 3 4 5 6 7 8 9		type of equipment required for each crop
1 2 3 4 5 6 7 8 9		soil sample results that indicate what nutrients need to be replenished
1 2 3 4 5 6 7 8 9		type of equipment owned by the ranch
1 2 3 4 5 6 7 8 9		estimated yield of each crop
1 2 3 4 5 6 7 8 9		crop with which you have the most experience
1 2 3 4 5 6 7 8 9		crop that you like the best
1 2 3 4 5 6 7 8 9		amount of labor required for each crop
1 2 3 4 5 6 7 8 9		weather forecast for the growing season
1 2 3 4 5 6 7 8 9		type of pests in the area

Scenario B:

You have just been hired to manage a 2,000 acre ranch in the Rocky Mountains. The average growing season is 90 days and average snowfall in the winter is 200 inches. The elevation is 6500 ft. Currently all of the land is used for grazing. It is possible to run 100 animal units on this ranch. The primary enterprise is livestock production.

Decision to be made:

Decide what specie(s) of animal(s) you will select for the ranch.

Facts about specie(s) you might select:

Cattle: Annual cow costs are \$230/head. Expected calving percentage is 85%. The average net return per calf sold is \$300. Winter feeding requires 6 hours of labor per day. At the ranch's high elevation pulmonary arterial pressures will determine the genetic type of cattle. One cow equals one animal unit.

Wildlife: The growing season allows enough forage for wildlife only if they are chosen as the primary enterprise. Labor is required for monitoring wildlife populations, animal condition, and to guide hunters. Hunters are charged \$8,000 per hunt. One elk equals .7 animal units. One mule deer equals .15 animal units.

Range Brood Mares: Annuals mare costs are \$270/head. Expected foaling percentage is 95%. Average return per weaned foal is \$300. Winter feeding requires 6 hours of labor per day. One horse equals 1.8 animal units.

Sheep: Annual ewe costs are \$9/head. Expected lambing percentage is 130%. Average return per weaned lamb is \$60. Wool income is \$20 per head per year. Winter feeding requires 4 hours of labor per day. One sheep equals .15 animal units.

Your Decision:

5. Which specie or species would you choose?

Explain your choice:

6. What factors weighed most heavily in your selection?

7. Why are these factors important?

Decision Factors:

In the table below read each statement and indicate how important each would be relative to the decision described on the previous page. 1=extremely important, 9=of no importance.

8.

Extremely Important	Not at all Important	Statement
1 2 3 4 5 6 7 8 9		type of specie you have experience/knowledge of
1 2 3 4 5 6 7 8 9		nutrient requirements for each specie
1 2 3 4 5 6 7 8 9		facilities and equipment necessary to handle each specie
1 2 3 4 5 6 7 8 9		forage requirements for each species
1 2 3 4 5 6 7 8 9		projected hours of labor required for each species being considered
1 2 3 4 5 6 7 8 9		cost for outside labor if necessary
1 2 3 4 5 6 7 8 9		potential profitability of guiding hunters on the ranch
1 2 3 4 5 6 7 8 9		initial cost for each species
1 2 3 4 5 6 7 8 9		cost of supplemental feed for each specie
1 2 3 4 5 6 7 8 9		expected profit for each species
1 2 3 4 5 6 7 8 9		current range condition
1 2 3 4 5 6 7 8 9		impact each species will have on the forage resource
1 2 3 4 5 6 7 8 9		forage availability at different times of the year
1 2 3 4 5 6 7 8 9		forage type
1 2 3 4 5 6 7 8 9		pasture terrain
1 2 3 4 5 6 7 8 9		species the previous manager chose
1 2 3 4 5 6 7 8 9		type of specie you like the best

Scenario C:

You have decided that you want to go to college and have narrowed your options to two schools. One is a junior college and the other is a state university. Both are similar distances from your home.. Your parents were not able to save money for your college, so you are on your own. You want to obtain the best possible education with the least cost

Decision to be made:

You must choose between the junior college the state university for at least your freshman year.

Facts about the school you might select:

Junior College:

- Solid reputation but offers only an associates degree
- Cheaper tuition costs
- Smaller number of students, smaller class sizes
- Rent is the same as the town with the State University
- Some but most likely not all of the classes will transfer to the State University

State University:

- One of the best for the course of study in which you are interested
- Tuition is more expensive than the junior college
- All classes taken will apply toward your degree
- Don't have to deal with the hassle of transferring to the State University
- Larger student body, larger class sizes
- More opportunities than Junior College (rec. center, library, organizations)

Your Decision:

5. Which school would you choose?

Explain your choice:

6. What factors weighed most heavily in your selection?

7. Why are these factors important?

Decision Factors:

In the table below read each statement and indicate how important each would be relative to the decision described on the previous page. 1=extremely important, 9=of no importance.

8.

Extremely Important	Not at all Important	Statement
1 2 3 4 5 6 7 8 9		cost of tuition
1 2 3 4 5 6 7 8 9		number of students in each class
1 2 3 4 5 6 7 8 9		school's reputation
1 2 3 4 5 6 7 8 9		cost of living in each area
1 2 3 4 5 6 7 8 9		extra-curricular opportunities
1 2 3 4 5 6 7 8 9		toughness of classes (rigor)
1 2 3 4 5 6 7 8 9		availability of work-study jobs
1 2 3 4 5 6 7 8 9		condition of dorms/student housing

Part E: Questions about the Decision Making Unit
Please answer each of the questions as completely as possible.

1. What did you like about the decision making unit?
2. What would you change about the decision making unit?
3. How will you use the information from the decision making unit when making decisions in your own life?
4. Please list any additional comments about the decision making unit.

Part A: Test Matchers

The next few questions are designed to ask you things that are unique about you. We do not ask your name because we want you to remain anonymous; however we want to be able to match this posttest with the pretest you took earlier.

13. Circle the **first letter** of your **mother's first name** in the list below.
For example, if your mother's name is Mary, you would circle the M below.

A B C D E F G H I J K L M N O P Q R S T U V W X Y
Z

14. Please circle the **last two digits** of your **phone number** below.
For example, if your phone number is 123-4567, you would circle 6 in the first column and 7 in the second column.

second to the last digit of your phone number	last digit of your phone number
1	1
2	2
3	3
4	4
5	5
6	6
7	7
8	8
9	9
0	0

15. Please circle the **day of your birth** from the following numbers.
For example, if you were born on the 3rd of the month, you would circle 3.

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17
18 19 20 21 22 23 24 25 26 27 28 29 30 31

Part B: Demographics

Please mark an "X" on the line next to your response for each of the following questions.

15. Gender

- male
 female

16. How old are you?

- 14
 15
 16
 17
 18
 19

17. What grade are you in?

- 9th
 10th
 11th
 12th

18. How many semester long vocational agriculture classes have you completed before this semester began?

- 0
 1-2
 3-4
 4+

19. Are you or were you in 4-H?

- yes
 no

20. Are you or were you in FFA?

- yes
 no

21. Do you live in a rural, suburban or urban background? Please mark one.

- Rural, farm or ranch
(rural = unincorporated community of less than 5,000 people)
 Rural, non-farm
 Suburban (incorporated community of less than 20,000)
 Urban (incorporated community of 20,000 or more)

Part C: Decision Situations

There are three scenarios on the following pages. Please read each situation and decision statement carefully. Then respond to each question.

Scenario D:

You are managing Hell's Fire Ranch located in the desert of West Texas. The new owner is an investment banker from New York City who knows little about cattle. Your market is selling calves at weaning on a commodity market. The summer averages 50 – 60 days of above 100 degrees. Average annual rainfall is 18 inches.

Decision to be made:

You are to decide what breed of cattle to select for this environment.

Facts about breeds you might select:

Angus: Moderate maintenance requirements, low heat tolerance, high meat quality, and low meat yield.

Simmental: High maintenance requirements, low heat tolerance, moderate meat quality, and high meat yield.

Brahman: Low maintenance requirements, high heat tolerance, travel well, provide low quality meat, meat yield is low/mod.

Brangus: Low/moderate maintenance requirements, moderate heat tolerance, meat quality and yield are moderate.

Your Decision:

5. What breed of cattle will you select for the ranch?

Explain your choice:

6. What factors weighed most heavily in your selection?

7. Why are these factors important?

Decision Factors:

In the table below read each statement and indicate how important each would be relative to the decision described on the previous page. 1=extremely important, 9=of no importance.

8.

Extremely Important	Not at all Important	Statement
1 2 3 4 5 6 7 8 9		temperament of the breed
1 2 3 4 5 6 7 8 9		milking ability of the breed
1 2 3 4 5 6 7 8 9		nutrient requirements of the breed
1 2 3 4 5 6 7 8 9		heat tolerance of the breed
1 2 3 4 5 6 7 8 9		frame size of the breed
1 2 3 4 5 6 7 8 9		distance animals will have to travel to graze and obtain water
1 2 3 4 5 6 7 8 9		cost of each breed
1 2 3 4 5 6 7 8 9		maintenance requirements of each breed
1 2 3 4 5 6 7 8 9		marketability of each breed
1 2 3 4 5 6 7 8 9		breed you like best
1 2 3 4 5 6 7 8 9		breed most suited to the environment

Scenario E:

Your newest assignment is to manage the calving operation at Hefty Herefords. You are in the process of decided when you want your cows to start calving in the spring. This decision will determine when you turn the bulls out with the cows. The ranch is located in southeastern Wyoming. The elevation is 5,000 ft. Spring green-up occurs around April 15. Gestating (pregnant) cows require 25 lbs. of hay/day. Lactating (milking) cows require 35 lbs. of hay/day. Hefty Herefords sells all of their calves at weaning.

Decision to be made:

You are to decide when to turn the bulls out with the cows.

Facts about turn-out dates you might select:

May 15: turnout would provide for calving season from late February through April. These calves would be weaned October 1. Their average weaning weight would be around 500 pounds assuming normal rainfall. Average market price for 500 pound calves on October 1st is \$103.13/cwt.

June 15: turnout would provide for a calving season from late March through May. These calves would be weaned October 15. Their average weaning weight would be around 470 pounds assuming normal rainfall. Average market price for 470 pounds calves on October 15th is \$105.60/cwt.

July 15: turnout would provide for a calving season from late April through June. These calves would be weaned November 1st. Their average weaning weight would be around 440 pounds assuming normal rainfall. Average market price for 440 pound calves on November 1st is \$107.90/cwt.

Your Decision:

5. When will you turn the bulls in with the cows?

Explain your choice:

6. What factors weighed most heavily in your selection?

7. Why are these factors important?

Decision Factors:

In the table below read each statement and indicate how important each would be relative to the decision described on the previous page. 1=extremely important, 9=of no importance.

8.

Extremely Important	Not at all Important	Statement
1 2 3 4 5 6 7 8 9		time of year at which you have experience calving
1 2 3 4 5 6 7 8 9		nutrient requirements for gestating (pregnant) cows
1 2 3 4 5 6 7 8 9		forecasted market price for calves at various times next fall
1 2 3 4 5 6 7 8 9		forage availability at potential calving dates
1 2 3 4 5 6 7 8 9		weather conditions (temperature, amount of snow) at potential calving dates
1 2 3 4 5 6 7 8 9		cost of supplemental hay
1 2 3 4 5 6 7 8 9		availability of the right type of bull for purchase
1 2 3 4 5 6 7 8 9		date that the neighbors turn their bulls out
1 2 3 4 5 6 7 8 9		amount of hay left after previous winter
1 2 3 4 5 6 7 8 9		expected weight of calves at potential selling dates
1 2 3 4 5 6 7 8 9		nutrient requirements of lactating cows
1 2 3 4 5 6 7 8 9		alliance opportunities at the different calving options
1 2 3 4 5 6 7 8 9		projected space availability at the local feedlot
1 2 3 4 5 6 7 8 9		availability of seasonal labor for the times considered
1 2 3 4 5 6 7 8 9		family time commitments during various calving options
1 2 3 4 5 6 7 8 9		buying or raising replacement females
1 2 3 4 5 6 7 8 9		facility restrictions or availability at calving options

Scenario F:

You are tired of depending on your parents and your friends for rides. You have saved a few thousand dollars and are considering two different vehicles for purchase. One vehicle is an older pick-up that you have enough money to buy but it needs some fixing up. The other vehicle is a newer smaller vehicle that costs more than you have but your parents have agreed to co-sign a loan for you.

Decision to be made:

You are to decide which vehicle would be the best for your economic situation.

Facts about vehicles you might select:

Older pickup:

You will not have any debt

You will have to do some work to make it dependable

It is a safe, well made vehicle

Compact car:

You will have debt

If it does break down, you will not have money to fix it

Not as safe as the older pickup

Gets better gas mileage

Your Decision:

5. Which vehicle will you select?

Explain your choice:

6. What factors weighed most heavily in your selection?

7. Why are these factors important?

Decision Factors:

In the table below read each statement and indicate how important each would be relative to the decision described on the previous page. 1=extremely important, 9=of no importance.

8.

Extremely Important	Not at all Important	Statement
1 2 3 4 5 6 7 8 9		gas mileage of each vehicle
1 2 3 4 5 6 7 8 9		cost of each vehicle
1 2 3 4 5 6 7 8 9		cost of insurance for each vehicle
1 2 3 4 5 6 7 8 9		estimated maintenance costs for each vehicle
1 2 3 4 5 6 7 8 9		your level of knowledge about vehicles and common repairs
1 2 3 4 5 6 7 8 9		number of people that will fit in each vehicle
1 2 3 4 5 6 7 8 9		how much you like the appearance of each vehicle
1 2 3 4 5 6 7 8 9		if a loan was required to get the vehicle

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18 19 20 21 22 23 24 25 26 27 28 29 30 31

Part B: Demographics

Please mark an "X" on the line next to your response for each of the following questions.

22. Gender

- male
 female

23. How old are you?

- 14
 15
 16
 17
 18
 19

24. What grade are you in?

- 9th
 10th
 11th
 12th

25. How many semester long vocational agriculture classes have you completed before this semester began?

- 0
 1-2
 3-4
 4+

26. Are you or were you in 4-H?

- yes
 no

27. Are you or were you in FFA?

- yes
 no

28. Do you live in a rural, suburban or urban background? Please mark one.

- Rural, farm or ranch
(rural = unincorporated community of less than 5,000 people)
 Rural, non-farm
 Suburban (incorporated community of less than 20,000)
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Decision to be made:

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Facts about breeds you might select:

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Brangus: Low/moderate maintenance requirements, moderate heat tolerance, meat quality and yield are moderate.

Your Decision:

9. What breed of cattle will you select for the ranch?

Explain your choice:

10. What factors weighed most heavily in your selection?

11. Why are these factors important?

Decision Factors:

In the table below read each statement and indicate how important each would be relative to the decision described on the previous page. 1=extremely important, 9=of no importance.

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Decision to be made:

You are to decide when to turn the bulls out with the cows.

Facts about turn-out dates you might select:

May 15: turnout would provide for calving season from late February through April. These calves would be weaned October 1. Their average weaning weight would be around 500 pounds assuming normal rainfall. Average market price for 500 pound calves on October 1st is \$103.13/cwt.

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July 15: turnout would provide for a calving season from late April through June. These calves would be weaned November 1st. Their average weaning weight would be around 440 pounds assuming normal rainfall. Average market price for 440 pound calves on November 1st is \$107.90/cwt.

Your Decision:

9. When will you turn the bulls in with the cows?

Explain your choice:

10. What factors weighed most heavily in your selection?

11. Why are these factors important?

Decision Factors:

In the table below read each statement and indicate how important each would be relative to the decision described on the previous page. 1=extremely important, 9=of no importance.

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1 2 3 4 5 6 7 8 9		expected weight of calves at potential selling dates
1 2 3 4 5 6 7 8 9		nutrient requirements of lactating cows
1 2 3 4 5 6 7 8 9		alliance opportunities at the different calving options
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1 2 3 4 5 6 7 8 9		availability of seasonal labor for the times considered
1 2 3 4 5 6 7 8 9		family time commitments during various calving options
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1 2 3 4 5 6 7 8 9		facility restrictions or availability at calving options

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You are tired of depending on your parents and your friends for rides. You have saved a few thousand dollars and are considering two different vehicles for purchase. One vehicle is an older pick-up that you have enough money to buy but it needs some fixing up. The other vehicle is a newer smaller vehicle that costs more than you have but your parents have agreed to co-sign a loan for you.

Decision to be made:

You are to decide which vehicle would be the best for your economic situation.

Facts about vehicles you might select:

Older pickup:

You will not have any debt

You will have to do some work to make it dependable

It is a safe, well made vehicle

Compact car:

You will have debt

If it does break down, you will not have money to fix it

Not as safe as the older pickup

Gets better gas mileage

Your Decision:

9. Which vehicle will you select?

Explain your choice:

10. What factors weighed most heavily in your selection?

11. Why are these factors important?

Decision Factors:

In the table below read each statement and indicate how important each would be relative to the decision described on the previous page. 1=extremely important, 9=of no importance.

12.

Extremely Important	Not at all Important	Statement
1 2 3 4 5 6 7 8 9		gas mileage of each vehicle
1 2 3 4 5 6 7 8 9		cost of each vehicle
1 2 3 4 5 6 7 8 9		cost of insurance for each vehicle
1 2 3 4 5 6 7 8 9		estimated maintenance costs for each vehicle
1 2 3 4 5 6 7 8 9		your level of knowledge about vehicles and common repairs
1 2 3 4 5 6 7 8 9		number of people that will fit in each vehicle
1 2 3 4 5 6 7 8 9		how much you like the appearance of each vehicle
1 2 3 4 5 6 7 8 9		if a loan was required to get the vehicle

APPENDIX X
Instructor Questionnaire

Instructor Questionnaire – Control Group

1. Gender
 - male
 - female

2. Including this year, how many years have you been teaching vocational agriculture?
 - 1 (first year teaching)
 - 2-3
 - 4-5
 - 6-7
 - 8-9
 - 10-19
 - 20+

3. What was your undergraduate major? _____

4. Do you have a graduate degree?
 - yes
 - no
 - currently pursuing

5. Describe the type of curriculum are you currently using for animal science?

6. Do you currently teach range/grazing?
 - a. If so, describe the type of curriculum are you currently using for range and grazing resource?

 - b. If not, would you if a curriculum were available?

7. Do you specifically teach decision-making skills?

8. Are your students good decision makers?

9. Would you use a decision making unit? How?

10. Please describe the percentage of class time that you spend on the following approaches, add others at the bottom that you use but are not listed.

Teaching Method	Avg. % of class time
Lecture	
Interactive activities	
Group work	
Students working independently	
Other, please describe:	
Other, please describe:	

11. What are the greatest challenges you face in the classroom as a vocational agriculture instructor?

12. If Colorado State were to develop additional materials, what type (content, format, etc.) would be most useful to you?

13. Any additional comments:

Instructor Questionnaire - IRM curriculum group

14. Your gender

- male
- female

15. Including this year, how many years have you been teaching vocational agriculture?

- 1 (first year teaching)
- 2-3
- 4-5
- 6-7
- 8-9
- 10-19
- 20+

16. What was your undergraduate major? _____

17. Do you have a graduate degree?

- yes
- no
- currently pursuing

18. Describe the type of curriculum are you currently using for animal science?

19. Do you currently teach range/grazing?

- a. If so, describe the type of curriculum are you currently using for range and grazing resource?

- b. If not, would you if a curriculum were available?

20. Do you specifically teach decision-making skills?

21. Are your students good decision makers?

22. Would you use a decision making unit? How?

23. Please describe the percentage of class time that you spend on the following approaches, add others at the bottom that you use but are not listed.

Teaching Method	Avg. % of class time
Lecture	
Interactive activities	
Group work	
Students working independently	
Other, please describe:	
Other, please describe:	

24. What are the greatest challenges you face in the classroom as a vocational agriculture instructor?

25. If Colorado State were to develop additional materials, what type (content, format, etc.) would be most useful to you?

Questions re: IRM Decision Making Unit

26. Please rate the usefulness of the following elements of the decision making unit?
 1=very useful, 2=somewhat useful, 3=indifferent, 4=of little use, 5=not useful, 6=did not use

VU	NU DNU					
1	2	3	4	5	6	
						Lesson plans
						Authorware presentations
						Learning diagnostic – questions about decision making at the beginning of the Authorware unit
						TILT review
						Decision making worksheet

27. How would you rate the content of the decision making unit for your students?

1. ___ Very difficult
2. ___ Moderately difficult
3. ___ Appropriate difficulty {Mixing content and its difficulty.}
4. ___ Moderately easy
5. ___ Very easy

28. What should be removed from the decision making curriculum?

29. What should be added to the decision making curriculum?

30. What would you change about the decision making curriculum?

31. Will you use the decision making unit again?

- ___ yes
 ___ no

32. Do you plan to use other units of the IRM curriculum?

33. Any additional comments:

APPENDIX XI
Decision Making Unit Lesson Plans

Unit 1 - Integrated Decision Making Lesson Plans

Day 1 – 50 minutes

Area: Integrated decision making overview

Job: Learn about the importance of making good decisions and how making decisions from an integrated approach differs from a traditional approach.

Daily objectives

- At the end of this lesson, learners will be able to:
 - identify a decision that resulted in an undesired response or result
 - identify what contributed to the undesired response or result
 - explain how an integrated approach to decision making is different from a traditional approach

Questions

1. What was a decision you made that resulted in undesirable consequences?
2. What additional information would have resulted in a better decision being made?
3. What does integrated mean?
4. What is integrated resource management?
5. How is an integrated approach to decision making different from a traditional approach?

Situation:

- Decision making skills are required of everyone in nearly every area of life however these skills are seldom specifically taught.

Motivation:

- Providing students with a decision making model will equip them to make informed decisions in all areas of life.

Content – Learning diagnostic and an integrated approach to decision making

- Start today with the learning diagnostic.
 - Authorware navigation:
 - Pages 1-2
 - Units menu = Unit 1, Main topic = Learning Diagnostic Frame
 - Ask students to identify a decision they or someone they know made that resulted in an undesired response or result.
 - Discuss their situations
 - Move the discussion on to introducing and explaining an integrated approach
- Integrated Approach
 - Authorware navigation:
 - Pages 3-10
 - Units menu = Unit 1, Main topic = IRM Defined

- Define “integrated”
- Discuss the many parts that go into a decision
- Define “resource” and “management” and their relationship to the many parts of a decision
- Ask students how many resources they can think of that should be considered when making decisions related to land and livestock.
 - Compare students’ list with that on page 8 of the Authorware presentation
- Explain why an integrated approach is important
 - Considers all variables in complex situations
- Ask students how an integrated approach differs from traditional thinking.
 - After they have discussed this click on the “show ideas” button on page 10 of the Authorware program.
- Conclude today by having students answer the questions listed above

Day 2: 50 minutes

Area: IRM Decision Making Model

Job: Learn the steps of the decision making model.

Daily objectives

- At the end of this lesson, learners will be able to:
 - identify a target, goal, desired endpoint or result (Step 1)
 - identify the current situation in relation to the target and identify the factors that are affecting the decision (Step 2)
 - identify potential options or action alternatives (Step 3)
 - identify potential results associated with selected each option that was identified in Step 3 (Step 4)
 - make a decision, select the most desirable option or course of action based on the information collected in Steps 1-4 (Step 5)
 - review the selected alternative, comparing it to the goals and target, make revisions as necessary (Step 6)

Questions

1. What is a decision making model?
2. List and describe the steps
3. What are advantages in using this model?
4. Are there any disadvantages in using this model?

Situation:

- Prior to making a decision, learners need to know where they would like to end up, what is affecting the situation, and what potential alternatives are available. After selecting potential alternatives or courses of action, it is important to identify what

will potentially be the effects of each choice. Once pros and cons are identified and considered, a decision is made. After the decision has been implemented, reviewing the actual results provides a context for revisions to be made.

Motivation:

- Making informed decisions saves time, results in better decisions, and helps to eliminate unwanted results. Often there are consequences that could not have been predicted. Reviewing and revising allows important adjustments to be made and often brings up more decisions. This brings the decision maker back to step 1.

Content – Car analogy, decision making model, TILT review

- Car analogy
 - Authorware navigation:
 - Page 11
 - Units menu = Unit 1, Main topic = Decision Making Introduction
 - Listed below are several questions that may be helpful in working through the car analogy with your class.
 - Ask students how different decisions may have led to the cars' conditions. (Remember their responses and refer to them later as they will likely relate to one of the six steps in the decision making model that will be covered in this lesson).
 - What's different about the two cars?
 - What decisions may have led to their present conditions?
 - List student responses, they will likely provide responses relating to driving under the influence
 - Follow up by asking what would cause someone to drive under the influence?
 - Again list their responses
 - Peer pressure, popularity, don't care, want to have a "good" time, etc.
 - Ask if all the decisions were made prior to the accident?
 - If the driver had worked through a decision-making model could the results have been different?
 - In the same way that drivers education provides new drivers with instruction, a decision making model provides individuals with an approach to use in applying what they know to a decision being faced.
- Decision Making Model
 - Authorware navigation:
 - Pages 12-28

- Continue on through the six steps of the decision making model.
 - Step 1: Identify a Target
 - Examples
 - Step 2: Identify the affecting elements, current location, and status relative to the situation
 - Examples
 - Step 3: Identify options or potential actions
 - Examples
 - Step 4: Identify potential results
 - Examples
 - Step 5: Make Decision
 - Examples
 - Step 6: Review and Revise
 - Examples
- Conclude today with a TILT review
 - TILT stands for, “Today I Learned That”
 - Ask students to write TILT at the top of a sheet of paper and then list the things that they learned today.

Homework:

- Give students the Decision Making Worksheet to take home and complete.

Day 3: 50 minutes

Area: Decision making review

Job: Review the decision making process

Daily objectives

- At the end of this lesson, learners will be able to:
 - Explain what integrated resource management means.
 - Describe how an integrated approach can lead to better decisions being made.
 - List the six steps of the decision making model in order.

Questions

1. What parts of the homework were difficult?
2. What does integrated resource management mean?
3. How does an integrated approach lead to better decisions being made?
4. Can an integrated approach be used with decisions that are not related to agriculture or natural resources?
5. What are the six steps of the decision making model?

Situation:

Students are at the end of the Integrated Decision Making Unit.

Motivation:

Reviewing the homework and chapter contents allows students to apply information from the chapter and receive feedback from their instructor.

Content – Review homework, Authorware example for review, Authorware review questions, Authorware review quiz

- Review homework assignment
 - Adjust according to your preference and as time allows.
 - Can use the worksheet as an in-class assignment rather than homework.
- Authorware example
 - Authorware navigation
 - Pages 29-35
 - Units menu = Unit 1, Main topic = Example for review
- Review Questions
 - Authorware navigation
 - Page 36
 - Units menu = Unit 1, Main topic = Review
- Review Matching Quiz
 - Authorware navigation
 - Page 37

APPENDIX XII
Decision Making Worksheet

Decision Making Worksheet

Name _____

Think of a decision you are facing. Fill in each area of the worksheet in regards to your decision.

Target/Goal:

Current situation and factors affecting the current situation:

Potential Options/Action Alternatives:

Potential results of each option, pros, cons, consequences, etc.:

Decision Made - option selected:

Review and Revise (What are specific points that can be measured and monitored that will indicate if you are moving toward the target or goal?)