

DISSERTATION

PERCEIVED POSITIVE AND NEGATIVE EFFECTS OF PARTICIPATION IN  
STUDENT CONSTRUCTION MANAGEMENT COMPETITIONS: A QUALITATIVE  
PRIORITY MIXED METHODS STUDY

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## ABSTRACT

### PERCEIVED POSITIVE AND NEGATIVE EFFECTS OF PARTICIPATION IN STUDENT CONSTRUCTION MANAGEMENT COMPETITIONS: A QUALITATIVE PRIORITY MIXED METHODS STUDY

In the discipline of construction management (CM) student competitions are well thought of and have good construction industry support. Very little published research was found however addressing these competitions. This qualitative priority, mixed methods study collected qualitative data via interviews and quantitative data via surveys to learn what the perceived positive and negative effects of competition participation are, and what differences there might be between participants and non-participants in the competitions.

The quantitative data from this study compared participants and non-participants in regard to starting salaries, GPA, and frequency of employment. However it did not produce statistically significant results in relation to any of these variables. Practical significance is however reported regarding the higher average starting salary of participants.

Using a grounded theory research design, the study's qualitative data produced positive and negative effects of participation. The four negative effects that emerged in coding, are reported; expectations, resources, scoring methods, and time. Time was the most strongly supported of the negative effects and presents an interesting point in this study's findings because, time emerged as a negative effect and time management emerged as a positive effect of competition participation.

This study was however, focused on the positive effects of competition participation. Eleven positive effects emerged; confidence, connecting all the dots, industry involvement leadership, motivation, presentation skills, problem solving, real world experience, teamwork, and time management. Following identification of these effects in open coding, construction industry involvement was identified as the central phenomenon connecting them in axial coding. The selective coding process then identified a cyclical pattern showing a connection between the positive effects, leadership and graduate key competencies, and construction industry involvement. The cycle tells the story of the phenomenon of student construction management competitions.

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## **CHAPTER 1 - INTRODUCTION**

### **Background/Overview**

In the academic discipline of construction management, student competitions have become a means for students to distinguish themselves and stand out from the crowd. Groups such as the Associated Schools of Construction (ASC), The Associated Builders and Contractors of America (ABC), and the National Association of Home Builders (NAHB) all hold annual competitions in construction related topics such as; Commercial Construction, Design-Build Construction, Heavy Civil Construction, Building Information modeling (BIM), Leadership in Energy Efficiency and Design (LEED), Preconstruction, Mechanical Construction, and Residential Construction. Teams of students participating in these competitions come from more than 100 colleges and universities in every part of the United States, and involve thousands of students each year.

The competitions all have similarities, but they also have differences. These differences between competitions occur in the format and the topic areas of each, but the general concept remains the same. Each team is given a problem (relating to their topic), and each team proposes and presents a solution to the problem. Every competition gives the teams a specified time frame ranging from hours to months to formulate, plan, and present their solution to the problem.

Competition participation represents a significant investment of time and effort on the part of the students, but it provides an experience and learning opportunity for the students who participate that is believed to be well worth the time invested. In the construction industry many have recognized the value of participation, as evidenced by the recruiting that occurs at the competitions, an indication that participation can be beneficial to students.

Student construction management competitions have a good reputation that is not limited to industry professionals. Students and faculty in construction management also think highly of them (Anglin & Robson, 1997). The volume of participation, even in years when the national economy has struggled, is evidence of their reputation and the strong positive opinion in favor of them. Despite the positive opinion and support, in construction management education, student competitions have seen little attention in published research. As a result, competitions have been the subject of even less empirical research. Among the published research found, there was only indirect consideration of impacts on participants. Anglin and Robson's (1997) study offered evidence of the value of student competitions to construction education through a survey of participants at one competition. They report: "Academic competitions should be considered as meaningful educational experiences for all competitors and potentially all students in the programs where the competitors are from" (p. 14), further they report that student motivation and interaction with teachers were increased. They infer from their findings: increased levels of learning, greater industry involvement in education, and self-promotion to employers. This study was however focused on the aspects of participation directly related to education.

The current study makes an in depth evaluation of the perceived positive and negative effects of competition participation for students, and closes with a brief comparison of participants and non-participants in undergraduate student construction management competitions. Educationally, it is widely accepted and has been shown in survey results that competitions can benefit a student's education (Anglin & Robson, 1997). However, consideration of the positive effects for students not specific to their education could lead to increased student participation in the competitions. Additional study of the perceived negatives of participation provides a holistic view of competition participation.

### **Statement of the Research Problem**

Student competitions are not exclusive to construction management education; they have been used in different academic disciplines for many years. They come in different formats, are measured in different ways, and have been considered beneficial (Anglin & Robson, 1997). However, there has been little or no published research to validate the value placed on them. Across disciplines, student competitions receive mixed reviews, with some individuals avidly supporting them and others strongly opposing them.

For many years, and across academic disciplines, competition has been used to improve education and thus benefit students. "Marcus Verrius Flaccus, a Roman teacher famous in the late 1st century BC, is credited to have introduced the principle of competition among his students as a pedagogical aid. He awarded attractive books as prizes" (Verhoff, 1997, p. 4). Despite the long history of their use, not all voices are in favor of competition, Cheng, Winston, Calvin, and Tak-Wai (2009), cite a decline in

performance often associated with competition failure. Robinson (2008) points out the humiliation for students and instructors from a poor competition showing.

A current problem in construction management is the limited volume of empirical studies or sources of data (quantitative or qualitative) relating to student participation in construction management competitions, and none of the studies found focus on positive or negative effects of participation. In construction management education, the positive effects of participation have only been considered as they relate to student's education. Other positive and negative effects have not been studied, nor have potential differences between participants and non-participants been considered.

In other disciplines the lack of published studies relating to student competitions has been noted in the literature. After studies in 1992 and 1993, Marra completed a third study on a national advertising competition in 1996. He noted "scant" research regarding advertising competitions. A study in vocational education reported; "Little actual research can be found among the myriad of articles and papers in the professional and research literature dealing with VSO's (Vocational Student Organizations) and student outcomes" (Camp, Jackson, Buser, Baldwin, 2000). In engineering a similar disparity between the support for competitions and the data showing their positive effects were noted by Wankat (2005). With a general lack of published empirical data regarding student competitions, it comes as no surprise that research on the positive and negative effects of student participation is also limited.

In the sphere of construction management, only a few instances were found wherein the topic of student competitions has been the subject of empirical research. In studies with a degree of methodological rigor, such as Anglin and Robson's (1997) study, the research is unfortunately not focused on the positive effects on students. Given the



scarcity of competition research within construction management, competitions in many different disciplines must also be considered.

Although it is helpful, and currently necessary for comparisons, research from other disciplines cannot take the place of research specific to construction management education. The lack of research both generally and specifically regarding student competitions in construction education requires comparison with other disciplines. However, research in the discipline of construction management is still necessary to support, or refute, the generally strong positive opinion regarding student construction management competitions.

Addressing construction management student competitions will provide insight for construction management faculty into an area with little published research but that has potential for dramatic impacts on students. The small amount of published data regarding student competitions in construction management, and specifically a lack of research addressing the positive effects on participants from participation is the research problem.

### **Statement of the Research Purpose**

The purpose of this mixed methods study is to inform construction management faculty and administrators of the positive and negative effects of competition participation. This study also seeks to inform CM students of the positive and negative effects of competition participation, however the researcher recognizes that students are most likely to learn about this study's findings through faculty and administrators, as a result CM faculty and administrators are the primary audience.

In this study qualitative methods take an in depth look at the perceived positive and negative effects of competition participation, while also considering how differences may occur between participants and non-participants. The study's quantitative reflection compares participants and non-participants. This study focuses on the qualitative data, but both quantitative and qualitative data were collected so the two types could converge and bring greater insight into the problem than could be obtained by either type alone (Creswell & Plano Clark, 2011). The mixed method design was chosen because it could provide greater insight, and thus inform faculty and administrators of the positive and negative effects of competition participation, as is the research purpose.

## **Research Questions**

### **Qualitative Questions**

1. What do competition team coaches and students perceive as positive effects on students from participation in construction management competitions?
  - a. What do competition team coaches and student participants perceive as the greatest benefit to competition participation?
  - b. How do competition team coaches attribute these positive effects to competition participation?
2. What negative effects of participation in construction management competitions do team coaches describe?

3. How do the perceptions of team coaches help to explain quantitative differences between participants and non-participants as it relates to:
  - c. Starting salaries?
  - d. GPAs?
  - e. Frequency of employment?

#### **Quantitative Question**

4. What are the differences between participants and non-participants in construction management competitions relating to:
  - a) starting salaries?
  - b) GPAs?
  - c) frequency of employment?

#### **Mixed Methods Question**

5. How do the quantitative survey results and the qualitative interview results combine to provide insight regarding the value and challenge of participation in construction management competitions for students?

#### **Definition of Terms**

To facilitate understanding and clarity of this study the researcher provides the following definitions of certain terms utilized in this study.

#### **Construction Management Student Competition:**

The NAHB, the ASC, and the ABC are all professional organizations that organize and sponsor yearly student competitions. These competitions each present a common

problem to the students, who then produce a solution to the problem in the form of a written proposal, which they then present to a panel of judges.

**Competition Team Coach:**

All student competition teams have a faculty member, or other individual deemed qualified, who acts as a coach for the team; these individuals may also be an advisor to the student chapters of the organizations who sponsor the competitions.

**Construction Management Student:**

Students pursuing undergraduate degrees, and are majoring in construction management, building construction management, building construction, or construction science are considered construction management students in this study. Students earning degrees in other disciplines were not considered.

**Graduating Senior:**

Students who are in the final semester before graduation are defined as graduating seniors. Data were collected only from these students. Students classified as seniors by their university, but who require additional semesters enrolled at their institution before graduation, were not used for data collection.

**Study Delimitations**

The interviews in this study are delimited to construction management competition team coaches with one year or more of experience as a competition team coach from: Cal Poly – San Luis Obispo, Colorado State University, Georgia Institute of Technology, North Dakota State University, Purdue University, and Texas A&M University.

The student survey used in this study is delimited to undergraduate students in their final semester before graduating. These students were also delimited to construction management majors. Based on the time frame of data collection these students were further delimited to graduates in the 2009 – 2010 school year, from the same schools where coaches were interviewed.

Both quantitative and qualitative portions of this study were delimited to construction management student competitions. Although there are other competitions available to students in programs of construction higher education this study is delimited to competitions organized by: NAHB, ASC, & ABC.

The delimitations of this study are in place to ensure that both qualitative and quantitative data collection come from the same locations. So when the data for the research as a whole are considered, there is a measure of consistency between qualitative and quantitative data sets. This consistency is important to research question five where the quantitative and qualitative data sets are intended to inform one another.

### **Limitations**

Three limitations were identified in this study. The first can be found in nearly all research involving human subjects with voluntary participation, it was participant honesty. Among the actual sample this research is limited by participant's honesty and willingness to answer all of the questions posed.

The second limitation of this study resulted from the funding that supported the research. Grant funding was applied for and won for this study. Those funds made the study possible; however it also stipulated the schools where data would be collected. As a

result data collection for the study was limited to those schools and a random sampling could not be done.

The third limitation results from the use of the pilot study findings to guide some of the interview questions. Because qualitative and quantitative data were being collected concurrently for this study, the quantitative data could not guide the qualitative interviews. So the pilot study data was used as a guide.

### **Need or Significance**

Significance of this study results from the strong positive opinion and support that exists for student competitions in construction management education such as: “Win or lose, it could well be your best experience of the year – it will definitely be your students” (Nobe, Glick, & Johnson, 2006, p. 19). This support however comes in the face of little empirical research in construction education on the topic.

A total of only six articles relating to student competitions in construction management were found, and only three of those could be considered empirical studies. Two of the three consider the ASC, ABC, & NAHB type competitions, and only one of those considers outcomes of competitions. That particular study has provided data to support the educational value of student participation in construction management competitions, but did little to address any tangible effects of competition participation on students. With only one study considering these competitions in the discipline, the body of research is extremely limited. This study is unique in construction management education because it focuses on the positive and negative effects of participation.

This study is significant because while there is literature regarding student competitions in other disciplines, in construction management education the limited volume of publications including empirical research indicates the need. The prevalent pro-competition sentiment in construction management education that is unsupported by literature shows this research has significance as it should help provide a basis to support or refute the pro-competition sentiment.

### **Conceptual Framework**

The educational value of student competitions in construction management education was established by Anglin and Robson's (1997) study. This study also touches on educational value, but is focused on the positive and negative effects for participants. After considering the perceived positive and negative effects of participation this study includes a quantitative reflection that looked for differences between participants and non-participants.

This study seeks to document the perceived positive and negative effects of participation and to quantify possible differences between participants and non-participants. A pilot study performed at Colorado State University found that participants had higher GPAs and starting salaries, it was believed that students who choose to participate in the competitions have higher starting salaries, higher GPAs, and higher rates of employment than students who do not participate. The Colorado State study served as a foundation for the quantitative strand of this study.

This research represents a largely unstudied area within the discipline of construction management. The difference hypotheses of this study are: The perceived

positive effects of participation outweigh perceived negative effects and that there is a difference between participants and non-participants in construction management competitions relating to: a) starting salaries, b) GPAs, and c) frequency of employment. The conceptual framework of this study is depicted in figures 1.1, and 1.2.

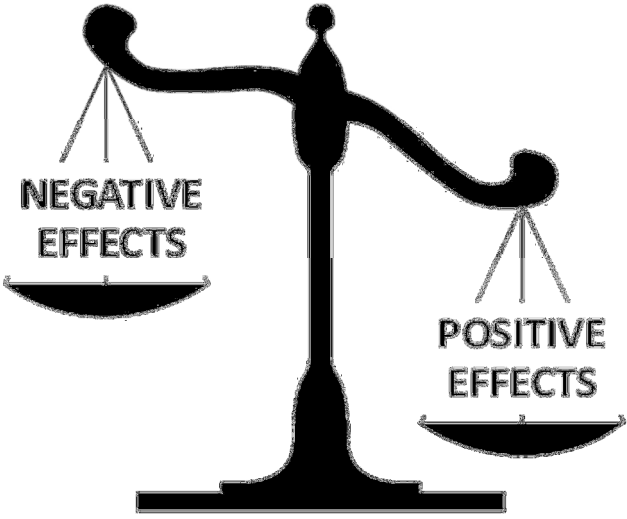


Figure 1.1 Conceptual framework of coaches perceptions.

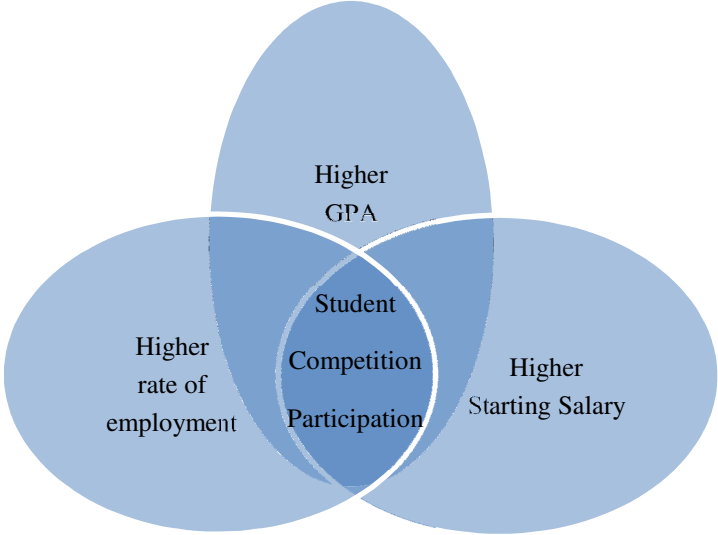


Figure 1.2. Conceptual framework of participant comparison.



The conceptual framework for this study are supported by four educational theories, Collaborative-based learning (CBL), Problem-based learning (PBL), Project-based learning (PjBL), and Competition-based learning (CnBL). Based on these theories it is believed that competition participants benefit from positive effects that non-participants do not obtain, and that these positive effects are greater than any negative effects of participation.

CBL focuses on activities that maximize the collaboration among students to improve their learning activities and results. Through the exchange of information and knowledge among students, learning is reinforced and students are motivated (Burguillo, 2010).

PBL is a student-centered instructional strategy in which students collaboratively solve problems and reflect on their experiences. Learning is driven by providing open-ended problems where students usually work in small collaborative groups. Students are encouraged to take the responsibility for organizing their group and managing the learning process. PBL is usually supported by a tutor or instructor acting as a learning facilitator (Burguillo, 2010).

PjBL provides complex tasks based on challenging questions or problems that involve the students' problem solving, decision making, investigative, and reflective skills. These skills are supported by a tutor who provides facilitation. The main difference between PBL and PjBL is that in PBL the task is typically on a micro level, perhaps just a portion of a whole project, while in PjBL the task is on a macro level, perhaps including many individual problems that tie together (Burguillo, 2010).

CnBL is a methodology where learning is achieved through a competition, but the learning result is independent of the student's score in such competition. CnBL is easily combined with any or all of the other learning methodologies discussed above; together they support competitions among student groups, and help to motivate and improve student performance (Burguillo, 2010).

While each competition is unique, all of the construction management student competitions considered in this study provide the positive effects of CBL, PBL, PjBL, and CnBL to participants. These learning theories relate to the conceptual framework of this study, as it is the positive effects gained through participation in competitions that this study seeks to document. Each of these learning theories (CBL, PBL, PjBL, and CnBL) are embodied in construction management student competitions and provide the basis for this study's conceptual framework and hypothesis.

### **Investigator's Perspective**

The researcher has been involved in student construction management education competitions since 2003 and believes they are perhaps the best experience and opportunity for learning that most construction management students have in their academic careers. As an undergraduate student the researcher participated twice in competitions; which resulted directly in securing an internship, and offer(s) of employment upon graduation. As a professional the researcher also attended a competition to recruit participants, and over the past four years has been a team coach for a competition teams at Colorado State University, and at Texas A&M University. It is the researcher's belief that the competitions provide opportunities for students to network, improve their resumes, and to

experience construction management in a way that is impossible in a typical classroom. As a student, professional, and now educator the researcher has seen and personally experienced the positive effects of competition participation. It is that experience that has led to this research, seeking measurement of the positive effects of competition participation. In hearing and speaking to others who have been involved in the competitions, many share the same feelings. While complaints about specific aspects of competition have been heard, the researcher has yet to encounter anyone who feels the negative effects are not outweighed by the positive. This and future research, are hoped to provide validation of the researcher's personal experiences as well as the results found in the Colorado State University pilot study.

### **Study Organization**

The remainder of this study is organized into four chapters, a bibliography, and appendices. Chapter two presents a review of literature on the subject of student competitions. Chapter three provides the detailed methodology utilized for this study. Chapter four contains the researcher's analysis and report of the findings. Finally, Chapter five gives a summary of the study including, discussion, conclusions, and recommendations. The bibliography and appendices follow to provide additional information the reader may find useful.

## **CHAPTER 2: LITERATURE REVIEW**

### **Literature Search Process**

The primary means of searching for literature on the topic of student competitions was through key word searches in various databases and search engines. It was found that literature regarding student competitions among all ages and academic disciplines was available from a wide variety of sources. The databases and search engines utilized for this literature review included: EBSCO Host wherein, Academic Search Premier, ERIC, PsycINFO, Business Source Premier, and Applied Science & Technology Abstracts were used. Additionally Compendex, ProQuest Dissertations & Theses, and Google Scholar were used. Finally a search within the Associated Schools of Construction (ASC) web site under the publications link was done to verify the inclusion of any published works from the International Journal of Construction Education and Research and ASC conference proceedings.

The words: student, undergraduate, academic, competition, contest, and outcome were the terms most commonly used in these searches. These terms were used individually and in many different combinations as the search for literature progressed. Most frequently, the combination “student competition” in the abstract of existing literature, was the initial search parameter. Searching for “competition” in document titles

and “student” in the abstract was also commonly used. Following each of these initial search parameters, others were introduced to refine each search. Different variations of the search parameters produced varying degrees of success in finding applicable literature.

The primary method of search was through the use of electronic data bases and search engines. But as relevant literature were located through those means, references and bibliographies provided more literature, applicable to the subject.

### **Overview**

The body of work regarding student competitions across all age groups and academic disciplines provided information from many different competitions about the positive effects of student participation in competitions. Many academic disciplines have student competitions. Their formats range from competitions associated with farm animals at the K-12 level to competitions associated with design and construction of high performance solar powered race cars by university engineering students (Anglin & Robson, 1997). For this review, competitions that are principally extracurricular in nature, which pit students against students from other schools, and those occurring at the post-secondary level were the initial focus.

There is ample literature regarding competitions, however it quickly became apparent that empirical studies were limited. Non-empirical studies and commentary arising from observation and participation in different competitions, constituted the greater part of the literature on this topic. Because of the shortage of empirical literature, the initial search parameters, seeking extracurricular post-secondary competitions, became a

lesser focus. Literature relating to all three of those criteria was considered ideal but, the use of literature meeting any of the three criteria became necessary.

A broad range of disciplines have competitions that fit at least one of the criteria for this review, however engineering provided the greatest amount of literature regarding student competitions. It can be surmised that this occurred within the broad scope of engineering because there are many disciplines and thus many differing competitions. The body of work relating to construction management competitions, on the other hand, was limited to only a handful of articles. Of those, most focused on describing the competitions with little consideration given to what the positive or negative effects might be to anyone involved, including students. Because of this general lack of published data relating to student competitions in construction management, information about competition histories and purposes primarily came from one article, personal communications (e-mail) with organizations that organize competitions, and individuals who have been involved since the inception of construction management student competitions.

The literature indicates that construction management is not the only academic discipline with a very limited amount of research regarding competitions. Marra (1996), who has published multiple papers regarding a national advertising competition, encountered only “scant literature relating to the competition”. In a study related to vocational and technical education the authors state: “Little actual research can be found among the myriad of articles and papers in the professional and research literature dealing with VSO’s (Vocational Student Organizations) and student outcomes” (Camp, Jackson, Buser, & Baldwin, 2000, p. 4). One Engineering researcher noted that despite significant effort and resources devoted to student competitions, there is no data on the breadth and

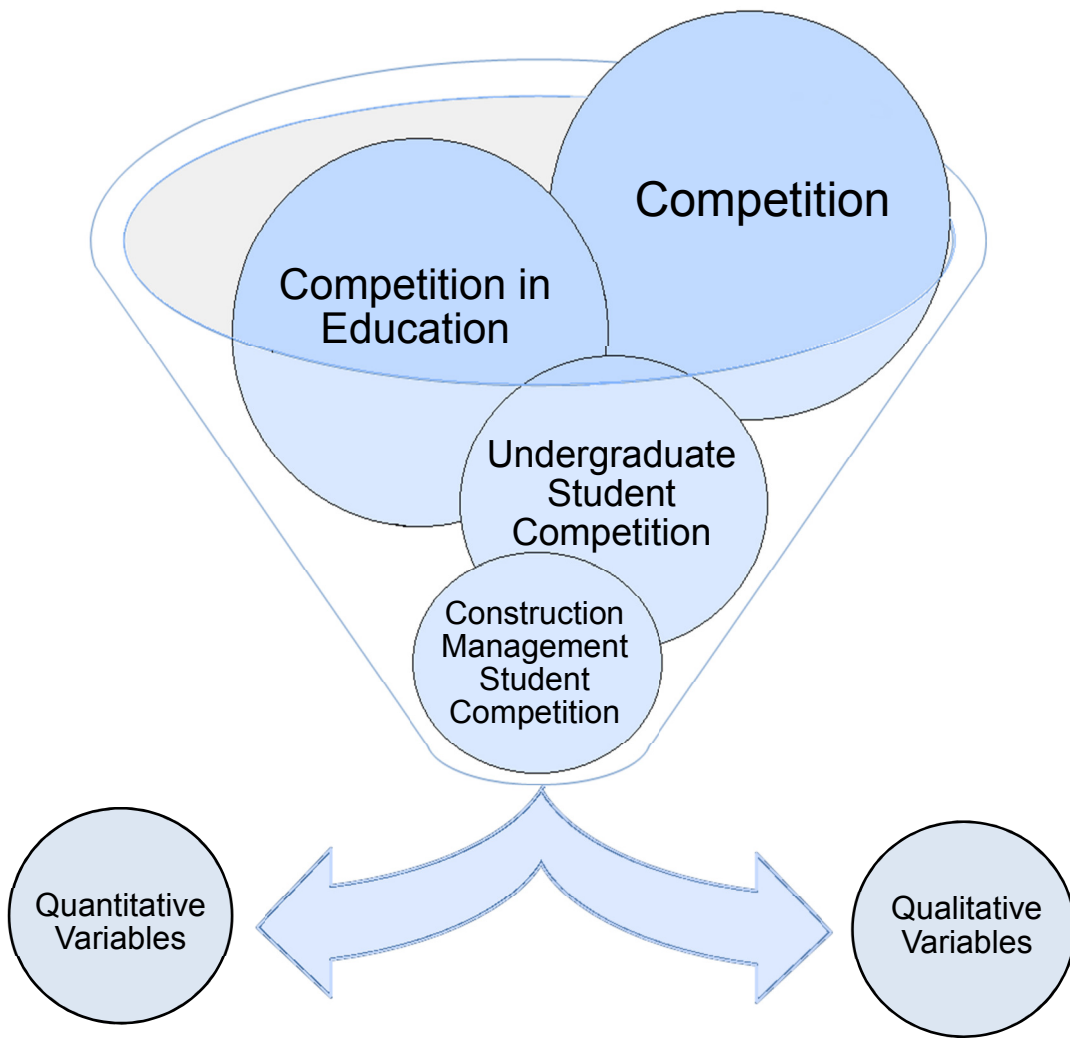
range of competitions (Wankat, 2005). An absolute reason for this lack of research is unknown but one study noted “it is not possible to draw quantified pedagogical conclusions of the benefits that resulted” (Labossiere & Bisby, 2010, p. 49). One recent article summarized the lack of research, stating:

A search shows that the majority of articles available explore the types of competitions and the expectations of those competitions.” However, “The published literature on the educational effects and influences of academic competitions has relied on anecdotal testimonials, survey research, and a few case studies. The lack of a body of solid research, either quantitative or qualitative, makes it nearly impossible to draw conclusions from the studies on this topic. It appears that the studies available lacked rigor in the research design. (Omdal & Richards, 2008, p. 13)

The lack of empirical study regarding student competitions makes producing a review of literature more difficult but, indicates this research will contribute to the foundation of the body of knowledge on student competitions in construction management as well as other disciplines.

### **Guiding Framework**

The relatively small body of literature relating specifically to student competitions in construction management, as compared with the amount of literature dealing with student competitions in all disciplines, led to the guiding framework for this literature review. Figure 2.1 is a depiction of this literature review’s guiding framework. This review begins with a broad historical look at competition and narrows to competition in specific educational disciplines at any school level. The review then focuses on



*Figure 2.1* Literature review guiding framework.

undergraduate student competitions, continuing to address competitions from different disciplines. The discipline of construction management specifically is considered last. This review then addresses the qualitative and quantitative variables considered in this study.



## Competition

Competition has been used for many years to try and elicit the very best from men and women in every facet of life. Competition has been a means to find out who the “best” is, in everything from professional sports to elementary school spelling bees. To compete and be the best (or maybe just better than the next guy) has been a driving force behind individuals and movements throughout history (Verhoeff, 1997). The use of competition continues today searching for talent to meet the growing demands in many industries (Omdal & Richards, 2008).

Early formal competitions were restricted to sports and games, and are known to have taken place as early as 2000 BC, but they likely were occurring long before that. It is known that the Greeks held their Olympic games from at least 776 BC, and it is believed that by that time the games had been occurring for at least 500 years. By the 11<sup>th</sup> century French and other European country’s military exercises had evolved into contests (Verhoeff, 1997).

Examples of early competition come from athletics and the military, but undoubtedly informal competition has always existed among men and in nature. Survival of the fittest or Darwin’s theory of natural selection hearkens to the seemingly innate role of competition in the natural world, where a species that cannot compete (find food/water, outwit its predators, and procreate) will eventually become extinct (Darwinism, 2008; Allaby, 1999). This type of informal competition plays out daily in the natural world.

It is not clear whether the desire to compete is inherited or acquired, but clearly children have a desire to compare themselves with others in every way. First born children are likely to be fierce competitors (Reiter, 1999). Running and games for example are beneficial to a child’s development, but from that play, physical and intellectual contests

come quickly and easily (Verhoeff, 1997). Given the lengthy history of competition both formal and informal, and the seemingly natural tendency of both man and beast to compete, it should come as no surprise that competition has found its way into many aspects of life including education.

### **Competition in Education**

Arguments for and against competition in education are typically based within disciplines, making discussion within specific disciplines necessary. The studies found in this review consider either a specific competition over time, or individual competitions as case studies. Although discussion within specific disciplines is necessary, first a general discussion, without regard to discipline, of potential positive and negative effects, is given.

The wide variety, differing formats, and varied subject matter make consideration across any discipline difficult. However, the common thread of competition gives relevance to good and bad findings across disciplines.

Opponents of competitions cite experiences such as the artist Gabriel de Saint-Aubin abandoning all career ambitions after failing to win a student competition (De Beaumont, 1998), or the negative effects of heated debate and argument among students (Tisdell & Mulva, 2007) as evidence of the negative effects of competitions in education. Clinkenbeard (1984) states that: “competitive goal structures in classrooms, with their emphasis on social comparison and normative evaluation, have negative effects on most students’ self-worth and achievement” (Anglin & Robson, 1997, p. 5). A more recent study reported similarly that, in competition, differences are spotlighted. Confident students might exhibit superior performance, while low performance students often find

themselves feeling depressed, frustrated, or inferior (Cheng, Winston, Calvin, & Tak-Wai, 2009). In the discipline of music, most band “survivors” can tell horror stories related to competition that may have created a sense of humiliation and shame for both students and teachers (Robinson, 2008). In one construction competition, the complexity of the subject led students to feel so overwhelmed they were on the verge of giving up (Gehrig & Cottrell, 2007). Although exact numbers and reasons for teams dropping out of competitions are unknown, these challenges likely contribute to attrition. Emotional and psychological impacts aside, Schuster and Mello (2006) note that competitions can distract students from their course work leading to inadequate design work, in favor of a build and test approach. Despite these concerns, competition continues to thrive in education. Perhaps because, in addition to the excitement and attention it draws, it is a well-structured activity with clearly defined goals for students (Cheng et al., 2009).

In their study, Anglin and Robson (1997) noted that; “most of the published information regarding competition for educational purposes is negative, which when compared to the favorable success of past competitions is very ironic”(p. 5). On the other hand in this review, the researcher encountered the opposite of Anglin and Robson (1997). Most of the literature was positive in regard to student competitions. Further, when the review was limited to only post- secondary competitions, the literature favored them. Burguillo (2010) found that competitive games promote learning in secondary and higher education, and when competition is used properly it can increase the motivation of students and lead to higher educational achievement. Another study found that students involved in academic competition had an improved attitude toward school, while students not involved in competition showed a decline in this area (Ballowe, 1985). A particularly significant finding regarding participation, that also refutes some of the literature opposed to

competitions, was that winning or losing doesn't seem to matter, students who are involved have positive attitudes towards competitions either way (Cassillo, 1987).

Anglin and Robson (1997) report that, participation in competitions improves a student's education. This finding was reported generally, however other research indicates specific areas where education is improved. Students who participate in competitions are provided with opportunities for hands on learning (Sirianni, Lee, LeFevre, Lindholm, Aghayere, & Valentine, 2003; Kaiser & Troxell, 2005). Based on observation, others report that participants are more motivated (Schster, Davol, & Mello, 2006; Kasier & Troxell, 2005). Empirically, Anglin and Robson's (1997) survey data showed that student motivation was greater for competitions than for a three-hour construction class. These same sources report, based on observation, that participants have experiences which closely mirror the real world with activities not possible to reproduce in a classroom (Anglin & Robson, 1997; Schster et al., 2006; Kaiser & Troxell, 2005).

An improvement in student's education benefits schools as they should produce better graduates, but participation in competitions also provides good public relations (Battersby, 1994) and free advertising (Pullin, 2003) for schools. Among the more tangible positive effects reported for students are: better employment, networking opportunities (Orlandella & Zeigler, 2002; Sepahpour & Chang, 2005; Sirianni et al., 2003), and improved problem solving, communication and/or teamwork skills (Sirianni et al., 2003; Gehrig & Cottrell, 2007). Although some of these findings come from observation, they are also the results of survey data.

None of the data gathered regarding student competitions in construction management indicated a negative educational experience. However, for construction

management students there is an additional factor that bears consideration, despite the possibility of negative effects:

Everyday thousands of contractors competitively bid construction projects across America. Although the competitive bid method of project delivery has many problems associated with it, our society continues to demand that only the lowest bidder be the "winning" bidder. When the best of contractors only win approximately one out of ten competitively bid projects it becomes apparent that we as educators must consider the lessons to be learned from losing (Anglin & Robson, 1997, p. 13).

These lessons should be stressed as part of a construction management student's education. As an observer in Clement's (2001) research put it: "Perhaps they will benefit more from defeat than they would have from victory," because a failure can provide an opportunity for reflection and self-improvement (Cheng et al., 2009).

Formal large scale competitions are a relatively recent phenomenon in education (Verhoeff, 1997), however competitions in general have enjoyed a long history in the educational arena. In the 1<sup>st</sup> Century B.C., Marcus Verrius Flaccus, a Roman teacher, introduced competition among his students. In the 18<sup>th</sup> Century, scientists working in the academies organized successful competitions for prizes to encourage the solution of mathematic and scientific problems (Verhoeff, 1997).

Competition in education has grown to encompass nearly every discipline. Student competitions ranging from national events pitting different schools against one another to simple competitions between classmates have evolved and been developed (Anglin & Robson, 1999). Most academic disciplines today have their own competitions, and each discipline follows with its own research and thus its own findings. The findings from

competitions in a handful of disciplines will be discussed here, beginning with competitions among younger students and moving to post-secondary students.

### **General Academics**

According to Verhoeff (1997), William Lowell Putnam started a mathematics competition for North America in 1938, but in 1959 the international Mathematics Olympiad (IMO) became the foremost competition in mathematics (IMO, 2009). The IMO was soon followed by other sciences: physics in 1967, Chemistry in 1969, informatics in 1989, biology in 1990, and astronomy in 1996 (Verhoeff, 1997).

Empirical findings considering mathematical achievements and participation in the IMO, indicate that performance in the IMO does not correlate to later achievements in mathematics (Verhoeff, 1997). Although a correlation was not found associating later achievements with participation, other research indicates different positive effects. Using a pretest posttest experiment Ballowe (1985) found that among fifth to twelfth graders, participants had improved attitudes toward school, and in a study of the Wisconsin Academic Decathlon, survey and interview data showed students grew in self-confidence, self-esteem, and the ability to communicate and work cooperatively (Cassillo, 1987). With the support of good methodologies these studies in general academic disciplines provide good support of academic competitions.

Other non-empirical studies also report that participation is a positive experience. In mathematics participants gain a deeper understanding of the subject matter (Grugnetti, 2005), and they appreciate the challenge and social aspect of competitions (Reiter, 1999). Cassillo (1987) reports personal growth and development through participation as positive effects.

## **Music**

Within a similar age range as the Academic Decathlon, organized student competitions occur in many musical settings, from solo and ensemble to marching band to chair challenges for individual instruments. As with other disciplines, the literature reports positive effects, but the strongest opposition to competitions were found relating to music.

Empirical evidence supporting competition in music reported increased student motivation, but the same study found that almost 1/3 of students did not believe competitions to be a good educational experience (Battersby, 1994). Based on survey results, Robinson (2008) reports an aversion to the culture of competition in band that was driving instructors away from it in favor of general music instruction. Unfortunately Robinson did not have data indicating why this is occurring, it could only point to examples of failure and humiliation as an anecdotal explanation. Rickels' (2010) study reports that a band's performance is not the only factor in winning a competition, that a larger band with more assistants has an increased probability of winning. On the surface that finding seems to favor larger schools, but because there was no discussion of how a larger band with more assistants, and thus more instructors, might lead to better performance and more wins at competitions, the finding should not be accepted without question.

The findings by Battersby (1994) that students did not view competitions as a good educational experience, and by Rickels' (2010) that in band competitions the selections of winners may not be wholly based on performance, could provide an explanation for Robinson's (2008) finding that competition was driving instructors away from band.

The negative aspects of competition reported in music are a sharp contrast to most other disciplines where competition is viewed more positively. The literature in music is

not all negative though. Studies in support of musical competitions report positive effects such as constructive criticism, opportunities for student growth and encouragement, and team members connecting as a family (Battersby, 1994). Given the negative effects reported, questions certainly exist as to whether competition in music is in need of change.

The strongest opposition to student competitions was found in music, among the same age ranges however, there is strong support for extra-curricular competitions in other disciplines. One strong example among younger students comes from 4-H.

#### **4-H**

Perhaps the best example in support of competitions for younger students is 4-H. The 4-H organization sponsors competitions in topics ranging from health and nutrition to animal husbandry. Research shows that participants maintain better grades than their non-competing counterparts (Astroth & Haynes, 2002), so positive educational effects are obvious. More interesting though, are the social impacts for students who participate. Students who were involved are less likely to drink alcohol, shoplift, use drugs, drive while intoxicated, ride with a drunk driver, purposely damage property, and smoke or use smokeless tobacco. Even more astounding, is that the students most likely to participate in 4-H come from demographics where these social issues are most often a problem (Astroth & Haynes, 2002).

Because the findings of this study are extremely positive, it is important to note that proper methodological steps were taken to ensure validity in the research, making these favorable results even more powerful. The researchers randomly selected counties and then two school districts within each of these counties. Using a 74-question survey of high quality (valid and reliable) questions taken from other national or state surveys, all



fifth, seventh, and ninth graders were surveyed returning nearly 2,800 surveys from more than 50 schools.

Research also indicates that 4-H has positive effects on other competitions. 4-H Chapters in some locations offer a “Gateway Academy” to prepare students for science, technology and engineering (STEM) competitions, and 90% of those participants said they would do so again (Ivey & Quam, 2009).

### **Future Farmers of America**

With programs similar to 4-H but operating only at high schools, the Future Farmers of America (FFA) have a long history as a sponsor of co-curricular competitions. Strongly focused on teaching and developing skills that young people can translate into agricultural careers, FFA competitions provide exposure and education to topics students don't get elsewhere. The results of interviews in one study report that students didn't feel winning was the most important factor, and they appreciated the process of the competition (Coleman, 1996). However an advantage to FFA competitions is that they often award scholarships to winners and their FFA chapters (Rural Cooperatives, 2008).

Despite their long history and the size of FFA, very little literature was found addressing competitions among these students, and even less documenting the positive effects of participation. As with some other disciplines most of the literature is limited to reports of who competed and what if any prizes were awarded.

Very similar to the FFA and 4-H are vocational and technical education competitions. The goals, organization, and age groups of vocational and technical education competitions and the FFA are very similar. In fact 4-H, & FFA teams are often

coached by the same faculty members as vocation and technical education teams (Ivey & Quam, 2009).

### **Vocational and Technical Education Competitions**

Common among secondary education students are co-curricular vocational and technical education competitions. Sponsored by groups such as: The Vocational industrial Clubs of America (VICA), Technology Student Association (TSA), and Technology Education Collegiate Association (TECA) these competitions involve tens of thousands of student participants each year. They are well known, and are well supported by industry (Tech Directions, 2003; Grady, 2003; Tech Directions, 1999).

Vocational student competitions are widely accepted, without question of their value in a student's education, but there is little research to support the validity of the competitions (Camp, Jackson, Buser, & Baldwin, 2000). Non-empirical study of vocational and technical education reports that students improve their job prospects as they learn to do in school what they will do in their careers (Linnell, 2007; Tech Directions, 1999). So students gain employability skills through the competitions (Grady, 2003). Further, students make connections between science, technology, and engineering through participation (Ivey & Quam, 2009). Ivey and Quam (2009) also report that vocational and technical education competitions improve critical thinking, communication, problem solving, collaboration, entrepreneurship, and leadership skills (Ivey & Quam, 2009). A different article reports increased student motivation, and teamwork skills (Tech Directions, 1999), all of which contribute to the competitions giving students a head start (Grady, 2001).

In their study Camp et al. (2000) were unable to find any literature with empirical support for student competitions in vocational and technical education. More than 10 years later, this review of literature found that still to be the case. Non-empirical studies provide strong support for these competitions, however vocational and technical education remains a discipline where empirical research is needed. Such research might support the long held belief that competitions contribute to the accomplishment of vocational and technical education goals (Camp et al., 2000). Although the literature lacks supporting methodology, because competencies tested in these competitions are set by industry (Tech Directions, 2003), it is understandable that those involved remain convinced of these competitions' value (Camp et al., 2000), particularly as a means for preparing students for their careers.

Vocational and technical education competitions have strong support both from educators and industry. Often considered part of vocational and technical education, robotics competitions enjoy similar levels of support from educators and industry, however robotics have the benefit of empirical study supporting them.

### **Robotics**

While general vocational and technical student competitions themselves lack empirical support, robotics competitions do not. With competitions that begin in elementary school and continue all the way through college, robotics draws from a very large participant base (Chew, Demidenko, Messom, & Sen Gupta, 2009; Yim, 2008). One study reports that 90% of competition participants would participate again, and over 50% of participants were not motivated by the prizes offered (Chew et al., 2009). Another study, more focused on the educational value to students, found that 97% of the students

saw the advantages and value to working in a team (Avanzato, 2009). These students also rated their competition as a 4.3 on a 5 point scale, and 93% said they would recommend the competition to another student (Avanzato, 2009). Both of these studies concluded that the competitions facilitate and encourage students to pursue education and careers in robotics or a closely related field (Chew et al., 2009; Avanzato, 2009). The findings of these studies are positive and support the goals of robotics competitions, however they are all the results of post competition surveys. As such there is the likelihood that they are skewed. It is probable that there were higher levels of reporting from students who had a positive experience at the competition, than from those students who did not. (Although this threat to validity may have been addressed; there was no discussion in the articles indicating if steps were taken to obtain a random sample or to survey the entire population.) Nevertheless, these findings provide good support for robotics competitions.

As with other disciplines, robotics competitions are not without positive effects reported in non-empirical research, and they are similar to those previously discussed relating to other disciplines. Creativity, practical experience (Yim, 2008), teamwork, problem solving (Cooley, Famouri, Collier, & Inman, 1999), and actually “making” something (Firebaugh & Piepmeier, 2008) are a few.

Among pre-college level student competitions, robotics represents the most studied and perhaps the largest competition format available. With competitions that start in grade school and extend past college age, the field is likely to see a great deal of further study and growth.

Findings relating to student competitions at a pre-college level are abundant, and while these findings have come from both empirical and non-empirical studies, overall they favor competitions. Given the variations in competition subjects, organization, and

ages, as well as the differences in data collection and biases of observers, the generally positive reports should serve as a good indicator that the effects are legitimate.

### **Undergraduate Student Competitions**

Among college level competitions, methodologically both qualified and unqualified studies have been performed, and no strong findings in opposition to student competitions at the college level were encountered. If all of the competitions were extra-curricular with voluntary participation, this might come as no surprise, but competitions occurred both through classes and as part of extra-curricular student organization activities. Given the broad support of competitions at this level, it could be assumed that extensive empirical research supports competitions, but that is not the case. There are empirical studies supporting competitions at this level, however most of the literature is non-empirical. Non-empirical study still provides insight into competitions, however reported findings must be cautiously considered since most are essentially the opinions of observers and/or participants.

#### **Computer Science**

The computer science competition sponsored by the Institute of Electrical and Electronics Engineers (IEEE) Computer Society is a good example of a competition where only non-empirical study has occurred. The competition's stated goal is to advance excellence in education by having student teams design and implement computer-based solutions to real-world problems. The IEEE reports that students learn teamwork skills which are often neglected in standard curriculum but are highly valued by industry

(Clements, 2001). No empirical study could be found indicating if the competition's goals are met, or if students indeed learn teamwork skills.

In computer science competitions, as in many disciplines, the lack of empirical data has not deterred support for competitions. The Computer Society International Design Competition (CSIDC) garnered participation from around the world (Manuel, 2003), and in 2003 Microsoft awarded the competition one million dollars (Computer, 2003). The money involved in the CSIDC competition is a differentiating factor from other disciplines and leads to the undeniable student benefit of cash and scholarship prizes to the top teams. In 2001 top teams could win up to fifteen thousand dollars (Clements, 2001). In 2004 a fifteen thousand dollar top prize was again at stake (Computer, 2004), and in 2005 that prize increased to twenty thousand dollars (Computer, 2005). Research could not be found indicating if these large prizes had impacts on student participation and motivation, or if they produced other positive effects. However after the 2007 competition was canceled because of a lack of funds (Clements, 2006), it is possible that these types of monetary incentives may be unsustainable. The CSIDC planned to launch the competition again in 2008 however, the competition did not take place in 2008 or 2009.

It is not the intent of this review to evaluate the effectiveness of a competition but, the literature on the CSIDC competition seems to indicate that money cannot be the driving force behind participation, if a competition is to have longevity and ultimately meet its goals.

## **Communication**

A large scale competition for communications students could not be found, in this discipline the use of smaller scale competitions is predominant. This way, individual

student organizations are able to raise funds by hosting smaller competitions (Bowman, Jones, Leonard, & Muller, 1995). As with computer science, the literature on communications competitions was devoid of any empirical study, however the literature reports that students gain valuable critique of their work, are able to network with professionals, and gain recognition for themselves and their school (Bowman et al., 1995; Ratcliffe, 2000). Similar to music, communication students were reported to receive useful criticism of their work, but unlike music there were no negative reports for student communication competitions.

### **Architecture**

Professional critique is also a reported benefit in architecture. The first known student competition in architecture was The Concorsi Clementini of 1728 conducted by the Roman Academy of St. Luke (Cousins, 1982). Competitions in architecture continue today across the country and around the world. Occurring in classes and studios as well as on a larger scale, the literature reports that participants gain generous analysis and useful feedback on their submissions by respected professional architects (Henault, 2007), and firsthand experience in guiding the design process (Mansy & Bilbeisi, 2008). While the positive effects reported may be true, as with other non-empirical studies, they lack methodological support and in most cases are little more than anecdotal observations by faculty members.

Although unstudied, an additional benefit reported in architecture that is hard to deny, is the opportunity to contribute and work on “real” projects which, in some instances, are the subject of the competition (Architectural Review, 2006). This benefit provides not only critique and feedback but also professional experience for students.

## **Program Evaluation**

Positive effects in program evaluation competitions include; working in high pressure situations, developing teamwork skills, and learning to communicate (Seasons & Meyers, 2003; Nykiforuk, Gavin, Yessin, Spencer, Lauzon, Pearce, & Cyarto, 2003). The most interesting finding reported in program evaluation however, addressed specifically how students learn to work in high pressure situations. “They learn to make the transition from perfectionist to “satisficer”, learning to do “well enough” in less than ideal circumstances” (Seasons & Meyers, 2003). In a normal class atmosphere some instructors might argue that most students already operate as “satisficers”, but when considered in the context of student competitions where participants are thought to typically consist of more dedicated students and there is a heightened desire to perform in order to win, the idea of a “satisficer” is unique. No further literature was found addressing this concept nor does this study directly address the issue. This finding may be an important distinction regarding how competitions are organized. In a competition structured to a short time frame with extensive deliverables, becoming a “satisficer” and delivering “well enough” may be the result, while in a competition with a longer time frame nothing short of a student’s very best is likely necessary.

## **Business**

Although many student competitions involve decidedly business related components, such as a financial analysis, or creation of a budget, and a marketing plan, as part of the problem, literature relating to competitions specifically for business was limited. Research about positive effects on student competition participants in the discipline of business were difficult to find, but the literature encountered had much better



methodological support than studies in other post-secondary disciplines. The best study found addressed a student competition in the business program at Baylor University. Rather than a national or regional competition, this competition involved student groups within the business program at the university. While this competition was geared toward teaching teamwork, it was also found to out-perform a traditional academic experience in reinforcing important class concepts, in enabling students to relate course concepts to the real world, in encouraging critical thinking and analysis, in teaching teamwork, and in generating more learning (Umble, Umble, & Artz, 2008). Although this study is essentially a case study considering only one cycle of the competition, it strongly supports the use of competitions in curriculum as the basis for a complete program of study, covering multiple courses and topics. Utilizing a survey of all students who participated, the study's means of data collection gives it additional weight.

A different business competition, sponsored by Google, found that competition stimulated student interest in technology and marketing, and provided an experience that could not be replicated in the classroom (Rosso, McClelland, Jansen, & Flemming, 2009). This study was also essentially a case study considering only one competition. Student feedback, as with the Baylor study, were collected from all students so although data from only one group was used, including the entire group in the sample helps the reliability of the results.

## **Advertising**

The National Student advertising Competition has taken place since 1973 (American Advertising Federation, 2009), and has had as many as 30% of all advertising students participating in a single year (Marra, 1996). As with many extra-curricular

university level competitions, almost all that was known about the competition came from the advertising industry, so after failing to find any research on its effects, Marra (1992) conducted his own study and found that student outcomes from participation are positive. A full 97% of students agreed that the competition was more demanding of their time than any other project, but that it was worth the time spent, and that it helped them learn how to work as part of a team. In a later study Marra (1996) considered faculty member's perceptions of the competitions and found that 73% strongly agreed that the competition was a valuable learning experience for students, and nearly half believed that the competition taught students more about advertising than most classes.

Marra's studies were methodologically well grounded, and as some of the only research conducted in advertising, Marra's research is a good example of the shortage of research on student competitions. The finding of "scant" research on the topic (Marra, 1996) further indicates a need in other disciplines for research on the effects of competition.

## **Engineering**

Participation in student engineering competitions is extensive, in part, because of the many different specialties (such as mechanical, civil, or electrical) under the broad heading of engineering. Containing both empirical and non-empirical research on student competitions, engineering represents the only discipline considered in this review, where more than a minimal amount of literature was found.

Engineering competitions range from national level events like the Concrete Canoe, Steel Bridge, and Formula Student competitions to in class competitions. One of the first student design competitions in engineering took place at MIT in 1979 (Cooley et al.,

1999). With a little more than thirty years of history, student competitions in engineering have seen tremendous growth.

Student engineering competitions, claim many of the same positive effects reported in other disciplines. For instance: students experience hands on projects (Pai, Filatovs, & Layton, 2000; Wankat, 2005; Kaiser & Troxell, 2005), participants gain recognition for their schools (Schster, Davol, & Mello, 2006; Professional Engineering, 2003), students experience an external evaluation process or critique (Kasier & Troxell, 2005), and the competitions are great motivators for the students (Kasier & Troxell, 2005; Wankat, 2005). Perhaps the most interesting benefit reported is the passion participants develop for engineering (Schster et al., 2006). An impressive 85% of engineering students felt their competition was a good experience (Wankat, 2005), and 56% of students, who were not members of student chapters (and thus involved with competitions), felt they missed out (Emerson & Mills, 2003). It seems clear from Emerson and Mills' (2003) finding that many students, who don't participate, recognize that they have "missed out" and that there are positive effects to participation.

Competitions in engineering are also reported to improve teamwork, and to encourage students to pursue further education and careers in the field of engineering (Dave, Janak, & Boronkay, 1997). Two additional studies report that participants experience more learning, creativity and teamwork, and greater synthesis of their education with future employment (Labossiere & Bisby, 2010; Orlandella & Zeigler, 2002). Although mostly positive, engineering competition was not without criticism. Schuster et al. (2006) reports that for those studying engineering and design, competitions can distract students from courses, lead to inadequate design work in favor of a build and test approach, and design changes for their own sake. Others criticize the sometimes vast

amount of time students spend on the competitions (Wankat, 2005), leading to neglect of course work and imbalance in their lives.

These criticisms represent valid negative aspects of competition, however like many of the positive effects reported, they are not empirically supported. The literature as a whole reports positively on competitions. In their 2003 study, Sirianni et al. conducted a survey among students resulting in strong support for participation in student engineering competitions. They found that participants had higher GPAs than non-participants, and also found that participants rated themselves higher in a series of personal development and professional skills categories than students who did not participate. The results of their survey indicated that participation enhanced student self-confidence, enthusiasm for the discipline, and job opportunities. The Sirianni et al. (2003) methodology is adequate to report a relationship, lending the findings credibility. However, because it used a basic comparative approach, the researchers should have taken greater care in reporting causation, particularly since there was no discussion of how higher GPAs could have contributed to the positive findings, or if it was simply students who earned higher GPAs who participated in the competitions.

One well known competition in engineering is the formula student competition. Students involved, design, build, and race formula one (F1) type race cars (this competition has also morphed into building other types of race vehicles such as baja buggies, and hybrid cars.) As reported in some other disciplines, real life experience and better job opportunities are reported as positive effects for participants in these competitions (Professional Engineering, 2007; Professional Engineering, 2003). Regarding job opportunities further context is given, competition participation motivates students and allows them an opportunity to showcase better understanding of concepts

relating to time and money than others who may have higher academic qualifications, but do not compete (Professional Engineering, 2007).

Formula student also reports that student participation improves outcomes on three of the Accreditation Board for Engineering and Technology (ABET) requirements, specifically (d) ability to function on a multi-disciplinary team, (g) ability to communicate effectively, and (e) knowledge of contemporary issues (White, McKisson, & Barott, 2007). In engineering, this finding is not exclusive to the formula student competition. Schrage (1997) reports that competitions in coursework better prepare engineering students to meet ABET requirements, and the concrete canoe, and steel bridge competitions are also reported to contribute to the ABET requirements (Sirianni et al., 2003).

As with the formula student competition the concrete canoe and steel bridge competitions encourage students to use their problem solving abilities in developing an acceptable design and making the design become a physical reality (Sirianni, et al., 2003). Orlandella and Zeigler (2002) report that some companies specifically ask to interview students who have participated in the concrete canoe and steel bridge competitions. They also note that the competitions require students to excel in teamwork, creativity, and problem solving. A study found that participation in the concrete canoe and steel bridge competitions enhances leadership, project management, teamwork, design and construction, and communication skills (Sirianni et al., 2003). It should also be noted that the higher GPA finding among competitors, discussed earlier, occurred among participants in the concrete canoe and steel bridge competitions.

The merits of the concrete canoe and steel bridge competitions are fairly well documented. They are not without critics however. Labossiere and Bisby (2010) state that they have limited value beyond teamwork, experience, and practical and spatial reasoning.

They cite the need for students to have a self-awareness experience related to the engineer's role in preserving public safety. They further argue in favor of design competitions where an actual structure be built or a real project serve as the subject of the competition.

Having students participate in competitions where the subject of the competition is always a real project is certainly an ideal situation and could have a tremendous positive impact on students' educations. However it seems that Labossiere and Bisby (2010) are "splitting hairs" in their argument. While a real project would always be an ideal competition subject, real projects are not always available or even feasible for use in student competitions. It is not the purpose of this study to identify the best competitions, however it seems obvious that student participation in a less than perfect competition is favorable to not participating in any competition at all.

Student competitions in engineering are perhaps most closely related to those in construction management. Arguments in favor of and in opposition to competitions in engineering and construction management are similar. A few of the competition elements which mimic those of professional engineering practice include; simulating customer/client relationship, and highlighting the competitive nature of engineering in general (Kasier & Troxell, 2005). These elements can also be found in construction management. Because of the shortage of literature regarding competitions in construction management (discussed further in the next section), literature from the discipline of engineering is included here as part of the knowledge base.

## **Construction Management Student Competitions**

Construction management competitions have not been around as long as those in some disciplines, but they are well established with thousands of students participating yearly. The first competitions in Construction Management education took place in 1986 or 1987, organized by the ASC (C. Gains, personal communication, November 12, 2009). The ASC is divided into seven different regions and in the years since the first ASC competitions, each of the seven regions now organizes its own set of competitions in various categories. An extension of the ASC competitions was held from 1999 to 2009 by the AGC (Associated General Contractors, 2009). This competition pitted the winners from each of the seven ASC regions for a National Student Championship. The ABC quickly followed the ASC, holding their first student competition in 1988 (J. Strock, personal communication, November 12, 2009). The NAHB has also been holding student competitions since 1988 or 1989 (S. Nellis, personal communication, July 12, 2010).

These competitions are run by different organizations, but they share common goals such as: synthesizing all of the student's course work; interacting and networking with construction industry professionals; honing critical thinking and problem solving skills; showing the necessity of communication on projects; and providing real-world construction management experience without risk (J. Strock, personal communication, November 11, 2009; C. Gains, personal communication, November 12, 2009).

Although they share common goals, the competitions originated for different reasons, which are reflected in their formats. The ASC competitions give students a matter of hours to solve a problem and produce a deliverable. They are intended to test what the students know to allow comparison of different schools. The ABC and NAHB competitions however, give students several months to solve a problem and produce a

deliverable. These competitions are geared more toward an experience where the students must go out and learn for themselves how best to address a problem.

Construction management education competitions have been occurring and influencing construction higher education for at least 23 years, but only three studies were found that consider the effects of construction management student competitions. In total six articles, three of which are empirical, relating to construction management student competitions were found. Of the remaining three one is non-empirical, one a press releases of a competition's problem and the winning solutions, and one documents the first ASC competition in region III.

The non-empirical study reported that the environment of competitions fosters an incredible transformation in students, moving them from expecting to be taught to wanting to learn. In addition, the study reports that students integrate their entire education into finding a solution and that win or lose "it will be your students best experience of the year" (Nobe, Glick, & Johnson, 2006, p. 19). Because of the non-empirical nature of this article the positive effects reported are considered opinion as they are not substantiated by any methodology. This article however, is a very accurate portrayal of the strong positive opinion held in construction management education toward student competitions.

The conclusions drawn in a case study of one co-curricular construction management competition were that the projects made students raise their work ethic, apply the knowledge they had gained, work as a group, and gain real world experience (Tisdell & Mulva, 2007). This study provided positive findings regarding the value of competition participation for construction management students. The reported findings also mirror those from other disciplines. Unfortunately the survey sample size (or lack thereof) and



the abundance of subjective opinion injected by the author, indicate the conclusions are likely biased, putting a question mark next to the reported findings.

A second case study regarding the ASC competitions weighed heavily on the preparation side of competitions and the learning curve associated with first time participation (Gehrig & Cottell, 2007). This case study collected mostly qualitative data; however it appeared to be unbiased and objectively evaluated. The researchers state that the student team reported learning a lot and were glad they participated, in addition they learned that the technical aspects were only one half of the problem, the other half being communication and teamwork (Gehrig & Cottrell, 2007). This article focused primarily on the logistics of the competition and first time participation, but it did not discuss in any further depth the effects on students, nor did it make any comparisons between students who participated and those who did not. The article has little applicability to this research, beyond the general subject of student competitions in construction management.

The third empirical study on construction management competitions was clearly the best, with a scope and methodology which make its findings reliable. The study collected data via survey of students and coaches at the 1997 ASC region V competition. It concluded that the competitions are a positive educational experience (Anglin & Robson, 1997). Based on survey data collected, the study found that competitions were viewed very positively, receiving a 9.24 rating out of 10. The researchers also report that competition was an effective student motivator. A question asking if the competition garnered a higher level of motivation than a three hour class for students, earned a 7.76 out of 10. This study also found that competition drove students to actively seek support from their professors, alumni, and industry professionals, indicating that the competitions also promote greater student/teacher interaction (Anglin & Robson, 1997).

In their literature review Anglin and Robson (1997) report some opposition to competitions in education, however the findings of their study were all positive in regard to construction management competitions, and are well qualified. The amount of opposition to student competitions found in the current study's literature review was comparably quite small, while that is not consistent with Anglin and Robson's (1997) literature review, it is consistent with the findings of their study.

Because only three empirical studies in construction management education were found relating to student competitions, construction management and engineering were considered jointly. Table 2.1 illustrates the most common empirical findings on student competitions in construction management and engineering. The studies included are ordered by the quality of methodology. While some of the research has weak methodology, many of the findings in studies with weak methodologies are consistent with the results in research with stronger methodologies. As a result, methodologically stronger studies give support to findings in studies with weaker methodologies through triangulation.

Anglin and Robson's (1997) study represents the most comprehensive attempt to quantify the impact of competitions in construction management education to date. It constitutes the bulk of the body of knowledge on construction management student competitions. In addition it is also the most methodologically sound of any research on student competition in construction management education, making it even more valuable to this study and to the discipline of construction management.

Table 2.1

*Commonly reported positive effects in Engineering and Construction Management Student Competition Empirical Research*

| Positive Effects                          | Articles |   |   |   |   |   |   |   | Studies Reporting |
|---|----------|---|---|---|---|---|---|---|-------------------|
|   | 1        | 2 | 3 | 4 | 5 | 6 | 7 | 8 |                   |
| <i>Work on a Real project</i>             | X        |   | X | X | X |   |   | X | 63%               |
| <i>Students drive learning</i>            | X        |   | X | X |   | X |   |   | 50%               |
| <i>Spend more time</i>                    | X        |   | X | X | X |   |   |   | 50%               |
| <i>Networking/ job opportunities</i>      | X        | X |   |   |   |   | X |   | 38%               |
| <i>Learn Teamwork</i>                     |          | X |   |   |   | X |   | X | 38%               |
| <i>Have more motivation</i>               | X        |   | X |   |   |   | X |   | 38%               |
| <i>Learn better communication</i>         |          | X |   |   |   | X |   |   | 25%               |
| <i>learn more</i>                         | X        |   |   | X | X |   |   |   | 38%               |
| <i>Build confidence</i>                   |          | X |   | X |   |   |   |   | 25%               |
| <i>mentor/protégé relationships</i>       |          | X |   |   |   |   | X |   | 25%               |
| <i>More teacher/student interaction</i>   | X        |   |   |   | X |   |   |   | 25%               |
| < Higher -Methodological Quality- Lower > |          |   |   |   |   |   |   |   |                   |

Articles Summarized:

1. Academic Competitions and ASC Region V 1997 Academic Competition Survey Data
2. Assessing the Impact of the Concrete Canoe and Steel Bridge Competitions on Civil Engineering Technology Students
3. Student Design Competitions in Undergraduate Engineering Education
4. Undergraduate Student Competitions
5. A Case Study of a Design-Build Competition in a Construction Program
6. Organization of a Multidisciplinary Capstone Design Project for the SAE Formula Hybrid
7. The Use of Student Design Competitions to Support the Teaching of Marine Design
8. Lessons Learned from a Design Competition for Structural Engineering Students

### Qualitative Variables

Qualitative variables have no natural sense of ordering, and as such are more difficult to define in a review of literature. The qualitative variables in this study result from research questions one and two, which ask what do competition team coaches perceive as positive and negative effects for students from participation in construction management competitions.

## **Participation Benefits**

There are an abundance of positive qualitative effects reported to result from participation in competitions, these effects come from both empirical and non-empirical studies. The best literature and the positive effects reported have already been discussed, so only a summary of the most common effects and the two best studies are given here.

Two of the most common positive effects reported are: Students learn teamwork (Avanzato, 2009; Seasons & Meyers, 2003; Umble, Umble, & Artz, 2008; Labossiere & Bisby, 2010; White, McKisson, & Barott, 2007), and students are more highly motivated (Battersby, 1994; Kasier & Troxell, 2005; Wankat, 2005; Anglin & Robson, 1997). Other common positive effects reported are shown in figure 2.1.

The best studies reporting on the positive effects of participation came from Sirianni et al. (2003) and Anglin and Robson (1997). Based on survey results Sirianni et al. (2003) reported that students who participate in competitions have enhanced leadership, project management, teamwork, design and construction, and communication skills, and have greater confidence in their abilities and enthusiasm for the profession. These differences were reported from surveys completed by both participants and non-participants. Still, the findings should be considered with caution. Sirianni et al. (2003) attributes these differences to participation, but the study fails to address if participants and non-participants were different before participating. The methodology did not support claims of causation either.

Anglin and Robson (1997) reported that students who participate reach a higher level of motivation for a competition than for a three-credit hour course. Their findings are the results of Likert scale questions in a survey completed by competition participants, and can be received with confidence.

Dominated by non-empirical research, the positive effects reported in the literature are all attributed to competition participation, but none of the studies found discuss whether the differences existed prior to competition participation, and with the exception of Anglin and Robson (1997), the studies found do not have adequate methodologies to support claims of causation. Competition participation is credited with causing these effects on students, but the existing research on the subject is lacking.

### **Participation Negatives**

What negative perceptions of participation in construction management competition do team coaches describe? While no empirical research was found indicating negative perceptions of competition participation, a handful of negative aspects have been reported in non-empirical study.

The emphasis on comparison in competition can lead low performing students to feel frustration, depression, or inferiority (Chen, Winston, Calvin, & Tak-Wai, 2009). In engineering, competitions have been credited with causing inadequate design work in favor of a build and test approach (Schuster, Davol, & Mello, 2006), as well as failing to teach students their responsibility in preserving public safety (Labossiere & Bisby, 2010). Although these negative perceptions can be mitigated through organization and coaching, there is one additional negative perception that is seemingly unavoidable and it likely is a major part of the reason competitions are such powerful learning experiences. In respect to the amount of time students devote to competitions, one faculty member reported that “these kids have no life” (Wankat, 2005). What exactly students are sacrificing to participate in the competitions is unstudied, and this negative is not easily addressed. The

negative perceptions of competition participation, although non-empirical in nature, represent valid observations which merit consideration and study.

### **Quantitative Variables**

The quantitative variables used in this study come from research question four, which asks: What are the differences between participants and non-participants in construction management competitions as it relates to: a) starting salaries, b) GPAs, and c) frequency of employment? The independent variable is competition participation, and the dependent variables are starting salaries, GPAs, and frequency of employment.

Discussion of this study's variables was not found in the literature related to construction management, and even considering literature from other disciplines, the reported findings did not specifically address each of the variables. Non-empirical research constitutes the majority of the literature that did consider these variables.

### **Starting Salaries**

No literature was found considering a relationship between starting salaries and student competition participation. Although starting salaries and competition participation are not addressed specifically, indirect links can be drawn between competitions and other factors that have been studied. The two factors found most frequently in the literature relating to starting salaries are: Internships and GPA.

Although student competitions and internships are different, they teach similar skill sets relating to team work, communication, and working on real projects. Teaching methods such as internships, which involve learning by doing, are highly valued among employers (Raymond, McNabb, & Matthaei, 1993). The value employers place on

learning by doing is one explanation why interns may earn higher starting salaries (Raymond et al., 1993), but it is an untested theory. In their study Raymond et al. (1993) found that students and employers ranked internships as the most effective means to involve learning by doing, but they did not collect data to investigate if there is a relationship between internships and higher salaries. Competition participation is also considered a “learning by doing” activity, so while Raymond et al.’s (1993) study might lead to inferences of competition participation leading to higher starting salaries, the theory is not an adequate basis for reporting a relationship between starting salaries and internships or competitions.

Although internships were commonly addressed in the literature, student academic performance, or grade point average was the most frequently studied factor relating to starting salaries. The literature studying whether GPA effects starting salaries has inconsistent findings. Methodologically sound research has shown that there is a relationship between the two variables (Sandvig, Tyran, & Ross, 2005), that there is not a relationship between them (Jones & Jackson, 1990), and that in some cases it does but in others does not matter (Rumberger & Thomas, 1993).

## **GPA**

The relationship between grade point average and student competition participation has been given some attention; however the literature is not consistent in the relationship reported. One study regarding student competitions links competition participation to higher grade point averages. Sirianni et al. (2003) found that the average GPA of competition participants was 3.26, while that of all students in the program was 2.90 for

the same quarter. The study attributes higher GPAs among competition participants to students applying the skills learned from competition participation to their course work. It does not however investigate the finding adequately, nor does its methodology qualify it to infer participation as the cause for higher GPAs. No differentiation was made between student classification, courses taken, or when the data were collected. The study's methodology does not support causation and disregarded too many variables to safely report that the difference in GPAs was a result of competition participation.

The literature found did not report any other research regarding participation and GPA, but it does indicate that GPAs are not related to success at competitions. Wankat (2005) notes that students who were at the top of their class in high school, but as undergraduates only earn GPAs in the 3.0 range, excel in the competitions as they become an outlet for them, and Cooley et al. (1999) reports that higher GPAs do not translate to student commitment or success in competitions.

### **Frequency of Employment**

In considering frequency of employment as a variable, the lone empirical study found indicated that extra-curricular activity participation was not related to job-seeking success (Carroll, 1966), however given the age of this study, student competitions in construction management and engineering could obviously not have been considered in the research (since they did not yet exist).

More recently some non-empirical studies in vocational and technical education, program evaluation, and engineering report those students who participate in competitions enjoy greater job opportunities (Linnell, 2007; Nykiforuk et al., 2003; Professional



Engineering, 2007). The key to these reports however is that they pertain only to increased job opportunities, if the opportunities translate into success, or to students being hired, is not reported. Orlandella and Ziegler (2002) state that some employers specifically ask to interview competition team participants, indicating that industry values the competition experience.

Seasons and Meyers (2003), Anglin and Robson (1997), and Sirianni et al. (2003) all report that through the networking facilitated at competitions, and industry involvement, students who participate are exposed to more potential employers. The literature also gives examples of competition participation leading directly to employment (Nykiforuk et al., 2003; Orlandella & Ziegler, 2002).

Professional Engineering reported in 2003 that; students who do this (competition) are more “placeable” in jobs because of their all-around capabilities. In 2007 they reported that companies come and seek these students (competition participants), and that students from teams are “head-hunted” by top companies.

These reports indicate that companies value the skills and experience of students who participate in competitions, explaining why competition participants may have greater opportunities for employment, and it is not unreasonable to infer that greater opportunities for employment may translate to a higher frequency of employment for participants, it is however untested.

## **Conclusion**

Whether based on building a house, a race car, a concrete canoe or an advertising campaign, student competitions have an extensive history. They occur in a multitude of

disciplines every year and involve tens of thousands of students from across the country. Some literature indicates that competition in education has negative effects. Most studies (empirical and non-empirical) however, dispute the negatives reporting a broad range of positive effects from participation. With only a few negative aspects reported, and a lack of consistency among them, the abundance of favorable opinion is understandable.

The volume of non-empirical literature, praising and promoting competitions is likely to grow. At the same time, the body of empirical research addressing competitions must increase to provide evidence either supporting or discrediting the opinions of coaches, organizers, and sponsors, who so actively promote their student competitions.

## **CHAPTER 3 - METHODOLOGY**

### **Introduction**

The research questions for this mixed methods study sought to identify how the perceptions of competition team coaches could provide an in depth explanation and description of the positive and negative effects of competition participation, as well as understanding of how differences between participants and non-participants occurred. Secondly the research questions sought to quantify differences between participants and non-participants, and asked how qualitative and quantitative data could combine to inform faculty and administrators about student construction management competitions.

The pilot study that led to this study, only used quantitative data, but was non experimental, giving rise to the need for additional data to support its findings. As a result this study primarily collected qualitative data, using quantitative data secondarily. Both data types were collected to better understand the research problem which is the basis for the use of a mixed methods research design (Creswell, 2009).

The use of both quantitative and qualitative data collection in this study produced a convergent parallel mixed methods research design where qualitative and quantitative data are collected simultaneously, interpreted, and then related to one another (Creswell & Plano Clark, 2011), the design is also considered fixed because the use of each method was

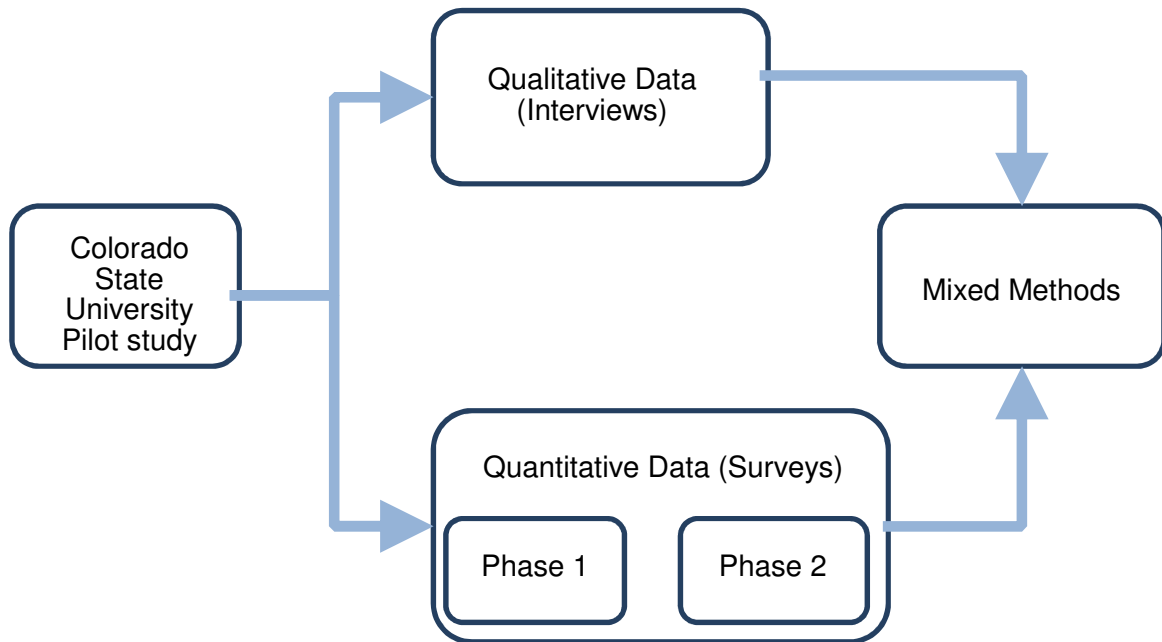
predetermined. Recognizing that there are many other variables which can affect the study's quantitative variables (Starting salaries, GPA's, and Employment rates), this study utilizes a qualitative priority. It places a greater emphasis on the qualitative strand producing an in depth description of competition positive and negative effects.

Quantitative methods are used in a secondary role (Creswell & Plano Clark, 2011).

A mixed methods research design was employed to address the research questions for this study, which could not all be addressed by one strand or the other. The qualitative strand was used to describe the perceived positive and negative effects of competition participation, and how potential quantitative differences might occur. The quantitative strand was used to consider differences between participants and non-participants. The reason for mixing methods was to gain triangulation, complementarity, and development from the two data types (Greene, Caracelli, & Graham, 1989). According to Green et al. (1989) Triangulation seeks convergence and corroboration between strands. Complementarity looks for, enhancement, illustration, and clarification of the results from one strand with results from the other strand, and development seeks to develop or inform the results from one strand with the other.

A convergent parallel mixed methods research design was used because it is an intuitive and efficient design (Creswell & Plano Clark, 2011). Quantitative research was used to address the process, while qualitative research is used to provide rich description. Figure 3.1 depicts the research strategy utilized for this study.

This research utilized mixed methods, but data collection in each part of the study was independent, for that reason, and because a convergent parallel design performs analysis for each strand individually before they are compared (Creswell & Plano Clark, 2011), the methodology of each strand is considered independently in this chapter.



*Figure 3.1.* Research strategy.

This study was funded by a grant from the National Housing Endowment (NHE). The NHE provided funding for both the quantitative and qualitative strands of this study. It did place some limitations on the study that primarily affected the quantitative strand of the research. Those limitations are discussed specifically in this chapter as they relate to each strand.

The qualitative methodology for this study is given first; it is followed by the investigator's philosophical stance and then quantitative methodology. The Colorado State University pilot study is briefly addressed in the quantitative methodology section, a more detailed description of it can be found in Appendix D. This chapter concludes discussing the mixed methods methodology.

## **Qualitative Methodology**

The qualitative strand this study sought to provide a rich description of the perceived positive and negative effects of participation. A secondary consideration was the explanation of how any differences between participants and non-participants in construction management education student competitions occurred. Data from the qualitative strand is used to address research questions one, two, and three.

Qualitative data were collected via interviews with competition team coaches, and through one open ended question to students in the survey that also collected quantitative data. Collection, transcription, and coding of the qualitative data, were performed by the researcher and guided by a protocol which can be found in appendix B.

Seven of Onwuegbuzie and Leech's (2007) strategies for legitimacy, or truth value, were used to strengthen any findings in the qualitative strand. The qualitative strand was also strengthened through the use of a purposeful sample.

### **Qualitative Research Strategy**

The qualitative approach to inquiry utilized in this study was grounded theory. Specifically, a systematic approach was utilized. Grounded theory was used because the researcher sought to develop theory(s) grounded in the perceptions of individuals with a high level of experience with construction management student competitions, through interviews (Leedy & Ormrod, 2010).

Competition team coaches were the primary subject population identified for qualitative data collection. Student participants were a secondary population utilized. Data were collected primarily from coaches because while getting students to complete a

web based survey was feasible, contacting and interviewing students seemed less efficient and unlikely to produce high quality data.

At some schools there is a regular turnover of team coaches, since service as a competition team coach often does not contribute towards tenure requirements and may be seen as having little benefit or reward for the faculty member (Marra, 1996). Because of the turnover, the sample was delimited to coaches who had served as a competition team coach in the past two years.

The theoretical population would include all construction management student competition team coaches from the past two years. The selected sample however, consisted of coaches from: California Polytechnic University – San Luis Obispo, Colorado State University, Georgia Technical University, North Dakota State University, Purdue University, and Texas Agricultural and Mechanical (A&M) University. The selected sample sought to obtain interviews with two coaches from each school. Six interviewees were identified before any data collection took place through purposeful sampling; however the remaining seven interviewees were identified as data collection progressed. The sample was left open to allow for additional interviews based on recommendations and availability. If more than two participants were identified at a site, the study sample could increase (snowball) to accommodate them.

From the selected sample of two interviews per school, the actual sample finished with one additional interview for a total of thirteen interviews from six schools. Four interviews resulted from participant's recommendations when asked if there were other faculty members at their respective schools who they recommended for interviews. In all other cases participant's made no recommendation or recommended faculty members who had already been interviewed.

## **Researcher's Role**

The researcher's role in this study was as the key data collection instrument. The researcher coordinated and conducted all thirteen interviews from which data were collected. A protocol, or questionnaire, guided the interviews, which was developed by the researcher specifically for use during the interviews in this study. A copy of the protocol can be found in Appendix B. The researcher's role was not limited to data collection however, analysis and coding of the interviews were also completed by the researcher.

## **Qualitative Data Collection Procedures**

The data for the qualitative strand of this study came principally from interviews with competition team coaches, and secondarily from one open ended question posed to students in the survey that also collected data for the quantitative strand of this study. The location of sample participants was limited by the grant award. California Polytechnic University – San Luis Obispo, Colorado State University, Georgia Technical University, North Dakota State University, Purdue University, and Texas Agricultural and Mechanical (A&M) University are all schools that received HELP Grants from the NHE. As a stipulation of the grant awarded for this study, The NHE required the data collection for this study to come from those schools. With this limitation, it was necessary to speak with the HELP Grant contact at each school before data collection could commence. From those conversations the researcher determined who each school's competition team coach(s) was, and thus identified the selected sample so the interviews could be arranged.



The qualitative interview questions received IRB human subject's approval. These interview questions formed a protocol for the study. Interviews were conducted in person as well as over the phone. Regardless of the collection method, anonymity was provided to the coaches who participated. The interview questionnaire (protocol) can be found in the Appendix B along with transcripts of the completed interviews in Appendix C.

Interviews were recorded with a handheld digital recording device, and all of the recorded interviews were transcribed by the researcher and saved as word documents for coding, which occurred initially using the Nvivo 9 software package, and later using hand coding techniques.

Approximately half of the qualitative data collected for this study were actually collected twice. The researcher originally performed five of the interviews in person at the International builder's show in January of 2010, however the recordings of those interviews were lost in February of 2010. The interviews were lost when the batteries in the researcher's digital recorder died and caused erasure of all the interviews before they were transcribed. In March of 2010, qualitative data collection began once more and all except two of the interviews took place over the phone. During spring of 2010, the researcher performed the thirteen interviews used in this study and transcribed the recordings.

Initially the five lost interviews presented tremendous frustration to the researcher. However, when the interview process began again, it was apparent that the loss had facilitated both a vetting process for the interview protocol, as well as interview practice for the researcher. Those first five interviews served as a pilot of the qualitative data collection, and as a result, the data collected in the subsequent interviews are considered to be of higher quality.

In qualitative data collection sample sizes are often defined by saturation or the point when the data is not producing new information, and further collection is counterproductive (Strauss & Corbin, 1998). Saturation was evaluated through constant comparison of the data (Bowen, 2008) as it was collected, and was evident when roughly three quarters of the interviews were complete. Two interviews from each school were still completed however to ensure nothing new came to light and thirteen interviews make up the actual sample.

### **Qualitative Data Analysis Procedures**

Data analysis procedures for the qualitative data consisted principally of coding. Coding occurred in three progressive steps, open, axial, and selective coding. Prior to coding however, data filtering was necessary to facilitate the coding process and to ensure, insofar as it was possible, that the data is contextual and not misleading.

Data collection via interview is a difficult process, particularly when a recorded interview is directly transcribed. Incomplete sentences, unfinished thoughts, and interjections commonly used in speaking such as “um,” or “like,” can easily distort meaning, or may simply make understanding of a transcript difficult. The researcher, as the key data collection instrument, is beneficial in filtering the transcribed interviews. As the interviewer, the researcher has, with the exception of the interviewee, the best point of reference regarding the interview context. This filtering process took place to facilitate coding. Interview transcripts can be found in Appendix C.

After filtering of the interviews was complete, coding began. Coding occurred in three steps; open coding, axial coding, and selective coding (Leedy & Ormrod, 2010;

Strauss & Corbin, 1998). All coding in this study is considered “in vivo” because the codes came from the exact words of the participant (Creswell & Plano Clark, 2011). The computer program, Nvivo 9, was utilized in the coding process to facilitate organization of the themes identified. Nvivo 9 can store documents for analysis, allow for blocking and labeling of text segments, and group codes into broader themes, facilitating the process (Creswell & Plano Clark, 2011), however the researcher ultimately stopped using the computer program in favor of coding by hand. The switch from computer to hand coding occurred because the researcher found greater comfort, confidence, and thus ease coding by hand.

Open coding involved segmenting the data into categories which would be major themes in the study (Strauss & Corbin, 1998; Leedy & Ormrod, 2010). Open coding of the data in this study was fairly simple because even though questions were open ended, the protocol provided consistency in the questions posed to each coach. Using the protocol as a basis for each interview meant the general categories of the study were created when the protocol was built. Specific positive and negative effects of participation constituted the primary open codes.

Axial coding was a more demanding process. In axial coding the researcher studies the categories developed in open coding, and identifies one as a central phenomenon. After identifying the phenomenon, the researcher returns to the data to identify causation, context, participant responses, and resulting consequences (Strauss & Corbin, 1998; Leedy & Ormrod, 2010). In this study the focus of axial coding was the identification of a common thread for the positive and negative effects of participation. Axial coding identified the central cause of the positive and negative effects of participation.

The final step in coding the data was selective coding. Selective coding is a final phase where the researcher relates the central phenomenon to other categories in order to validate the relationships established in axial coding (Strauss & Corbin, 1990). Selective coding forms the story line for the phenomenon (Leedy & Ormrod). For this study selective coding focused on explaining the theory that developed from the data.

Coding was one of the most difficult portions of this study for the researcher, because of the subjective nature of coding, and the potential personal bias involved. Although subjectivity is inherent and accepted as part of qualitative research (Creswell & Plano Clark, 2011), it must be recognized as an issue (Strauss & Corbin, 1998) and proved challenging for the researcher, because of the subjectivity that comes from personal bias is an aspect of qualitative data analysis.

### **Qualitative Legitimacy**

Different methods for ensuring rigor and determining validity in a qualitative study have been put forth, however they are not intended to be followed dogmatically, rather they are to be considered flexibly and creatively as the researcher sees fit (Strauss & Corbin 1998). Most of these methods have merit with certain research designs but a single silver bullet for validity in qualitative research has not been recognized (Onwuegbuzie & Leech, 2007).

Although there is no method that is guaranteed to yield valid data or trustworthy conclusions, nevertheless an assessment of procedures used in qualitative studies is imperative for ruling in or ruling out rival interpretations of data. Such strategies either help to evaluate legitimation or to increase legitimation, or both (Onwuegbuzie & Leech, 2007, pp. 239).

Onwuegbuzie and Leech (2007) put forth 24 strategies for assessing what they call “truth value” which is the legitimacy of a study. They also recognize that in a particular qualitative study only some of their strategies will be relevant.

Legitimacy in this study was established through seven of the 24 strategies, including: triangulation, weighting the evidence, checking representativeness, checking for researcher effects/clarifying researcher bias, structural relationships, assessing rival explanations, and confirmatory data analyses. A brief discussion of each is given next.

Triangulation is corroboration between different data sources and methods (Onwuegbuzie & Leech, 2007, pp. 239). By collecting data from competition team coaches in interviews, and from students in survey, data were collected from different sources and by different methods, which could then be corroborated.

Weighting the evidence, because competition team coaches were reporting on their first hand observations and perceptions, and because their interviews were performed in informal settings the interview data is of high quality, and are given greater weight than data returned in surveys.

Representativeness was established by requiring that a team coach have at least one year of recent experience in the coaching role. It was further produced by the distribution of schools. Although the schools were determined by the grant award body, the diversity in geography and school size of the sample well represented the population, leading to representativeness.

In any qualitative study, interviewer or researcher bias is an important consideration. Understanding, or at least knowledge of, a researcher’s background, philosophical stance, and resultant bias, is important. The researcher’s philosophical stance is provided in this chapter, and the investigator’s perspective in chapter one provide

the reader adequate reference to potential bias. To reduce bias the researcher's intentions were made clear, and interviews were conducted at a neutral sites.

Structural relationships between data were considered continuously through the interview process. By comparing each new interview with those already performed, comparison and contrast within the data set occurred throughout data collection.

Rival explanations were not only considered but sought in the qualitative data collection process. Through open ended questions which allowed for any explanation, coaches were asked what they thought were the benefits of participation. Coaches were also asked what negative aspects they perceived from competition participation, to ensure data in favor of and opposed to participation were considered.

Confirmatory data analysis occurred by chance in the study after the loss of the first five interviews necessitated repeating them. As noted an exact comparison of the interviews is not possible but the absence of any significant changes in responses from those first interviews to the second interviews provides a small degree of confirmatory data analysis.

These measures cannot assure validity, but they can indicate that the qualitative portion of this study has an adequate level of legitimacy and is likely trustworthy.

### **Qualitative Limitations**

Limitations affecting the qualitative portion of this study include participant honesty, which schools data would be collected from, and the basis of some interview questions on data from the pilot study.

The researcher had little control over participant honesty, but the study offered anonymity to participants, providing greater confidence that responses are accurate and honest.

The data collection sites were established by grant funding, making the sample non-probabilistic (Creswell & Plano Clark, 2011). They represented a broad spectrum of construction management programs in the United States, as well as a good range of school sizes, giving the sample greater representativeness. Further in qualitative research the intentional use of a nonrandom sample in the form of purposeful sampling is commonly used and accepted (Leedy & Ormond, 2010). Rather than limiting the study, the stipulation of data collection locations by the grant, acted as a purposeful sampling technique. It provided for the inclusion of many individuals that the researcher felt would yield a high level of information and whom the researcher had already identified as desirable sample members. Because of the prior grant awards through the NHE they were more easily contacted and willing to be interviewed. So while the NHE placed a limitation on the sample its impact was considered positive.

The convergent parallel design of this study allowed for qualitative and quantitative data to be collected simultaneously, however without the results of the quantitative strand, some of the questions used in qualitative data collection were based on the results of the pilot study.

### **Qualitative Methodology Conclusion**

The qualitative portion of this study was intended to provide data, through interviews and one survey question that could provide empirical research documenting the

perceived positive and negative effects of student construction management competition participation, and give a rich description of those positive and negative effects. The qualitative research design has characteristics providing for legitimacy and achieved saturation in the sample. As a result, any findings should be considered qualified.

### **Philosophical Stance**

Philosophical ideas influence the practice of research, and without an explanation of a researcher's philosophical stance those ideas remain largely hidden in the research (Creswell, 2009). A researcher's philosophical stance or worldview is an important disclosure in research, particularly in qualitative research, since it identifies potential bias and the general orientation of the researcher.

Creswell (2009) identifies four philosophical world views; Post-positivism, Constructivism, Advocacy/Participatory, and Pragmatism. A brief definition of each stance follows, concluding with the stance taken by this researcher. Further description of that stance, and how it shaped the approach to this research, is also given.

Post-positivists have typically represented the traditional form of research, wherein a researcher begins with a theory, and then collects and analyzes data. Depending on whether the data supports or refutes the original theory, revisions are made and additional data is collected to test the theory. Post-positivists hold the development of numerical measurement paramount and thus are inclined to quantitative research (Creswell, 2009)

Individuals favoring the constructionist stance typically lean to qualitative research. Constructionists seek to understand the world they live in and the meaning of their experiences. Meaning is constructed through interaction with other people. Thus the



researcher's own background and experience become an important component of the research. Research in this worldview seldom begins with a specific research question; rather questions are developed as the researcher interacts and collects data (Creswell, 2009).

As with a constructivist stance, the advocacy and participatory stance is seen typically with qualitative research. In an advocacy and participatory worldview, research is geared to advocate an agenda that will help marginalized people or groups. The research is thus intertwined with politics. Additionally the participants in the research may be included in the research design so as not to further marginalize them or their group (Creswell, 2009).

A pragmatic stance is the fourth position. In the pragmatic worldview the primary concern comprises applications and solutions to problems. While the other three stances prefer quantitative or qualitative inquiry in research, the pragmatic stance uses any approach available to understand the problem, and derive knowledge about it. It often incorporates mixed methods studies. Because it is not tied to a particular type of research, a pragmatic stance may also encourage the researcher toward a mixture of worldviews (Creswell, 2009).

It is important to understand various worldviews in research as well as the stance of a researcher, in order to adequately evaluate research and reported findings. Table 1.1 from Creswell (2009), provides a summary of the four worldviews. A reproduction is shown as table 3.1.

Based on Creswell's description and definition of worldviews, prior to this study, the philosophical stance of this researcher was post-positivism. The researcher was better able to conceptualize and approach research when there is a problem identified, research

Table 3.1.  
*Four Philosophical Worldviews/Stances (Creswell, 2009)*

| Four Worldviews   |   |
|---|---|
| <b>Postpositivism</b>   | <b>Constructivism</b>   |
| <ul style="list-style-type: none"> <li>- Determination</li> <li>- Reductionism</li> <li>- Empirical observation and measurement</li> <li>- Theory Verification</li> </ul> | <ul style="list-style-type: none"> <li>- Understanding</li> <li>- Multiple participant meanings</li> <li>- Social and historical construction</li> <li>- Theory generation</li> </ul> |
| <b>Advocacy/Participatory</b>   | <b>Pragmatism</b>   |
| <ul style="list-style-type: none"> <li>- Political</li> <li>- Empowerment issue oriented</li> <li>- Collaborative</li> <li>- Change-oriented</li> </ul>                   | <ul style="list-style-type: none"> <li>- Consequences of action</li> <li>- Problem-centered</li> <li>- Pluralistic</li> <li>- Real-world practice oriented</li> </ul>                 |

questions developed, and a methodology created to address the questions. Further numerical evidence was considered paramount. The pilot study, from which this research evolved, occurred in a post-positivist worldview. In the early stages of design of this study a shift to a pragmatic philosophy occurred, when research questions were being developed that could not be answered by the quantitative data being collected.

For this researcher the conclusion was made that while the method for finding an answer is important, it is the answer that is most valuable. According to Creswell (2009) a primary concern comprised of applications and solutions to problems defines a pragmatic philosophical stance, and seems to describe the researcher.

A pragmatic stance is frequently associated with mixed methods research, and more than 100 years ago William James described it saying: “I offer the oddly-named thing pragmatism as a philosophy that can satisfy both kinds of demand. It can remain religious like the rationalisms, but at the same time, like the empiricisms, it can preserve the richest

intimacy with facts” (p. 33). In more recent years Steven Hawking has presented a philosophy called Model Dependent Realism that matches pragmatism and mixed methods (Gloeckner, 2012). According to Model Dependent Realism there are many ways to solve one problem (or answer a question), in fact there may be billions of ways to do so.

If a researcher must categorize themselves by one philosophy or another, this researcher could be classified as a Creswell or Williams - Pragmatist or perhaps a Hawking - Model Dependent Realist, however this researcher agrees most with Gloeckner’s (2012) argument that students aren’t likely to place much credence in arguing that data should be collected via counting or via words. He makes an effective allusion to this point stating:

How silly it would be to go to the doctor’s office and not have the physician gather both quantitative data (temperature, blood pressure, etc.) and qualitative data (How do you feel? Do you have any pain/discomfort?), are there visual signs of ill health (color, marks, blood shot eyes, etc.)? (Gloeckner, 2012)

This researcher recognizes that philosophy can be an important indicator of bias, but the philosophy justifying an approach does not have nearly the value that simply solving the problem or answering the question does.

### **Quantitative Methodology**

The quantitative methodology for this study was influenced by and evolved from the pilot study performed at Colorado State University. In that pilot study significant differences were found between participants and non-participants based on starting salaries and GPAs. As a result, this study sought to collect data from multiple schools to explore if the same results would occur on a broader scale. The qualitative strand of this study evolved from the pilot study so a brief description of said pilot study is given here first, a

more detailed description of the pilot study can be found in Appendix D. The methodology of the quantitative strand of this study is then given.

### **Colorado State University Pilot Study**

The pilot study performed at Colorado State University was done in the spring of 2009, and was quantitative in design. The study compared participants and non-participants based on starting salaries and grade point averages, and found a statistically significant difference between the groups for both variables. Participants earned average starting salaries \$3,500 higher ( $p = .015$ ), and had GPAs .318 points higher ( $p = .001$ ) than non-participants.

The data represents quantitative findings in favor of the many non-empirical voices supporting student construction management competitions. It shows that competition participation is correlated to at least two positive effects. Students enter the construction industry earning higher starting salaries, and while they are in school they have better grades. Because the study was non-experimental it is important to note that the findings are only correlations, causation cannot be inferred.

### **Quantitative Methodology Introduction**

The quantitative strand of this study sought to replicate the pilot study on a larger scale, by collecting data from multiple schools. The survey collected descriptive data about students to enable comparisons of means to be performed between participants and non-participants. Following the statistically significant findings of the pilot study, it was believed that the same results would occur in data collected on a larger scale. Comparison

of the two groups was planned to be performed via the administration of *t*-tests, because they were used in the pilot study and because when comparing only two groups the *t*-test is customary (Morgan, Leech, Gloeckner, Barrett, 2007). As analysis commenced however, ANOVA was the method used most to allow consideration of individual schools.

The quantitative methodology was intended to answer research question number four which asks: What are the differences between participants and non-participants in construction management competitions relating to: starting salaries, GPAs, and frequency of employment. The independent variable in this question is competition participation, and the dependent variables are starting salaries, GPAs, and frequency of employment.

### **Quantitative Research Design**

The quantitative strand of this study represents a post-positivist paradigm or framework, where a specific plan was developed prior to the study (Gilner et al., 2009). The use of attribute independent variables led to a non-experimental approach in the research. Specifically a comparative research approach was followed and difference Inferential statistics were used.

### **Quantitative Population and Sample**

The theoretical population for which this study could have an impact includes all construction management students at all institutions in the United States offering a four year degree in construction management or similar program. The theoretical population this study sought to collect data from is significantly smaller however, consisting of only

graduating seniors in construction management at schools which participate in construction management competitions.

From the theoretical population of all graduating seniors in construction management, at schools which participated in student competitions, the selected sample was narrowed significantly. The selected sample for this study included graduating seniors in construction management at: California Polytechnic University – San Luis Obispo, Colorado State University, East Carolina University, Georgia Technical University, Middle Tennessee State University, North Dakota State University, Purdue University, Texas Agricultural and Mechanical (A&M) University, and The University of Maryland Eastern shore. These schools were used because they had each previously received a grant from the NHE.

Although the selected sample included nine different schools, as data collection sites, the actual sample was narrowed to six schools, and included: California Polytechnic University – San Luis Obispo, Colorado State University, Georgia Technical University, North Dakota State University, Purdue University, and Texas Agricultural and Mechanical (A&M) University.

The actual sample for this study included graduating seniors in construction management from the 2009-2010 school year at: California Polytechnic University – San Luis Obispo, Colorado State University, Georgia Technical University, North Dakota State University, Purdue University, and Texas Agricultural and Mechanical (A&M) University. At each site all graduating seniors in construction management were invited to participate in the survey.

## **Quantitative Sampling Procedures**

The selected sample was chosen because the sites each had been awarded HELP grants by the NHE. Of the HELP grant awardees the selected sites offered bachelor degrees in construction management. The NHE wanted these schools to be the data collection sites because a relationship already existed between these schools and the NHE, which they (the NHE) felt would facilitate data collection. While this proved accurate and successful for qualitative data collection, this was unfortunately not the case for quantitative data collection at two sites. Additionally the use of these sites, based on their HELP grant awards, eliminated the possibility of a random sample.

The actual sample from which data were collected in this study represents a nonprobability sample, because the selection of clusters (schools) from which to collect data, are a convenience sample. This occurred as a result of the NHE's request. However, within each cluster all members of the accessible population were included in the selected sample. Using the whole population is not the best way to make generalizations about the population, but it is a common practice in the social sciences and education (Gilner et al., 2009), and given the limitation on data collection sites it was the best strategy to mitigate the use of a nonprobability sample.

The original selected sample was estimated to be no more than 900 students. When the data collection sites were reduced from nine to six schools, the actual selected sample was estimated at no more than 750. From the selected sample of 750, the survey was completed 230 times. After filtering the 230 survey responses, the actual sample consisted of 152 useable surveys (78 of the surveys did not provide responses to any survey questions pertaining to the quantitative variables). List-wise deletion was not used as it would have reduced the number of usable surveys to 51, instead pairwise deletion was

used, leaving 152 usable surveys. From those 152, sample sizes for each variable range from  $n = 52$  to  $n = 149$ . The difference in sample sizes resulted from many surveys including responses to only one or two of the variables but not all three. Students were particularly reserved about providing their starting salary.

### **Quantitative Instrumentation**

There are certain challenges to data collection through surveys. In a voluntary study, participants cannot be forced to take a survey, and with limited funds supporting the research, incentives for participation were not possible. As a result, sample size and sample quality cannot be guaranteed. Despite these challenges, a survey was still chosen for this study because of the successful use of survey data collection in other research, particularly the pilot study.

The survey used in this study was web based, and was derived from the paper and pencil survey that collected data in the pilot study. The use of an internet based survey helped to control costs, and simplified dissemination to students at each university. Administration of a survey had been seen to be effective in producing data for the pilot study, and in other studies considering starting salaries they were the means used to collect data (Jones & Jackson, 1990; Sandvig et al., 2005; Rumberger & Thomas, 1993).

Key questions regarding instrumentation in a study are measurement reliability and measurement validity. As they provide weight to the survey instrument and its ability to collect the desired data.



### **Measurement reliability.**

Because of this study's research approach, and the nature of the data collected, the survey did not measure constructs, so a formal assessment of measurement reliability was not performed.

The survey for this study was adapted directly from that used in the pilot study, which has been in use by the department of Construction Management at Colorado State University for at least five years. It was altered in three ways for use in this study. First, any questions that provided identifying information, such as name, age, or gender, were removed. Second, two questions were added which asked (1) if students had participated in the competitions, and (2) if so, which competitions. Third, the survey was converted from a paper and pencil format to an electronic internet-based design. Its reliability providing information regarding job placement and starting salaries to the Department of Construction Management at Colorado State University was evidence that the survey could also yield reliable data for this study.

### **Measurement validity.**

The survey used in the study collected only information about participants from the two groups, for comparison. As with other components of validity, the biggest threat for this study was subject honesty.

The study has no numerical support for measurement validity, because it did not measure constructs, but it was still evaluated by evidence based on the five areas presented by Morgan et al. (2009). Those areas are: content, response process, internal structure, relation to other variables, and consequences. It should be noted that these are not separate types of measurement validity, so evidence from one of these measures alone is

insufficient to deduce a degree of measurement validity (Gilner et al., 2009). Table 3.2 provides a summary of this study’s response to the aforementioned measurements.

Table 3.2  
*Summary of Measurement Validity*

| <b>Evidence Based on.....</b> | <b>Strength of support</b> | <b>Explanation</b>  |
|-------------------------------|----------------------------|---|
| Content                       | Strong                     | Direct questions, Review of survey content by others.                                     |
| Response Process              | Medium to Strong           | Participants able to take survey when and where they wanted, mitigating social pressures. |
| Internal Structure            | Weak                       | No factor analysis because of simplicity of survey, no objective evaluation.              |
| Relation to other variables   | Weak                       | Calculated effect sizes were small.   |
| Consequences                  | Strong                     | No negative consequences have been or were identified.                                    |
| <b><i>Overall</i></b>         | <b><i>Medium</i></b>       | <b><i>Two strong, Two weak, and one medium to strong.</i></b>                             |

Evidence for measurement validity based on content, is considered strong. Because the study sought to compare job placement, starting salaries, and GPAs of students from the two groups. Using direct questions that required no interpretation, the survey collected the desired data. The survey was reviewed by the researcher, faculty members, and the NHE, and the parties agreed the content could provide data representing the variables in question.

Measurement validity based on response process is medium to strong. Participant responses could not be directly observed, since the survey was web-based and distributed via e-mail. A web based survey can provide assurance that responses are honest and not influenced by the environment because students can participate when and where they

chose, and because participation is anonymous the impact of factors such as social pressure and acceptability are mitigated.

Evidence based on internal structure is more subjective. Because the survey did not measure constructs, factor analysis was not used to evaluate the survey. As a result, evidence based on internal structure is left unevaluated. A subjective consideration of the relationship between the survey questions and the framework of the study are clear, however because that evaluation is subjective, without objective numerical quantification, measurement validity is considered weak for this measure.

Evidence based on relations to other variables was considered using effect sizes. Effect sizes were calculated by using the formula:  $d = (\mu_A - \mu_B) / \sqrt{[(n_A - 1)SD_A^2 + (n_B - 1)SD_B^2] / (n_A + n_B - 2)}$ . This formula was used rather than taking the difference in means divided by the pooled standard deviation to account for the difference in  $n$  between the two groups. Were this evaluation based on the effect sizes encountered in the pilot study ( $d = .553$  starting salaries, and  $d = .795$  GPA), evidence based on relations to other variables would be strong. However, based on this study's calculated effect sizes ( $d = .320$  starting salaries, and  $d = .01$  GPA) evidence based on relations to other variables is weak. With such small effect sizes relations to other variables is also weak (Gilner et al., 2009).

Evidence based on consequences is also strong. Participation in this study was anonymous and required less than 15 minutes of time. There were no negative consequences identified when the study was designed, nor have any come to light in the period since. The positive consequences of this study are yet to be seen, but regardless of any ensuing positive consequences, the lack of any negative consequences is evidence for measurement validity.

Because the survey did not measure constructs, traditional evaluations of measurement reliability and measurement validity were not performed; however threats to reliability and validity were still addressed to the extent possible. There is no numerical support for validity, but evidence based on the five criteria from Gilner et al. (2009) indicates a measurement validity of medium.

### **Quantitative External Validity**

External validity, or the extent to which samples, settings, treatment variables, and measurement variables can be generalized beyond this study (Gilner et al., 2009) is an important component of this study. This study hopes to generalize its findings to the theoretical population of construction management students in the United States, with the goal that positive findings can be used to increase competition participation within the population. Despite the use of a non-probability sample, an evaluation of external validity of the quantitative strand of this study is considered medium and is based on the representativeness of the sample.

Creswell (2009) presents a list of threats to external validity. Creswell's method for evaluating external validity was considered only briefly however, and is not the basis for determining this study's level of external validity.

For this study Gilner et al. (2009) provides guidelines to consider external validity that are better suited to this study's methodology. Their evaluation of external validity is based on population external validity and ecological external validity. This study's external validity is measured by these two components

External validity, as it relates to population, begins with subject selection. Whether the actual sample of participants is representative of the theoretical or target population is the question (Gilner et al., 2009). Sample sizes for different types of research are not set in stone, but for social science and educational research, a historical minimum of 30 participants has been used (Gilner et al., 2009). A study with two groups and only 30 total participants, however, is not likely to be large enough to have the desired statistical power. Power can be estimated using estimated effect sizes based on a previous study and estimated  $n$  using Table 16.1 from Gilner et al., (2009). For this study, although estimated power was good using the pilot study effect sizes, the study's actual effect size produced low power ratings.

The selected sample was thought to be more than adequate to produce a large enough actual sample, attention was turned to representativeness, which according to Gilner et al. (2009) is a more important consideration than sample size. The apparent theoretical population, consisting of all graduating seniors from four year construction management programs in the United States, numbers in the thousands. The accessible population was much smaller, and because the accessible population was defined by the grant, random selection of data collection sites was eliminated.

The clusters, or schools, where data were collected, were not chosen randomly, but they do provide a good representation of the population. The cluster's geographical locations represent a broad cross-section of the United States including the West Coast, the Rocky Mountains, the Mid-West, the South, and the East. Figure 3.2 shows the location of the data collection sites around the U.S. These clusters represent a range of



*Figure 3.2* Data collection sites map.

school sizes, with enrollment ranging from around ten thousand to more than forty five thousand students. Population external validity is reduced because the clusters used in the sample were not randomly selected. In spite of non-random sampling, the population is still represented well by the sample. External validity based on population can be considered medium to high for this study, because of the sample's representativeness of the population (Gilner et al., 2009).

The second component considered is ecological external validity. Because this was not an experimental study, external validity based on ecology has only indirect application. In addition, the nature of the data being gathered (ex-post facto collection of descriptive variables) caused an inability to control most of the ecological variables.

External validity for the study is somewhat artificial because data were collected via survey. Because constructs were not measured, normal standards for ecological

external validity do not apply well, but are nonetheless considered here. The participants could complete the survey when and where they wanted, but a survey questionnaire cannot directly measure behavior in a typical environment (Gilner et al., 2009). Although the research was not in a laboratory, and the questionnaire was distributed via the internet the ecological external validity is increased only slightly. Based on these characteristics, ecological external validity for this study is considered medium (Gilner et al., 2009).

Based on the evaluations of population and ecological external validity, the overall external validity of this study is considered medium. The research approach, using a survey to collect data about attribute variables, limited the use of traditional strategies to achieve a higher level of external validity, however the sampling technique resulted in a sample that is representative of the theoretical population. It is the sample's representativeness of the population is the basis for a medium strength.

### **Quantitative Data Collection Procedures**

A student survey was used to collect information from the population. A survey was used because they gather factual information about a population, and can establish relationships between independent and dependent variables (Berry, 2005) as well as because of the successful use of a survey in the pilot study.

In light of funding and travel restrictions, and also to facilitate participation from as many students at each school as possible, the survey was administered via an online service, known as surveymonkey.com. Survey Monkey offered an effective means of distributing the survey to all students in the sample. In addition, the internet based survey facilitated the subject's ability to take their time, and maintain privacy while completing

the survey. Participants were asked to share GPA's and starting salaries, two variables that would likely be considered private, so offering student's privacy was considered vital to obtain an adequate response rate.

Perhaps the greatest advantage to the internet survey however, was the ease and security of data collection (Gilner et al., 2009). While an internet based survey requires that the subjects have access to a computer in order to participate, the sample subjects were made up of senior level post-secondary students, and computer access was only a minimal concern. If the subjects didn't have computer or internet access from their homes, they would most certainly have computer and internet access at their schools.

As mentioned previously, Human Subjects approval was sought and granted from all the data collection sites. The researcher noted that the process for human subjects approval seemed to be directly related to the level of research performed at each school. At larger, and more research based schools the process and approval was a fairly straight forward one. Smaller schools however, with less research focus, presented a much greater challenge.

### **Quantitative Data Analysis**

As introduced previously, the quantitative research question(s) this study seeks to answer are:

What are the differences between participants and non-participants in construction management competitions as it relates to:

- a) starting salaries?
- b) GPAs?



c) frequency of employment?

The purpose of the qualitative strand of this study was to explore the relationship between; GPA, employment, and starting salary for students who participated in competitions and students who did not participate.

The general approach was non-experimental because the independent variables were attributes to the subjects. The specific approach was comparative between the two groups of students (competition participants and non-participants), which also made the specific purpose to compare groups. Difference type research questions resulted, which led to the initial use of difference inferential statistics like the independent t-test, chi-square, and later ANOVA.

In order to create the division between students who had participated and students who had not, the survey simply asked whether the subjects had participated in a student construction management competition or not. The survey then asked all of the students: what their GPA was, whether they had accepted a job, and if so, what their starting salary would be. Comparison of means from the two groups (participants and non-participants) was made based on these variables. Although t-tests were used in the pilot study, based on the research questions and the collection of data at six different schools, ANOVA became the principle means by which comparison occurred between groups.

One-way ANOVA was used to consider the sample as a whole and to search for any relationships between the independent variable (competition participation) and the dependent variables (starting salary, GPA, and rate of employment). Along with the one-way ANOVA, a test for homogeneity of variance was run. The Levene's Test for homogeneity of variance was not significant. Because the Levene's Test and the results of F from the ANOVA were not significant, no post hoc comparisons were performed. Two-

way ANOVA were then performed to search for any relationships between the independent variable and dependent variables at each of the schools where data were collected.

### **Quantitative Limitations**

The greatest limitations to this study are the honesty of the subjects, and their willingness to respond to the survey questions. These limitations are not uncommon when data are collected via survey and interview. All data collected for this study are presented with the assumption that the survey participants answered the questions candidly. There is little a researcher can do to mitigate the limitation for subject honesty, and voluntary participation renders it impossible to guarantee a sample size. However, to minimize the limitation of sample size, the researcher planned for a large selected sample size, using multiple phases of data collection (collection of data over multiple semesters). Even with a poor response rate, the actual sample would then be adequate for analysis.

This study was also limited in its subject population. The sample population for the study included only schools which the NHE had awarded HELP grants. This relationship between the NHE and the recipient schools, determined the data collection sites, and was accepted as a stipulation of the grant that funded this study. This limitation resulted in a non-experimental sample for the quantitative strand.

### **Quantitative Delimitations**

This study was delimited to undergraduate students in their final semester before graduating, these students were delimited to construction management majors, who graduated in the 2009 – 2010 school year. The study also only considered participation in

construction management student competitions. Although there are other competitions available to students in programs of construction higher education this study is delimited to competitions organized by: NAHB, ASC, & ABC.

### **Quantitative Methodology Conclusion**

The intent of the quantitative strand of this study was to explore the findings of the Colorado State University pilot study on a broader scale, using additional data collection sites. With some small variations, comparable data were collected. As with the pilot study the non-experimental nature of the study made evaluations of external and measurement validity difficult as it did not measure constructs. Collection of ex-post facto data made control of ecological aspects impossible. However, to mitigate threats to the validity, this study focused on using a sample that was as representative of the population as possible.

Recognizing the limitations of a non-experimental study, particularly relating to internal validity, this research was designed to use both quantitative and qualitative data. This study uses mixed methods because together quantitative and qualitative approaches can provide a better understanding than either approach alone (Creswell & Plano Clark, 2011). Using non-experimental data meant the quantitative portion of this study could not infer causation, so results from the quantitative strand of this study are only intended to lend support to the qualitative findings. As is typical in mixed methods research, quantitative results can provide explanation of qualitative results and vice versa, to help build understanding (Creswell & Plano Clark, 2011).

## **Mixed Methods Methodology**

A mixed methods research design was necessary to address all of the research questions for this study. The qualitative strand was used to learn what the perceived positive and negative effects of competition participation are and to provide rich description of those effects. The quantitative strand was used to consider how differences between participants and non-participants might occur. This study was designed such that both quantitative and qualitative data strands could build on one another and provide triangulation, complementarity, and development to the findings (Greene et al., 1989). This study is considered a fixed mixed methods design because it planned for the use of quantitative and qualitative methods from the beginning (Creswell & Plano Clark, 2011).

Research questions one, two, and three, are addressed by the qualitative strand of this study, and are the primary focus of this research. For these questions, triangulation was sought so that through triangulation the effects of participation would be corroborated by the quantitative reflection (Greene et al., 1989).

The quantitative strand only addressed research question four. The mixed methods approach sought complementarity and development from this strand. The qualitative strand could enhance and illustrate the results of the quantitative strand, and development was intended to inform the quantitative strand regarding how differences may occur.

Research question five developed from the use of mixed methods and is synergistic, requiring data from both strands to be addressed. The individual quantitative and qualitative strands of this study sought to use triangulation, complementarity, and development such that each strand could benefit the other. Research question five however, is more constructivist in nature as it does not seek a specific answer, or to support one strand to support the other. Instead it asks how the two data strands interact

and inform one another. As such this question could only be addressed upon completion of data collection and analysis for each strand.

The use of both quantitative and qualitative data in this study produced a convergent research design where quantitative and qualitative data were collected and then could be related to one another (Creswell & Plano Clark, 2011). A convergent parallel design was used for this study for multiple reasons including: the design makes intuitive sense, data could be collected simultaneously, and traditional data analysis could be used on each strand of data (Creswell & Plano Clark, 2011). From the researcher's pragmatic approach, considering each type of data, then using the results jointly to enhance the findings was logical and intuitive, additionally the ability to collect data simultaneously allowed a more efficient use of time and shortened data collection duration.

Although the study represents a convergent design, when considering the influence of the pilot study on this study, the quantitative strand has elements of an exploratory design as well, because it expands the scope of the pilot study to additional data collection sites, thus exploring the differences found in the pilot study on a broader scale.

This study's design has a qualitative priority, its emphasis is on an in depth consideration of the positive and negative effects of construction management student competition participation. It secondarily considered a quantitative data strand where differences between participants and non-participants were considered. The qualitative priority of this study resulted because of the quantitative strand's non-experimental design, and because the variables considered (Starting salaries, GPA's, and Employment rates) can be influenced by too many other things. Despite these drawbacks, the quantitative strand was retained in the study because of the value added by making the study mixed methods.

## **Conclusion**

Consideration of the positive and negative effects on student construction management competition participation has seen little published literature. This study utilizes a qualitative priority mixed methods approach to make an in depth study of the effects of participation. Qualitative data were collected via interview with thirteen competition team coaches. Quantitative data were the result of a student survey.

The Qualitative priority of this study is the result a non-experimental design in the quantitative strand, and the large number of outside influences on the quantitative variables that are uncontrolled. So this study's interview data (qualitative strand) is the focus of this study, while the quantitative strand is a reflection to provide support.

The study's selected sample represented a solid cross section of construction education in the United States. Data for both strands were collected from the same locations using an internet based survey for the quantitative strand and in person as well as telephone interviews for the qualitative strand.

The combination of the two methods is intended to produce greater insight into the positive and negative effects of participation in construction management student competitions than could be obtained by qualitative data alone (Creswell & Plano Clark, 2011).

## **CHAPTER 4 - RESULTS**

### **Introduction**

This study utilized a convergent parallel mixed methods design which allowed for independent collection and analysis of the qualitative and quantitative data strands (Creswell, Plano Clark, 2011). The separate collection and analysis of the two data strands led to the research questions being categorized as quantitative, qualitative, and mixed. The research questions are the basis for the organization of this chapter with each one addressed in its own subsection. Questions one, two, and three are qualitative and are addressed first, question four is quantitative, and is then addressed. Question five is mixed methods, considering both data strands and is discussed in chapter five.

This chapter reports the results of the qualitative and quantitative data strands, because this study has a qualitative priority focusing on the positive and negative effects of participation in student construction management (CM) competitions. Rich description of themes that emerged from analyzing open, axial, and selective codes are identified, as well as interconnections between the positive and negative effects of participation in CM competitions. Themes were further broken down into codes through key word repetition (frequency) and pattern matching of comments from coaches and students. Data were collected through a student survey and interviews with competition team coaches.

Although the identification and description of the positive and negative effects of competition participation are the focus, this study also quantitatively considered the differences between participants and non-participants in construction management competitions based on starting salaries, frequency of employment, and GPAs. Those quantitative results are reported following the qualitative analysis as they were intended to compliment the qualitative findings.

### **Qualitative Questions**

The positive and negative effects of competition participation are the central focus of this study. According to Strauss and Corbin (2008) the central category is usually identified in the data, but this study was different in that respect because the central category was already identified. The pilot study results pointed to some positive effects of participation, and the grant funding supporting this study cemented it as the central category. This study sought to describe and develop the central category using Strauss and Corbin's (1998) steps of open, axial, and selective coding.

Utilizing the principle analytic strategies of asking questions and making comparisons (Corbin & Strauss, 2008), the researcher asked: what are the positive and negative effects of competition participation? Data collected from interviews and surveys were directed at this question. The responses from students and coaches were continuously compared, and those comparisons were the basic process for identifying themes in the data and were a means for evaluating saturation in the open, axial, and selective coding (Strauss & Corbin, 1998; Bowen, 2008).



Within the central category of the positive and negative effects of competition participation, rich description of the category was focused upon. Coding was used to identify and provide description of the themes. In the coding process descriptive statistics were employed to help deepen the analysis. Counts of the number of different coaches and students that independently addressed the codes identified were made and are reported.

The qualitative focus of this study is evident with three of the five research questions based on the qualitative strand of data. Detailed description of the analysis of each of the three qualitative research questions is given in the following sections, and while all of the research questions are important, questions one and two are those directly tied to the central category of this study.

### **Research Question One**

Question one asked: What do competition team coaches perceive as positive effects on students from participation in construction management competitions?

The literature review in chapter two reported positive effects from competition participation in engineering and construction management, those effects are summarized in table 2.1. Some of the positive effects that emerged in open coding are similar, or the same as those reported in the literature, but one of the codes that emerged from this study was not found in the literature, making the data unique to this study.

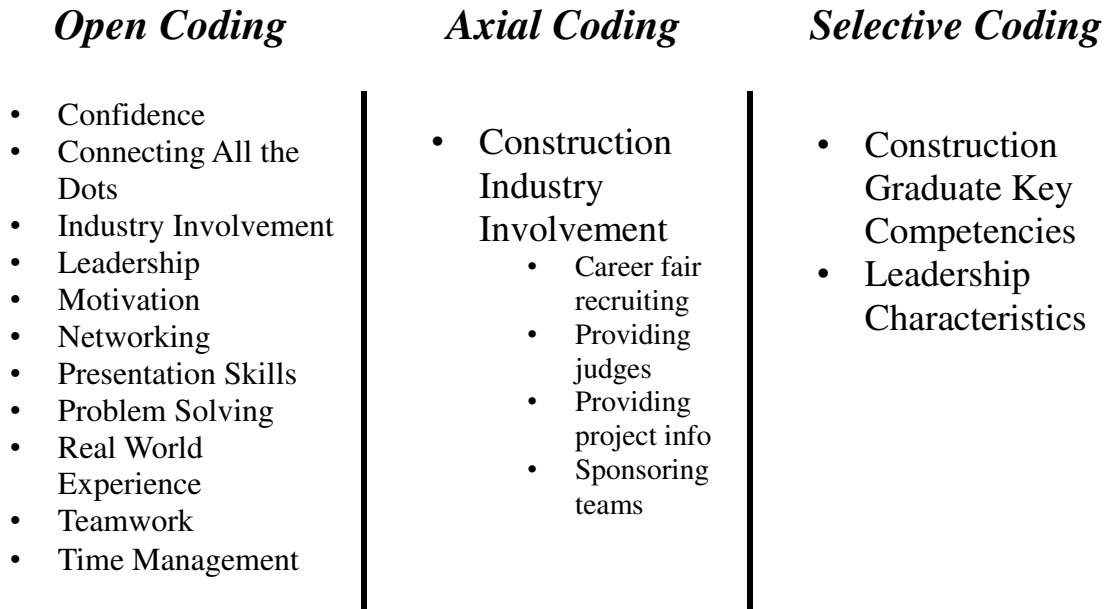
The data for the perceived positive effects were collected from team coaches and student participants. This data were transcribed and separation of the data into codes was initially performed using the Nvivo 9 software package, but the researcher soon shifted to coding by hand. Transcribed interviews and student responses were printed out and as

statements linked to different codes, they were cut out and the slips of paper were grouped with corresponding statements from other sample members. While this produced many slips of paper and lots of piles, the researcher found greater comfort and confidence coding by hand. From the coding process, ten open codes, one axial code and two selective codes emerged. Each of these codes is presented in the next subsection.

Strauss and Corbin's (1998) three step coding process was utilized in this study. In open coding ten specific positive effects to participation in construction management student competitions were identified. As analysis moved to the second step (axial coding) the researcher struggled with what Strauss and Corbin (2008) identified as "difficulty committing to a central unifying concept" (p. 105), this challenge was magnified because the code identified was unique from anything found in the review of literature. According to Strauss & Corbin (1998), the researcher should move from selective coding into the grounded theory development inherent within this qualitative analytic process. The researcher was challenge by the grounded theory process, especially because of his lack of experience and accompanying lack of confidence in his own theorizing analytic ability.

The lack of confidence led the researcher to review additional literature in search of support for the selective codes identified. Going to the literature gave the researcher confidence in the codes that emerged because the literature addressing leadership and key competencies gave various attributes of these topics that directly connected to the open codes that emerged in this study. Those connections are addressed specifically in the section on selective coding. The steps of coding led to development of a cyclical theory on how open, axial, and selective coding are interrelated. This theory helps explains the phenomenon of student construction management competitions, and is described in detail

at the conclusion of this section. Figure 4.1 shows the codes identified in each step of the coding process relating to the central category of positive effects of participation.



*Figure 4.1* Positive effects emerging in the coding process.

The detailed description of each theme identified, in each of the coding steps (open, axial, and selective) are discussed in the following, subsections.

**Question 1 - Open coding.**

The first step of open coding was extracting all of the statements made that reflected positive effects of competition participation. From the general category of positive effects, specific effects of competition participation were identified as codes. After reviewing the data in each code, a count was made to identify the number of coaches and students that talked about the same codes. This count was used to produce descriptive statistics, which provided further description of the data. The codes reported as positive

effects were all addressed by at least two coaches. These counts also led to the inference that more frequently reported codes would affect a greater number of student competition participants. Counting also provided a means to triangulate the themes reported by coaches and students to improve the study's legitimacy (Onwuegbuzie & Leech, 2007).

The open codes identified by this study as positive effects of participation include, confidence, connecting all the dots, industry involvement, leadership, motivation, networking, presentation skills, problem solving, real world experience, teamwork, and time management. Improved time management was a theme that is unique to CM student competitions. It was the only positive effect that emerged in open coding that was not found in the literature as a positive effect. All of the remaining effects, or very similar ones (confidence, connecting all the dots, industry involvement, leadership, motivation, networking, presentation skills, problem solving, real world experience, and teamwork) were all reported in the construction management and engineering literature (Sirianni et al., 2003; Orlandella & Zeigler, 2002; Anglin & Robson, 1997; Kasier & Troxell, 2005), further discussion of the findings of this study and those reported in the review of literature can be found in chapter five.

Table 4.1 lists the open codes that emerged and displays counts for each one. Those positive effects reported here were all addressed by at least two coaches. Some detail for each open code is given in detail in the sub sections following table 4.1. Codes are reported in alphabetical order.

Table 4.1  
*Counting of positive effects identified in open coding*

| Positive Effect         | times reported         |      |                         |     |                       |     |
|-------------------------|------------------------|------|-------------------------|-----|-----------------------|-----|
|                         | Coaches<br><i>n=13</i> | %    | Students<br><i>n=43</i> | %   | Total<br><i>n= 56</i> | %   |
| Confidence              | 3                      | 23%  | 1                       | 2%  | 4                     | 9%  |
| Connecting all the Dots | 7                      | 54%  | 7                       | 16% | 14                    | 25% |
| Industry Involvement    | 4                      | 31%  | 4                       | 9%  | 8                     | 14% |
| Leadership              | 2                      | 15%  | 0                       | 0%  | 2                     | 4%  |
| Motivation              | 7                      | 54%  | 1                       | 2%  | 8                     | 14% |
| Networking              | 5                      | 38%  | 8                       | 19% | 13                    | 23% |
| Presentation Skills     | 4                      | 31%  | 4                       | 9%  | 8                     | 14% |
| Problem Solving         | 5                      | 38%  | 0                       | 0%  | 5                     | 9%  |
| Real World Experience   | 13                     | 100% | 16                      | 37% | 29                    | 52% |
| Teamwork                | 3                      | 23%  | 13                      | 30% | 16                    | 29% |
| Time Management         | 3                      | 23%  | 9                       | 21% | 12                    | 21% |

***Confidence.***

Three coaches and one student indicated that increased confidence was a positive effect of competition participation. Although it was not a theme addressed very often by either coaches or students, Coach Seven returned to the effect of “confidence building” for students three times during their interview, at one point saying: “Confidence building, I would say confidence building more than any other thing” is the greatest positive effect of competition participation. Coach Six said: “they’re totally secure, they’re confident in what they know (following participation)”, and Coach Thirteen reported that: “It bolsters them up in a classroom”. One student said: “my confidence was greatly increased”. Coaches did not clearly or directly state how students obtain confidence as they participate, only that student confidence increases as a result of participation.

### *Connecting all the dots.*

Seven of the thirteen team coaches indicated that their students were able to better understand how the different courses in their construction management (CM) curriculum link together. As Coach Six put it: “In the competitions you’re forced to put all those things (schedules and estimates) together and realize how they’re integrated”. Coach Seven reported similarly saying that: “Seeing how they relate to each other and how they affect each other, that’s what these teams do”. It was Coach Four’s statement relating to this theme: “The competitions force you to connect all the dots” that provided the title of this code.

When asked what the positive effects of competition participation were for them, seven students wrote about utilizing the materials they learned in different classes and combining them into a single proposal for the competitions. Students recognized that their curriculum was related but needed to be connected. Specifically, one student answered the question by stating: “putting together knowledge from several classes at once”.

Coach Six discussed connecting all the dots, and tied it back to the effect of confidence stating:

I see my seniors that don’t do competitions, . . . for students who have never done it that’s their first presentation where they put it all together in four years. Whereas the competitions students may have done that three times by the time they get to the capstone and it’s totally different, you can tell the difference, they’re totally secure, they’re confident in what they know and they have no problem getting up in front of class and talking. It makes a big difference.

Regardless of a student’s ability to synthesize coursework or connect all the dots prior to a competition, participation positively affects students by improving on their ability to analyze curriculum clearly and synthesize the concepts, theory, and practice of CM. With half of the coaches, and seven students identifying this code it is strengthened

by frequency. It's frequency among both students and coaches triangulate this code to further reinforce it (Onwuegbuzie & Leech, 2007). Through constant comparison, frequency also shows saturation of this theme in the data.

### ***Industry involvement.***

Construction industry involvement was a theme that emerged with four coaches and five students addressing this positive effect. Industry involvement occurs in various ways, but some of the most common are career fair recruiting, providing judges and project information, sponsoring individual teams, hospitality rooms, and competition categories.

The positive effects of industry involvement are closely connected to the other open codes identified which are a principal reason why construction industry involvement was identified in axial coding as well. In a general sense Coach Two indicated: "it's great that they actually get the interaction with the industry folks", and coach nine built on that saying: "anytime you can participate with industry professionals that's a good thing". Student responses primarily tied to the connections they made with industry folks and demonstrate the close connection between industry involvement and networking.

### ***Leadership.***

Only two coaches recognized leadership specifically as a positive effect of participation, and like confidence the coaches did not provide direct indication why they attribute it to participation. The low frequency and lack of description in the interview data did not strongly support this theme, which resulted in leadership being initially left out as an open code. However, the researcher returned to leadership as a theme in open coding after leadership emerged in selective coding.

The word leadership was infrequently encountered in the data, but variations and leadership skills were more common. It was not until selective coding had occurred that the researcher recognized many of those variations as literature on the topic was evaluated. The direct interconnections between open and selective coding regarding leadership were identified based on Badger, Weisel, and Bopp's (2007) research on leadership skills, which identified four of the themes in open coding as leadership skills. So while specifically it was not frequently addressed, leadership was continually alluded to and is a clear open code.

### ***Motivation.***

Seven of the thirteen team coaches talked about student motivation in their interview responses. Some indicated that competition participation motivates students and others said the students have a higher drive, or are ambitious. Coaches Five and Nine both indicated that "slacker" students just don't get involved with the competitions.

Anglin and Robson (1997) quantitatively found that competitions increase motivation, but as a theme identified in this study, motivation is of note because the data indicates that it is also an attribute of participants prior to competition participation. Coach Seven described participants as: "They're motivated, self-motivated type individuals that enjoy those kind of things"; and Coach Two said: "the kind of student who would be attracted to do something like that is the one who goes to class, and you know they're going to attend class and get good grades anyways".

Motivation increases for competition participation, but coaches also indicate that students who participate are more motivated than non-participants to begin with. This theme that students are more motivated to begin with serves to illuminate this category.



### ***Networking opportunities.***

Networking was frequently cited in the engineering literature as a positive effect of competition participation. So it was no surprise that this code emerged in CM student competitions. Coach Five simply said: “Greatest benefit, I think it’s the opportunity to network”. As a theme in the data, networking was mentioned by five coaches, and eight students also reported it. The construction industry sponsorship of student CM competitions makes opportunities to network inherent to them. Although the positive effect of networking is very similar to industry involvement, both are reported because both were specifically addressed in the data.

### ***Real world experience.***

A real world experience is similar to several of the other themes discussed, and could serve as an umbrella theme to nearly all of the open codes identified. It was considered separately from the other themes however because it was specifically identified so frequently. Every coach and sixteen students spoke about it.

Some student responses included: “It gave us a real life situation”, “gaining real world experience before you leave the classroom”, and “what it’s like to be in a real world situation where bidding time is tight and stress levels are high with a lot on the line”. Students appreciated the realism of the competition projects, and coaches recognized that the experience was something that could not completely be replicated in a classroom, saying: “They’re (the competitions) the closest thing to real world experience that students can get other than actually having an internship, working for a builder” (Coach Five), and “it’s as close to reality as you’re going to get without actually being out there working” (Coach Six).

The frequency of this theme makes it the most saturated of the codes that emerged from the data, and constant comparison showed the relationship between real world experience and the other open codes.

### ***Presentation skills.***

Four team coaches as well as four students discussed presentation skills as a positive effect of competition participation. Coach Two's perception was that the presentation was the most beneficial component of student competitions stating:

I think that presentation is the most valuable part from where I sit. All the CM programs around the country can produce students who can estimate, I mean at the end of the day it's counting. But it's when those students have to get up in front and encapsulate their plan and their vision for the project I think that part's really valuable.

Coach Two later commented on presentation skills stating:

The competition element of it, in just putting you in front of industry and then making them sit up there and get poked at, just like industry does where clients poke at you in a presentation and stuff, that's just a phenomenal experience, I think those kids just come out and they can present themselves better.

Coach Eleven agreed with the value of the presentation, saying: "The real value is when they hit the road and get down to actually present[ing] it, oral presentations".

Student's responses, though abbreviated, were similar to the coach's. They pointed to "presentation skills", "learning to present", and "public speaking skills". The similar views between coaches and students on presentation skills triangulate to give strength to this code as a positive effect of participation.

### ***Problem solving.***

The student competitions considered in this study are an exercise in applied problem solving. As described earlier, construction management student competitions

give students a problem, and asks them to solve it. Problem solving was a commonly reported positive effect by team coaches. Five coaches identified problem solving skills as a positive effect of student competition participation. Coach Thirteen noted; “that’s what the program is all about, to develop leaders and people who can think and analyze on their own”. Producing a solution to a competition problem is how coaches attribute problem solving to participation. Coach Three indicated students benefited by it saying: “the process of putting that bid together, reading those plans, understanding where the problems lie, problem solving for that, and then presenting that”. This code is attributed to competition participation through the thinking and analysis that occurs as part of competition participation.

### ***Teamwork.***

The code of teamwork occurred in three of the thirteen coach’s interviews. They indicated teamwork improved from participation. Saturation however occurred in the student responses, teamwork was the second most commonly reported theme. Thirteen students recognized and reported teamwork skills as a positive effect from their competition participation.

The format and organization of the competitions makes students work in teams, and the scope of the problems make it improbable if not impossible for one person to perform all or even a majority of the work. This contrasts a classroom where a student may find it easier to just do more work than assigned to ensure a good grade. Coach nine indicated “Your sort of slacker type student is not going to participate”, so participants gain not only additional experience working on a team, but working on a team that likely has a higher

level of commitment. The response of one student describes the higher level of commitment saying they benefited by “learning to work with a driven team”.

***Time management.***

Three coaches talked about time management as a positive effect of participation, and nine students discussed the deadlines, time pressures, and the stress associated with the competition format that helped their time management skills.

The amount of preparation for the competitions varies from problem category to category, but with each there is some level of preparation that the students do prior to the competition. The sometimes significant additional time commitment participation requires can be classified as a form of experiential education. Coach Six described it saying:

It makes them really think about what they are doing, cause one of the important things about that is probably for students to learn how to manage their time, and we really don't teach that as a separate class.....what you do with your time is critical.

Through the increased work load placed on students participating in competitions, students improved their time management.

Time management was reported as a positive effect by three coaches, but nine coaches indicated the time commitment may be a negative aspect of the competitions. This was the only open code that emerged as both a positive and a negative of participation. Coaches indicated that if participants did not adequately manage their time, it could lead to negative consequences relating to participant's grades and academic standing. Time as a negative effect is discussed in greater depth in the section on research question three which addresses perceived negative effects.

### ***Question 1 - Open coding conclusion.***

Competition team coaches and students perceive: confidence, connecting all the dots, industry involvement, leadership, motivation, networking, presentation skills, problem solving, real world experience, teamwork, and time management as positive effects of student construction management competition participation. Other codes emerged, however they are not reported here because with less than two coaches addressing them, they lacked weight, and could not be triangulated (Onwuegbuzie & Leech, 2007), or interconnected with other steps of coding for support (Stauss & Corbin, 2008).

Ten of the eleven codes identified in this study were also found in the literature on student competitions. Because of the common themes identified it is important to note that the researcher did not intentionally use deductive coding, taking themes from the literature and searching for them in the data. Rather the codes that emerged were those positive effects that multiple coaches identified in their interviews.

These positive effects do not extend to all students, or impact them at the same level, but both coaches and students identify these themes as positive effects of competition participation, which provides an opportunity for development of these skills. How these positive effects are connected and benefit students is the focus of axial coding, addressed next.

### **Question 1 - Axial coding.**

The central phenomenon identified in the axial coding process was connected to each of the various open codes in different ways. The axial code identified in this study

relating to the positive effects of CM student competitions is: construction industry involvement.

The involvement of the construction industry as sponsors, judges, and recruiters at the competitions emerged as a theme in directly discussed in open coding, but was also indirectly referenced in many of the interviews, being spoken of in a contextual manner. Coach Two recognized this involvement as a positive effect when they said: “I think it’s great that they actually get the interaction with the industry folks”.

When industry involvement emerged in axial coding, a review of the open codes quickly showed its relationship and interconnections to each of the positive effects identified in the open coding process. In some of the interviews when coaches spoke about the positive effects that emerged as open codes, such as networking, they directly referenced industry involvement. For other codes, like teamwork, the connection between the axial and open codes was indirect. The unique conditions produced by industry involvement at the competitions are the basis for the link in a number of cases.

The following subsections address those connections between the axial and open codes, to provide causation and context for the axial coding. The following subsections are organized by the names of the open codes.

***Presentation skills, problem solving, confidence, connecting the dots, and teamwork.***

All of the competitions considered in this study have a presentation component, a problem for students to solve, and necessity of a team. So participation inherently benefits students as they team up, prepare for, and give a presentation based on their solution to the

problem. Improved presentation, problem solving, and teamwork skills then result from going through a competition and the associated process.

In and of themselves, the positive effects of improved problem solving, presentation skills, and teamwork could be gained in a typical classroom, but industry sponsorship distinguishes these positive effects when obtained at competitions. Through industry sponsorship, the problem to be solved comes from a real project, and student presentations are given to judges who are industry professionals that have typically worked on the project that is the subject of the competition. Coach Two discussed this comparison stating:

If a student goes through a really good capstone course I think they can get some of those same benefits but the competition element of it, in just putting you in front of industry and then making them sit up there and get poked at just like industry does where clients poke at you in a presentation and stuff, that's just a phenomenal experience.

As students go through the experience as a team of solving the problem, presenting their solution, and then fielding questions from industry professionals, an atmosphere is created that improves student's skills in these areas, and it increases their confidence as they have to defend their solutions to construction industry professionals. It is a situation that is difficult if not impossible to reproduce.

For the same reason that participants positively benefit from improved problem solving, presentation, and teamwork skills, Participant's ability to synthesize their coursework, or "connect all the dots" (Coach Four), is increased by completing the competition process. These positive effects identified in open coding could be achieved in a typical class, however the industry involvement in competitions amplifies these effects making obtaining them to the same degree in a typical classroom unlikely.

This amplification of the positive effects results directly from construction industry involvement in the competitions. Indirectly, motivation impacts these effects as well. The increase in motivation from industry involvement, amplifies the degree to which students improve their problem solving, presentation skills, and ability to connect the dots of their education.

***Motivation and networking.***

Increased motivation is a positive effect of participation, but as discussed in the previous section it also plays a role amplifying the positive effects of competitions over the same effects available in a typical classroom.

Coaches identified students who participate in the competitions as being more motivated to begin with, and while student motivation may be high entering the competitions, the opportunity to interact with and present to industry professionals, increases the level of motivation. Students want to win and they want to get jobs, and companies come to the competitions to meet and hire students, as Coach Six said:

One of our former students who is now on the other side of the table hiring our students, she said yeah our company pretty much only looks at competition students we look at those first before we look at anybody else.

Coach Two provided some reasoning why networking is effective at the competitions and why companies hire students there, saying:

They have philanthropic intentions for doing this, you know it might cost the average company 30 or 40K to sponsor one of these things but they have the opportunity to have the best of the best come walking in front of them for in essence a 2 day interview.

Because of the networking that occurs, students want to look good in front of the judges and they want to win, so motivation increases as opportunities for employment may



be on the line. Networking opportunities lead to the jobs students want, and with many companies converging on the competitions to hire, conditions are primed for networking. The central phenomenon that drives motivation and makes networking possible is construction industry involvement, it is the unique central theme of competition participation and it amplifies the positive effects available through participation.

***Real world experience, and time management.***

Because all of the other themes could fall under it, and because of the frequency with which it was reported, real world experience is considered the greatest benefit of competition participation. As with all of the other positive effects reported here, real world experience is not exclusive to competition participation, and can be attained elsewhere. However for real world experience the data clearly indicates that coaches don't see any activity being as close to the real world, other than actually working.

Companies look at this as you know close to real world experience, so it's like having a student that has more experience in the field on his resume than just someone that just sat through course work and so the companies value it more. (Coach Five)

It's as close to reality as you're going to get without actually being out there working so it's extremely important to the point that I think that it would benefit students to pay to get on a competition team if they had to. (Coach Six)

The connection of time management as an open code and industry involvement as an axial code is less obvious and occurs primarily through real world experience, Coaches Ten, Eight, and Five aptly described the interrelation of time management and a real world experience saying:

Being able to make decisions under pressure, pressurized situations I guess because you know they have such a short time frame and during the competition they usually switch up, and throw curve balls in so that they actually have to make

decisions on the fly which is very much like it is in the construction management world (Coach Ten)

For the competitions that are the short time I think that they get a sample of working on a deadline, they have to organize all of their work in a short period of time and then produce or deliver a proposal on their tight schedule. (Coach Eight)

There's times on projects that you only have 24-48 hours to kick it out the door and bid something, so um that's like real world too at times. The pressure and what you've got to produce in a short amount of time, is typical in the day to day world of construction. (Coach Five)

The use of a real project alone does not produce these positive effects. It's the life-like time deadlines, direct industry involvement, and the motivation created, along with the use of a real project that makes these effects of participation unique and difficult if not impossible to attain outside of the competitions.

Time management is inherent with the real world in construction management. Improved time management and a real world experience for CM students are positive effects of participation that are unrivaled in a typical classroom because of construction industry involvement. In some competitions industry involvement creates a short time frame for solving the competition problem, in other competitions it is simply the additional work load imposed by competition preparation, and driven by motivation. Both lead to improved time management and result directly from industry involvement in the competitions.

***Question 1 - Axial coding conclusion.***

The purpose of axial coding is to identify a central phenomenon from the open codes that emerged in the data (Strauss & Corbin, 1998). The central phenomenon identified in this study was: construction industry involvement.

While industry involvement comes in various forms and fashions, it is a common thread connecting each of the positive effects identified in open coding. It makes the competitions a vehicle for students to obtain the positive effects reported. The value of industry involvement results from the unique components it adds to the competitions amplifying the positive effects available beyond what students might obtain in a typical class, and outside of the classroom it contributes to recruiting. Construction companies get involved with the competitions to use them as a recruiting tool. As Coach Six reported: “. . . our company pretty much only looks at competition students, we look at those first before we look at anybody else.” Why the construction industry prefers to hire these students is a question answered in the next step in coding. Selective coding provides the storyline that describes what happens in a phenomenon (Leedy & Ormrod, 2010), and interconnects all three coding steps.

#### **Question 1 - Selective coding.**

Selective coding is the final step in the coding process for a grounded theory study (Strauss & Corbin, 1990; Leedy & Ormrod, 2010). Selective coding of this data indicates that the relationships identified between open and axial coding are interdependent. The positive effects identified in open coding are available and increased because of construction industry involvement. Construction industry involvement occurs because the students who participate in the competitions are better prepared for success in the construction industry, so companies want to hire them. Although, sponsorship and involvement with competitions can be expensive for companies, because success depends on people, they see involvement in the competitions not as charity but rather a recruiting tool. As Coach Two stated:

I've spoken to several of the companies who sponsor these and while it's very philanthropic for them to do it and everything what some of them will tell you. . . is that they have selfish intentions, as well as philanthropic intentions for doing this you know it might cost the average company 30 or 40K to sponsor one of these things but they have the opportunity to have the best of the best come walking in front of them for in essence a 2 day interview. And one of the guys from one of the companies put it that way. . . . He goes this is great for us because we figure out who the great kids are and guess what we do after the competition, we go out and offer them jobs.

Students participating in the competitions are high achievers, the data specifically points to participants being more motivated, however as participants in the competitions they benefit from further development of skills and characteristics that are important to success in the construction industry. The positive effects students obtain are directly linked to leadership skills, and key competencies for construction graduates. The connections between these areas, axial, and open coding show “what happens” (Leedy & Ormrod, 2010) regarding the positive effects of student participation in CM competitions. They also show a cyclical interdependence between the effects identified in each step of coding.

#### ***Leadership characteristics.***

Four of the positive effects identified in open coding are leadership characteristics. These effects are supported as leadership characteristics by Badger, Weisel, and Bopp (2007) who identified eight leadership skills as the most frequently mentioned in a review of “hundreds of articles and papers” (pg 3). The relationships between the open codes that emerged in leadership, indicate that the effects of competition participation include development of leadership skills.

Written and oral communication skills, motivating, problem identification and solving, and team work are the leadership characteristics identified by Badger et al. (2007) that directly relate to the positive effects reported by this study. So while the effect of leadership was only weakly supported in open coding, the positive effects of: presentation skills, motivation, problem solving, and teamwork are all considered leadership skills. The construction industry values these leadership skills in their employees, and students participating in the competitions developed them through participation, making participants more desirable as employees.

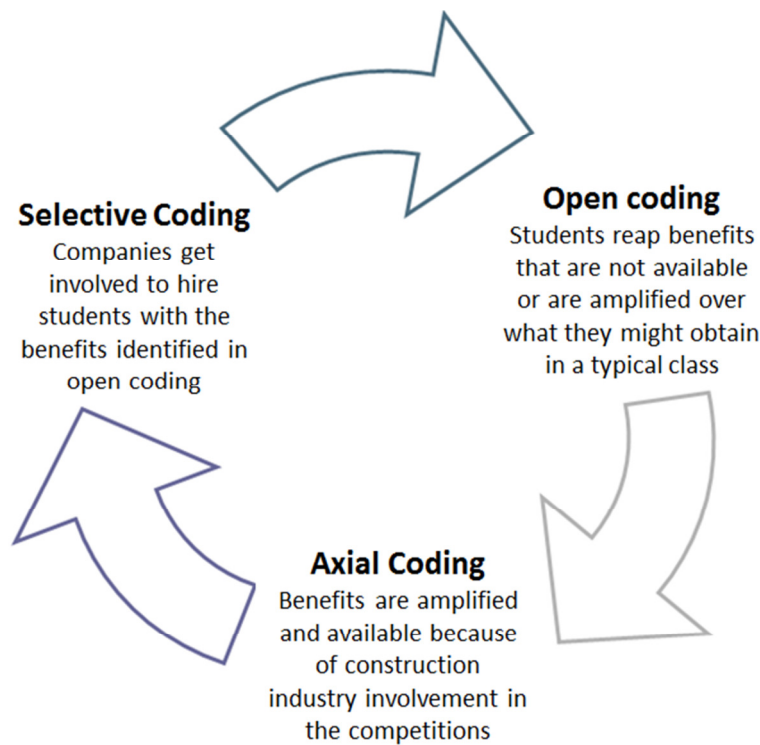
***Construction graduate key competencies.***

In their research Ahn, Kwon, Pearce, and Shin, (2010) present fifteen key competencies for construction graduates. As with the leadership skills identified, there are direct connections between four of these key competencies and the positive effects identified in open coding. The key competencies directly linked to the effects of participation include: Problem solving skills, Leadership, Collaborative skills, and Communication. Although not directly related, interpersonal skills, technical skills, and estimating/scheduling skills are three additional key competencies reported by Ahn et al. (2010), that may result from competition participation.

The key competencies given indicate what recruiters at over 100 construction companies want in graduates (Ahn et al., 2010). By helping student's develop these competencies, CM competitions provide graduates with the skills companies want. Further the competitions provide companies with a place they can come to see these "best of the best" (Coach Two) students.

**Question 1 - Coding conclusion.**

The interconnection of open, axial, and selective coding form a cycle, that explains the phenomenon of student construction management competition participation. This cycle represents the theory developed in this study. Figure 4.2 depicts this cycle, and serves as a visual model representing the theory. Although the selective codes of leadership and key competencies were identified last, starting with the selective coding the cycle is described: Companies see better prepared students with leadership skills and



*Figure 4.2* Interconnection of coding steps.

key competencies at the competitions, they want to hire the best people to be successful, so they attend the competitions. Attendance leads them to involvement in the competitions to gain better access to the students. This industry involvement leads to the positive effects identified that contribute to leadership and key competencies for student participants.

These effects better prepare the students for employment and success, which is recognized by the companies and then the cycle repeats.

Construction industry involvement leads to positive effects for participants. Those effects, described specifically in open coding, and more generally as leadership and key competencies in selective coding, result from construction industry involvement in CM competitions and are what make competition participants more desirable to construction companies.

### **Research Question One-a.**

Research question one simply asked what are the positive effects of competition participation? Question one-a more specifically asked what the greatest benefit to competition participation is?

In open coding many different positive effects of participation were reported. The diversity of the positive effects found was not surprising, and following the extensive list of effects reported in the literature, many were expected. While any of the themes reported could represent the greatest benefit for one individual, this study utilized descriptive statistics based on content analysis and the frequency of reporting of the different positive effects to determine which of the themes that emerged in open coding is the greatest benefit of participation.

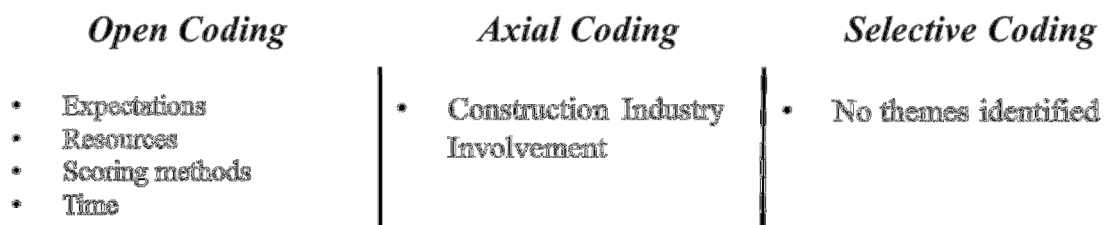
As could be seen in the section on open coding, the frequency of reporting the different effects of participation varied greatly between students and coaches. Effects frequently cited by coaches were infrequently cited by students and vice versa, as can be seen in table 4.1. However, “real world experience” was the exception. It was the most

frequently reported by both groups with every coach and sixteen students citing it. With all of the coaches addressing it, it was the only theme unanimously addressed.

For some participants there may be positive effects that are greater than “real world experience” but based on content analysis, this study infers that it is the effect with the broadest touch, and ability to impact the most students. So it is considered the greatest benefit to competition participation.

### **Research Question Two**

Although the predominant opinion regarding competition participation is positive, the review of literature indicated that there are those who oppose competitions because of their negative effects. As a result research question two (What negative effects of participation in construction management competitions do team coaches describe?) evolved to investigate what the negative effects of participation might be, and to compare them to the positive effects that emerged. This comparison was also necessary to address the difference hypothesis that: the perceived positive effects of participation would outweigh perceived negative effects. Figure 4.2 illustrates the codes that emerged in data relating to negative effects of participation.



*Figure 4.3* Negative effects emerging in the coding process.



When asked about positive effects of competition participation, coaches tended to respond quickly with their perceptions and then gradually built upon them as the interview progressed. When asked about negative effects of competition participation however, a few of the coaches had quick responses, but the majority required time to think before they responded. Ultimately every coach provided some perceived negative effects of competition participation, but the speed and difficulty with which coaches responded pointed to a greater number of positive than negative effects, which is in line with the findings of the literature review where many different positive effects were found but much fewer negatives.

### **Question 2 - Open Coding.**

As was done for the positive effects of competition participation, Strauss and Corbin's (1998) steps to coding were followed. From the coach's interviews five themes emerged as negative effects of competition participation in open coding, Capacity, Expectations, Resources, Scoring methods, and Time. Unlike the perceived positive effects of participation student responses concerning negative effects are not reported, because students were not asked about negative effects. Consideration of each theme identified as a negative effect is given in the following subsections.

#### ***Capacity.***

Coaches Six and Seven reported competition capacity as a negative effect. This effect was described as the number of students who are able to participate in the competitions.

The only negative side to the competition is that we can't get all the students involved, we don't have enough faculty, we don't have enough space we don't have enough money to be able to have every student do a competition (Coach Six).

Coach Two specifically indicated that students who want to participate should be able to do so, saying: "the only negative is if somebody who really wanted to be there couldn't be there". Whether this negative effect falls on schools for not sending more students to the competitions, or on the competitions for not accommodating a larger number of participants was not studied, and this effect is considered outside the scope of this study. Based on the delimitations of this study capacity does not qualify, this study addresses the negatives for participants and capacity would apply to students who are unable to or do not participate so this negative effect is not addressed further.

### *Expectations.*

This negative effect brings up a unique situation, as it illuminates a seemingly contradictory element of the competitions. Coach Ten indicated that after participating in the competitions students often feel that they are ready for and deserve a higher entry level position than their experience or education supports. These students have the expectation that they should be promoted faster and skip the lower level positions and salaries. It was Coach Ten's view that: "it sets unrealistic expectations in the student's minds". Because the proposals that the students put together for the competitions are similar in scope, content, and topics to one that would be assembled by upper level managers, students expect to do that same work rather than the often menial day to day responsibilities they face in entry level positions. This negative effect presents an interesting contrast to the positive effects of participation. As students benefit from the positive effects of participation and become better prepared for managerial positions in their careers, they

must also understand that those are not the positions they will be taking as new graduates and that they are unlikely to assume those positions for many years.

As a negative effect of participation, expectations are poorly supported with only one coach addressing it. It was reported here however, because with so few negative effects emerging from the data, all are reported.

### ***Resources.***

Inequality of team resources was a negative effect reported by Coach Eight. They said: “the students felt that they are at a disadvantage to universities that are bigger, that have bigger budgets because they see larger groups that are better equipped”. This negative effect cannot be considered to affect all participants in construction management competitions, however for those participants attending schools with less resources and smaller budgets, it does highlight a potential inequality at the competitions.

As with the negative of expectations, resources was only cited by one coach and so is only weakly supported.

### ***Scoring methods.***

Two of the coaches reported that the judging methodology, or lack thereof, was a negative effect of participation. Coach Nine discussed attendance at competitions where the best teams did not win because of questionable judging or loosely defined judging criteria, and Coach One discussed the need for faster and improved feedback from judges so students could learn and better understand where improvement is necessary. In both cases scoring methods represent a negative effect of competition participation.

### ***Time.***

The most frequently perceived negative effect of competition participation related to the additional time preparation and participation required of students. While some coaches were very general, simply stating that participation takes a lot of time (Coaches Four, Six, Seven, and Twelve), others were more specific saying things like: “the time would be an issue” (Coach One), or “It’s time consuming” (Coach Three). Most of the responses referred to the time students spent preparing for the competitions, Coaches Four, Ten, and Twelve specifically pointed to the potential damage to a student’s grades if they don’t adequately manage their preparation time before leaving for the competitions. Coaches Two and Eleven pointed to students missing classes because of the time away to actually compete.

As addressed in the section on positive effects of participation, time is unique because it is reported as both a positive and negative effect of participation. But with nine of thirteen coaches identifying it as a negative of participation, time is the negative effect that emerged most strongly supported.

### ***Question 2 - Open coding conclusion.***

As was the case with the review of literature, few negative effects were identified relating to competition participation. In all, five negative effect emerged in open coding of the data, however because the negative effect of capacity does not fall within the scope of this study (delimited to competition participants), only four negative effects are applicable. Of these effects (expectations, resources, scoring method, and time) time was the most strongly supported in the data, which was consistent with the review of literature where time was also the best supported negative effect of competition participation.

## **Question 2 - Axial coding.**

The central phenomenon, identified relating to the negative effects of competition participation was: construction industry involvement, the same axial code identified for the positive effects of participation. The following subsections give details of the interconnections between the negative effects identified as open codes and the axial code.

### ***Expectations and scoring methods.***

Competition participation provides a real world experience for students through industry involvement. However as companies get involved, they provide the projects, the problems to be solved, and the judges. As a result of companies providing those aspects, “some of these competitions are geared for the students to play the role of senior level management” (Coach Ten). As this occurs students develop unrealistic expectations, these expectations are ultimately the result of decisions made by the companies involved with the competitions.

Scoring methods link to construction industry involvement the same way. Competition subjects and judges are typically members of the team working on the project that is a competition’s subject. This serves to improve the experience for students, but as the projects used in the competition change every year, so then do judges, which leads to inconsistent methods. Additionally competition judging criteria ranges from generally defined categories, to judging protocol that is left at the discretion of the sponsoring company. Coach Nine described it saying: “I’ve participated long enough to see that the judging is not comprehensive.” So with turn-over of judges and judging criteria potentially changing each year, this negative effect is closely connected to industry involvement.

### ***Resources.***

The disparity in resources available between schools of different sizes, and of different teams emerged as a negative effect in open coding. This negative contributes to the real world experience of the competition, as the disparity in resources from one team to another adeptly mirrors the real world. Companies of different shapes, sizes, and resources bid and compete for the same projects every day, and each must learn how to be competitive in the market. For participants, the same challenge is presented in the competitions.

The connection between this negative effect and industry involvement comes back to cost. As Coach Two indicated, sponsorship of a competition is very expensive, and solutions such as the sponsor providing each team the same equipment (Coach Eight), or policing teams to ensure the use of approved resources would increase those costs. Even if cost were not a factor, companies would likely still allow teams to utilize all the resources at their disposal because in competing for a bid every company uses the unique resources it has, and that is part of the real world experience students gain. As Coach Three said: “it’s the real world, . . . you’ve got to have a winner and a loser”.

### ***Time.***

Just like the positive effect of time management, for the negative effect of time the connection to the axial code, industry involvement, occurs as a result of the use of a real project with time deadlines and involvement with industry professionals.

The emergence of time management as a positive, and time as a negative effect indicate that competition participation is like a “baptism by fire” relating to time. While industry involvement serves to motivate and push some students to learn time management

through participation, for those who do not learn, the time required to participate has significant drawbacks. The real world experience, deadlines, and motivation that result from industry involvement produces results both negative and positive effects regarding time. Why the effects may be negative or positive for different students was not addressed in this study.

***Question 2 - Coding conclusion.***

Involvement of the construction industry in student competitions results in positive and negative effects for participants. The emergence of industry involvement as the axial code or central phenomenon interconnecting the open codes identified for both positive and negative effects of participation paints a complete picture of competition participation. This common interconnection shows that while coaches perceived the positive effects “far outweighed the negatives” (Coach Eleven), both exist and both are the result of industry involvement.

Establishing expectations, greater consistency in scoring and judging methods, a level playing field, and eliminating the negative time impacts are certainly desirable, and could improve the competitions. However, because the industry involvement that is interconnected with these negative effects is likewise interconnected with the positive effects of participation, any changes should be approached cautiously.

**Theory.**

According to Strauss and Corbin (2008) description is necessary for interpretations of data and theory development, but may not lead to theory, they further state: “not everything can or should be reduced to one clever theoretical explanatory scheme, as helpful as that scheme might be” (pg. 55). The previous sections have provided

description of the negative effects that emerged in open coding and their interconnections identified in axial coding. That description is the extent of the results relating to the negative effects of competition participation provided, as the researcher did not identify the emergence of a theory in the data.

### **Question 2 - conclusion.**

From the data collected five themes emerged in open coding as negative effects of competition participation, however only four fell within the scope of this study. Those negative effects are: expectations, resources, scoring methods, and time. As with the positive effects of competition, industry involvement emerged as the central phenomenon that connected each of these negative effects.

The negative effects reported will not affect every participant, and coach's perceptions should be considered with them. Coach Thirteen summarizes many of the comments saying: "I don't really see any negative to it because they are learning, you know somebody's got to loose, somebody's got to win".

Various negative effects of competition participation emerged in the data with varying strength. All of these negative effects are interconnected and can be linked back to industry involvement but, coach's tended to minimize those negative effects, indicating the positive effects of participation represent more valuable data.

### **Research Question Three**

Research question three asked: how do the perceptions of team coaches help to explain the quantitative differences between participants and non-participants as it relates to: starting salaries, and GPAs.



The quantitative portion of this study took place concurrently with the qualitative portion, so the questions asked in interviews were based on the findings of the Colorado State University pilot study. Because the results from research question four and the pilot study do not agree the results reported here must be considered with caution.

A basic qualitative approach was taken to report the themes that emerged from the qualitative data for this question, the themes are reported here in separate subsections for each category (Starting salary and GPA).

### **Starting salaries.**

Team coaches were asked why they thought that students who participated in the competition were found to have higher average starting salaries than non-participants (as was found in the pilot study). Although all thirteen of the coaches thought it made sense that competition participants might obtain a higher starting salary, the strength of conviction among them varied. Some coaches were guarded in their thoughts and comments, but others quickly agreed that it made sense. Still others strongly agreed and cited examples supporting participants obtaining higher starting salaries, Coach Two commented:

I think those kids just come out and they can present themselves better and they get more money, the dirty secret out there is, not every company offers the same amount to every student and students are naïve to think they do.

None of the coaches disagreed with or challenged higher starting salaries for participants, beyond Coach Eight commenting that perhaps higher participant GPAs were leading to the higher starting salaries (no correlation was found). The coaches all agreed

that participants would obtain higher average starting salaries than non-participants, and were consistent indicating competition was the reason for the higher salaries.

Twelve of the thirteen coaches indicated that companies and the construction industry place a high value on competition participation, specifically on the experience gained by students through participation. The coaches believed that the experience gained through competition participation is what increased student's value to companies and would result in participants earning higher salaries. As Coach Three put it "they are in more demand just because they have that experience", and Coach Seven said: "the industry sees the value of having done something extra number one, and number two done something extra that relates directly to the industry, so you win on both points and those students are in higher demand." The experience gained through competition participation is perceived to be a driving factor for higher starting salaries among participants, and was aptly described by Coach Two who recently left the construction industry;

If a student can sit in front of me and talk intelligently about the big picture and the processes and understand RFP's and RFQ's and presentations and they get that, then I was always inclined to give them a couple extra grand more than other people coming through the door.

As described, the qualitative results support higher starting salaries among participants as a result of competition participation. The quantitative strand of this study found the mean starting salary for participants was higher than the mean starting salary for non-participants but that difference was not statistically significant. The insignificant findings place a question mark next to the themes that emerged here.

## **GPA's.**

The students surveyed for this study were not found to have significantly different GPA's based on competition participation when assigned to participant and non-participant groups, and the qualitative data provided no evidence to support higher GPAs for competition participants resulting from competition participation.

With only one exception the team coaches felt that higher GPA's were not a result of competition participation. The remaining twelve coaches were all very definitive in their responses that the higher average GPA found in the pilot study resulted from competition participants being better students to begin with. The data indicated that beyond simply being more motivated, these students are also those who are already involved in extracurricular activities, and at some schools coaches select their teams so it is higher achieving students who are asked to participate, indicating that participation has little if any impact on student's performance.

We hand pick our students I mean I'm looking for the brightest and the best so I'm out trying to see who has the good grades and are involved The students who are involved are typically the ones who do have the better grades (Coach Three),

Coach's perceptions produced data that strongly indicates that competition participants are perceived to be better students before participating, so competition participation does not cause higher GPAs. However as with starting salaries, the lack of a significant difference in the quantitative strand makes this finding questionable.

## **Quantitative Research Question**

The quantitative strand of this study played a reflective role, with the intention that it could support the findings from the qualitative strand. The quantitative exploration only

addresses one research question, and evolved directly from the Colorado State University pilot study which found a significant difference between competition participants and non-participants relating to GPAs and starting salaries. Similar results were expected, but the findings of this study were not significant. Additional analysis was performed in an attempt to understand the conflicting results between this study and the pilot study. While there are some clear shortcomings of this study's sample, exactly why the results were not significant is not understood, and this quantitative exploration does not support the qualitative findings.

#### **Research Question Four**

Question four asks what the differences are between participants and non-participants in construction management competitions relating to the following: GPAs, frequency of employment, and starting salaries? A preliminary evaluation of these variable's means produced mixed results. Frequency of employment and GPA means for participants and non-participants were almost the same (Table 4.2 displays those means). However starting salaries showed participants earning about \$3,200 more than non-participants, which was very similar to the statistically significant difference (\$3,500) found in the pilot study.

Statistical analysis of the dependent variables confirmed that there was no statistically significant difference between participant and non-participant GPAs and frequency of employment. It further showed that the difference in starting salaries was not significant.

Analysis of the sample was performed using a *t*-test. No significant difference was found between the groups. Table 4.2 shows that participants were not significantly different from non-participants on GPA, ( $p = .743$ ). Inspection of the two group means shows that the average GPA for participants ( $M = 3.228$ ) was slightly lower than for non-

Table 4.2

*Comparison of Participants and Non-Participants in Student Construction Management Competitions on GPA (n = 50 Participants, 92 Non-Participants), and Starting Salaries (n = 16 Participants and 33 non-participants).*

| Variable            | <i>M</i> | <i>SD</i> | <i>t</i> | <i>df</i> | <i>p</i> |
|---------------------|----------|-----------|----------|-----------|----------|
| Grade Point Average |          |           | -.328    | 140       | .743     |
| Participants        | 3.228    | .336      |          |           |          |
| Non-Participants    | 3.249    | .388      |          |           |          |
| Starting Salaries   |          |           | .876     | 47        | .385     |
| Participants        | \$55,119 | \$10,532  |          |           |          |
| Non-Participants    | \$51,906 | \$12,683  |          |           |          |

participants ( $M = 3.249$ ), but the difference was not significant. Not surprisingly the effect size *d* was approximately -.06, a very small effect according to Cohen (1988).

Participants and non-participants were not significantly different on starting salaries ( $p = .385$ ) either. Inspection of the two group means shows that the average starting salary for participants but the difference is not significant. The effect size *d* was approximately .27, a small effect size according to Cohen (1988).

Although a statistically significant difference between participants and non-participants was not found relating to starting salaries, the data does provide some practical significance (Morgan et al., 2007). As noted the average starting salary for participants ( $M = 55,118$ ) is higher than that of non-participants ( $M = 51,906$ ) by \$3,212. This difference while not statistically significant is practically significant.

To investigate whether participants and non-participants differ on frequency of employment, a chi-square statistic was used. Frequency of employment was measured by students reporting they had accepted job offers. Assumptions of nominal and independent data, and frequency levels were checked and met. Table 4.3 shows the Pearson chi-square results and indicates that participants and non-participants are not significantly different on frequency of employment ( $\chi^2 = .026$ ,  $df = 1$ ,  $N = 143$ ,  $p < .872$ ). Phi, which indicates the strength of the association between the two variables, is  $-.013$  and, thus the effect size is considered to be very small according to Cohen (1988).

Table 4.3  
*Chi-square Analysis of Frequency of Employment Among Participants and Non-participants.*

| Variable                | n   | Competition Involvement |                  | $\chi^2$ | p    |
|-------------------------|-----|-------------------------|------------------|----------|------|
|                         |     | Participants            | Non-Participants |          |      |
| Frequency of Employment |     |                         |                  | .026     | .872 |
| Has Job                 | 59  | 21                      | 38               |          |      |
| Does not have job       | 84  | 31                      | 53               |          |      |
| Totals                  | 143 | 52                      | 91               |          |      |

Analysis of the quantitative data collected indicates that there was no statistically significant difference between participants and non-participants in construction management student competitions as it relates to GPAs, frequency of employment, and starting salaries. These findings fail to reject the null hypothesis.

Additional analyses were performed on the data in an effort provide explanation of why the results were not significant. These analyses are described next.

### Starting salaries and GPA.

When this study failed to reject the null hypothesis, the researcher was interested to learn if this study would show a correlation between starting salary and GPA or not.

A scatter plot was created to explore the correlation of GPAs with starting salaries; it is shown below as figure 4.3. The regression line indicates a very weak if any correlation between the variables.

To further investigate if there was a statistically significant association between GPAs and starting salaries a Spearman correlation was calculated,  $r_s(48) = .09, p = .541$ ,

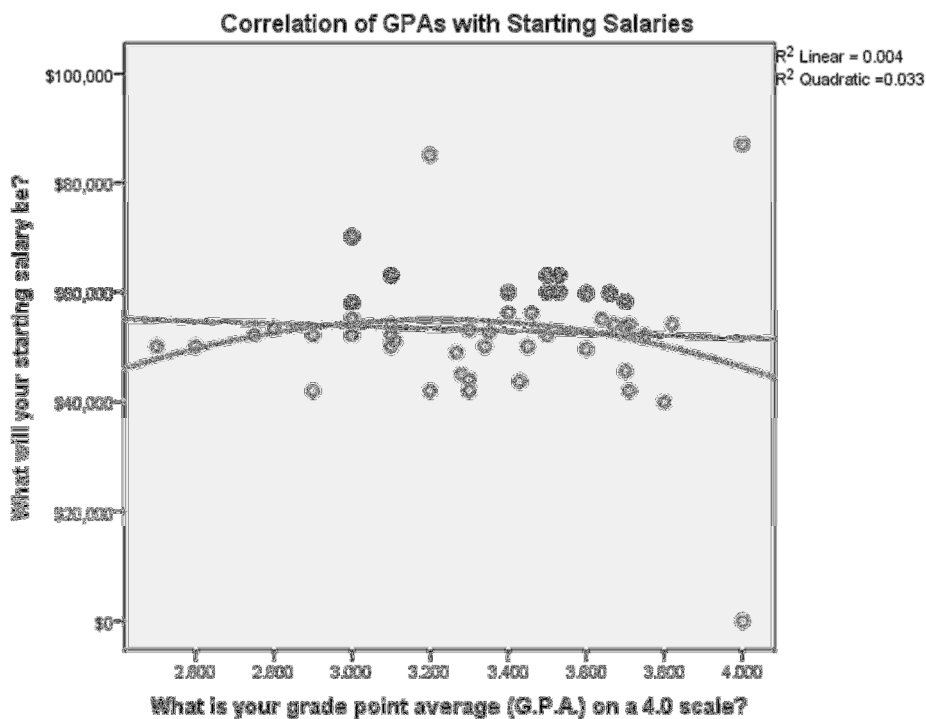


Figure 4.4 Correlation of GPAs with Starting Salaries.

and indicated there was no significant relationship between starting salaries and GPAs. A Spearman correlation was used because the starting salary data were skewed (1.576).

### **GPA, frequency of employment, and starting salaries at each school.**

With no significant difference between groups, some exploratory research was performed using the data from each school. Each school was considered individually to look for significant differences. Although the sample as a whole showed no significant differences, it was hypothesized that significant differences might occur at the individual schools. Factorial ANOVA and Fisher's Exact Test were the statistics used.

#### ***GPA at each school.***

Consideration of GPAs for participants and non-participants at each school was performed first using factorial ANOVA. Table 4.4 provides descriptive statistics which indicated that at three of the schools (Purdue University, Colorado State University, and Cal-Poly San Luis Obispo), mean GPAs for participants were higher than for non-participants. At the three remaining schools (North Dakota State University, Georgia Technical Institute, and Texas A&M University), mean GPAs for non-participants were higher than for participants. Further evaluation of Table 4.4 indicates that none of the samples were close to the  $n = 30$  in each of the groups being compared, as recommended by Gilner et al. (2010). As a result any findings should be interpreted with caution

Table 4.4  
*Means, Standard Deviations, and n for GPA as a Function of Competition Participation and School*

| School | <i>n</i> | Participant |      | Non-Participant |       |      | <i>n</i> | Total |      |
|--------|----------|-------------|------|-----------------|-------|------|----------|-------|------|
|        |          | M           | SD   | <i>n</i>        | M     | SD   |          | M     | SD   |
| CPSLO  | 25       | 3.215       | .345 | 13              | 3.112 | .292 | 38       | 3.18  | .328 |
| CSU    | 7        | 3.260       | .476 | 8               | 3.115 | .367 | 35       | 3.144 | .388 |
| GT     | 3        | 3.263       | .100 | 11              | 3.511 | .450 | 14       | 3.458 | .411 |
| NDSU   | 6        | 3.075       | .756 | 3               | 3.533 | .330 | 9        | 3.228 | .289 |
| PU     | 7        | 3.384       | .393 | 21              | 3.256 | .405 | 28       | 3.288 | .398 |
| TAMU   | 2        | 3.150       | .071 | 16              | 3.355 | .331 | 18       | 3.332 | .319 |
| Total  | 50       | 3.228       | .336 | 92              | 3.250 | .389 | 142      | .242  | 370  |



Table 4.5 shows that there was no significant interaction between school and competition participation on GPAs,  $F(5, 130) = 1.41, p = .225, \text{partial } \eta^2 = .051$ . Assumptions of homogeneity of variance and normal distribution of the dependent variables were not violated. Because there were no significant results no post hoc analysis were performed.

Table 4.5  
*Factorial Analysis of Variance for GPA as a Function of Competition Participation and School*

| Variable and Source  | df  | MS   | F     | Partial $\eta^2$ | eta  |
|----------------------|-----|------|-------|------------------|------|
| <b>GPA</b>           |     |      |       |                  |      |
| Competition          | 1   | .146 | 1.113 | .008             | .089 |
| School               | 5   | .127 | .971  | .036             | .189 |
| Competition * School | 5   | .185 | 1.411 | .051             | .226 |
| Error                | 130 | .131 |       |                  |      |

***Frequency of employment at each school.***

Consideration of frequency of employment for participants and non-participants at each school indicated that with the exception of Texas A&M University, competition participants at all schools had higher rates of employment than non-participants. Table 4.6 shows these descriptive statistics. As with GPAs at each school, evaluation of Table

Table 4.6  
*Means, Standard Deviations, and n for Frequency of Employment After List Wise deletion.*

| School | Participant |      |      | Non-participant |      |      | Total |      |      |
|--------|-------------|------|------|-----------------|------|------|-------|------|------|
|        | n           | M    | SD   | n               | M    | SD   | n     | M    | SD   |
| CPSLO  | 25          | 0.20 | 0.41 | 13              | 0.08 | 0.28 | 38    | 0.16 | 0.37 |
| CSU    | 7           | 0.86 | 0.38 | 28              | 0.46 | 0.51 | 35    | 0.54 | 0.51 |
| GT     | 3           | 0.67 | 0.58 | 10              | 0.40 | 0.52 | 13    | 0.46 | 0.52 |
| NDSU   | 6           | 0.17 | 0.41 | 4               | 0.00 | 0.00 | 10    | 0.10 | 0.32 |
| PU     | 7           | 0.71 | 0.49 | 21              | 0.62 | 0.50 | 28    | 0.64 | 0.49 |
| TAMU   | 2           | .00  | 0.00 | 16              | 0.44 | 0.51 | 18    | 0.39 | 0.50 |
| Total  | 50          | 0.38 | 0.49 | 92              | 0.41 | 0.50 | 142   | 0.40 | 0.49 |

4.6 indicates that in fact all of the samples were less than  $n = 30$  in each of the groups being compared, as recommended by Gilner et al. (2010), so any findings should again be interpreted with caution.

For this exploratory research a chi-square statistic was used to evaluate each individual school, because all of the six schools have frequencies less than five the Fisher's exact test is reported (Morgan et al., 2007). Tables 4.7 through 4.12 show the Fisher's Exact results for each school in the sample.

Table 4.7 shows the Fisher's exact results at Cal Poly San Luis Obispo. It indicates that participants and non-participants are not significantly different on frequency of employment ( $p < .388$ , Fisher's exact test). Phi, which indicated the strength of the association between the two variables, is .189 and, thus the effect size is small or smaller than typical according to Cohen (1988).

Table 4.7  
*Fishers Exact Test on Frequency of Employment at CPSLO.*

| Variable                | n  | Competition Involvement |                  | $\chi^2$ | p    |
|-------------------------|----|-------------------------|------------------|----------|------|
|                         |    | Participants            | Non-Participants |          |      |
| Frequency of Employment |    |                         |                  | 1.393    | .388 |
| Has Job                 | 7  | 6                       | 1                |          |      |
| Does not have job       | 32 | 20                      | 12               |          |      |
| Totals                  | 39 | 26                      | 13               |          |      |

Table 4.8 shows the Fisher's exact results at Colorado State. It indicates that participants and non-participants are not significantly different on frequency of employment ( $p < .096$ , Fisher's exact test). Phi, which indicated the strength of the association between the two variables, is .315 and, thus the effect size is medium or typical according to Cohen (1988).

Table 4.8  
*Fishers Exact Test on Frequency of Employment at CSU.*

| Variable                | <i>n</i> | Competition Involvement |                  | $\chi^2$ | <i>p</i> |
|-------------------------|----------|-------------------------|------------------|----------|----------|
|                         |          | Participants            | Non-Participants |          |          |
| Frequency of Employment |          |                         |                  | 3.483    | .096     |
| Has Job                 | 7        | 6                       | 1                |          |          |
| Does not have job       | 28       | 13                      | 15               |          |          |
| Totals                  | 35       | 19                      | 16               |          |          |

Table 4.9 shows the Fisher's exact results at Georgia Tech. It indicates that participants and non-participants are not significantly different on frequency of employment ( $p < 1$ , Fisher's exact test). Phi, which indicated the strength of the association between the two variables, is .174 and, thus the effect size is small or smaller than typical according to Cohen (1988).

Table 4.9  
*Fishers Exact Test on Frequency of Employment at GT.*

| Variable                | <i>n</i> | Competition Involvement |                  | $\chi^2$ | <i>p</i> |
|-------------------------|----------|-------------------------|------------------|----------|----------|
|                         |          | Participants            | Non-Participants |          |          |
| Frequency of Employment |          |                         |                  | .424     | .999     |
| Has Job                 | 7        | 2                       | 5                |          |          |
| Does not have job       | 7        | 1                       | 6                |          |          |
| Totals                  | 14       | 3                       | 11               |          |          |

Table 4.10 shows the Fisher's exact results at North Dakota State. It indicates that participants and non-participants are not significantly different on frequency of employment ( $p < 1$ , Fisher's exact test). Phi, which indicated the strength of the association between the two variables, is .250 and, thus the effect size is medium or typical according to Cohen (1988).

Table 4.10  
*Fishers Exact Test on Frequency of Employment at NDSU.*

| Variable                | <i>n</i> | Competition Involvement |                  | $\chi^2$ | <i>p</i> |
|-------------------------|----------|-------------------------|------------------|----------|----------|
|                         |          | Participants            | Non-Participants |          |          |
| Frequency of Employment |          |                         |                  | .563     | .999     |
| Has Job                 | 1        | 1                       | 0                |          |          |
| Does not have job       | 8        | 5                       | 3                |          |          |
| Totals                  | 9        | 6                       | 3                |          |          |

Table 4.11 shows the Fisher's exact results at Purdue. It indicates that participants and non-participants are not significantly different on frequency of employment ( $p < .678$ , Fisher's exact test). Phi, which indicated the strength of the association between the two variables, is .104 and, thus the effect size is small or smaller than typical according to Cohen (1988).

Table 4.11  
*Fishers Exact Test on Frequency of Employment at PU.*

| Variable                | <i>n</i> | Competition Involvement |                  | $\chi^2$ | <i>p</i> |
|-------------------------|----------|-------------------------|------------------|----------|----------|
|                         |          | Participants            | Non-Participants |          |          |
| Frequency of Employment |          |                         |                  | .290     | .678     |
| Has Job                 | 17       | 5                       | 12               |          |          |
| Does not have job       | 10       | 2                       | 8                |          |          |
| Totals                  | 27       | 7                       | 20               |          |          |

Table 4.12 shows the Fisher's exact results at Texas A&M. It indicates that participants and non-participants are not significantly different on frequency of employment ( $p < .1$ , Fisher's exact test). Phi, which indicated the strength of the association between the two variables, is -.077 and, thus the effect size is small or smaller than typical according to Cohen (1988).

Table 4.12  
*Fishers Exact Test on Frequency of Employment at TAMU.*

| Variable                | n  | Competition Involvement |                  | $\chi^2$ | p    |
|-------------------------|----|-------------------------|------------------|----------|------|
|                         |    | Participants            | Non-Participants |          |      |
| Frequency of Employment |    |                         |                  | .112     | .999 |
| Has Job                 | 8  | 1                       | 7                |          |      |
| Does not have job       | 11 | 2                       | 9                |          |      |
| Totals                  | 19 | 3                       | 16               |          |      |

The non-significant results at all of the schools individually make it impossible to infer that one specific location was responsible for the non-significant results of the sample.

As previously noted these analyses were exploratory research to consider the data collection sites individually. Because these analyses were exploratory, looking for indications from the data collected at each site for the non-significant overall chi square result, no corrections (i.e. Bonferroni) were used to compensate for alpha and the number of tests.

***Starting salaries at each school.***

The results of the analysis indicated the difference in average starting salaries was due to chance, so each institution was again considered. By evaluating each institution separately, it was hypothesized that an indication would surface for the non-significance of the sample as a whole, despite the difference in means.

The results of a factorial ANOVA showed there was no significant relationship between starting salary and competition participation at the individual schools in the sample, however none of the institutions had adequate responses for the analysis to produce reliable findings.

Table 4.13 shows the descriptive statistics from the factorial ANOVA used to consider starting salaries at each school. As with the other dependent variables, none of the samples were close to  $n = 30$  in each of the groups being compared, as recommended

by Gilner et al. (2010). Even without dividing into each school, the total sample size ( $n = 16$  participants, 33 non-participants) did not in fact reach Gilner et al.'s (2010) recommended size minimum, and three of the schools did not return any data for one of the groups. So it is not surprising that no significant differences were found in the factorial ANOVA.

Table 4.13  
Means, Standard Deviations, and n for Starting Salaries as a Function of Competition Participation and School

| School | Participant |         |         | Non-Participant |         |         | Total    |         |         |
|--------|-------------|---------|---------|-----------------|---------|---------|----------|---------|---------|
|        | <i>n</i>    | M       | SD      | <i>n</i>        | M       | SD      | <i>n</i> | M       | SD      |
| CPSLO  | 4           | \$58650 | \$4683  | -               | -       | -       | 4        | \$58650 | \$4683  |
| CSU    | 5           | \$61460 | \$13723 | 12              | \$52900 | \$6770  | 17       | \$55417 | \$9734  |
| GT     | 2           | \$47000 | \$4243  | 5               | \$48608 | \$31136 | 7        | \$48149 | \$25494 |
| NDSU   | 1           | \$52000 | 0       | -               | -       | -       | 1        | \$52000 | 0       |
| PU     | 4           | \$48500 | \$9292  | 10              | \$51268 | \$7015  | 14       | \$50477 | \$6812  |
| TAMU   | -           | -       | -       | 6               | \$53730 | \$6812  | 6        | \$53730 | \$6812  |
| Total  | 16          | \$55119 | \$10532 | 33              | \$51906 | \$12683 | 49       | \$52955 | \$12009 |

Table 4.14 shows that there was no significant interaction between school and competition participation on starting salary,  $F(5, 40) = .757, p = .476, \text{partial } \eta^2 = .036$ . A Levene's test indicated that the assumption of homogeneity of variance was violated. However because the result was not significant, post hoc analyses were not performed.

Table 4.14  
*Factorial Analysis of Variance for Starting Salaries as a Function of Competition Participation and School*

| Variable and source  | df | MS       | F    | Partial $\eta^2$ | Eta  |
|----------------------|----|----------|------|------------------|------|
| GPA                  |    |          |      |                  |      |
| Competition          | 1  | 13129392 | .085 | .090             | .045 |
| School               | 5  | 12120000 | .788 | .090             | .300 |
| Competition * School | 2  | 11650000 | .757 | .036             | .190 |
| Error                | 40 | 15380000 |      |                  |      |

Further analysis of the quantitative data collected provided no indication there were significant findings in this study. The sample size met the requirements for evaluation established by Gilner et al. (2009), but the return rates at each school provides a clear indication that this study was hampered by low participation.

### **Conclusion.**

In response to research question four which asked, “What are the differences between participants and non-participants in construction management competitions relating to: GPAs, frequency of employment, and starting salaries?” this study fails to reject the null hypothesis and found no significant difference between competition participants and non-participants in terms of GPA, frequency of employment, or starting salaries. The expectation of the researcher was that this study’s findings would be similar to those of the pilot study but that did not occur.

The lack of a significant difference between participants and non-participants does not provide support to the positive effects reported in the qualitative strand of this research. An exact reason why no significant difference was found is not known. The researcher believes this study’s sample puts the quantitative results in question, and that the results of the pilot study are more reliable. Because of the shortcomings of this study’s sample, discussion of that opinion is given in chapter five.

### **Mixed Methods Question**

The final research question of this study asked: how do the quantitative survey results and the qualitative interview results combine to provide insight regarding the value and challenge of participation in construction management competitions for students?

As the research question suggests, it was expected that the results of each strand of this study would support one another, and their mixture would then produce a better understanding of the positive and negative effects of competition participation than either data strand alone could produce alone. However this study's quantitative and qualitative data strands produced contradictory findings, so a clear answer to the research question did not emerge. Qualitative data strongly showed that there are many positive effects of competition participation and that one of those should be higher starting salaries. The Qualitative data also indicates that while competition participation does not cause higher GPAs, the students who participate are better students to begin with and thus should have higher GPAs. The quantitative data meanwhile showed no difference between participants and non-participants relating to GPA. The Starting salary data showed a practical significance but no statistically significant difference.

These conflicting results indicate that in regard to GPAs and starting salaries, either the quantitative or qualitative strand is unreliable. The absence of a statistically significant difference relating to starting salaries while a practical significance was found, is an indication (in addition to the shortcomings of the quantitative sample already discussed) that the quantitative data strand is unreliable.

The practical significance found in starting salaries quantitatively agrees with the qualitative data. This combination of quantitative and qualitative data strands is valuable



as it indicates that the positive effects of competition participation are not all intangible, rather that participation also has tangible positive effects (like a higher starting salary).

Although it is disappointing that the two data strands did not support each other further, divergent results are not uncommon in mixed methods research. In this study the divergence of results caused the researcher to dig deeper into the analysis and discover a likely cause of the divergent results. Further discussion of the mixture of the qualitative and quantitative data strands can be found in chapter five.

### **Conclusion**

The positive opinion in support of student construction management competitions is well founded and supported by this study's qualitative data, which was the focus of this study. A number of positive effects of participation are reported and are well supported by the data. Additionally some negative effects of participation were identified and reported. In the qualitative data the most strongly supported positive effect was: real world hands on experience, while time was the most strongly supported negative effect.

In the quantitative data a practical significance was found in average starting salaries, participants were found to have starting salaries \$3,212 higher than non-participants, however no statistically significant differences were found between participants and non-participants in starting salaries, GPAs, or frequency of employment. This lack of any significant results led to analysis of the descriptive statistics, and found some shortcomings in the sample which are believed to be the cause of the inconsistent results between the two studies.

The combination of this study's two data strands did not provide insight regarding the value and challenges of competition participation, because they did not support one another, however it is not uncommon in mixed methods research for the two data strands to diverge and in this study it led to deeper scrutiny of the data and research design. This study's qualitative findings should be received with confidence, the quantitative and mixed findings however suffer, the researcher believes as a result of the sample. So those findings should be received with caution and provide a platform for future research.

## **CHAPTER-5 DISCUSSION**

### **Introduction**

This chapter summarizes the current study and discusses its findings. A summary of the study is given first, followed by a comparison of the study's findings and those findings from the review of literature. Discussion of some of the findings presented in chapter four is given including the researcher's conclusions, implications of the results, and finally recommendations for future study are given.

### **Summary of the Study**

The ASC, ABC, and NAHB all hold annual competitions in construction related topics. Teams of students from schools across the country participate each year. Teams are given a problem, and then come up with and present their solution to the problem.

The construction industry, as well as students, and faculty think highly of participation (Anglin & Robson, 1997; Nobe et al., 2006), but in construction management education, student competitions have been the subject of little empirical research. This study reports on a focused evaluation of the perceived positive and negative effects of competition participation for students.

## **Research Problem**

In construction education the small amount of published research on student competitions, and specifically a lack of research on the positive effects of participation is the research problem.

## **Research Purpose**

The purpose of this study is to inform construction management faculty and administrators of the positive and negative effects of competition participation. Qualitative and quantitative methods are used to address the research questions. A mixed method design was chosen because it can give greater insight into the positive and negative effects of participation, which serves the research purpose to inform faculty and administrators. Construction management students are also a target of the research, however because the findings of this study will most likely reach students through faculty and administrators they are the primary audience.

## **Research Questions**

The research questions for this study were divided by the research type, as a result there are qualitative, quantitative and mixed methods questions.

### **Qualitative questions.**

1. What do competition team coaches and students perceive as positive effects on students from participation in construction management competitions?
  - a. What do competition team coaches and student participants perceive as the greatest benefit to competition participation?

- b. How do competition team coaches attribute these positive effects to competition participation?
- 2. What negative effects of participation in construction management competitions do team coaches describe?
- 3. How do the perceptions of team coaches help to explain the quantitative differences between participants and non-participants as it relates to:
  - a. Starting salaries?
  - b. GPAs?
  - c. Frequency of employment?

**Quantitative question.**

- 4. What are the differences between participants and non-participants in construction management competitions relating to:
  - a. starting salaries?
  - b. GPAs?
  - c. frequency of employment?

**Mixed methods question.**

- 5. How do the quantitative survey results and the qualitative interview results combine to provide insight regarding the value and challenge of participation in construction management competitions for students?

## **Need / Significance**

Only three empirical studies relating to construction management student competitions were found in the review of literature (Anglin & Robson, 1997; Tisdell & Mulva, 2007; Gehrig & Cottrell, 2007), and only one of those is focused on effects of competition participation on participants. With only one study in construction education addressing effects on students, further study is needed. The current study is significant because it focuses on the positive and negative effects of participation, and will provide empirical research to support or refute the value of competition participation.

## **Methodology**

The research questions for this study could not all be addressed by qualitative or quantitative data so a mixed methods design was employed. Mixing methods allowed for triangulation, complementarity, and development from the two data types (Greene, Caracelli, & Graham, 1989).

A convergent parallel mixed methods research design was used because it allowed for qualitative and quantitative data to be collected simultaneously, analyzed separately, and then related to one another (Creswell & Plano Clark, 2011). Although both types of data were collected this study has a qualitative priority, and quantitative data are secondary.

### **Qualitative methodology.**

The qualitative strand of the current study sought to provide a rich description of the perceived positive and negative effects of participation. The qualitative approach to inquiry utilized in this study was grounded theory with a systematic approach. This was

done to develop theory(s) grounded in the perceptions of individuals with a high level of experience with construction management student competitions, through interviews.

***Qualitative data collection.***

Qualitative data were collected via interviews with competition team coaches, and by one open ended question to students in the survey that collected quantitative data. The actual sample consisted of thirteen interviews from coaches at six different schools. Saturation was evaluated through constant comparison (Bowen, 2008) as data were collected.

The interviews took place in person as well as over the phone, and were guided by a protocol which can be found in Appendix B. Anonymity was provided to participants, and IRB human subject's approval was obtained.

California Polytechnic University – San Luis Obispo, Colorado State University, Georgia Technical University, North Dakota State University, Purdue University, and Texas Agricultural and Mechanical (A&M) University are the schools data was collected from. These schools were selected because they received HELP Grants from the National Housing Endowment (NHE) which also funded this study.

***Qualitative data analysis procedures.***

Coding was performed on the qualitative data in three progressive steps open, axial, and selective coding. Prior to coding data, filtering was performed to make sure the data were contextual. All coding is considered “in vivo” because the coding labels come from the exact words of the participants (Creswell & Plano Clark, 2011). Nvivo 9, as well as hand coding techniques were used to organize the themes identified.

Open coding formed the basis for the general themes of positive and negative effects of participation. Axial coding identified specific positive and negative effects of participation as themes within the data, and looked at the interconnections between open and axial coding. Selective coding provided the conclusions of this study regarding leadership and key competencies in construction management, and told the story of the phenomenon.

### ***Qualitative legitimacy.***

Legitimacy of this study was evaluated based on Onwuebuozie and Leech's (2007) 24 strategies for assessing "truth value". Every study has its own unique combination of these 24 strategies to achieve legitimacy. The current study utilized: triangulation, weighting the evidence, checking representativeness, checking for researcher effects/clarifying researcher bias, structural relationships, assessing rival explanations, and confirmatory data analyses. These measures cannot assure validity but they do indicate that the qualitative strand of this study has legitimacy and is likely trustworthy.

### ***Qualitative methodology conclusion.***

The qualitative portion of this study collected data, through interviews and one survey question that document the perceived positive and negative effects of student construction management competition participation, and provided rich description of those effects. It also provided explanatory data addressing how differences between participants and non-participants may occur.

### **Quantitative methodology.**

The quantitative portion of the current study was intended to compliment the qualitative findings. It evolved from a pilot study performed at Colorado State University,



so a brief description of that study is provided and followed by the methodology of the quantitative strand of the current study.

***Colorado state university pilot study.***

The pilot study performed at Colorado State University compared participant's and non-participant's starting salaries and grade point averages. The data were ex-post facto, and a non-experimental comparative research approach was used. An independent samples t-test, and a test for correlation were performed. A statistically significant difference in both variables resulted, and no relationship was found between the variables. Students who participated in competitions had higher average starting salaries and higher average grade point averages than students who did not participate in competitions. However, because the data were non-experimental, it could not infer causation.

***Quantitative methodology.***

A survey was used to collect descriptive data about students to enable comparisons of means between participants and non-participants. A comparative research approach was used with difference Inferential Statistics, but the use of attribute independent variables made the research non-experimental.

The actual sample for this study included graduating seniors in construction management from the 2009-2010 school year. Data were collected at the same schools as the qualitative data. All graduating seniors in construction management from those schools were invited to participate. The sample ( $n = 152$ ) represents the total number of usable surveys however after pairwise deletion, sample sizes for each variable vary from  $n = 52$  to  $n = 149$ .

An internet based survey was used to collect data for the study. It did not measure constructs, so measurement validity is not numerically supported, but it was evaluated based on Gilner et al.'s (2009) five areas: content, response processes, internal structure, relation to other variables, and consequences. Based on those criteria measurement validity of medium was assigned to the survey.

Gilner et al.'s (2009) guidelines for external validity were also used. The study was not experimental so ecological external validity was not directly applicable. Population external validity was weakened by the non-random sample that resulted from the grant award, but based on school sizes and geographic locations, representativeness of the sample was good, making external validity medium.

Comparison of the two groups was performed using *t*-tests, Chi-Square, and ANOVA. The results from the quantitative strand of this study cannot infer causation and were only intended to lend support to the qualitative findings.

#### **Mixed methods methodology.**

A convergent parallel design was used to collect both strands of data. Although the study is mixed, there is emphasis on the qualitative data strand. The study was designed with a qualitative priority so the quantitative data would build on the qualitative strand. The mixed methods methodology represents a culmination of the quantitative and qualitative strands of this study.

## **Discussion of Findings Related to the Literature**

There are common themes between this study and the literature. Some findings come from CM literature, and others from literature focused on competitions in other disciplines. Ten of the eleven positive effects were found in the literature. Anglin and Robson (1997) and Schster, Davol, and Mello (2006) both reported: industry involvement, motivation, and working on a real project as positive effects. Problem solving, and teamwork were reported by Gehrig and Cotrell, (2007). Networking, confidence, and presentation skills were reported by Sirianni et al. (2003), and Ivey and Quam, (2009) reported leadership. Finally “connecting all the dots” was reported by Schster and Mello (2006) who indicate that when students use their classroom skills to design, build and test a product they gain a first hand sense of importance for different topics and how they come together. Time management was the only positive effect identified in this study that was not also encountered in the literature as a positive effect (although it is identified as a negative effect in the literature).

When students engage in the competitions, this study found that there were negative effects of participation. Three of the four negative themes that emerged in this study were identified in the literature. The first two, scoring methods and resources were addressed by Rickels’ (2010), who found that in some competitions larger groups had an advantage over smaller groups that reduced objectivity in judging. The third negative, time, was identified by Wankat (2005) and Schster et al. (2006) Time was addressed most frequently in the literature as a negative effect, and Wankat (2005) and Schuster et al. (2006) specifically indicated the amount of time required and pointed to student’s overlooking school, work, or personal responsibilities to work on competition projects.

The fourth negative effect, expectations, identified in this study, is unique and was not found in the review of literature.

The axial and selective codes that emerged in this study indicating construction industry involvement, leadership and graduate competencies were positive benefits of competition participation, and were also found in the review of literature. A significant difference exists between these findings and those reported in the literature however. In the literature, industry involvement, leadership, and graduate competencies were reported similarly to the positive effects reported in this study in open coding. This study reports these positive effects in axial and selective coding as: causes of, connecting links between, and explanation of the positive effects that emerged in open coding. This difference is important as the axial and selective codes are telling the story, and providing rich description of the effects of competition participation, not simply reporting them.

While most of the positive and negative effects reported in this study were also found in the review of literature, two important points need to be made in comparison of this study's findings and those from the review of literature. Deductive coding was not used in this study and no study reported all of the same effects that emerged in this research. These two points demonstrate the common benefits of competition participation regardless of the academic discipline while also showing the unique benefits available to participants from different competitions.

Deductive coding is a process where themes or codes identified in the literature are searched for in research data. In this study deductive coding was not used. The researcher recognizes that after being immersed in the literature for such a long period of time, it is doubtless that the effects identified in the literature would have an effect on the coding

process, but a formal deductive coding process was not followed. “In vivo” coding, using the actual words of participants as codes (Creswell & Plano Clarke, 2011), is evidence that codes emerged from the data collected not simply from the review of literature. For example Coach Four stated: “the competitions force you to connect all the dots, the dots being each class” and Coach Three said: “these kids put a lot of extra work in, and develop leadership” which led to “connecting all the dots” and “leadership” as codes for the positive effects of participation. Competition participation has effects that are common between different disciplines.

With ten of the eleven positive effects emerging in this study also occurring in the literature, there is clear evidence that some positive effects of competition participation occur in different competition subjects and formats, showing that participation in general positively effects participants. While participation has positive effects without regard to discipline, the combination of effects available at each competition is unique and are important.

No single study in the literature identified more than three of the eleven positive effects found in this study. Five different studies were needed to compile the list of positive effects from CM competition participation, so while there are effects common to participation, every competition has its own unique set of positive effects. Participants in CM competition will share some effects with competitions in engineering or technical education, however the unique set of effects found for participants in CM competitions is not found in any other discipline. Competitions from different disciplines will have effects in common, but each offers its own unique set that is individual to each competition.

## **Discussion of Findings**

The findings of this study are summarized below as, qualitative, quantitative, and mixed findings, a pattern developed by the research design. Some of the findings were generally straightforward and are not discussed here but are detailed in chapter four. The findings addressed here represent those the researcher felt merited additional discussion and summary for various reasons. These sections also present the opinions and perspectives of the researcher, based on their experience with this research study.

### **Qualitative Findings**

The qualitative findings were the emphasis of this study (qualitative priority). Of particular importance are the positive and negative effects of participation. These qualitative findings are considered by the researcher to be the most valuable results of this research.

#### **Positive effects.**

Students who participate in construction management competitions are perceived to enjoy the positive effects of; confidence, connecting the dots, industry involvement, leadership, motivation, networking, presentation skills, problem solving, real world experience, teamwork, and time management. The emergence of these effects in open coding is important because even though participants are typically higher achieving students to begin with, it shows that participation builds on student's abilities in these areas.

While it was expected that participation had positive effects such as those reported, identification of what those effects might be are a valuable contribution of this study. Although most of the effects of participation could be found in the literature spread over competitions in different disciplines, this study documents a core group of positive effects of CM competition participation, and documents them for future research on CM student competitions.

Identification and documentation of that group of benefits is important, of even greater value however was the identification of construction industry involvement as the central theme of this in the competitions. Some positive effects of participation in CM competitions have been identified, but the source of those positive effects was not reported. Construction industry involvement's connection to the positive effects of participation is important because it is not simply participation but industry involvement that leads to the positive effects for students. A competition devoid of industry involvement would be unable to provide the group of positive effects reported, and would be unable to provide any positive effects to the same degree as a competition with industry involvement. Industry involvement also helped describe the phenomenon of student construction management competition participation. Industry support occurs because of what participation provides to students, and the positive effects of participation occur in turn because of industry participation.

Competition team coaches described and attributed the positive effects identified to construction management competition participation. This study concludes that these positive effects should be attributed to the construction industry involvement at the competitions. Construction industry involvement is the key. It is what sets the

competitions apart from a class project, and makes participation a unique opportunity for students to obtain this group of positive effects. Because of industry involvement, students can obtain skills and improve themselves in ways that employers value. Industry participation makes competitions a truly unique experience, and amplifies the effects of participation beyond what a student could achieve in a classroom. It is the key to the unique group of benefits available, and the success of CM student competitions.

**Negative effects.**

Coaches cited; student expectations after participation, resources, scoring methods, and the large time commitment, as negative effects of the competitions. However many of the coaches had difficulty coming up with negative effects, some indicated that they did not see any true negatives of participation, and only one negative effect was solidly supported in the data. These three factors support the idea that the positive effects of competition outweigh the negative effects and show that the positive sentiment and support for CM student competitions is well grounded.

The one negative effect that achieved saturation in the data, and was thus well supported was time. It's emergence as a negative effect, and time management as a positive effect are interesting results of this study. Both the positive and negative effects related to time were triangulated and achieved saturation so concluding that it is more likely to be one type of effect than the other would be speculative. Time is somewhat better supported as a negative effect of participation because it was found in the literature as a negative effect, but not as a positive effect. However the conclusion of this researcher is that time plays a balanced role as a negative and positive effect, but is highly polarizing in relation to it. Student participants either benefit by gaining time management skills, or



suffer from their absence. All competitions require a significant time commitment from participants in regard to preparation leading up to the competition which certainly plays a role, however in the largest CM student competitions, organized by the ASC, there is an additional wrinkle related to this effect. At the ASC competitions students are not given the complete description of the problem to be solved until they arrive at the competition. They then have only a matter of hours to produce their deliverable and their presentation for it. The researcher's conclusion is that time occurred so strongly as a negative and a positive effect of participation because of that detail in CM competitions.

In CM student competitions, just like most other competitions students who don't learn time management may suffer in their academic or personal lives as preparation for competitions can become very time consuming. Unlike other competitions however, in CM student competitions (specifically the ASC) if students don't learn time management skills they jeopardize completing the project, which puts some of the positive effects available to them on the line as well. The highly polarizing nature of time as an effect of competition participation is very important, because participants who benefit from this effect are led to the other positive effects of participation, but for those students who experience time as a negative effect, the consequence likely impacts them personally, academically, and professionally.

### **Quantitative Findings**

The quantitative data collected and analyzed were intended to support the qualitative data in this study, however that did not turn out to be the case. Further the inconsistency between the pilot study results and this study were a great surprise when no

significant difference was found between participants and non-participants. With no significant difference found among the sample as a whole, the data from each school was analyzed to learn if there were significant differences at any of the individual schools, again none were found.

Analysis of the entire sample and the parts of the sample at each school however did lead the researcher to conclude that the quantitative results are not reliable. The first indication of a problem was the sample size ( $n = 16$  participants and  $n = 33$  non-participants) for starting salaries. The sample size stood out because of Gilner et al.'s (2009) recommendation of  $n = 30$  in each group. Further digging into the sample showed that three of the data collection sites only returned data for one of the groups (participant or non-participant) and the largest sample from any of the schools only included seventeen total students ( $n = 5$  participant,  $n = 12$  non-participant).

Following the evaluation of the starting salaries sample, the samples for GPA, and frequency of employment were evaluated. While the size of the sample overall ( $n = 50$  participants,  $n = 92$  non-participants) met Gilner et al.'s (2009) recommendation. Drilling into the sample from each school showed shortcomings, such as: only one school with more than single digit participants, including only three participants at one school and two at another. It appears that for GPA and frequency of employment, the overall sample size masked the shortcomings of the sample at each cluster or school.

The researcher concludes that these inconsistencies in the sample make the quantitative findings of the current study unreliable, and meaningful conclusions are not to be had in mixing the data strands because of the problems identified with the sample for the quantitative data strand.

Although the pilot study data were taken from a different sample, it is closely related to the current study's population, it met the requirements of the sample for this study except for the graduation dates, and the same data was collected from them as the sample in this study. The results of the pilot study are considered reliable, and as a result comparison of the pilot study's quantitative data with this study's qualitative data are recommended, and is preferable to use of this study's quantitative findings. Discussion of these comparisons is given in the next section.

### **Mixed Methods Findings**

It was expected that the results of each strand of the current study would support one another and their mixture would then produce a better understanding of the positive and negative effects of competition participation. This did not happen however, and the mixture of qualitative and quantitative data served to muddy the water regarding this study's findings.

Although the quantitative findings are considered unreliable, discussion of their results with the qualitative results is given in the following sections. Because this study utilized a convergent parallel design where data strands are collected and analyzed separately before mixing, the qualitative results of this study are easily mixed with the quantitative results of the Colorado State pilot study, so discussion mixing the qualitative results of this study and the pilot study is also given. The quantitative data strand was separated into the principle categories of starting salaries and GPA, so discussion of the mixed methods findings is given next based on those categories.

### **Starting salaries - this study.**

The mixture of this study's two data strands gave divergent results regarding starting salaries. While the qualitative strand indicated there is a relationship between participation and higher starting salaries, the quantitative strand indicated there is not a significant relationship. With the quantitative strand showing no statistical significance but that there is a practical significance, the researcher concludes that the quantitative results are unreliable and the qualitative results are. So a relationship between competition participation and higher starting salaries does exist.

The researcher considers the divergent results in the two data strands as very important to this study because it was the quantitative strand's non-significant findings that led to further scrutiny of the sample, and discovery of the shortcomings there. Had the quantitative data shown a significant relationship the researcher may not have discovered the challenges with the sample and likely would have cited the quantitative data as supporting the qualitative data, even though it was unreliable.

### **Starting salaries - pilot study.**

The mixture of the pilot study quantitative data with this study's qualitative data indicates that competition participation leads to higher starting salaries. The pilot study found significantly higher average starting salaries among participants. This study's qualitative strand indicated higher starting salaries are related to participation. The mixture of the two data sources indicates there is a relationship between the variables.

The relationship of participation with higher starting salaries occurs through the positive effects of competition participation. The positive effects of participation, identified in coding, are the cause of higher salaries for competition participants, by

obtaining the positive effects available they garner higher starting salaries. A higher starting salary may be attainable through other means, and the effects reported here are certainly not the only factors that affect starting salaries, however the qualitative relationship between higher starting salaries and participation occurs because companies have learned that students participating in the competitions are likely to have obtained those positive effects, which they value.

Based on the perception of competition team coaches the positive effects identified are a causal factor to higher starting salaries. The basis of that relationship is that construction companies recognize that students gain those positive effects at the competitions and so seek out participants. The research does not conclude that the positive effects are the only factor in higher starting salaries, it would be foolish to ignore the study's finding that participants tend to be better students and more motivated to begin with. Rather the positive effects of participation are one factor leading to higher starting salaries for participants.

#### **GPA - this study.**

This study's two data strands combine to show that participation is not correlated to higher GPAs. No difference was found quantitatively between participants and non-participants, and the qualitative data indicated that participation does not improve grades. However the two strands diverge regarding the existence of any relationship between participation and GPA. The qualitative strand strongly indicated that students who participated in competitions were better students to begin with, which makes higher GPAs an expectation among participants. The coach's perceptions lead to the inference that a correlative relationship exists where participants should have higher GPAs than non-

participants, not because of participation but because typically participants are better students to begin with. That relationship however was not supported by the quantitative data, which showed no statistically significant difference between competition participants and non-participants.

The researcher concludes that as with starting salaries, the divergent results regarding GPAs are the result of the problems in the quantitative sample. Those results, like the sample for starting salaries, are not considered reliable. Based on the qualitative data, students who participate have higher GPAs than non-participants. Competitions are attracting better more motivated students who become engaged in their activities.

#### **GPA - pilot study.**

The qualitative results of this study which, as discussed in the previous section, indicate there is a correlative relationship between higher GPAs and competition participation. Those findings are supported by the quantitative results of the Colorado State Pilot study, which showed participants had significantly higher GPAs than non-participants.

The separate analysis and then mixing of the qualitative and quantitative data strands show that indeed participation is related to higher GPA, because better students are participating to begin with. The mixture of the two strands provides insight neither strand alone could provide. The quantitative strand was non-experimental and thus could only infer the existence of a relationship. The qualitative strand was produced from the perceptions of competition team coaches who interact with students before and after participation, and so could speak to the type of relationship. The two methods build upon and support one another.

### **Mixed methods conclusion.**

In this study quantitative and qualitative data converge and agree that higher GPAs do not result from competition participation. For the remaining questions posed in the study, the quantitative and qualitative strands diverged. Mixing the two data strands in this study did not provide the insight hoped for. The divergence of results is attributed to the problems in the quantitative sample, which is not considered reliable.

The current study's qualitative data was mixed with the Colorado State Pilot study data because the pilot study collected the same data that the quantitative strand of this study sought to collect, however the pilot study sample was known to be reliable. So the mixture provides support and insight into both study's findings. While the two studies can be compared with confidence because of their similarities, the researcher recommends further quantitative study to confirm a relationship between these variables and the results of this research.

### **Implications for Action**

The findings of this study support the positive opinion of student construction management competitions, that participation guides students to develop skills and competencies that will help lead them to success in their careers. These findings provide evidence to faculty and administrators that participation in student construction management competitions has value for students and participation should not only be encouraged but emphasized for as many students as possible. Because CM faculty and administrators serve as gatekeepers to the competitions to students, it is incumbent upon

them to disseminate the information to students so they can access the positive effects available.

The divergent results of the two data strands also imply a need for further study, regarding student competitions, to indicate if the researcher acted appropriately in rejecting the quantitative findings based on the problems with the sample. Specific recommendations for further study are given next.

### **Recommendations for Further Research**

The researcher recommends further research in two primary areas. First, additional quantitative study of the variables considered in this study, and second, research collecting data from construction industry professionals regarding student competition participation.

Additional quantitative study is recommended because, this study produced quantitative results that diverged from the qualitative results and the quantitative results of the pilot study, as a result the researcher recommends a study that would support or refute the quantitative findings of this study. Currently the shortcomings of the sample in this study are the reason it is not considered reliable, so a follow up study with greater care taken to ensure a high quality sample could show whether or not there is a correlation between participation and higher starting salaries and higher GPAs (as indicated by the qualitative data and the pilot study). Following the results of this study the key to any quantitative follow up is ensuring a high quality sample.

Should a follow up study confirm that participants earn higher starting salaries and have higher GPAs, the research could be taken a step further to collect the qualitative data



from participants to learn what their perceptions are regarding participation's effects on their starting salaries and GPAs. Such a study would provide a more complete look at those impacts than this study which only considered team coach's perceptions of the effects.

Students, faculty, and industry represent the three groups involved in student competitions. Research collecting data primarily from construction industry professionals is recommended because the construction industry represents the group that has not yet been the focus of research. Anglin and Robson (1997) focused on data collection from students in their research, and this study, while collecting some data from students, focused on coaches (faculty). A study focused on data collection from construction industry professionals could indicate if they perceive the same positive effects as coaches, and what they feel the negative effects of participation are. A study focused on industry involvement could also look more closely at why the construction industry supports the competitions.

### **Concluding Remarks**

Positive effects of competition participation are evident and some of the effects are consistent with those derived from competition participation in other disciplines. Competition participation provides students with positive effects that build leaders and help provide graduates with key competencies for their success. Construction industry involvement however, is the key to all of the effects.

The study did not provide clear answers to all of the research questions because of the shortcomings in the quantitative sample. However the positive effects that emerged in the qualitative portion of the study, are well qualified and give specific reasons why faculty and administrators should support and encourage participation in student construction management competitions. Students learn more doing competitions than they do perhaps anywhere else in their education.

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## **APPENDIX A**

### **Student Survey**

Sample cover letter

12/4/09

Dear Participant,

My name is Ben Bigelow and I am a researcher from Colorado State University in the Construction Management department. We are conducting a research study on participation in student competitions. The title of our project is: Studying the effects of participation in student competitions. The Principal Investigator is Gene Gloeckner, Education and I am the Co-Principal Investigator. This study is being funded by the National Housing Endowment and Colorado State University.

We would like you to complete a brief survey. Participation will take approximately five minutes. Your participation in this research is voluntary. If you decide to participate in the study, you may withdraw your consent and stop participation at any time without penalty. No personal information will be connected to the data you provide and the collected data will be kept by the research team and published in aggregate. While there are no direct benefits to you, we hope to gain more knowledge on what the measurable benefits of participation in student competitions may be. There are no known risks related to participation however, 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.

If you have any questions, please contact Ben Bigelow at (970) 491-8121 or bigelowben@hotmail.com. If you have any questions about your rights as a volunteer in this research, contact Janell Barker, Human Research Administrator, at 970-491-1655.

Sincerely,

Gene Gloeckner

Professor

Ben Bigelow

Ph.D Student

## Construction Student Survey

\*1. Which college or University do you attend?

(checkbox) Unchecked

Cal Poly -San Luis Obispo

Colorado State University

Georgia Tech

East Carolina University

Middle Tennessee State University

North Dakota State University

Purdue University

Texas A&M University



2. Is your major; Construction Management, Building Construction Management, Building Construction, or Construction Science?

Yes

No

3. Are you graduating this semester?

Yes

No

4. What is your grade point average (G.P.A.) on a 4.0 scale?

5a. Have you accepted a job offer yet?

yes

No

5b. What company will you be working for?

5c. What type(s) of work does the company do?

Residential

Commercial

Industrial

Heavy Highway

Other

5d. What will your starting salary be?

6. As a student have you participated in any regional or national student construction management competitions?

Yes

No

6a. Which student competition(s) have you participated in?

ABC

NAHB

ASC

DBIA

Other (please specify)

6b. What do you think were the greatest benefits to you from participation in student competitions?

6c. What would you change about the student competition(s) you participated in?

You're all done!

Thank you for your participation

## APPENDIX B

### Interview Questions

1. How long have you been involved with student construction management competitions?
2. Which competition(s) has your experience been with?
3. What is your opinion of the competitions and their value to students?
4. There are two general types of construction management competitions, short term and long term.
  - a) Short term competitions typically presents a problem to students, and gives them about one day to produce and present a solution to the problem (ASC) what do you think is the greatest value of this type of format?
  - b) The long term competitions present a problem to students, and gives them a few months to produce a solution and then present it (NAHB, ABC). What do you think is the greatest value of this type of format?
  - c) Do you think one format provides greater value to the students?

- d) Which one, and why?
5. A survey of construction management students has indicated that students who participate in the competitions average GPA's (difference found) higher than students who do not. Why do you think that is?
  6. Overall would you consider this an instance of causation or just correlation?
  7. The same survey of construction management student has indicated that students who participate in the competitions have starting salaries (difference found) higher on average than students who do not. Why do you think that is?
  8. Overall would you consider this an instance of causation or just correlation?
  9. Based on your experience with the competitions what do you feel is the greatest benefit to the students who participate?
  10. Do you think there are negative aspects to competition participation? What are they?
  11. How would you change the competitions?
  12. Is there anything else you'd like to add?

13. Is there anyone else in your department that I should interview?

## APPENDIX C

### Transcribed Interviews

#### Coach One Interview

*How long have you been involved with the student construction management competitions?*

We have a student construction organization association or something like that, SCA. And I'm academic advisor for them this year. And then next year there would be another advisor it's kind of on the rotating base in our faculty but I've been involved since past fall, and I think students attended 4 kinds of competition, one regional ASC, south east regional and I think they ended up 2<sup>nd</sup> on regional design build. And then there was the mechanical association and homebuilders competition. And I think ABC competition in San Diego, but I was just able to go to one of them the earlier stage of the mechanical competition in Denver it was through MECA.

*So in general what do you think of the competitions and their value to students.*

They really like it, I have to say they really like it and particularly there were a few competitions that gave them more time before so they knew the topic and they know what they had to bid on and basically they liked those more than the others because they give them more time to work on actual projects, they like it because it's not a class room assignment. It's most often real projects with real clients, so they found that interesting. It's a lot of work for them, it's a lot of work, and they get to know local people who are involved in that type of....., I remember there was a MECA competition the mechanical contractors, that was renovation of a kitchen of a hospital, kitchen and dining area and that was something related to the health care type of sector so they get to know those kinds of

people, that was something they really like. They give them the chance to know the local chapter, which usually construction is very local so our students get jobs around the area. Sometimes they got involved with big corporations they may go to some other parts of the country but they really like to be involved in the regional. It's really valuable but at the same time I have to say I'm not really qualified to give you the details as far as okay what could be the characteristics of what would be a good competition, don't take me as an expert.

*Really what we're trying to do is take the experiences of people who've been involved, and in a qualitative sense try to explain some findings that we had in a study here, and that would lead to my next question. We did a study here*

One thing, the whole excitement, I have seen the students working. There is an area outside my office and I've seen them preparing, I think it's really joyful and maybe something on the side the program and the competitions organizer support the travel, if the location was good that's also extra motivation. If you have them in good places if it's a hot destination they really like that, the cost of the accommodations might be different, for instance the university of Florida Gainesville it's alright but if you have it in places like San Diego or Vegas, or Miami they like it more. We had several competitions we couldn't get enough students to go. Timing is also very important I believe, if you have them early semester like around the time before they hit the meat of the semester, I think around Feb is a good time, also in the summer time. We could get more students, some of them say we have too many things going on. That's another observation I have. I'm personally interested to get more masters students involved with them, but unfortunately most of them are part time, they really help they're helpful and if our students have problems they can



ask, but their time is limited. On top of their full time work they have courses to catch up, I found some of them are very interested. If they could be sort of, like a consulting basis, they give advice. They may not be able to go to that competition or get the preparation 2-3 weeks before, that doesn't fit on their schedule but if the competition would allow them to consult a couple of people outside their team, That would add to the quality of the work and involve the graduate students. I know ASC is like that, they can't e-mail or call anybody but if the competition said that you can have maybe one person on call. Maybe a team should be 6 undergrads and 1 masters student to look over their work. It should be fair and equitable to everyone so I'm not sure how to work it but our number of masters students is almost double our undergraduate and they're coming from various industries with usually minimum of 5-10 year experience. They're not involved partly because the student organization doesn't involve them but also because it's not feasible for them, really they can't fit it on their schedule, 1 or 2 days travel no but to be on call.

*For the student you mentioned a number of things that would benefit them like having the graduate students involved do you think there are negative aspects to them participating in the competitions?*

Negative aspects like.....

*Ways the competitions may not benefit the students*

That would be a good thing to ask the students I think. If it's well organized they should be neutral about it. If they attended a competition they say why did we do that?

*Exactly things that don't benefit the students by participating*

The time would be an issue, if it s a bad time and they got behind their courses, let me tell you my experience this year they attend four competitions and none of them, I never got any bad feedback from them, I spoke to each team. They never said anything bad about it. Most of these have a session where companies come, they have a job fair sort of thing. If you combine it with a job fair they like it very much, they always want to schedule with the job fair they want to stay to get their resume out. Honestly I was not involved as a judge or anything on these but if they don't get the first place or the second but they never complain, it would be a good idea for someone to get back and tell them where they missed. But I never hear the students complain about oh we had the best project. They watch Colorado state and say wow they really did a better job. But on the evaluation side they need concrete examples of where they need to do better. Usually it takes a long time for the organizer to get the comments back from the judges and then to the students if that could be facilitated faster and be very specific. It would be very good, if someone would develop a rubric, a very good evaluation system. And have an example if you want an A it should look like this, if you want a grade like that it should look like this. I haven't seen rubrics for competitions and I think you may want to do a pre and post evaluation. You can develop rubrics for each type (residential, design-build.) Rubrics should be very detailed very well established outlines; what you should do, what you will be graded on are the evaluation forms. What do we mean on the evaluation forms, 1-5 what is 1 what is 5. What is the distinction between 3 and 4. I have developed them for my class projects. I always try to have a template but it takes time. Give it to each group and see which group is more satisfied. And it makes each judge more concise. You may want to consider that because the projects are very vague.

*So we did a pilot study here at CSU, and I just have two questions for you, we found that the students who participated in the competitions versus those who didn't and we found that the students who did had higher GPAs and they also had higher starting salaries. The questions is if you think the higher GPAs are an instance that they are caused by the competitions or if it's an instance where it happens to be the better students participating, and likewise with the starting salaries, if it's caused by the competitions or just correlated to it.*

That's a good hypothesis, I would be cautious about any conclusions because they might be correlated but not in the form of causal relationship, maybe they come together but I have to say I would be careful to consider a large pool of the students. Particularly with the GPA, the salary maybe because these are the guys who usually are good for the manager type of position. Really I can't say anything, it's good the result is good and it's maybe true, but honestly it should be validated based on several, a large number of students and maybe a few other schools. Particularly these are the people who like the volunteer type of work who like to work with the communities. If I'm coming from the industry and I'm seeing good quality of work, and there is no money involved and I see the person, I would see that's a good person, and I would hire them. They like the job fair, they like the exhibition of the companies. That's interesting and I would like to see it validated on a large number of students. I wouldn't be surprised that both or at least one of them could be true, the salary part. The companies look at your GPA but they value your internship and other job experiences more. The GPA of 3.9 yes that's good, but you don't have field experiences if you haven't done a good internship. Having that on your resume would be valuable and the companies appreciate that.

## **Coach Two Interview**

*So how long have you been involved with the construction management competitions?*

This is my first year, last fall was my first time doing it.

*Which competition was your experience with?*

I did a lot of work with AGC, I should say ASC

*Were you involved with a particular branch, like the commercial, or industrial*

Commercial

*In a broad sense very generally, what is your opinion of the competitions and their value to the students?*

I think they're huge, actually, I think the value of those competitions in a lot of ways exceeds a lot of the things we're teaching them in class, it's kind of real world capstone if you will. Plus I think it's great that they actually get the interaction with the industry folks.

*Okay great, now there are two general types of the competitions, there's a longer term like the NAHB or ABC does, where the students have a couple of months where they're working on the project and then they actually go their competitions and just do their presentations. And then there the shorter term like the ASC where the students do some preparation going in but essentially you're getting the problems and you have that very short time period, I think it's 16 hours to solve the problem and present. Speaking of the*

*format specifically, what do you think is the greatest value of the short term format they do at the ASC?*

I think the greatest thing about that is literally I think it's a positive that they don't have all that time, they've got to prioritize just like our industry partners have to do every day, and the ASC competition almost intentionally overloads the students so they have to get really good at prioritizing their work, I think it's also a better test of the students themselves. I helped on the sidelines of ABC, I want make sure I'm clear on this I wasn't their faculty advisor, I didn't go out there with them but I helped them on some of their front end stuff. And I could see advantages to both but the nice thing about the ASC is they have to do it on their own, they can get themselves set up before they go out there but when they're locked in that room with no faculty and no industry partners to call up and ask questions. They've got to put the whole plan together on their own, the particular competition I went to did a really good job of isolating the students and making them really create their own project and that part I liked, I really liked that part.

*Where you've had some experience, not as a coach but some involvement with the ABC. If you're speaking to that longer format what would you say the value is to that longer format?*

I think what the longer format does is, allows them to use the competition as a means to go out and talk to other people, and do dry runs in front of industry folks and I'm sure some universities have students who don't do much work ahead of time and some do all kinds of work ahead of time, I think in that program really clearly the indicated winner most likely is going to be the one who did a lot of the homework. Do you know what I mean, talking to, going out and talking to, meeting with an industry partner and saying

here's out presentation would you guys come in and critic it and tell us what you think how we did? Can you help us with this can you help us with that, not from a stand point will you do it for us, can you help us understand things better, that's my though I guess it allows them the opportunity to engage industry, to engage professors and things like that, you know.

*that makes sense. From a student's perspective do you think one format provides a great value than the other or are they just different?*

They're just different, I guess I really can't speak to it I didn't go to the ABC one I was just one of those guys that they asked my opinion of a few things, I do like if you are truly trying to test the skills of the students and I don't know if test is the right word for that, the short term one is going to be a better test of that.

*That actually that's something I learned in doing these interviews, that was the original intention to have a means to compare and test students from different institutions on where they're at cause like you said once they're in the room it's on them, they don't have those outside resources.*

If you really want to test the skills of the students the short term is the way to go, cause if you do the long term you allow them the opportunity to go and meet to seek input, but from what I understand that's what they intended they want you to do that kind of stuff, they want you to sit there and study everything and go look at the property or whatever it is.

*It's similar with the NAHB they're wanting it as a learning experience.*

So I don't think there is a right or wrong, if you were to ask me which one tests them better I would say it's the short term

*So at CSU last year we did a little pilot study where we surveyed the graduating seniors and we found in the survey, on average the students who had participated in the competitions, and these are in any of the competitions, they had higher average GPA's than the students who didn't participate in the competitions.*

Oh it's simple, I don't need statistics to tell me it's just kind of common sense that if you do a call out for a competition team, it's going to be the better students who come out to do it. You know we did a call out for our team so the students had to come with their resumes and their skills and sit there and kind of sell themselves, why they should be on the team and I think it's only kind of natural that the students who do that type of, the kind of student who would be attracted to do something like that is most likely the who goes to class and you know they're going to attend class and get good grades anyways.

*So your getting the better students to begin with?*

And it's not that we're going out and tapping them on the head saying I want you to be on this team, we really let this be a student led group. They pick their team and they've now got enough, the flywheel is spinning, now people want to be on that team because now people realize the direct benefit of doing the competition and learning it. Now what they've started to find out is that there are industry partners who look at this very highly and actually you might be about to land a job because of doing the competition. Especially in today's economic down turn, as much as they want to learn, and the excitement of a competition, but selfishly they're going I might land a job from this thing.

*That something that we're hoping this study will show is some documented evidence that it can provide that for the students. So in the same survey we also found that the same students that were participating in the competitions were earning higher average starting salaries than the students who weren't, what are your thoughts as to why that happens or why we found that*

Oh that's simple I just left industry so I used to go to all those schools and hire people, if a student can sit in front of me and talk intelligently about the big picture and the processes and understand RFP's and RFQ's and presentations and they get that, then I was always inclined to give them a couple extra grand more than other people coming through the door. It was that simple, they had a presence of understanding construction management that other students just didn't have, now if a student goes through a really good capstone course I think they can get some of those same benefits but the competition element of it, in just putting you in front industry and then making them sit up there and get poked at just like industry does where clients poke at you in a presentation and stuff, that's just a phenomenal experience, I think those kids just come out and they can present themselves better and they get more money, the dirty secret out there is not every company offers the same amount to every student and students are naïve to think they do.

*If you had to say that there was a single thing that was the greatest benefit to students who participate, what would that be?*

It has to do with the real world, if they changed the competitions around and didn't make them real world, I'd have a problem with them, it has to do with just doing a real world exercise. I think the interaction with the industry sponsors during the presentation is huge. I know ASC focus a lot on the estimating skills of the students, as much as I think



that's important I think the students getting up in front of that industry team who built that actual job, I think that presentation the most valuable part from where I sit. All the CM programs around the country can produce students who can estimate, I mean at the end of the day it's counting. But it's when those students have to get up in front and encapsulate their plan and their vision for the project I think that part's really valuable. I guess what I'm saying is if the competitions were ever to say to save time and money were going to cancel the presentations and we're just going to do the you make your book and turn it in, I think it would lose a lot. And actually speaking to that, that was one of the things that disappointed me, and again I'm naïve to the ABC but when their team came to me and told me that only the top 3 teams get to present, that was disappointing to me that all those teams would go to all that work and not have that opportunity to present their ideas.

*So you mentioned that if they were to change the competition to where the students didn't present that would not benefit the students, that would be a negative thing, do you think that there are negative aspects for the students who participate in general?*

Are there any negative to doing this whole thing? I can't think of any aside from maybe missing class for a couple of days, but I don't know many students who are broken up about that one, I mean I really don't see this as a negative, it's the real world and our teams that have won are thrilled about it but its not about the trophy, you've got to have a winner and a loser, you've got to have a winner and you've got to have people who aren't winners but it's a learning process that's phenomenal, I guess I have a hard time seeing any negatives. I suppose thinking out loud, we had more students who wanted to be on the team than could be on the team and so we actually made some of the students alternates if you will and the plan would be that hopefully next year they would move up to being on

the team. I guess my only thought there is that, and I think we're fortunate in that we probably had more, I can't say that every school probably has more students than they want being on the teams but I guess that would be the only negative is if somebody who really wanted to be there couldn't be there. But I've got to believe any university would find a way to do that.

*How would you change the competitions?*

I was disappointed this year that the national competition got canceled, quite honestly because the team I was the coach on won and they really wanted to go compete on a national level rather than a regional level but I understand why it got canceled. What could they do better, I don't know that one I'd have to think about, you know the one team, the company that did the competition that we had that sponsored ours, they ended up bidding the job differently than the job was bid, a different delivery method if you will, I don't think that really affected it but when they did the question and answers and debrief, the students asked how much money did you make and everything, everyone kind of danced around it, because they had taken a job that was a perfect example for this class for estimating and everything but they chose to have it be a, I think it was a negotiated contract and they actually had the students bid it as a lump sum contract, what I'm saying is it would be great if the project could truly mimic what you ask the students to do rather than them having modify it for the competition. On the flip side I've been that industry person where someone says can you give me an example and you can't. You can never find a perfect example.

*Last question, is there anything else about the competitions you like to add, or you thoughts or opinions about them.*

I'm huge, I'm huge on them the only other insight I can give you is I've spoken to several of the companies who sponsor these and while it's very philanthropic for them to do it and everything what some of them will tell you, and I don't know if you're interviewing any of them, is that they have selfish intentions, as well philanthropic intentions for doing this you know it might cost the average company 30 or 40K to sponsor one of these things but they have the opportunity to have the best of the best come walking in front of them for in essence a 2 day interview. And one of the guys from one of the companies put it that way, I can't take credit for it. He goes this is great for us because we figure out who the great kids are and guess what we do after the competition we go out and offer them jobs. I don't know if you've heard that insight or not but that's it.

### **Coach Three Interview**

*So you've been involved with the competitions for 5 years?*

I think five I can't remember exactly what my first year was, five or six years.

*Okay and has your experience been with the ASC?*

yes

*Have you been involved with any others?*

No

*So really broadly or generally what's your opinion and their value to students?*

Well from what the students have told me this is probably the most beneficial educational experience they have, where they get to put the whole thing together and go out like it was a real world situation. So I think it's kind of like an advanced capstone to be honest, I think it's great I think it's the best thing a student could do.

*So having been involved with the ASC, it's a shorter term format as opposed to the NAHB, specific to the format what do you think is the greatest value of that short term format.*

The greatest value is the student's time, I mean they spend a lot of time in the fall getting ready for it but then the competition weekend, it's basically one weekend of competition and they're done. It's training up to that point, I'm not sure that's a lot different than how the NAHB does it, because they spend the whole semester putting their packet together where as we just spend basically whatever it is, 16 hours, putting it together. But it's all preparation to that point, I guess I don't have a good answer for that.

*So I'm at Colorado State right now and we did a survey last year among the graduating students and we found that the students who participated in the competitions had, on average, a higher GPA than the students who didn't participate in the competitions.*

Well I don't know how you guys do it there but I would say if you're looking at our students and found that to be the case that's because we hand pick our students I mean I'm looking for the brightest and the best so I'm out trying to see who has the good grades and are involved The students who are involved are typically the ones who do have the better grades so I don't know, which came first the chicken or the egg I don't know. I think it's because they're handpicked by me anyway.

*So they're the better students to begin with*

That's what I would surmise.

*In that same survey that we did, the same students who are participating also have higher average starting salaries than those who don't, why would you think that is?*

Well I can tell you the companies always ask us to point out which are the kids that were on the competition team, cause they know what the competitions team is, they know these kids put a lot of extra work in, and develop leadership and speaking skills through that. And I think they are in more demand just because they have that experience.

*So if you had to say that there was one that that was the greatest benefit to the students who participate, what would that be?*

One thing Ben, you're really going to make me choose that in a matter of seconds.. One thing that benefits them, I'm going to say the overall experience, and that's probably broader than what you're looking for, if you're going to make me pick one word I'm going to say the experience.

*Are you referring the travel going to where the conference is?*

No, the process of putting that bid together reading those plans, understanding where the problems lie, problem solving for that, and then presenting that. I think that process is one of the best experiences educationally that a student can have.

*Do you think there are negative aspects to participation?*

Well for the students or for me?

*How about both*

It's time consuming, that's the negative aspect for both, its time. But anything worth doing is going to take some time to do it. So the time, it's the time.

*How would you change the competitions?*

I would make it probably a little more real world and let them have more than 16 hours to put that project together, with that said I know that lends itself to a lot of problems as far as coaching and teaching and cheating so I understand the process, but it's not real world because of that situation but everybody's in the same boat so I guess it's fair in that aspect.

#### **Coach Four Interview**

*How long have you been involved with the student construction management competitions?*

Six years.

*And has it been all with the ASC or have you been involved with others?*

I was involved with ASC as a graduate student, member of the student team in I think 04 or 05' I also was a co-coach of the ABC competition with Steve Jaoen in probably the same time period and then the last, I helped, I help a lot of teams every year. I help with ABC because I'm the faculty sponsor. I helped Design Build this year, and then the team I coach is the LEED team. So you know If they want help and I have time I'll go

listen to them, give feedback, read what they have, give them criticism, constructive criticism.

*Okay great, so In a broad sense what is your opinion of the competitions and their value to students?*

The competitions force you to connect all the dots, the dots being each class. So if you're taking estimating I, estimating II, you've taken scheduling, you get to capstone you're supposed to put those together. A lot of students do this before capstone and it's like a 24hr capstone class, so it really forces them to think about how all this stuff goes together. So if they're doing it their freshman year, which is rare, in their sophomore year as an alternate, being groomed for their junior, senior level they really get a much better idea before their internship how some of this stuff starts to fit, and I think it also gives them a better potential for jobs before they go out because there is a job fair that's there, but people look for competitions and extracurricular activities on resumes so it sets them apart already from maybe the top tier of the class that they're in, but also the top tier of all the competitive classes from all the schools that they're competing against for jobs.

*Okay, so as you know cause you've worked with the ASC there are two types of the competitions, typically there's the shorter term like the 24 hr lockdown similar to what they do with most of the ASC competitions where the students show up they have their problem and they have the shorter time period to solve it and you have the ABC or the NAHB where it's a long term problem and they're spaced out over a number of months to work on their problem so just two questions about each type. Regarding the ASC or the short term, what would you say is the greatest value to that format?*

The short term is that it teaches you to think on your feet, you have to respond like you would in a job site situation when a critical issue comes up on a job. Where not only are you the go-to person but you're expected to have an answer, have the ability to come up with an answer in a rational and systematic manner to lead you to the point at the end whatever that answer is and keep you on track for whatever task you're at so you have to be able to think on the fly and manipulate and integrate a lot of data, analyze it and give an output in a certain format in a short period of time, key skills to be on a job site. The ones for the longer format like you mentioned for the ABC and the NAHB is that they want you to have background information going into that project. Now the short term stuff from the ASC you still get background data, what the project might be is it a hospital, is it a bridge something like that. The longer format they want that data set, you might have a core and shell they want tenant finish out, they want more deliverable from you than that short time would allow, so anybody can build a core and a shell that's pretty easy and if that's what your long term thing is for ABC you get there and it's like okay now here's the finish out and we want you to price different options so the owner has a good idea of what they can do with their budget to get their outcome for tenant finish, for example. So you've given that long term to think about it. Then the short term is the ASC where it's like now here's the rest of the problem, you've given them enough background but you still have to think on your feet.

*Do you think one format provides a greater benefit to the students than the other, or are they just different?*

I'm not sure that there is an answer for which format provides the greatest value to the student, it's as much what is the student putting into it, what is the student getting out of



it? If you have the longer format and the student puts a lot of time into that format at the expense of other things like their job or their school work that takes away from what they should be learning in addition to what they're working on for the competition. So that should help with time management. Where in the shorter format your time management is taken care of, here's the problem here's the time you have, here's your deliverable requirements. Both cases you hit time management organization and delivery so I think it lends itself more to what's more convenient and conducive to the problems, or at least the perceived problems and the sponsors to those problems. What works for delivery to get out what they want out, they may realize it takes two days for the students to do this in the long format, we don't have two days so lets give them some information up front and let them get familiar with the project and then really hit them with what we're going to grade them a lot on in the short term format of that.

*Okay so we did a pilot study at CSU and we found that on average the students who participate in the competitions have a higher GPA than the students who didn't, that's GPA at graduation. So why do you think that that is, that we're finding higher GPA's among participants than non-participants.*

Because you always have a distribution of grades whether they're in extracurricular or not, typically 10-15% that are in A's, hopefully 10% or less that are in F's, but you have a normal distribution so the one's I think you find that are in competition, they have to be a member of a club so they're already doing extracurricular they've identified that as a value target for their career, extracurricular activities, and then by virtue of being able to get into one of these competition teams that's even more added value. So I think that you've got the best competing for the next level of the best. The ones that get on the team are the best

of the best. So I think they're already predisposed to wanting to achieve, to excel at what they set their goals to in education, and they understand the value of it. The 80% in the center those that get B's to D's they're always there and they may work diligently and hard, but they don't see any value in doing anything besides just what they are assigned to do. Then at the other end are the F's they're here and who knows why.

*So essentially it's the better students who are participating in the competitions and that's why, you think*

I'm not sure that you're going to say their grades are better because they're in a competition, they're in a competition because they already have good grades.

*Okay great so the same study found that those students, the students who participate in the competitions where also gaining higher starting salaries than those who were not. So the same question, why do you think that I, that they're seeing higher salaries among competition participants?*

Because more people want them, cause they're a proven commodity. If they're on a team they know that they're going to work hard, they've got good grades and if I want to hire them somebody else probably wants to hire them. If I've watched them at the competition perform and present I know what value they can add to my company. It's an investment decision for me, and if I see higher return by having to pay them 5 or 10% more to get that person I'm going to do that if I think it's a good investment.

*So back to the competition just in general we talked about a lot of things that are valuable as a result of the competition for the students but if you had to say there was one thing that*

*was greatest value, biggest reason why a student should participate what do you think that is? The greatest benefit to the students?*

Personal growth, by that I mean it forces them to look inside and really pull on the knowledge that they've been accumulating and put it together in a way that's going to make them a better more marketable employee, which is why they're here right?.

*Do you think that there are negative aspects for the students to participating in the competitions?*

Only if they let it. Like I said, if the student lets it be a negative influence, they don't go to class they don't go to a job they don't do this that or the other because all they can see is competition that could be a negative because you can make a competition team go to a competition do relatively well and get D's in your classes that semester it's not a win-win situation for anybody.

*How would you change the competitions any of them. If you have any opinions in those regards.*

I don't know if I would. There is a lot of politics in the competitions, commercial is one of those areas where there's a lot of politics, and you don't know what the politics of the company that's sponsoring those projects are. There's been rumors of some teams wining because they got sponsors in to a project or an area they want to be in. Which is not that fair to students that really should have deserved to win, but If you change that it wouldn't be real life cause that happens in real life too. So I'm not sure that you can make the competitions perfect, I think they're good the way they are.

## **Coach Five Interview**

*How long have you been involved with the student construction management competitions now?*

3 years.

*And has your experience been only with the NAHB competitions?*

Yes.

*Okay, um just generally what's your opinion of the competitions and their value to students?*

Uh they're the closest thing to real world experience that students can get other than actually having an internship working for a builder, so they're extremely valuable. The feedback we, from the builders we have relationships with and what we hear from the judges every year is that, you know, this really sets students apart to have this on their resume, for them to participate. We put a very high importance with it in our department.

*Okay, now talking about the two types, the general types of competitions, the longer format like the NAHB and then the shorter format like they do at the ASC, what do you think is the greatest value of the short term format?*

I don't have a lot of experience with that but it's still, it's like there's times on projects that you only have 24-48 hours to kick it out the door and bid something, so um that's like real world too at times. The pressure and what you've got to produce in a short amount of time, is typical in the day to day world of construction.

*Okay same question for the longer format, based on that format type what do you think is the greatest value of it?*

I think that the students get to be more immersed into the project they get to see all the other aspects of it and learn a lot. I guess a lot more opportunity to learn, where it's more like a cramming session for the other part. So there's just so much more you can do over course of the semester, compared to you know just 3-4 day sequestered in a hotel.

*Okay, Do you think one provides a greater value for a student, um or maybe are they just different?*

They're just different, they have their pros and cons to each, um the short format is more intense but uh you know they're just different they have learning implications on both sides.

*Okay so we did the pilot study here are CSU that showed that the students who participated, on average the students who participated in the competitions had higher GPA's why do you think that is?*

Usually the students that participate in these competitions are motivated are driven, a lot of the times they're after hour classes or extracurricular activities and so those are usually the students that are the overachievers. They set themselves apart anyway by being part of it and so they usually do pretty well in their other classes too. You don't get the slackers involved with these competitions typically.

*Okay, so you'd say it's more an issue of correlation, the students who are participating are the better students?*

I think it's better students but I also think it gives them more real world experience so they are more passionate about the business. Depending on what they learned from this, it can be taken away to other classes. Here it's juniors and seniors that get involved so usually it's the better students.

*Okay, so the pilot study we did also indicated that the students were attaining higher average starting salaries than the students who didn't participate in the competitions, so the same question, why do you think that result was there?*

Well the students were the better students, and you know companies look at this as you know close to real world experience so it's like having a student that has more experience in the field on his resume than just someone that just sat through course work and so the companies value it more.

*Okay so then uh just a couple more questions based on your experience with the competitions, what do you think is the greatest benefit to the students who participate?*

Greatest benefit, I think it's the opportunity to network and to work on real world projects, and get exposed to the builders and the international builders show.

*Okay,*

Uh it gets them out of the classroom bubble and gets them into the real world.

*Okay, so the last one.*

Do you feel like there are negatives for the students to participation?

It definitely takes a time commitment to extra-curricular activity but no I guess those are inconveniences but not true negatives because you know employers want to see them, want to see students that are doing extra work other than just course work, I can't come up with anything that I would consider a true negative over it.

*Okay is there anything else you'd want to add regarding the competitions?*

Hope to kick your butt next year!

*How would you change the competitions?*

I can't come up with anything that I would change.

### **Coach Six Interview**

*So first question, how long have you been involved with the students construction management competitions?*

Probably 6 years

*And has your experience been only with the ASC or have you been involved with the others, the ABC or the NAHB?*

I've been involved with the local design build competitions, been doing that for 3 or 4 years. Very involved with ASC with various teams, but involved only from the aspect with the other ones that I'm the outreach coordinator. So I kind of oversee their competitions to some degree.

*So very, just real generally, we'll get a little more specific in just a minute, what's your opinion of the competitions regarding their value to the students?*

I think the competitions are extremely valuable to the students, matter of fact so much that my capstone class is very similar it just takes it even further, and to quote some people from the industry, it's as close to reality as you're going to get without actually being out there working so it's extremely important to the point that I think that it would benefit students to pay to get on a competition team if they had to.

*Great, typically there are the two types of the competition, there's the longer term like the ABC and the NAHB and I think the Rocky Mountain Design Build is a little bit similar where the students are working on the project and then they go and present versus the ASC where they go and are given the problem and have a shorter period of time to solve it.*

With ASC they're actually given part of the problem in September and then they don't present until February, so they work on it for about 3 months,

*Really*

Yeah actually working on part of the project, even though some of them don't know specifically what it is they still work on putting together their prequalification packet and their information before they go. Some of the teams at ASC, I think actually get pretty much the problem and then once they get there they have to work out things.

*All there,*

Yeah



*Okay, so regarding that short term, at ASC where they're basically getting the problem there, I know they're doing some preparation but essentially they're getting the bulk of their problem there. What do you think is the biggest value or the greatest value to that shorter format?*

I'd say one of the biggest values is again it's part of reality, when you're out there working on a job as a super or a PM you're going to still be doing that and you'll have a 4 or 5 day window where you have to put together a bid and put it together. So that's critical, and it also makes them really think about what they're doing cause one of the important things about that is probably for students to learn how to manage their time, and we really don't teach that as a separate class, I teach it in the capstone but, no they're doing it to learn this stuff, but it's time management. What you do with your time is critical. Not only in here but when you get out of here, cause you're going to have a lot of things pulling on you on projects and you'd better learn how to manage your time. So I think that short window is important, the regional Design Build competition they get their project like on a Friday and they have one week to put it together, everything.

*So it's still pretty short term*

It's even shorter, it's even shorter than Reno, it's real intense so it causes them to look at what's important, to make sure they pick the important things and make sure they do those and sequence basically schedule what they're going to do and stick to those.

*So basically time management*

Time management is, so important.

*Okay, I know you don't have experience other than as the outreach coordinator with the NAHB and ABC where they're working over the course of months, but do you have any opinions of the greatest value of that type of format, where they're spending a long period of time working on it?*

I think they're both important, I've worked with the NAHB because some of my seniors were on NAHB teams so I got their packets and their information and they come to me for help, so I'm familiar with theirs to some degree as well as the other, I think there's benefit there because it allows you to dig into it even deeper and make it more professional. So it gives you the time to really get into the thought process over a long period of time rather than just we've got to jump into this and make this happen overnight. They're both beneficial.

*Okay, so you kind of already answered this but do you think that one provides a greater value or are they just different?*

I think they are just different, I don't think you can really rate them, they give the students experience, they cause them to work in a team effort, they cause them to understand their time management on all of them, and they also give them great industry feedback and contacts so I think they're all very important.

*So last year we did a pilot study, and we found that on average the students who participate in the competitions have higher GPA's than students who did not, Why do you think that is?*

I think probably the main reason for that is they're forced, they're self- forced rather than teach forced into learning, so the students who really want to get some value

out of the program, and I hear some students say this every single semester “I can’t believe how much I’ve learned being in the competitions” its like putting all my learning together, and especially for the freshmen, sophomores, and juniors that haven’t gotten to some of the upper level classes they’re learning it early, so they’re getting involved learning it early and tying it all together much better than students who don’t get involved in the competitions, because up until that point its okay I’m taking scheduling, I’m taking estimating but how do those things really work together. What does my schedule have to do with my estimate, what does that have to do with my contacts and my pay requests. Where as in the competitions you’re forced to put all those things together and realize how they’re integrated.

*So what they’re learning at the competition is then benefiting them as students.*

Oh yeah very much so it causes them to learn it quicker and I think it really helps them to see the value of their education more, they go wow talking to the industry they say that if I’ve been in the competitions we know so much more, this is a great opportunity, and I’m going to dig in an learn. And I think those students are willing, they get on the competitions and they are willing to go above and beyond, so those students typically have a stronger drive to learn and to accomplish what they can while they are here. They want to learn all they can so when they get out of here they are going to be in a better position, and they are. The students get job offers way ahead of what other do, from multiple companies.

*Do you still find that’s the case right now since the economy’s gotten more difficult, with those kids?*

Yeah when I was in Reno, and industry rep came up and was talking to one of my students after the presentation and asked him If he had a job offer yet? I think this was for actually for his internship, in this particular student, he said yeah I haven't totally committed yet, he said I want you to come talk to me before you commit I want you to work for our company. So the student goes wow, and this same student was in Washington D.C. at the national design build conference, and he had companies telling him the same thing, all my students that went all three that were there. if you don't have an internship we want you, so they're getting internships and they're getting job offers, multiple job offers even in today's economy.

*So this is a similar question but the same survey that we did of the students here it found that they were getting higher starting salaries you listed some of the reasons but do you think there is anything additional why they would be getting higher salaries? On average those that are participating versus those that don't?*

Yes, a friend of mine who is a head, a head hiring person for a company in California probably said it best, he said: your students are turn-key, when they come out they are finished and ready to go, and he typically just talks to the competition teams, That's who he sees when he goes to Reno to watch them. He said these kids they're just sharp they're well prepared and they have a drive to succeed. And by being on the competitions that speaks loudly. Matter of fact at the career fair we just had I was talking to one of our former students who is now on the other side of the table hiring our students, she said yeah our company pretty much only looks at competition students we look at those first before we look at anybody else. And she had a standing offer when she was a junior from a company and had I think 5 job offers when she left and was on the

competitions. As a result of it, she said it had made a major difference and really pushed, made them prepare. I see my seniors that don't do competitions, and we have a competition like that in senior capstone, for students who have never done it that's their first presentation where they put it all together in four years. Whereas the competitions students may have done that 3 times by the time they get to the capstone and it's totally different and you can tell the difference they're totally secure, they're confident in what they know, and they have no problem getting up in front of class and talking. It makes a big difference. You can tell I like the competitions. It's important and having been out in the industry for years they need that, they need that reality.

*Yeah I'm in the same boat I participated as a student, and that's where the who idea for the study came from, just talking about what is the value cause there's lots of opinion about how great they are but has anyone ever put something together.*

Documented it.

*Yeah so similar question to what we started with, but I want to be a little more specific, so when we're talking about the competitions if you had to say there was a single greatest benefit to the students if you had to say there is one thing and this is the best thing what is it?*

Single benefit, probably from the student's perspective is that it opens up job opportunities, that's what school's all about. And going beyond job opportunities, it provides those job opportunities because they are better prepared than students who don't do competitions, it puts them in front of more industry people just because they go to competitions because industry people go there to get those students because they are the

cream of the crop, that's who they want. It gives them the opportunity and we do the same thing in capstone we have industry people come and watch them, where else can industry people go and see them perform on what they're going to have to do when they get out. They're saying okay can you do scheduling, can you do BIM, can you do estimating, watch the students do it watch how they present themselves. You can't get that in a one on one interview not going to happen.

*Or a career fair*

Or a career fair and these people say yeah if people realized what they missed by not coming to these for interviews they would be flocking here and paying to come to your capstone class just to watch the students.

*Yeah that's interesting. Your position puts you in a unique, or your role as the coordinator I think puts you in a unique position, this will be good with the data I've collected so far.*

I get a lot of feedback from corporations and since I raise the funds for the competitions, I have them call me and say I want to sponsor such and such a team instead of me having to do the calling and begging all the time, now I have companies call and say I want to sponsor that team this year.

*That's outstanding, so the next question do you think there are any negative aspects to participation and if you do what are they?*

I don't really see any negative, cause we don't really make it a party it's very serious they're representing the university, representing the department and students go there realizing that. I think there had been some problems potentially in the past, that just

wasn't stressed enough so now I just stress it very much that this is, this is a professional thing that were going to. The only negative side to the competition is that we can't get all the students involved, we don't have enough faculty, we don't have enough space we don't have enough money to be able to have every student do a competition. I think it would be great to have sophomore competitions, junior competitions, within our own department.

*That would be great, it really would be*

I think it would be extremely valuable and then if you, depending on how well you do on those, you get picked to do the competitions, NAHB or Reno. Cause I told my students this year if you don't do the regional design build competition and do well there, you don't go to Reno. I had three teams apply and one of them was the NAHB team actually.

*Yeah a student talked about that*

Cause he said we want to learn.

*Right*

What better way to learn, do a competition and I think they learned a bunch as a result of it.

*That's true I was talking to the student about that, I think he realized how much he learned doing the competition last year but then I was talking to him and saying you know you can't let your classes suffer because this, you've found this is more valuable and he was yeah yeah I know, but.....*

That's part of the time management and we tell them up front if you're going to do the competition your other work still has to go on. This is above and beyond, and for some students it becomes a problem probably because they get so involved in doing the competition that it can affect. But I don't see that as a negative, I see that as an individual choice of how you're going to manage your time.

*Probably better they learn now than...*

Much better they learn now than getting out of here and learning and losing your job.

*So are there any changes you would make to the competitions, how they work or anything like that?*

Probably, the things I would make to the competition itself or preparing for the competition or anything?

*Either or, anything*

The thing I would like to see our department do is make it more competitive and we're working on that and making that happen now, rather than just anyone who wants to sign up gets on there now, just have competitions within the grades where they have to perform in order to be able to get on the competition. It's already become something that's held pretty highly in regard based on the number of students that come each year to our open forum, it's standing room only. Students have found out that it's extremely valuable for learning and it's also extremely valuable to get a job. The biggest complaint I hear is that well I didn't get the opportunity to get on a competition team, they were already full and I say well did you try any other teams did you try NAHB did you try this did you try



the regional design build, no, well there were opportunities you just didn't take them. And can we have 800 students go to Reno, no not going to happen. Not everybody wants to, not everybody can, we took 62 people last year plus we had 3 teams do the regional design build, we had the NAHB and these all cost money and take a lot of time for the professors for the coaches to get involved and make these things happen, so the change yeah get more faculty, get more teams cause there are still teams that we can do. We just need more faculty and that's how we do it. As far as the way they work I think it's good. I'd like to see little more competitive, my design build, commercial they are very competitive you have to do a 5 minute presentation you have to write a letter saying what your strong points are why you should even be on the team if you get on the team what position would you be best at. So it's fairly competitive if they don't get past then not even going to be on the team.

*So do you have any other comments or thoughts based on your experience with the competition that you'd want to throw on here?*

I think it's something that's very valuable and important to the department, it's something that has to continue. I think that's one of the things that's probably helped us be one of the best if not the best departments in the United States, cause the number of students we have that get involved, that do the competitions cause every year we go out there and everybody goes you got how many people out here, wow that's a bunch. And the awards we bring back, when industry's sitting out there and other schools are sitting out there and Colorado State University is called up 7 times during the awards ceremony this past year in Reno, 7 times that's a bunch, they keep hearing Colorado State, Colorado State, Colorado State so that lifts us up in everybody's view point, I know that the schools

I hear and listen to their names that are called up and it's repeated, and those are all good schools, so it's a good program it's as close to reality as the students are going to get. To really learning what they need, if they don't like that then they should be a history major.

### **Coach Seven Interview**

*So how long have you been involved with the student construction management competitions?*

Since 2002.

*So that would be about 9 years then or 8 years*

8 or 9 years yeah.

*Has your experience with the competitions been with both the NAHB and the ASC?*

Yes

*Have you been involved with others?*

No only those two

*Speaking very broad and we'll get more specific later, what's your opinion of the competitions and their value to students*

Okay, the two competitions I've been involved with, the NAHB and then the ASC commercial recently, both of those in my opinion are invaluable to the students, I mean they are just off the charts, because it teaches students to work as a team together to solve

problems that they necessarily might have some fundamental knowledge on but they're learning to put them together. I'm always talking about, you know you guys are great at estimating and scheduling and management but what ya'lls challenge is, is seeing how they relate to each other and how they effect each other and that's what these teams do.

*So having been involved with both the NAHB and the ASC you know there are two general types the shorter term format and the longer term format, and within the shorter term format like the ASC, specific to that type what do you think is the greatest value to the students?*

That's a good question, probably in that competition it's probably problem solving on a quick basis. In other words giving a problem and having a limited time as a team to problem solve and brain storm and come up with a solution to that problem within whatever that time period is. I can't remember 16hours or whatever it is. But I think that's the biggest thing learning to problem solve on a short term basis.

*And then regarding the longer term type format what you think the greatest value to that type is?*

It's sort of the opposite thing and that is learning to problem solve on a very detailed basis, in other words you're still solving problems but you have so much time that you're solving them in tremendous detail, rather than a short term problem solve. I think both have wonderful goals they're just different and both reflect reality in the industry.

*Okay great, so we did a survey of construction management students here at CSU and we found that the students who participate in the competitions, at graduation they're having a higher average GPA's than the students who do not participate, why do you think that is?*

I think it's probably two things, one students with high GPA's are more likely to get involved with competitions, because they're motivated, self motivated type individuals that enjoy those kind of things. I would think also after the competition it benefits them in their classes to some degree but I think probably the biggest factor is that's just the kind of students that are going to get involved.

*You're just getting the better students to begin with.*

You're getting the better students because you're getting the self motivated type students, I think it probably does help other wise, they've learned some things that they can use in their later classes but I doubt that's as big a factor, I would guess. It would be interesting to ask how high were their GPA's before they started and did they change. Probably they were your top students before they got on the team.

*That's interesting I wish we had that data, so the same survey found that the students who are participating in the competitions are earning higher starting salaries than those who weren't, why would you think that is?*

Because participating on a competition is certainly a resume separator, between the rest of the students. I think the industry sees the value of having done something extra #1 and #2 done something extra that relates directly to the industry and so you win on both points and those students are in higher demand by the industry. I don't think there's any doubt the students who participate on the competitions receive more offers of jobs and

higher salaries, in fact when I was doing NAHB a lot I tracked that and it was pretty clear. So that survey doesn't surprise me a whole lot.

*Yea the whole study seems a little bit intuitive but when we went to look there was nothing documented anywhere about it so it gave rise to this little study.*

And I think, Ben right now it's what I'm telling, cause I'm teaching senior seminar right now, it's too late but what I tell those students in senior seminar if you graduate from here in construction the industry is going to say you are technically competent, most likely, but so are the others that graduate, so what have you done that separates you from the crowd. Cause every body's that, and the competitions are probably the number one thing other than job experience. Job experience probably #1 competitions would be #2.

*Alright so back to the benefits to the competitions if you had to say there was one think that there was the greatest value to the students, what would you say that is?*

I think it develops the student's confidence in themselves

*So do you think there are negative aspects to competitions participation?*

You know I guess there's the negative that there's a lot of time, but I think it's well spent so I don't think it's a negative necessarily, it does take a lot of time but I think it's a good investment of time frankly. I don't think there's any negative to it. As a department head, expense. Let mention that one cause we're fighting that right now, not ASC and I'm not involved but ABC and MECA they like to hold them in Hawaii, and Puerto Rico and places. We don't have that kind of money. Cost of sending teams to competitions is certainly becoming problematic in my opinion as an administrator. Because I'd love to

send even more than we send but some of these competitions are very expensive and that becomes problematic especially in a market like we have now, where we used to be able to go out and raise the money right now that's hard to do. So that's probably the only kind of negative to it, is the cost. That's why I love the ASC competitions cause it's regional and it's cheap.

*So for ya'll is funding always coming out of the department,*

Our Industry advisory council pays for part of it but they don't fund enough to pay it all especially for these national type competitions.

How would you change the competitions, or would you change them?

I would not change the ASC competition at all, I would think about if I were NAHB doing a regional competition and then taking the winners or the top 3 or something to a national, something of that nature because I think it would allow more teams to participate. And the same is true where they only do a national competition that because of cost I would consider doing a regional competition.

### **Coach Eight Interview**

*I know this past year you weren't involved with the competitions but before that how long were you involved with them?*

At here on year, the previous school 3 years.

*Okay great and which competitions has your experience been with?*

We did the AGC and the NAHB and at now I was involved with AGC ABC & NAHB.

*Oh great, so just in general speaking very broadly what is your opinion of the competitions and their value to the students?*

Well the competitions, each one has a different purpose, but mainly experience in a quasi- real life environment for the different tasks that they have to perform and working under pressure and that's another good thing that I think the competitions provide the students, in addition to all the networking opportunities that the students have. Some competitions have career fair so they get connections with industry practitioners and some of them actually get jobs out of that so that's pretty valuable for the students I believe.

*So having been involved with them, there are kind of two formats that we're seeing in the competitions, the longer term where the students have a couple of months before their actual competition to work on their projects and then there is the shorter term like the ASC where most of the time the students arrive at their competition and then they have a period of hours, 16 or 18 hours to work on their proposals. So a couple of questions speaking to the format of the competitions, for that short term format what do you think is the greatest value to the students is?*

For the competitions that are the short time I think that they get a sample of working on a deadline, they have to organize all of their work in a short period of time and then produce or deliver a proposal on their tight schedule. In reality people usually get more a little bit more time to work on proposals but when there is a very competitive market usually that's what happens, everything is last minute, so I think that the realistic

working environment, that experience is the most valuable thing about that format. If you want me to talk about the other format I can tell you a couple of things about that too.

*Yes please*

There is benefit in having all the materials beforehand and being able to have access to the documents and you can do a lot more research beforehand, more detailed research so you're able to prepare more, so it helps to relieve the stress of having to get to the competition and then not having the information that you need. Pretty much that ensures that the team that was able to prepare the best beforehand, I guess get the most appropriate assistance will do much better on those competitions. So It has its advantages because then they just concentrate on the tasks assigned to them at the competitions site, the one that I went to was pretty much just putting together a presentation and doing a little bit more fine tuning of a proposal, they throw in some curve balls in there so they have to react to that but I think it's less stressful than the other competitions, I think it's a better experience In that sense.

*For the students and as far as the value to them, do you think that one format provides greater value for them? Or perhaps are they just different?*

No they are different, each one has it's good things and it's not so good things, so in general I like them both, each one has its purpose so I think they are equally beneficial.

*Here at CSU we did a little pilot study and we found that on average the students who did the competitions had higher GPA's than the students who did not participate in the competitions, what are your thoughts as to why we found that.*



So you're saying that the students who participated in the competitions were found to have higher GPA's than the students who did not participate?

*Correct*

Did you measure or collect information on their GPA before they went to the competition, and then after they went to the competition and waited like a semester and then collected GPA's again?

*No, we didn't do a comparison of the same students, we took the GPA at graduation and just simply compared the students who had competed versus the students who hadn't just doing some simple t tests on the averages.*

I can tell you a couple things about that, especially my experience, the students who are involved in competition are usually the more applied students so I would expect that to be the case without having comparative measurement of before and after I wouldn't venture to state that the competitions had an effect on the GPA because you didn't have data from before the competition, the other thing that I would caution you is that also has to do with the courses they took so if they had courses that were more concentration courses before they went to the competition, meaning if they went to the competition later in their career you know their GPA was probably what it was going to be. If you had students who went early in their career before they took the courses and they went to the competition and that helped them to understand some things and then they went back and did better in their courses that could be another result but that would require measurement before and after and tracking those students to see if that actually influenced their performance, that would be a little hard to prove actually. I think that's what I

immediately think of when you indicate that you observe students that went to the competitions had a higher GPA, I would immediately say that usually the ones that participate are the more applied students, in my opinion they would do equally well if they did not go to the competitions, that's what I'm saying. But that's probably not what you're out to prove, you're probably out to prove the contrary.

*No, really on that particular question we just want to know what people's thoughts were, because I tend to agree with you I don't know that we could say it's a result of the competition it's just something that we found.*

It's interesting yeah but the trick is how do you prove that there was an effect?

*Certainly, you're exactly right. So the next question is, in that same study we also looked at the starting salaries because the survey was done at graduation, the students who had participated in the competitions were found to have higher average starting salaries than those who were not.*

The students who participated in the competitions have higher starting salaries?

Correct.

Well I'm not sure if then that would be also related to the fact that they had higher academic achievement so that could be one factor that effects their starting position. For sure the competition would give them an advantage because that's part of showing that they have leadership skills and that they were involved in extracurricular activities and employers value that, so I think that yeah it makes sense that they're in a better position starting out because employers value that experience. So yeah that would be, I guess an expected result of competition participation.

*So based on your experience, this is similar to our first question, if you had to say there was a single thing that was the greatest value or greatest benefit to the students for participation, what would that be?*

I would say the fact that they get to work with other students in their program in a collaborative team and work through a live fire exercise if you will, and are able to go through a process that most of them won't be exposed to until they go out to the work place. Even students who work on capstone projects, the capstone is not a team capstone and many programs do not do that. We have a two person capstone but it's not a full circle capstone like the competitions are. Where you have to develop a lot more comprehensive estimate and then like your marketing plans and presentations and things like that. They get that experience and I think that's the most valuable thing. They have the experience to go through a process that most people don't see until they go to work.

*Again we're talking specifically to the students, but do you feel there are negative aspects for the students who participate?*

One thing that I've seen in many of the competitions that I've seen and that happened more at the other university, it was a smaller university, it has less resources so the students felt that they are at a disadvantage to universities that are bigger that have bigger budgets because they see larger groups that are better equipped, so they have the perception that the other universities do well because they have access to more resources, they feel they are at a disadvantage. That is not necessarily true but that is the perception that many of them see. Not all of them but a large number of the students feel that way. That is something that we bring up at faculty meetings try to come up with ways to of

balancing things out. It's the larger institutions that take the position that if you have the access it shouldn't be precluded or you shouldn't be limited to using those resources, it's fair but that's the one thing that, there is always the perception that the little guy is at the disadvantage. That has been disproven several times, first time contestants do very well so it's hard to come to the conclusion that that is actually affecting performance, access to resources, but that's the thing that comes to mind immediately.

*The next question is just, are there ways that you would change the competitions?*

That's a hard question, recently there has been issues with sponsorships, you probably have heard of issues with sponsors and some sponsors dropping and those are separate from the effects of economic downturn and budgets being cut and companies not being able to support at much as they have in the past but, I think competitions are well defined and there is no standard format, each organization has a format and students can choose or I guess universities can choose which competitions they want to expose their students to. What I would change is and it's very hard because I wouldn't want to make a single format knowing that there are advantages to all the formats that are available. I don't think I would change anything, I think that it's good that there is choice, having choice is a good thing. Maybe the only thing and I think that it has been talked about at faculty groups is that for students that are not participating in the completion but attend to observe, to give them activities to work on in mixed teams from differing institutions, so one thing would be to explore the possibility of doing the same thing for the actual competition, all the institutions show up and then at random they will be teamed up and then see what happens. That would be an interesting experiment because you would have the way you join two institutions that have a lot of resources then they would have a big

advantage over others so I'm not sure how you would address that. And another option would be to just have students show up without equipment and then the sponsors provide all the equipment, have the competition at actual offices of companies and then students just use whatever the company has. Everybody has the same resources and they are mixed with students from differing universities so that would probably level a lot of things out.

*So last question here is just if there is anything else regarding the competitions that you would like to add*

No not really that last question, I think I really went over all the things that I think could really change or be added so not really no.

### **Coach Nine Interview**

*How long have you been involved with student competitions in construction management*

You mean All the student competitions or just the NAHB

*All of them any that you've been involved with*

10 years

*And has that been with both the NAHB and the ASC?*

Yes

*Okay so just generally, very broad what is your opinion of the competitions and their value for students*

Well I think they're invaluable, I think it's an excellent opportunity for students to put together something that's much closer to real life than they typically get in classroom and anytime you can participate with industry professionals that's a good thing.

*Okay So having experience with both, you know there Is the two basic formats, there is the shorter term like the ASC and the longer term like the NAHB or the ABC does, speaking to the shorter term type format, what do you think the greatest value to that type of format is to a student.*

Now which one do you define as the shorter one?

*Where they're basically going to the competition and they're given there the problem and they're given, what is it 18 hours I believe to come up with their solution before they submit it as opposed to like the NAHB or ABC where they get it various months in advance and they are working on it at their home institution.*

Okay they are quite different so I don't think one, well I think comprehensively the students who do the longer one the NAHB they really do have a very very very deep understanding of what they have put together. In other words it's very comprehensive, their documents are well thought out their documents are highly investigated, they've done a lot of research, all those things. I like that component of it what they don't have though is they don't have the pressure of trying to accomplish this all in that very very short time frame but I do like the fact I really do think when students are done with that competition the students are very clear what they accomplished. With the shorter version the good thing is they are thrown all kinds of curve balls throughout the whole thing and it's a tremendous immersive experience, but I'm not always certain that they really have time to

observe, or how do I want to say, soak in what it is they just learned, in other words they're throwing things together, the knowledge they already have, maybe this is the distinction the knowledge that they already have is what's being tested. So there is no new knowledge in that experience, the short one they're just taking what they already know and that was the original intent, I don't know if you know the history but Jim Rodger at Cal Poly's the one who sort of invented the ASC competition and the original intent of it was to take what you already know and compete against other students from different universities, that was the original intent from the beginning and that's still the case, what do you already know going in. Where the NAHB one is really the ability, the competition causes you to learn more than you already know. So it doesn't start from what you know it goes way beyond that, those students who do the NAHB competition know far far far more than any of their classmates going through the curriculum. The one educational benefit that the short competition gives the students is their ability to work on their future. So that's new knowledge about themselves or new insights about themselves and what they are capable of producing in a short period of time. So that new knowledge or new awareness is really about their own capabilities to me if that makes sense. But there to me is a clear distinction and I wouldn't say one is better than the other they are different competitions. Students who have the opportunity to do both, they would really be the ones that you may want to interview at some point.

*That's great that really insightful, some of what you shared will really help guide the research because, I didn't know that the original intent of the ASC's was to test the students against other programs on what they know, so that has a great impact thank you. So we'll move on to the next question here. Talking about the competitions in general, we*

*did a pilot study here at CSU and we found that on average the students who are competing have higher GPA's than students who are not competing. Why do you think that is, do you think it's an instance that the competitions are causing the students to do better in their classes or is it just that perhaps it's just the better students who are participating in the competitions.*

Your saying they have a higher GPA afterwards or before the competition?

*We're surveying them afterwards at graduation, so when they graduate the GPAs of those who participate are higher than those who have not.*

I'm going to guess that I think the competition is not necessarily a factor in that, in other words I would not guess that the GPA would increase after competitions I don't know that though, but I think you're attracting the students who apply themselves more to begin with, cause it takes a lot to do these competitions so the students your sort of slacker type students is not going to participate in these competitions I think you're sort of drawing the cream of the crop as it is. I can't say one way or the other if doing the competition impacts that or not.

*We're certainly not asking for definitive answers, just your opinions on what we've found. So that same survey found, this is at graduation again, the students who participated in the competitions were commanding a high starting salary than the students who had not participated, so again do you think that's an issue of the participation in competition caused that, or perhaps that because these are the higher achieving not the slacker students that they would be getting those higher salaries anyhow.*



You know again it's really my opinion, I don't know, that's my opinion. The students I think the students who do the competitions end up with a great deal more confidence, and you have more confidence at the time of graduation and you can articulate better you can present yourself better, you have a deeper sense of knowledge about what your education's about, that's really the biggest benefit and that would not surprise me then that you would end up with a higher salary and you would end up with maybe a higher GPA, so I do think there is an impact there's no doubt that there's a that the competitions will have an impact on the way the students present themselves, articulate, and their confidence level and that all plays into everything associated with them going out into the market.

*Now back to specifically talking about the students, do you think there are negative aspects to the student's participation in the competitions.*

No, from a personal perspective I don't see any negative to it. I just think it's an extraordinary opportunity for the students, I can't think of a single negative to be honest with you.

*We talked a little bit about the general value of it to the students, if you had to say there was one thing that's the greatest benefit to participation.*

I think the greatest benefit is exposure to industry, and confidence building, I would say confidence building more than anything else.

*Great, are there ways or how would you change the competitions if you could. Either of them*

Well let me start with the ASC one, I the ASC competition used to be a 24 hour format, I think now what's happening it's really jammed up to a really small timeframe and like I said it's almost become, well one of my concerns it it's become a race to the finish, that it's lost some of its, it's way to have students shine. In other words it's so jammed in, lots of teams don't finish, they finish but it's incomplete it's not accurate and I just don't, it's a good test for them to test sort of their mettle, I guess in terms of working under pressure, I guess what I'm concerned with is the end product, boy if you compare the end product from the ASC competition with the end product for the NAHB they're like 300 miles apart the quality of the packet for the NAHB is excellent, the quality of the deliverable of the ASC to me is rushed incomplete, you know it's kind of, you know when it was 24 hours it was a little bit better in that the students had time to prepare presentation materials, I mean believe it or not they had a little more time. The whole thing is so that they could get some sleep, they don't anyway but that's the biggest thing I don't like. I'm concerned that it's so rushed that they clearly don't have time to do a good deliverable. It's okay it's not bad I mean here's what people say: it's amazing what they can deliver in 16 hours. Yes it's amazing to see what they come up with but if you actually go back and look at the work it's mediocre. That's my opinion, so I would like to see, some people may not think that's an improvement but I would like to see it go back to a little longer time frame. The NAHB I'm pretty pleased with, a lot of people aren't happy with the way they judge it but I'm okay with it in that I kind of know how it works, it not necessarily the best team always winning at the NAHB but it's not with the ASC either. Because I've participated long enough to see that the judging is not comprehensive when it comes to either competition honestly the thing I'm most disappointed with in both is probably the judging methodology.

*Is there anything you would like to add based on your experiences about the competitions?*

No I think they are extraordinary opportunities for students you know I think they're opportunities for students I've probably been involved with ASC longer than NAHB actually but I've always liked what was produced in the NAHB, the actual work itself. I do wish they would give them a little more than 15 minutes to present at that competition, but other than that I think the competitions are an extraordinary opportunity for the students. I just think it's a great opportunity, if every student could participate in that it would be really really beneficial.

### **Coach Ten Interview**

*How long have you been involved with the student construction management competitions?*

3 years

*And which competitions has your experience been with? Is that all with the NAHB or have you also been involved with the ASC's?*

NAHB & ASC

*Okay Because you're familiar with both types there's the short term and, similar to what they do at the ASC and then the long term type format that the NAHB does. For the short term type format, what do you think is the greatest value to the students of that type of a format?*

Being able to make decisions under pressure, pressurized situations I guess because you know they have such a short time frame and during the competition they usually switch up, and throw curve balls in so that they actually have to make decisions on the fly which is very much like it is in the construction management world

*Ok great so then same question regarding the longer type format, what do you think the greatest value is of that to the students of that type of format?*

It gives them the opportunity to provide a more in-depth solution.

*And now not speaking to one competition or the other what is your opinion of the competitions and their overall value to the students?*

I think that the competitions give the students the opportunity to apply what they've learned in the class room to a real world scenario and it helps to better prepare them to for industry.

*Okay thank you.*

That's what I feel, my opinion.

*That's all were asking for, your opinions, because those are going to be based on your experiences with it, so that's what this study values. So there was a pilot study done here at CSU that found that the students who participate in the competitions, their average GPA was higher than the students who did not participate, why do you think that is?*

It's hard for me to speculate, One of the reasons maybe is the people, the faculty that may have selected the teams, part of their selection factor may have been based on

GPA. That's maybe why, because I don't feel that GPA has anything to do with the performance of a student on a team. The GPA is coming from general education classes like poetry.

*That's a good point. The same study also found that the students who were participating in the competitions were obtaining higher average starting salaries than the students who hadn't participated in the competitions, why do you think that is? Do you think that because the student participated their getting higher salaries or maybe they're just the better students in the competitions their getting those salaries anyway*

Yeah it's hard for me to speculate on that as well without reading the studies, but maybe the reason is that at these competitions there's recruiters that are there to recruit them and then provide them with internships, and they may get in bed with a company and they may work for them after school, after several internships with them, and therefore starting at a slightly higher salary. I think that's one of the great things about these competitions is the actual job fairs that they have there and the companies that they have there recruiting.

*So the students are definitely getting more exposure at the competitions.*

Right

*Again like all the questions this is based on your experience what do you think is the single greatest benefit to the students, if you had to pick one thing.*

I'd have to repeat what I said earlier, the single greatest benefit is that it gives them the opportunity to apply what they've learned in the classroom to a real world scenario so it gives them an opportunity to strengthen their learning from school.

*Okay, do you think there are negative aspects for the students for participation.*

There can be negative aspects depending on if the student is working to support themselves through college they jeopardize, maybe how they perform in school because they spread themselves so thin with working, student competitions, and going to school. The same thing if they're taking a lot of units because they need to get through in a timely manner because of the cost of education. They may spread themselves too thin getting out of balance and focusing on the competition maybe more so than school. There can be some risks involved as far as time management.

*Do you think that those potential time management things, are those negatives outweighed by the student's participation, or do you have any thoughts there. ....I guess what I'm saying do you feel what the student gains from the competition do feel it's worth potentially the time constraints that they can encounter?*

It's worth it if they can balance it out and make it work, it's not worth it if they get on academic probation because of it and jeopardize graduating.

*Interesting*

So they really have to balance out what they're doing, but as far as negative aspects of the competition I really don't see any. That's really the only thing I can think of.

*In ya'lls program are the coaches selecting the team members? You commented earlier that the GPA being a selection criteria. Is that how ya'll do it? The coach is actually selecting the team.*

It just depends on an individual basis. Sometimes they'll be a team, sometimes they'll be a team captain from a previous year that then selects the team it all depends on a individual basis on who's the faculty advisor, the only other thing that could be a negative is that some of these competitions are geared for the students to play the role of senior level management which they may not get to the position of that type until 10 years out of their college career yet the students may feel that they should be in playing that type of role, and want to be climbing the ladder within the company faster than that. So sometimes I feel like it sets unrealistic expectations in that in the student's minds

*You also mentioned that the students can jeopardize their academic standing or potentially graduating, have you seen instances of that, do you think that's common or a more uncommon thing?*

I think that's an uncommon thing, the reason why I say that is because we've just discussed as a faculty that if a student is on academic probation and they are on that for two quarters in a row then they can no longer, they can't be at our school. And so we've discussed. If somebody's on academic probation they probably shouldn't be trying to be on a student competition because of that fact that it may jeopardize their graduation.

*Makes sense, alright, so. Last question how would you change the competitions or is there anything you would change about them.*

That's a really broad questions let me think about that for a minute here. Only thing I would change is that I would see if the companies who sponsor them make sure that, set that expectation that they should be involved at some level through the good times and bad times if at all possible cause you know education isn't as cyclical as their industry, you know education is constantly producing qualified students entering the construction industry but with a lack of support it makes it more difficult, even though they may not be hiring at the current time their involvement will produce the pipeline of students that they will need in the future when things pick back up. Have them remain involved.

*Excellent*

Through the bad times

*Is there anything else you'd like to add?*

No, Overall they are a very positive thing for the students that's all.

### **Coach Eleven Interview**

*Is it okay if I record?*

Yeah no problem.

*Okay great, Um your name won't be attached to anything that I use, I'm just trying to just trying to have a recorder so I can transcribe later. So like I said in the e-mail all my questions are based on the competitions and your experiences with them so I appreciate*



*your willingness to participate and talk to me. So how long have you been involved with the student construction management competitions?*

Uh what was the first year?

*I really don't know if it's been that long I'll, I'd say that speaks volumes.*

Well I was involved with Penn State, I went down to Atlanta in 1989 and we didn't, we brought students but I'm trying to think if the competition started then or if it was 90 or 91 I can't remember but when I was at Penn State we went to the first one which was very small I must admit, but it's picked up steam since then so basically since it's inception.

*Okay excellent, and has your experience been solely with the NAHB competitions or have you been involved with the ASC's as well?*

ASC as well, what are we region 4? Yeah I go down to Nebraska City, I've only done that one though, I've been involved with ASC competition just one year.

*Okay, So just in a very broad sense, what is your opinion of the competitions and their value particularly to the students?*

Yeah I think there is tremendous value to the students, they learn a sense of teamwork, while they're at their home universities they can collaborate with the team mentor or the faculty advisor who ever is coordinating the project. I'd say it's typically a real project and they gain all those skills and have to package it so there's value there. The real value is when they hit the road and get down to actually present it, oral presentations. All the students do very well with it typically as a group. But the biggest advantage is

getting out and they get to meet other students and see the show and hopefully go to a couple technical sessions. Most of the students I don't think take advantage of that although I know most of them do hit the floor and see all the vendors and collect all the junk that they have down there. But that's the real value when you get out of your home institution and you see what's going on at a big trade show like this and you take advantage of all the networking opportunities that are there.

*Excellent, So having been involved with both the NAHB and the ASC you know there is the two. The ASC typically has that shorter format, versus the NAHB. Speaking particularly to the ASC's shorter format the shorter term, what do you think is the greatest value to that sort of a format?*

Well it puts everybody on a relatively level playing field because you don't know, you really don't know what you're going to get until you get there. Then the project is dumped on you whether it's design build, residential, commercial, heavy highway, cause we do all four of those in our zone. But it's it is an entirely different format, I don't prefer one over the other but uh that short intense work out that you get with the ASC, it's almost too much too fast in a sense but then that kind of mimics, a little bit, in theory, that's what they're trying to. It mimics the bid build, the design bid build or whatever it is process. High intensity, short duration, the learning experience is there guaranteed but I don't know if it's long lasting in a sense. Kids like it because they prepare their power-points and get all their stuff ready as best they can but its not a lot of work they can do before they get there, then when they get there it's a mad rush to get it done and there's always a curve ball thrown in at the eleventh hour and they have to scramble and think on their feet and go from there and of course the presentation. But the kids like it, they're over and done with

quick, and they learn some stuff but I really thing there's a much more valuable learning experience when you stretch that over almost 6 months, well October, November, December, January. four months.

*Okay so you think the value to the longer format maybe is that the longer format the students are just learning more?*

I don't, I would think they are retaining more of it.

*Retaining okay. Excellent, would you say, considering the two where the longer term is helping the students to retain more, do you think that provides a greater value to the students or do you think that there is, that one perhaps outweighs the other, from the student standpoint and the value that they gain?*

Well there's value gained in both but I think there's a long term effect on the retention on the NAHB style. It just makes sense to me they spend more time on it, a lot more time on it because they have to. They worked on it for a longer period of time it's typically a more involved project. The documentation they have to do and quite a few things, there's just more time spent on it and with anything the more time you spend on anything the more you're going to get back.

*Excellent. So we did a pilot study here at Colorado State and we found that on average the students who participate in the competitions, and this is across all competitions the NAHBs or ASC's that those students who were competing had a higher average GPA, than the students who didn't compete, why do you think that is? Do you think that is an issue that*

*the competitions are helping the students have higher GPA's or perhaps just that the students who are participating are the higher achieving students?*

Yeah I didn't do a GPA one. I know my opinion is that, I don't know at my institution I'm not sure on the GPA, I think it's all over the board however the um the students that participate are the students that are active in the chapter and who are the students that are active in many other things, we have a lot of crossover between ASC and NAHB especially on the residential competitions and those are just the students that are active not just in the student chapter, they're active in the department they're active in their classes they're just active students. And they're the ones that go up to the career fair. They got all sorts of stuff going on and usually the busier the person is the kind of person you want on your team, because they seem to get things done and move forward. The person that's so busy trying to get stuff done they don't have time for anything that's not typically the person you want on your team they can't really balance the work or produce or actually schedule themselves very well, so I don't know if it's a, maybe that's true with the GPA, the students that can actually balance their work load and delegate their own personal time to various aspects and then focus on that aspect at that given time, they're going to be productive in life anyway no matter what they do in their job or in their personal life so I don't know if GPA is the indicator or just the personality of the student, this would be uh this would be a very interesting follow up study to really get into some personality tests and see what goes there.

*Certainly, well thank you. So that same pilot study that we did here looked at starting salaries as well and found that the students participating in the competitions also were earning higher average starting salaries, so kind of the same question do you think that is*

*the result of these students that are better able to manage their time and so forth or do you think that is a result from competition participation?*

I think it's both but all I know is if you have more experience than somebody else, your worth more so hence your starting salary might be a bit higher, I don't think it's dramatically higher in most cases. But there probably is a difference, yeah I mean this is the selling point on any competition or any activity or anything basically, if the student is active and an active participant in take NAHB for example that sets you apart from the thousands of other construction students that are out there looking for the same limited number of jobs, you're worth more so it wouldn't be a surprise if you got paid more.

*Excellent so based on your experience if you had to say there was one thing that was the greatest benefit to the students for participation in any of the competitions what would you say that is?*

My personal philosophy on this is that travel is your best education. You get out, you get out of your own little cocoon, and you're out in a different environment where you have to function uh that's what travel does it forces you to expand your horizon it makes you a more diverse person, and that's a good thing you see different cultures different environments different social settings and you're expected to function in all of those, so get out of the place you're at, the university and go to a national show or conference, I don't care where you go but get out there and meet new people and learn new ideas. Travel is the key, the key aspect for me.

*So do you think there are negative aspects to competition participation*

Oh undoubtedly there are I can probably come up with a little laundry list here if you give me a few seconds, but I will qualify all of this by saying: whatever negatives there are there's no comparison to the positive benefits, they far outweigh the negatives. Negatives being well okay the students are going to miss some classes undoubtedly they're going to spend their own money sometimes depending on how the student chapter works. There's the risk when they go to place like Las Vegas that they could get into a little bit of trouble, this has happened in the past, schools have policies on drinking and all sorts of other things I mean, the worst place in the world is Las Vegas, you know I was 21 years old once too and younger than that, too much temptation. So all of these evils, but to me that's trivial. A day or two of class you miss for the benefits that you get out of this competition well, it does put a strain on the student's time especially in the fall semester, they're meeting at night they're working together as a group they're working on different packages or different components of this entire package but it's optional, it's their choice to do that and I guess all of those could be considered negatives but I don't see any of those as negatives really.

*Yeah the benefits certainly outweigh those difficulties*

Absolutely.

*Okay, excellent, so then the last question is just if there are any ways that you want to change the competitions for the benefit of the students?*

Which one's, both?

*Yeah*

Nope, I've been thinking about that for this is going on ten years now, I like both formats and I think it's important, being involved with both of them. I understand the reasoning for ASC's high intensity short duration activity I also see NAHB's value there for the longer process, so I wouldn't change either one at all. The only thing that I, and they fixed it last year, the only think that really bugged me was the presentations, not this year but last year when they were at Cesear's Palace versus getting the kids over at the Hilton or the convention center. That really threw a kink in the whole thing because a lot of the students never showed up to the convention center in Las Vegas. Now they corrected that last year in the sense that all the student presentations were at the Hilton which is right next door which is easy access for them, I'm glad they corrected that because for the students there's no easy access from the Ceasar's Place over to the convention center no matter how you go and it's almost too much of a temptation not to go.

*Right we had the encountered the same with our students a lot of them just never made it over there because it was just not easy.*

That's the logistics of the conference, that's part of the competition too, that's an easy fix and they already fixed that. Orlando is going to be different they will be right in the west wing or the west conference center as they were three years ago. I wouldn't change too much I would like to see more participation from industry but we all would. Maybe a few more judges, one or two more judges but I've talked to Steve about this 100 times. That's a tough draw just to get the judges we have. No I don't have any real changes I'd make, maybe some little things.

## **Coach Twelve Interview**

*How long have you been involved with the student construction management competitions?*

4 years

*An which competitions has your experience been with*

Just residential

*Just the NAHB*

Or CMC

*In a very broad sense what is your opinion of the competitions and their value to the students?*

I think a common statement I hear is; this is the greatest experience they learned more doing the competition team than they did from anything else in their time in the construction science department. So I think that it's valuable in that it gives them an overall perspective of the residential construction process how everything fits together. So it's an incredible opportunity and for the first time ever I've had 5 people return to do it a second time.

*So among the CM competitions there are two general types short term and long term, long term being like the NAHB where the students have a couple months to work on their projects, where the short term would be more like the ASC where they have a matter of*



*hours to present their solutions and so forth, I know you haven't been involved with the ASC but do you have any opinion of what the greatest value of that shorter format is, or would be?*

I guess the shorter can be nice in that, it's sort of like boot camp where you have a very intense short period of time that you have to create a product so it's very intense. So yeah there are benefits in that and they do practice that several times during the semester before the competition. But sure I see good value in that.

*Regarding the NAHB type format what do you see as the greatest value to that type, of the longer format is?*

It provides opportunity for students, it's different than the shorter term because students are required to work with each other over a long period of time and they can have disagreements throughout that, their relationship over that period of time and they still have to come back together and they still have to at the very end stand next to each other and compete together as a team, so I dealing with those team dynamics over a long period of time is really helpful and pretty realistic to what you're doing in the business world in the real world and That's been one of the greatest learning experiences of these students is to be in the middle of an intense work environment, to have disagreements but yet be able to come together and in the end be able to have this bonding that they'll have for life and this appreciation for one another.

*So we did a survey here at CSU of the CM students and we found that the students who participate have higher average GPA's at graduation than the students who did not, why would you think that is?*

Well I think that their willingness to step out and beyond by joining a team, they may have a higher drive in them that reflects itself not only towards stepping out into extracurricular activities but also in school, stepping ahead and working hard in what they're doing and trying to stand out. That seems to make sense.

*So Maybe you're just getting the better students who are participating?*

Yeah, you may be getting the more passionate students for the subject. But I have had students who have not done too well, that are maybe not the highest achieving undergrad students but who have just stepped in there and wanted to go for this experience and this challenge, there could be those who want more of a application based experience, but for the most part I would say that it's those passionate students in class and in the extracurricular activities like this that are the norm

*In the same survey we also found that the same students who participate in the competitions have higher starting salaries than the students who did not, why do you think that is?*

Part of that can be the relationships that are developed as a result of the competition teams, from what I've gathered the reason there are competitions they were created by industry to have top students from around the nation coming to spot where employers could watch these students in action and actually hire them, so I think that it puts you into this pool of students that are seen at a national level by top or high ranking employers so if you compare that with students who don't join and aren't member who are only exposed to local construction companies or regional construction companies that can help explain that, and at the same time it does look good on the resume to have that experience. But I have

seen our students, employers from around, national level HR people know our students, and those students get recruited in big ways so it's almost like they have a national reputation, so that makes sense that they would have a higher starting salary

*So Back to your experience with the competitions if you had to say there was one thing that was greatest benefit to the students what would that be? If there was a single thing.*

I heard you, that's tough, responsibility. It is on their shoulders to get this written project in the hands of the judges by a certain date and it's their responsibility to be prepared and to have their presentation ready and be ready to answer questions and explain themselves in public with the presentations. Something that just jumps out to me is just the responsibility that they feel they feel a big weight on their shoulders and they have to be responsible, they have to answer that task, those tasks.

*Do you think there are negative aspects to participating in the competitions?*

It can be negative if they choose to focus on the residential competition versus their grades, their normal coursework, there is always the temptation to try to balance those so it's important for the sponsors for everyone involved to keep their eye on those students make sure that they are not neglecting their course work for this extracurricular activity. Everything else, everything is positive. Just to keep everything, just have to keep it in perspective.

*How would you change the competitions?*

I guess one thing that, I like them as they are, I know that there's that momentum or that feeling that it takes more and more time it gets to be a bigger and bigger product, I

guess the concern I have is that the bar is going to keep getting raised and raised, which in part is a good thing but when you have packets that are not as realistic to the world as far as the amount of data that is collected. I think it's good what was done this year where they made a limit to the number of pages but somehow having some limits, I don't know if I'm making myself clear on that, when you're given a lot of time there is a lot that you can do and it seems like that bar keeps getting raised with the amount of stuff that you put in, to where it really is encompassing which is a good thing but for an extracurricular it needs to have balance.

### **Coach Thirteen Interview**

*How long have you been involved with the student construction competitions?*

3 years

*And which competition has your experience been with?*

The home builders

*In a very broad general sense what is your opinion of the value of the competition to students?*

I think that the students actually gain a lot, a lot of knowledge, a lot more practical experience than they would in just a standard class room situation. They have the opportunity to research and get experience, some of them may not have had estimating so they work on the estimating with someone who has, so they pick up that additional experience and tend to understand it a little bit better.

*Now there are two general formats to the competitions, we're saying that the homebuilders type format is a longer term where they have a couple months to work on their project and then they go and make their presentations, and then on the other hand there are the short term competitions like the ASC where the students do some preparation but essentially they go to their competition and have I think it's, some of them are 16 hours to make their proposal and do their competition. In speaking specifically to format, what do you think is the greatest value of that long term type format, that the home builders use?*

To me the biggest benefit is the students have the opportunity to do a lot of research because when you look at like in recent years the emphasis is placed on green building, a lot of students aren't really experienced with that and they aren't getting much of that in the classroom or at least not as much as they should, by having this longer time period they can sit down and they can actually research what the green building standards are for the NAHB, what they are for LEED, for neighborhood developments, green developments, so they can find out more of this information and the nice thing is that they retain this information because it's not just quick, they look up something they find something really quick they use that information and two weeks down the road they forget it, it's more ingrained because of that.

*Okay, and you haven't been involved with the ASC you said correct?*

No, no I haven't

*We'll skip this next one then. So like I mentioned in my e-mail I'm over here at Colorado State University and we did a survey of our graduates last year and we found that the*

*students who participate in the competitions on average have a higher GPA than students who didn't participate in the competitions, why do you think that is?*

I think what we end up getting, at least from my experience, we tend to get the students that are more ambitious that are looking to do something extra, which carries over to their classwork, they probably had a better GPA coming into that competition but they pursued that competition for the simple fact that they could apply some of this knowledge that they got, plus pick up a few other things along the way that are going to benefit them down the road. I think most of them coming into it have the higher GPA to begin with because, a real common term is like a sponge, but that's what they really are they come into to it with an open mind and wanting to learn at the same time, and I think they do that all through their college career.

*Great, so in the same survey we also found that the same students who were participating in the competitions were gaining higher starting salaries when they graduated, why do you think that is? So the students that were involved in the competitions had higher average starting salaries.*

Well I think that it's because, having reviewed or hired interns looking at the resumes and stuff like that, when I look at that, especially for like the intern students coming in, I look at the stuff they've participated in and what's really going to give them practical knowledge to work with me, and when they have on there, especially students who've gone to the competitions multiple times, to me that is a strong indicator that this student has taken time outside of their college life, their college career and pursued other interests that are very pertinent to what they want to do outside of that when they graduate

so to me that shows that they are more ambitious that they've learned more they've acquired more practical knowledge than just book knowledge.

*So No going back to the value to the students if you had to say there was just one thing that was the greatest benefit to the students to participation, what would that be?*

Teamwork

*When you say teamwork are you talking about as they're working on the project or when they get to the competition or just overall.*

Overall, because one of the things, I don't know how you guys at CSU do it, or how your professors at CSU run their classes, but when I teach a class, I'm adjunct faculty, I bring in projects, I bring in things where they have to work as a team, where they develop a company and take that teamwork and work together along with other groups in order to come up with solutions. I'm a strong believer in trouble shooting for these guys because that's how they develop the skills for when they graduate to work with architects, engineers, stuff like that. I think that's the greatest thing that they get out. It is to be able to work as a team, even though you may not like everybody on your team you have to learn to work with them.

*Do you think that there are negative aspects to competition participation?*

No I don't really see any negative to it because they are learning, you know somebody's got to loose somebody's got to win, these guys are old enough to understand that, but as long as they gain additional knowledge I think they win in the long run, so I don't see any negative as far as that goes.

*How would you change the competition?*

Let me see, boy that's a tough question. Some of the things I guess I'd look at is, what I've seen some schools because of the size of the school they have more money that goes to the programs which also offers the students more opportunity too, which in the past they've been able to go on site visits, or the students pay for that or the program pays for it, and you've got a lot of schools that don't have the support from the local home builder's association or from local business and it's harder for them to go and get the money to do that. I like the way it was done this last year where there was no actual project going on, it was a failed project and the students didn't have a site to go out to, they were given a little bit more free rein and they could change things and I think that created a little bit more excitement for the students because now they have to do the design for that development along with all the rest of the stuff that is required, the scheduling the estimates the proposals all this stuff, they had a chance to do something that they had a hand in designing, at least with our students is created a little bit more excitement and interest in it.

*That's all the questions I have is there anything you'd want to add in regard to the competitions?*

Not really not too much, I think the competitions are great, I think it really challenges the students and if they do well they take a lot of pride in it, and if they don't do well they still take pride in the fact that they put in the time they competed and in their own mind they felt that they did the best job that they can and in their own mind they take that with them forever, it something that they can look back on and feel good about, but it also encourages them, I've seen this with students it encourages them to participate more, it



bolsters them up in a classroom it helps them to work with their fellow students on projects and all of this carries through and if they really pursue it, it does tend to make them a better leader, and that's what the program is all about is to develop leaders and people who can think and analyze on their own, and become better at what they do when they graduate.

## **APPENDIX D**

### **Colorado State University Pilot Study**

The pilot study performed at Colorado State University was done in the spring of 2009, and was quantitative in design. The study sought to quantify the differences, if any, between construction management students who participated in construction management competitions and students who did not. The Colorado State study compared participants and non-participants based on starting salaries and grade point averages, and found a statistically significant difference between the groups for both variables. Grade point averages and starting salaries were also compared to identify a possible relationship, however none was found. It is important to note that the pilot study was non-experimental in nature, and thus could not infer causation.

#### **Pilot study research design**

The pilot study considered only quantitative ex-post facto data and used a non-experimental, comparative research approach/design. The data was taken from written exit surveys administered to graduating seniors that are kept on file by the Department of Construction Management at Colorado State University. Although the data already existed, human subject's approval was obtained through the IRB before it was accessed by the researcher in the Department of Construction Management's files.

#### **Pilot study population and sample**

The theoretical population for the pilot study included graduates of the construction management program at Colorado State University. The selected sample for the study consisted of graduates from the Spring 2006, Fall 2006, Spring 2007, Spring 2008, and

Fall 2008 semesters (information from the Fall 2007 term could not be located in the files and thus was not included). The actual sample consisted of those students who completed the departmental survey in their senior capstone course and turned it in.

### **Pilot study sampling procedures**

The data for the pilot study came from surveys previously completed by graduating seniors. Student's inclusion in the study occurred if they had completed and turned in a survey prior to graduation. The sample represented a convenience sample because data was only collected at Colorado State University, with no attempt to collect data elsewhere. Additionally, the data was used because it was readily available. The sample represents a convenience sample, but with a sample size of 379 data points, the response rate was estimated at 75% making the sample representative of the target population.

Representativeness of the sample is important because it improves the external validity of the study (Gilner, Morgan, & Leech, 2009).

### **Pilot study data collection procedures**

The data were originally collected from construction management majors roughly two weeks prior to graduation. The data came from a paper and pencil survey administered to students in their senior capstone course. The survey gathered GPA and starting salary data; it did not, include questions regarding student competition participation. For that information the researcher collected rosters of student competition participants from team coaches, as well as the organizing bodies of the competitions, for the years 2005, 2006, 2007, and 2008. With the data from the written surveys and the team rosters, a spreadsheet was built to organize the data. Identifying information was used to indicate which students had participated in the competitions. Once competition

participants were identified in the database, identifying information such as; name, age, and gender, were deleted.

Measurement reliability of the survey used in the pilot study was not formally evaluated, because it does not measure constructs. The survey only collected information about attribute variables which would not change and which do not require specialized interpretation.

### **Pilot study data analysis**

A comparative research approach was taken, utilizing difference statistics. An independent samples t-test, and a test for correlation were the methods of analysis used. The independent variable was student construction management competitions and whether students participated or not. The dependent variables were grade point averages and starting salaries. An independent samples t-test was used to compare the groups. A t-test was used because it is customary when there is comparison of only two groups (Morgan, Leech, Gloeckner, & Barrett, 2007). Table 3.1 shows competition participants were significantly different from non-participants on starting salaries, ( $p = .015$ ). Inspection of the two group mean indicates that the average starting salary of non-participants ( $M = \$51,324.69$ ) is significantly lower than the score ( $M = \$54,857.14$ ) for participants. The difference between the means is \$3532.45. The effect size ( $d = .55$ ) is large according to Cohen (1988). Competition participants were also significantly different from non-participants on GPAs ( $p = .001$ ). Inspection of the two group means

Table 3.1

*Comparison of starting salaries and GPAs of construction management graduates from Colorado State University who participated in student competitions with those who did not. (n=286 non-participants, 21 participants)*

| Variable        | M      | SD     | <i>t</i> | <i>df</i> | <i>p</i> |
|-----------------|--------|--------|----------|-----------|----------|
| GPA             |        |        | 3.349    | 283       | .001     |
| Competition     | 3.3695 | .42802 |          |           |          |
| No competition  | 3.0508 | .39879 |          |           |          |
| Starting Salary |        |        | 2.446    | 305       | .015     |
| Competition     | 54,857 | 8,271  |          |           |          |
| No competition  | 51,325 | 6,233  |          |           |          |

indicates that the average GPA for non-participants ( $M = 3.050$ ) is significantly lower than the score ( $M = 3.369$ ) for participants. The effect size,  $d$ , is approximately .79. The results of this study indicated that construction management competition participants at Colorado State University, earned average starting salaries \$3,532.45 higher, and had average overall GPAs .318 points higher than non-participants.

The statistical significance of both Salary and GPA to competition participation led to a test for correlation between GPAs and starting salaries. To investigate if a relationship existed between them, a scatterplot was created. An almost perfectly flat regression line indicated there was no correlation between a higher GPA and a higher starting salary. For further verification that no correlation existed, a Pearson correlation was calculated,  $r_s(282) = .004$ ,  $p = .95$ , and showed no statistical significance.

### **Pilot study conclusion**

Students who participated in competitions had higher average starting salaries and higher average grade point averages than students who did not participate in competitions. It also concluded that higher starting salaries were not related to higher grade point averages. The data in this study represent quantitative findings in favor of the many non-empirical voices supporting student construction management competitions. The study shows that competition participation is correlated to at least two positive benefits.

Students enter the construction industry earning higher starting salaries, and while they are in school they have better grades. Because the study was non-experimental it should be noted that the findings are only correlations, causation could not be inferred.