DISSERTATION

NEEDS ASSESSMENT: CONSTRUCTION MANAGEMENT DOCTORAL PROGRAMS IN THE UNITED STATES

Submitted by

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WE HEREBY RECOMMEND THAT THE DISSERTATION PREPARED UNDER OUR SUPPERVISION BY DAVID E. GUNDERSON ENTITLED NEEDS ASSESSMENT: CONSTRUCTION MANAGEMENT DOCTORAL PROGRAMS IN THE UNITED STATES BE ACCEPTED AS FULLFILING IN PART REQUIREMENTS FOR THE DEGREE OF DOCTOR OF PHILOSOPHY.

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ABSTRACT OF DISSERTATION

NEEDS ASSESSMENT: CONSTRUCTION MANAGEMENT DOCTORAL PROGRAMS IN THE UNITED STATES

Prior to July 1, 2005 there were no doctoral degree programs in the United States focusing solely on construction management. Along with the one construction management doctoral degree there are at least 16 universities self-reporting to have a doctoral degree allowing for a construction related emphasis. Many of these programs offer a doctoral degree in engineering, architecture, technology, or education. Even though construction education programs were established as early as 1926, the majority of the oldest undergraduate construction education programs were established between 50 and 60 years ago. Construction education programs are maturing with the Associated Schools of Construction (ASC) reporting that 31 (55.4%) out of 56 American Council for Construction Education (ACCE) accredited programs offer a master's degree. Eighteen (58.1%) of these master's degrees have the word "construction" in the degree title.

While construction management programs are interdisciplinary in their content drawing on engineering, architecture, technology, and business, they are a unique discipline. Even the Department of Educational Statistics classifies Construction Management as a distinctive program in their Classification of Instructional Programs under category 52 (Business, Management, Marketing, and Related Support Services). During the 2004 – 2005 academic year 100% of the ASC advertisements for open construction education faculty positions required or preferred the candidate to have a

doctoral degree. Many of the open positions go unfilled because the demand for faculty members to teach in construction education programs exceeds the available supply.

There are five primary qualification areas for candidates around which search committees evaluate individuals to fill open faculty positions in construction education: doctoral degree, experience in the construction industry, the ability to be a good teacher, the ability to be a good researcher, and professional registration or certification. This research confirms what is found in existing literature: about half of faculty members teaching in construction education programs have a doctoral degree and meet the current qualification requirements. Interviews with construction education department heads and a survey completed by faculty teaching in ACCE accredited postsecondary construction education programs very clearly indicate that construction management doctoral programs are needed in the United States.

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CHAPTER 1: INTRODUCTION

The introduction explains the background of this study, which is grounded in the needs of the construction industry and one specific aspect of construction education that supports the industry. This is followed by a statement of the problem that is the focus of the research. The purpose of the study is presented and is followed by a definition of terms. The research questions are presented, followed by the delimitations of this study. The last part of this chapter will include potential limitations, assumptions, and the researcher's perspective.

Background

The background section has four major parts which provide a foundation for the significance of this study. The first section looks at the impact of the construction industry on employment in the United States. The second section discusses the role that construction education Bachelor of Science programs play in the construction industry. The third section explains the various positions that graduates of these programs fill after graduation. The last section discusses the demand for these graduates.

Construction Industry Impact on Employment in the United States

In 1998 the United States construction industry had an annual expenditure of approximately $650 billion and accounted for almost 10% of the gross national product (Clough, Sears, & Sears, 2000). During 2004 the United States construction industry employed approximately seven million people at any given time (United States Department of Labor, May 7, 2004). Construction companies hire the graduates from the

approximately 100 construction education programs in the United States to assist in the management of the construction projects on which these millions of individuals work. According to the director of the Joseph Phelps Placement Office in the Department of Construction Management (CM) at Colorado State University, the department has a 100% placement rate after the students graduate, and the average starting annual salary for CM graduates was approximately $45,000 in 2003 (J. D. Moore, personal communication, March 15, 2004). This 100% placement rate is reported by "most construction education programs" in the United States (Bilbo, Fetters, Burt, & Avant, 2000, p. 78), and the majority of these programs are members of the Associated Schools of Construction (Rosenbaum & Rubin, 2001).

Construction Education and the Associated Schools of Construction

The Associated Schools of Construction (ASC) represents 104 post secondary academic institution members that have construction education programs. The majority of these programs result in a Bachelor of Science degree for the graduates. These construction education programs produce graduates with degree titles (majors) as Construction Management, Construction Engineering, Construction Engineering Management, Construction Engineering Technology, and Construction Management Technology among others (Gunderson, Ra, Schroeder, & Holland, 2002). The most common major title is Construction Management used by 51 of the 88 members of the ASC who responded to an Engineering News-Record survey (Rosenbaum & Rubin, 2001).

The ASC provides support for postgraduate construction education programs. On March 19 and 20, 1965, fourteen representatives from nine postgraduate institutions met

at the University of Florida to consider the formation of what was to become the ASC (Associated Schools of Construction, May 9, 2001). See Appendix A for a more complete delineation of the goals for the ASC as established at this first meeting of construction educators.

In addition to the purposes and goals identified, the ASC publishes the *International Journal of Construction Education and Research*, formerly the *Journal of Construction Education* prior to 2004. This ASC publication provides a resource for faculty in construction education programs to publish and read research focused on construction education and construction practice. Proceedings of the ASC annual conference are published providing construction education faculty with a forum to present their research and for publication.

Positions Held by Construction Management Graduates

Graduates from construction education programs across the United States fill entry-level positions in the construction industry with titles that include estimator, field engineer, scheduling engineer, office engineer, project engineer, or project manager (Gunderson et al., 2002). The duties that these individuals perform include, but are not limited to, generating material quantity surveys, pricing material and labor, layout of site and structure, creating work schedules (critical path networks), reviewing and submission of submittals (shop drawings, product data, samples, test reports, etc.) to the owner or design team, writing and administering subcontract agreements and purchase orders, generating and negotiating change order proposals, and writing and issuing change orders to subcontractors and suppliers. These individuals may also be involved in establishing

construction budgets and cost control systems for construction projects and/or construction companies.

Demand for Construction Management Graduates

The U.S. Department of Labor estimated in May 2003 that more than 500,000 individuals worked as first line supervisors and managers in the construction and extraction industries. Construction companies hire graduates from construction education programs to become some of these managers. Bilbo, Fetters, Burt, and Avant (2000) stated, "Demand for the construction graduate has exceeded the available supply in recent years, and based on the results, this trend will continue" (p. 88). Rosenbaum and Rubin (2001) stated the following in the *Engineering News-Record* special report on construction education:

> California State University, Sacramento, offers a glimpse of the promise and pressure in construction education today. "We can't turn out graduates fast enough" says Donald W. Nostrant, a professor of construction management. Entry-level enrollment is up 40% there in the last two years since a program name change from "engineering technology" to "Construction Management." (p. 26)

As more students enroll in construction education programs in the United States, the demand for qualified faculty increases. Some of these positions were unfilled with the teaching being done by adjunct faculty usually from the construction industry. Rosenbaum and Rubin (2001) stated, "Teaching assistants, part-time faculty and lecturers, as well as crossover candidates from other engineering disciplines, fill current faculty gaps" (p. 31). Badger (2002) found the same to be true, stating:

> Samples of some of the ACCE [American Council of Construction Education] findings regarding weaknesses in personnel, funding, and developmental funding for faculty members [at accredited CM programs] were: 1. Lack of sufficient number of faculty to meet teaching demand and research expectations. 2. Lack of support from the University to hire qualified faculty. (p. 117)

Statement of the Problem

There is a shortage of qualified individuals to fill faculty positions in construction education bachelor's and master's programs according to the current president of ASC (M. M. Khattab, personal communication, September 17, 2004). The ASC president stated that between 1996 and 2004, the ASC website advertised 140 faculty positions in construction education, and that 79% of the advertisements required or preferred that applicants have a Ph.D. The ASC president stated that someone qualified to teach in a construction management program should possess a doctoral degree and should have at least five years of construction industry work experience (M. M. Khattab, personal communication, September 17, 2004). The demand for faculty in construction education with doctoral degrees may indicate a need for additional doctoral programs to supplement the current supply of construction education faculty. The doctoral degrees conferred on some of the current construction education faculty members are in engineering, architecture, technology, business, law, and education. But since there does not seem to be enough faculty with doctoral degrees from other disciplines to fill current positions in construction education programs in the United States, the question is whether or not there is a need for the creation of doctoral degree programs in construction management. Williams and Bilbo (1999) stated, "The demand for construction Ph.D. graduates is in academia" and demand "has been extremely high for several years" (p. 123). Badger (2002) concurs stating that there is "the need to create new CM Ph.D. programs that are actively pursuing research in the discipline" (p. 117).

Purpose of the Research

This study has determined there is a need for construction management doctoral programs in the United States. The results of this research project provide documentation that is available for construction management departments to take to deans, provosts, curriculum committees, university governing boards, and state agencies such as commissions of higher education in support of establishing doctoral programs in CM. Determining if construction management doctoral programs are needed was the core purpose of this study.

Definition of Terms

Accreditation Board for Engineering and Technology (ABET) is the accrediting organization for engineering programs including construction engineering programs.

Architectural Engineering Technology is defined by the United States Department of Education, through its Classification of Instructional Programs (CIP) as follows, giving it the CIP code 15.0101.

> A program that prepares individuals to apply basic engineering principles and technical skills in support of architects, engineers and planners engaged in designing and developing buildings, urban complexes, and related systems. Includes instruction in design testing procedures, building site analysis, model building and computer graphics, engineering drawing, structural systems testing, analysis of prototype mechanical and interior systems, test equipment operation and maintenance, and report preparation. (National Center for Educational Statistics, 2000)

American Council on Construction Education (ACCE) is the accrediting organization for construction management programs.

Associated Schools of Construction (ASC) is the organization that represents postgraduate construction education programs. The ASC "is the professional association

for the development and advancement of construction education" (Associated Schools of Construction, n.d.).

Construction Education is the generic term referring to any postsecondary programs with a construction related focus. These programs could be construction management programs with curricula consistent with the guidelines set forth for accreditation by ACCE, or they could be construction engineering programs with curricula consistent with the guidelines set forth for accreditation by ABET.

Construction Engineering Technology is defined by the United States Department of Education, through its Classification of Instructional Programs (CIP) as follows, giving it the CIP code 15.1001.

> A program that prepares individuals to apply basic engineering principles and technical skills in support of engineers, engineering contractors and other professionals engaged in the construction of buildings and related structures. Includes instruction in basic structural engineering principles and construction techniques, building site inspection, site supervision, construction personnel supervision, plan and specification interpretation, supply logistics and procurement, applicable building codes, and report preparation. (National Center for Educational Statistics, 2000)

Construction Management (CM) is defined by the United States Department of Education, through its Classification of Instructional Programs (CIP) as follows, giving it the CIP code 52.2001.

> A program that prepares individuals to manage, coordinate, and supervise the construction process from concept development through project completion on timely and economic bases. Includes instruction in commercial, residential, mechanical, highway/heavy civil, electrical, environmental, industrial, and specialty construction; facilities management; project planning; budgeting and cost control; logistics and materials management; personnel management and labor relations; site safety; construction contracting; construction processes and techniques; organization and scheduling; and applicable codes and regulations. (National Center for Educational Statistics, 2000)

Interdisciplinary academic discipline programs are those supported by more than one other academic discipline. Construction management academic programs may be supported by architecture, business, and/or engineering for example. The interdisciplinary nature of construction management curricula is often consistent with the guidelines set forth for accreditation by ACCE.

Project is defined by Webster's Third New International Dictionary (Gove, 1993) as "a specific plan or design" and "a planned undertaking" (p. 1813).

Project Management as defined by the Project Management Institute (2001) "is the application of knowledge, skills, tools, and techniques to project activities to meet project requirements. Project management is accomplished through the use of processes such as: initiating, planning, executing, controlling, and closing" (p. 6)

Research Questions

The current president of the Associated Schools of Construction stated that many advertised CM faculty positions go unfilled (Khattab, 2004). This statement needs to be verified to determine if there may be a need for CM faculty in the United States. Therefore, the first set of research questions focused on the advertised faculty positions and answered the following:

- What is the extent or magnitude of demand for faculty in construction management programs?
- What are the required and/or desired qualifications of these faculty positions?
- How are the responsibilities of unfilled construction management faculty positions met?

Based on the definition of construction management as defined by the Department of Education in its Classification of Instructional Programs as quoted above, the next questions focused on the need for a doctoral degree solely focused on construction management from the perspective of department heads and faculty teaching in post secondary construction education 4-year programs.

- Is there a need for doctoral degree programs to prepare individuals to teach and do research in the interdisciplinary academic discipline called construction management?
- How would the creation of these doctoral degree programs impact the availability of construction management faculty?

The following questions were addressed using data from current construction management faculty:

- Is there a difference between the size of the programs in which the faculty members teach and the perceived need for construction management faculty in the program in which they are teaching? And perceived need for faculty in the United States?
- Is there a difference between the responding faculty members' current teaching appointment (tenured, tenure-track, special appointment, adjunct, etc.) and the perceived need for construction management faculty in the department in which they are teaching? And perceived need for faculty in the United States?
- Is there an association between the perceived need for construction management faculty and the length of time they plan to continue teaching in any construction education program?

- Is there a difference between the academic degrees earned by current faculty members and the perceived need for construction management faculty in the department in which they are teaching? And perceived need for faculty in the United States?
- Is there an association between the perceived need for construction management faculty and the number of years that they have taught in construction education?
- Is there an association between the perceived need for construction management faculty and the amount of the faculty's construction industry experience?

Additional questions emerged during interviews with construction management department chairs and search committee chairs. These additional questions were added to the survey instrument that was sent to existing faculty teaching in ACCE accredited construction education programs. This study was designed to be open to additional research questions throughout the data gathering process.

Delimitations

One of the delimiting factors in this study was the population from which the participants were selected. As stated earlier, there are more than 100 collegiate construction education programs in the United States. This study selected participants for the first phase qualitative interviews and the second phase quantitative questionnaire from construction management programs that are accredited by the American Council for Construction Education (ACCE). The participants in this study were narrowed to programs that are ACCE accredited because there are many different types of construction education programs that may have various emphases or focus areas as evidenced by their accreditation through organizations other than ACCE. For example,

there are construction education programs that have received accreditation through the Accreditation Board for Engineering and Technology (ABET) or the National Association of Industrial Technology (NAIT). Academic programs accredited through ABET have an engineering emphasis, and programs accredited through NAIT have a technology emphasis.

A related delimiting factor is the curriculum in the individual construction education programs that were studied. This project limited its focus to construction management programs as defined by the United States Department of Education. The CIP code for Construction Management is 52.2001 which is under category 52, Business, Management, Marketing, and Related Support Services which states, "Instructional programs that prepare individuals to perform managerial, technical support, and applied research functions related to the operation of commercial and non-profit enterprises and the buying and selling of goods and services" (National Center for Educational Statistics, 2000, ¶ 1). This definition of instructional programs is consistent with the ACCE curriculum requirements for accredited programs so that if a program is ACCE accredited, that program and its faculty are part of this study. As stated above, programs accredited by ABET or NAIT may have other foci in their curricula.

Another delimiting factor is that practitioners in the construction industry will not be studied with respect to their perceived need for construction management doctoral programs. Members of the construction industry might include: general contractors, subcontractors, material suppliers, and material and equipment manufacturers. These groups of individuals may be stakeholders in the results of this study, but they will not be part of this study. This is also addressed in the assumptions section.

These delimitations were found to be appropriate because it was determined that there is a need for doctoral programs focused solely on construction management. The perspectives of faculty teaching in construction education programs that are not ACCE accredited, and the perspectives of industry practitioners are very important and it is recommended that this be included in another study.

Limitations

One possible limitation of this study was a low response rate to the quantitative questionnaire. If a low number of faculty members returned the survey instrument, then the quality of the sample would be low or the study may have been invalid (Gliner & Morgan, 2000). Refer to Chapter 4 for the response rates. Since the research design for this study is mixed methods rather than a multimethod design, the first phase qualitative interviews may not stand alone as a complete research project (Morse, 2003). The first phase of the project needs the second phase of the project to be complete.

Assumptions

It is assumed that a need for construction management doctoral programs in the United States can be shown without including construction industry practitioners in the study. It is also assumed that the individuals most knowledgeable about the need for the creation of construction management doctoral programs are the faculty and administrators teaching and working in construction education programs.

Researcher's Perspective

My position as a faculty member in an ACCE accredited construction management program must be acknowledged. This position may have enhanced access to individuals during the qualitative phase of the research and may have a positive impact

on the response rate during the quantitative phase of the research. It is my opinion that the interdisciplinary nature of construction management is a unique discipline and that doctoral programs focused solely on construction management need to be created. I am aware of the influence that I may have on the findings and have worked to minimize the influence of personal bias. My goal of maintaining validity and reliability throughout the study was the overarching research criteria to provide credibility for the project.

Following is a short synopsis of my experience in the construction industry and in construction management education. After working in the construction trades as a laborer, carpenter, concrete finisher, and construction foreman for six years after high school, I enrolled in a construction management program and four years later received a Bachelor of Science degree. After graduation I worked for more than 20 years in managerial positions of the industry as a construction engineer, scheduling engineer, project engineer, quality control engineer, quality control manager, project superintendent, and project manager. I have been teaching in an ACCE accredited construction management program for 2½ years. My opinion developed over time is that in addition to construction management being a unique interdisciplinary discipline, having a doctorate is virtually essential to teaching in higher education. It is my opinion that the importance of this academic discipline necessitates the creation of doctoral degrees focused solely on construction management so that the research and instruction can be allowed to improve in quality and quantity within this discipline.

CHAPTER 2: LITERATURE REVIEW

"Graduate education is essentially a vehicle of inquiry, which leads the mind out, and as such, graduate education is to be thought of primarily as being indeed education rather than training" (Storr, 1973, p. 84). The primary focus of this research within graduate education is doctoral degrees. The first aspect of this literature review focuses on the definitions associated with a Doctor of Philosophy (Ph.D.) and all non-professional doctoral degrees in general. Defining the subject of the research provides common ground on which additional information can be built. The next part of this review of literature investigates the history of doctoral degrees in the United States including where and when they were first conferred and the historical roots of this academic degree. Then the focus of the review will shift to the reasons why doctoral degrees were created in the United States and look at how those doctoral degrees have changed over time. The history of construction management (CM) education programs will be presented followed by the current status of CM graduate programs. The last sections will explore the documentation on the current faculty teaching in these programs and current doctoral programs that provide an emphasis on construction management.

Definition of Doctor of Philosophy

Noble (1994) defines a doctoral degree "as an academic university qualification that requires a research thesis above the master degree level" (p. 1). The dictionary defines doctor as "a person competent by reason of skill and knowledge to teach or expound authoritatively on a subject or field of knowledge," and goes on to state that a

doctor is "a person who has earned one of the highest academic degrees (as a Ph.D.) conferred by a university" (Gove, 1993, p. 666). The National Academy of Sciences (1995) states that the "doctor of philosophy degree is the highest academic degree granted by North American Universities" and that "Ph.D. programs are designed to prepare students to become scholars, that is, to discover, integrate, and apply knowledge, as well as to communicate and disseminate it" (¶ 1). There are certainly many more definitions of doctoral degrees, but they are very similar, and the definition from the National Academy of Sciences is succinct. These definitions of a doctoral degree and the research requirements differ from a doctoral degree earned through a professional education. A distinction should be made between graduate education and professional education.

According to Hauptman (1986), graduate programs lead to either a "research doctorate or a master's degree. Professional school programs are those in medicine, dentistry, other medical-related fields (such as osteopathy), law and theology" (p. 1). All of the literature found makes this distinction and is focused on either a research doctorate or a professional degree so that a Doctor of Philosophy and a Medical Doctor are never confused or included in the same category of academic degree. Delineating the requirements for a Ph.D. may also help clarify the definition of Ph.D.

The requirements for successful completion of the Ph.D. degree have varied only slightly in the United States since the first degrees were conferred in 1861. The original requirements at Yale University, where the first Ph.D. degrees were conferred, included two years of study in "two distinct departments of learning in the Department of Philosophy and the Arts," the student should pass a final exam, and "should present a

thesis proving high attainments in their studies" (Storr, 1973, p. 37). The dictionary also provides a list of requirements for this advanced degree stating that the doctoral student earns the degree "by spending several years in advanced study of a specialized field, by writing an acceptable dissertation, and by passing numerous rigorous examinations" (Gove, 1993, p. 666). The Association of American Universities also provides a definition of doctoral education that focuses on the curricula requirements:

> Graduate education at the doctoral level in the U.S. is a combination of study and apprenticeship. Along with taking courses and seminars, a student works with a faculty mentor in teaching and research. This is a dynamic partnership that matches the skills of an experienced faculty member with the excitement and creativity of a young colleague. The primary purpose of graduate students' teaching and research activities is to enable them to acquire an understanding of teaching and research techniques. At the end of their course of study, they are required to demonstrate they can do independent research. (http://www.aau.edu/sheets/GradEdFS.html)

In Table 1 Noble (1994) provides a similar way to define a doctoral degree through the defined research requirements and goals at universities in the United States.

Table 1 *Research Requirements for Doctoral Degrees from Selected Universities*

University	Research Requirements
Colorado State University	Independent intellectual achievement, contribution to wisdom, knowledge, or culture of field
Cornell University	Imaginative contribution to knowledge
Johns Hopkins University	Original investigation worthy of publication
Massachusetts Institute of Technology	Original research
Ohio State University	Scholarly contribution to knowledge
Princeton University	Independent technical mastery, enlarge/modify what is known or new significant treatment
Stanford University	Original contribution to scholarship or scientific knowledge
University of Colorado at Boulder	Original investigation, mature scholarship, critical judgment
University of Southern California	Original investigation, technical mastery, independent research, scholarly ability

(p. 77)

It should be noted that the requirements for a Ph.D. have changed a little in the past 20 or 30 years. Heiss (1970) identified six requirements that "practically all Ph.D. programs uniformly specify that a doctoral student" meet:

- Satisfy a residency requirement;
- Demonstrate a reading proficiency in one or more foreign languages;
- Master the substantive background offered in a series of courses and seminars;
- Successfully complete a written qualifying examination and an oral examination;
- Secure the approval of a faculty committee on his choice of a research topic and of the method to be used in its study;
- Write the results of his research in a form approved by three or more members of the graduate faculty. (p. 109)

The distinct difference between the requirements for a Ph.D. in 2004 and a Ph.D. in 1970 seems to be the requirement to demonstrate a proficiency in reading one or more foreign languages. A brief history of Ph.D. programs in the United States reveals when these programs got their first start and from where in Europe they immigrated.

History of Ph.D. Programs in the United States

A brief history of the Ph.D. provides a clear understanding of how doctoral degrees in the United States began and how popular doctoral graduate education has become in less than 150 years.

First Ph.D. Degrees Conferred

The first three men to receive a Ph.D. in the United States were Eugene Schuyler, James Morris Whiton, and Arthur William Wright in 1861 from Yale University, and the first woman to receive a Ph.D. was Helen Magill in 1887 at Boston University (Noble, 1994, p. 73). Yale conferred three more Ph.D. degrees in 1862 and only one in 1863 (Storr, 1973). But who taught these people to be scholars and where did they receive

their education? A brief history of the Ph.D. degree in Europe will be presented so that the roots of the Ph.D. in the United States are exposed.

First Doctoral and Ph.D. Degrees Conferred in Europe

The first doctorate degree was conferred by the university in Paris during the last half of the twelfth century (Noble, 1994). Noble also states that the first "Philosophiae Doctor" was conferred at the university in Paris about 100 years after the first doctorates appeared in Europe (p. 9). The German influence on the research focus at universities was witnessed in German-speaking countries before Germany came into existence in "1871 after the Franco-Prussian war" (Noble, 1994, p. 9). Noble lists three changes in the Ph.D. degree since it first appeared in Paris and since it became established in Berlin:

1. A written thesis has become a requirement for the degree, whereas originally students presented their theses verbally for public disputation.
2. The degree no longer signifies the holder's competence only in philosophy, as it did in early years when liberal art faculties were labeled philosophy to distinguish them from professional faculties of law, medicine, or theology.
3. Whereas the older European doctor of philosophy doctorate was bestowed on those considered to be at their intellectual peak, the contemporary doctorate signifies the holder possesses academically acceptable abilities to commence independent scholarly investigation. (p. 10)

Therefore, prior to 1861 when Ph.D.s were conferred at Yale, men from the United States went to Europe, with more than half going to Germany, for advanced education (Turner & Bernard, 2000). When these men returned to America, they infused the German research university style of education on what was to become the graduate schools in the United States.

German Research University and the German Influence

Grigg (1965) states that graduate education in the United States was not officially recognized until the founding of The Johns Hopkins University in 1876. Grigg contends

that the German system of research and specialization had the most significant impact on graduate education in the United States. Roger Geiger (1997) agrees that the German influence was strong in graduate education when he states, "When Yale conferred the first American Ph.D.s in 1861, it was consciously imitating the German degree" (p. 9). Geiger also confirms that Johns Hopkins was founded as a "German-style university" (p. 9). Graham and Diamond (1997) agree with Grigg when they state, "When the German model of the research university was imported to the United States by way of Johns Hopkins late in the nineteenth century, it was admired and emulated" (p. 18). Geiger (1986) emphasizes the role that Johns Hopkins University played in advancing the Ph.D. in the United States, stating that "Hopkins produced more Ph.D.'s during the 1870s and 1880s than Harvard and Yale combined" (p. 8).

The Morrill Land-Grant College Acts of 1862 and 1890: Influence on Ph.D. Programs

The establishment of colleges and universities because of the Morrill Land-Grant College Act of 1862 provided a foundation upon which graduate education could grow (Grigg, 1965). Justin Smith Morrill was the congressman from Vermont responsible for passage of the Morrill Act, and he wanted the bill to establish at least one college in every state founded on the ideal that a "higher and broader education should be placed in every state" (North Dakota State University, ¶ 6).

The Second Morrill Act, approved on August 30, 1890, increases support for higher education stating, "An act to apply a portion of the proceeds of the public lands to the more complete endowment and support of the colleges for the benefit of agriculture and the mechanic arts established under the provisions of an act of Congress approved July second, eighteen hundred and sixty-two" (North Carolina State University, 2004, ¶

1). The Second Morrill Act insured funding for minority students although it also permitted segregation:

> Provided, That no money shall be paid out under this act to any State or Territory for the support and maintenance of a college where a distinction of race or color is made in the admission of students, but the establishment and maintenance of such colleges separately for white and colored students shall be held to be a compliance with the provisions of this act if the funds received in such State or Territory be equitably divided as hereinafter set forth: (North Carolina State University, 2004, ¶ 3)

> Provided, That in any State in which there has been one college established in pursuance of the act of July second, eighteen hundred and sixty-two, and also in which an educational institution of like character has been established, or may be hereafter established, and is now aided by such a state from its own revenue, for the education of colored students in agriculture and the mechanic arts, however named or styled, or whether or not it has received money heretofore under the act to which this act is an amendment, the legislature of such a State may propose and report to the Secretary of the Interior a just and equitable division of the fund to be received under this act between one college for white students and one institution for colored students established as aforesaid, which shall be divided into two parts and paid accordingly, and thereupon such institution for colored students shall be entitled to the benefits of this act and subject to its provisions, as much as it would have been if it had been included under the act of eighteen hundred and sixty-two, and the fulfillment of the foregoing provisions shall be taken as a compliance with the provision in reference to separate colleges for white and colored students. (North Carolina State University, 2004, ¶ 4)

The increase in colleges and universities in the United States seems to coincide with the increased production of Ph.D.s although no direct data substantiating this correlation were found.

Growth of the Ph.D. and Number of Degrees Conferred

During the period from 1900 to 1918 graduate education was relatively stagnant. Very little growth in graduate education occurred until the end of World War I (Grigg, 1965). Although doctoral education did not grow during this period, the research universities did thrive. Geiger (1997) states that "in 1894 the combined enrollment of the eleven largest research universities (Chicago, Columbia, Cornell, Harvard, Penn, Yale,

California, Illinois, Michigan, Minnesota, and Wisconsin) was roughly 21,000; in 1904 it exceeded 35,500; and in 1914 they counted 53,000 students" (p. 18). Refocusing on Ph.D. production, Grigg states that 562 Ph.D.s were conferred in 1918, 1,064 in 1924, and 3,526 in 1941 (p. 11). Grigg quotes more recent statistics to 1963 from the U.S. Department of Health, Education, and Welfare presented in Table 2:

Table 2 *Ph.D. Degrees Conferred 1950 – 1963*

Year	Total Ph.D.s Conferred	Arts, Humanities. Soc. Sci.	Biological Sciences	Physical Sciences	Education	All Other Ph.D.s Conferred
1950	6,420	1,811	644	1,473	953	1,539
1955	8,840	2,700	996	1,715	1,470	1,959
1960	9,829	3,173	1,206	1,839	1,474	2,137
1963	12,822	3,939	1,457	2,382	1,943	3,101

(p. 63)

The number of Ph.D. degrees conferred each year doubled in the 13 years between 1950 and 1963. Table 3 shows that the number of Ph.D. degrees conferred each year continued to increase, although at a slower rate, with more than twice as many degrees being conferred in 1990 than in 1965.

The U.S. Department of Health, Education, and Welfare made projections in 1963 for the years listed below (Grigg, 1965, p. 63). This compares to actual data collected by the National Research Council (1995) presented in Table 3.

Table 3 *Projected and Actual Ph.D. Degrees Conferred 1965 – 1993*

Year	Projection by U.S. Department of Health, Education and Welfare in 1963	Actual Ph.D.s Conferred, National Research Council
1965	13,300	16,340
1970	18,300	29,498
1975	24,600	32,952
1980	No projection made	31,020
1985	No projection made	31,298
1990	No projection made	36,068
1993	No projection made	39,754

(National Academy of Sciences, 1995, p. 20)

The projections made by U.S. Department of Health, Education and Welfare in 1963 were understated, and Ph.D. education has continued to grow. According to the National Center for Education Statistics, 44,904 Ph.D.s were conferred during the 2000-2001 school year (National Center for Education Statistics, 2002).

The growth of the Ph.D. in the United States is well documented in terms of the approximate number of Ph.D. degrees conferred every year. An important aspect of the history of the Ph.D. in the United States focuses on why these doctoral programs were created.

Why Doctoral Programs in the United States Were Created

The two primary reasons that Ph.D. degree programs were created in the United States were, and may still be, the need for college and university teachers and the need for research. A secondary reason why Ph.D. programs were created is that the Ph.D. has become the essence of what a higher education community is all about. Storr (1973) paraphrases Berelson (1960, pp. 16-17) and states that "what defined a university was the offering of graduate work and that what completed it, in essence as well as in time, was the granting of Ph.D. degrees" (p. 45). A detailed discussion about the graduate teaching assistant, an important American invention that supported the growth of graduate education, is included in a following section. Following that section, a discussion about how the GI Bill after World War II (WWII) also had a significant impact on higher education and, therefore, graduate schools. This section discusses how WWII also had a significant impact on the increase in the amount of federally funded research that was being done at universities.

Doctoral Degree Recipients and College/University Teaching

The first reason for the Ph.D. to exist was to allow the degree recipient to teach in a college or university. Although the first Ph.D.s were conferred at Yale, it was the establishment of Johns Hopkins University in 1876 that gave the "American Ph.D. momentum" (Storr, 1973, p. 40). As Storr states about the graduate student experience at Johns Hopkins during the late 1870s and 1880s, "the student graduated from college, entered a community devoted largely, although not exclusively, to research, attended a seminar in a chosen field, perhaps won a fellowship, did research for a thesis, took a Ph.D., and looked forward to a professional career in an academic post" (p. 42). Carmichael (1961) states that "the Doctor of Philosophy degree in the United States has a unique status. For the profession of college teaching it is the union card" (p. 119). It appears that from the beginning the Ph.D. was meant to facilitate research as well as prepare individuals for teaching careers. The need for research as well as teaching in colleges and universities lead to an American model that persists today.

The Graduate Teaching Assistant: An American Invention

Many courses in today's universities are taught by graduate teaching assistants (GTAs). As the GTA takes on a teaching load, a professor has more free time to do research. The position of GTA originated in the United States and has a long history of supporting higher education. It was in 1899 that the American invention of the "graduate teaching fellow" helped increase the number of students who could now afford to pursue doctoral degrees. In 1899 Harvard received a substantial bequest designed to encourage research. The university used the money to create 30 fellowships for graduate students, which included the obligation to teach half-time (Geiger, 1997, p. 19). Typically there is

a link between the undergraduate and graduate programs in a university. Storr (1973) references Link as he quotes the 28th President of the United States, "Woodrow Wilson, at Princeton, struck the appropriate note: The idea overshadowed all others in his mind was that 'there should be a constant, conscious, intimate action, interaction, and reaction between graduates and undergraduates in the organization of the university' (Link, 1947, p. 80)" (p. 46). The link between the undergraduate and graduate programs seems to be that graduate students, master's and Ph.D. students, are meant to assist in the teaching and mentoring of undergraduate students.

The GI Bill of Rights and the Impact WWII had on Research Universities

The population of the United States in 1900 was 75 million and in 1950 it was 150 million, a 100% increase. The enrollment at colleges and universities in 1900 was 238,000 and in 1950 it was 2,300,000, an 866% increase (Carmichael, 1961, p. 132). College and university enrollments increased after World War II (WWII), primarily because of the GI Bill. On June 22, 1944, President Franklin D. Roosevelt signed the "Servicemen's Readjustment Act of 1944", better known as the "GI Bill of Rights" (Veterans Administration, n.d., p. 3, ¶ 1). This U.S. government web site states that at the peak in 1947, veterans accounted for 49% of college enrollment, and that 2,230,000 WWII veterans went to college on the GI Bill. Carmichael (1961) points out that there was a shortage of Ph.D. recipients to teach at universities in the 1950s because enrollment at colleges and universities increased so dramatically.

The demand for research during and after WWII also created a demand for Ph.D. graduates (Geiger, 1993). The amount spent on research in 1959 was $12 billion and in 1961 it was $16 billion (Carmichael, 1961, p. 133). Geiger (1993) states, "The chemistry

chairman at Rochester has provided an account of his department's dependency on outside funds (1950), most of which came from federal sources. These funds paid for 35 percent of the department payroll, bought 42 percent of its equipment and supplies, supported ten of eleven postdocs and most of the advanced graduate students" (p. 60).

The need for research to be done at colleges and universities seems to continue today. The history of doctoral degrees in the United States has shown continued growth. It is appropriate to now focus attention on the current status of doctoral degrees in the United States.

Current Status of Doctoral Degrees in the United States

A primary reason why it is very difficult to quantify current doctoral degree programs and compare the present to a list of doctoral programs that existed 5,10, or 20 years ago is that there is no single agency, association, or entity that collects and publishes this information for all graduate programs. The U. S. Department of Education does not have any information about graduate programs. There are a number of organizations that have collected data on graduate programs in the past, but none of them have collected any information on graduate programs that have recently come into existence. Hauptman (1986) has identified organizations or agencies that have collected information on graduate programs. They include the National Center for Education Statistics, the National Research Council, the National Science Foundation, the Council on Graduate Schools, and the Association of American Universities.

The National Center for Education Statistics (NCES) collects information on degrees that have been conferred indicating that 44,904 doctoral degrees were conferred by public and private institutions in the 2000-2001 school year. However, they do not

provide a list of the institutions that have conferred these degrees and the disciplines of the degrees that reside in those institutions. The NCES does state that this quantification of degrees conferred includes Ph.D., Ed.D., and comparable degrees at the doctoral level, but does not include professional degrees such as M.D., D.D.S., and law degrees.

The National Research Council, part of the National Academies which also comprises the National Academy of Science, the National Academy of Engineering, and the Institute of Medicine, has published several texts that focus on specific doctoral disciplines and may or may not be very current. For example, the National Academies published a document in 1982 titled *An Assessment of Research-Doctorate Programs in the United States: Social and Behavioral Science,* which provides recommendations for further research along with generalizations about doctoral programs. It does not, however, provide a list of the programs. "The Research Council was organized by the National Academy of Sciences in 1916 to associate the broad community of science and technology with the Academy's purposes of further knowledge and advising the federal government" (National Research Council, 2004, ¶ 1).

The National Science Foundation (NSF) in 1996 published a document in which Chapter 2 focused its data collection on science and engineering doctoral programs but it does not provide a list of programs or the institutions where they reside. The NSF also collects information on federal research and development funds (Hauptman, 1986).

The Council on Graduate Schools (CGS) has published several documents focused on doctoral education but does not have a list of doctoral programs in the United States. In addition to researching the Council on Graduate Schools website located at

http://www.cgsnet.org/, a call to the CGS offices in Washington, DC verified that they do not maintain a list of doctoral programs in the United States.

The Association of American Universities (AAU), currently with 62 members, was founded in 1900 and has statistics on its member institutions but does not have data on all higher education institutions. The AAU was instrumental in helping doctoral programs come into existence, but the association does not represent all universities that confer doctoral degrees.

How Doctoral Degrees have Changed Over Time

The National Research Council (NRC) appointed the Committee for the Study of Research-Doctorate Programs in the United States to conduct a 4-year study to identify changes in doctoral programs in the United States between 1981 and 1993. This study included a large sample of doctoral programs in the United States: 3,634 research-doctoral programs at 274 universities. This sample used by the NRC represents about 35 percent more programs than the number included in the 1982 study. The study does not quantify and/or list all research-doctoral programs in the United States but does provide some interesting information on institutions awarding a doctoral degree and new areas of study. The NRC identified an increase in institutions awarding a Ph.D. "from 325 in 1980 to 364 in 1992" (Goldberger, Maher, & Flattau, 1995, p. 12). These new doctoral fields of study may indicate that in addition to an increase in the number of universities awarding Ph.D. degrees, the areas of specialization are increasing along with the new knowledge that doctoral study and research reveals. The study by Goldberger et al. (1995) also revealed that in 1963 non-U.S. citizens earned 1,605 Ph.D. degrees in the United States, and in 1993 non-U.S. citizens earned 12,173 Ph.D. degrees. Non-U.S.

citizens earned 13% of the Ph.D.s conferred in 1963 and 30 years later non-U.S. citizens earned 32% of the Ph.D.s conferred (p. 4). It appears that universities in the United States have become a magnet for individuals from other countries seeking doctoral education.

The first doctoral degree in Europe was conferred more than 800 years ago. The first doctoral degrees in the United States were conferred less than 150 years ago. Although the history of doctoral education in the United States is relatively short, the impact that it has had can be seen around the world as non-U.S. citizens receive Ph.D. degrees in the United States. These non-U.S. citizens with newly acquired doctoral degrees often return to their home lands with new knowledge often to develop graduate study. The dramatic growth in the number of Ph.D. recipients continues to increase along with the number of specialization areas.

History of Construction Management in the United States

The first three identifiable construction education undergraduate programs in the United States were established at the Massachusetts Institute of Technology, Union University (Tennessee), and Yale University (Connecticut) in 1926 (Dermish, 1983). The University of Florida established the next construction education program in 1935 in the Department of Architecture called Building Construction (Dermish, 1983). After WWII, Johns-Manville and representatives of the building industry approached colleges and universities to set up programs with curriculum that would train students to meet the demand for construction managers projected by the federal government. For example, the Light Construction and Marketing program was initiated at Colorado Agricultural and Mechanical College (currently Colorado State University) in 1946, and was administered

by the Industrial Arts Department (Hauck, 1998; Knievel, 1965). The first graduates from this program received degrees in 1949. This program was similar to programs initiated at 20 other universities as a result of being approached by Johns-Manville and representatives of the building industry (Knievel, 1965). Johns-Manville had identified the need for an increase in residential construction because individuals were returning from serving in WWII and would need housing. This increase in residential construction would require managers to coordinate and manage these projects (Knievel, 1965).

After these construction education programs were established and began to grow, accreditation was the next step in gaining academic and industry respect. The first college-level construction education program at the University of Florida (now the M. E. Rinker School of Building Construction) earned recognition in 1975 through accreditation by the American Council of Construction Education. There are currently as many as 170 construction education programs in the United States with at least 82 programs being accredited by one or more of the following: American Council for Construction Education (ACCE), Accreditation Board for Engineering and Technology (ABET), and/or National Association for Industrial Technology (NAIT). ACCE accreditation covers programs focused on construction management, where ABET accreditation is focused on construction engineering. NAIT accreditation does not require a construction focus (Rosenbaum & Rubin, 2001). The ACCE web site lists 56 programs with current baccalaureate degree accreditation and seven programs that are candidates for baccalaureate degree accreditation (Accreditation Board for Engineering and Technology, 2004). The ABET web site lists 10 programs focused on engineering management; three of those programs incorporated the word construction in their

program titles (Accreditation Board for Engineering and Technology, 2004). The NAIT web site listed seven baccalaureate degree programs with the word construction included in the degree title (National Association for Industrial Technology, n.d.).

Current Faculty in ACCE Accredited and ASC Member Construction Programs

College and university members of ASC have 558 faculty members teaching at their construction education programs (Associated Schools of Construction, 2004). Data from self-reporting faculty members in these programs are dated between October 11, 2001, and October 18, 2004. The highest degrees earned reported by each of these faculty members are presented in Table 4.

Table 4 *Highest Degrees Earned by Self-Reporting ASC Faculty*

Highest Degree Earned by Faculty	ASC Member Faculty	ASC Member Faculty %	ACCE & ASC Member Faculty	ACCE & ASC Member Faculty %
Doctor of Philosophy (Ph.D.)	258	46.2 %	184	44.6%
Doctor of Education (Ed.D.)	22	3.9%	14	3.4%
Jurist Doctorate (J.D.)	13	2.3%	10	2.4%
Doctor of Engineering (Eng.D.)	4	0.7%	4	1.0%
Doctor of Management (Mgt.D.)	1	0.2%	1	0.2%
Master of Science (M.S.)	165	29.6%	131	31.7%
Master of Arts (M.A.)	24	4.3%	20	4.8%
Master of Engineering (M.Eng.)	3	0.5%	1	0.2%
Master of Architecture (M.Arch.)	5	0.9%	4	1.0%
Master of Technology (M.T.)	2	0.4%	0	0%
Master of Business Administration (MBA)	1	0.2%	1	0.2%
Mater of Education (M.Ed.)	1	0.2%	1	0.2%
Bachelor of Science (B.S.)	32	5.7%	19	4.6%
Bachelor of Arts (B.A.)	3	0.5%	3	0.7%
Associate Degree (A.A.S.)	1	0.2%	1	0.2%
No Degree Listed	23	4.1%	19	4.6%
Total	558	100%	413	100%

(Associated Schools of Construction, 2004)

For comparison purposes, the highest degrees earned by faculty members in ASC member programs that are also accredited by ACCE are included in Table 4.

Graduate Programs in Construction Management in the United States

There is no accrediting body for master's programs that focus on construction related academic pursuits. The Associated Schools of Construction (2004) reports that 31 (55.4%) of the 56 ACCE accredited programs offer a master's degree. Eighteen (58.1%) of these master's degrees include the word "construction" in the degree title. Fourteen (32.6%) of the 43 ASC member programs that are not ACCE accredited offer a master's degree. Six (42.3%) of these master's degrees include the word "construction" in the degree title.

Doctoral Programs that Allow an Emphasis in Construction Management

Before making any recommendations about the need for construction education doctoral programs, it is important to know the current status of construction related doctoral programs in the United States. This will be followed by a look at the type of doctoral programs where current construction education faculty received their doctoral degrees.

Sixteen doctoral programs were identified because the institutions self-reported that they offered a Ph.D. program when responding to a survey by *Engineering News-Record* (Rosenbaum & Rubin, 2001). Of these, 15 universities are currently members of the Associated Schools of Construction. A list of programs that have self-reported offering a Ph.D. program is provided in Table 5.

Table 5 *Self-Reporting Ph.D. Programs with a Construction Focus*

University	Self–Reporting Ph.D. Degree Title	Self–Reporting Master's Degree Title	Self–Reporting Bachelor of Science Degree Title
Clarkson University (NY)	Civil Engineering	Civil Engineering	Civil and Environmental Eng.
State University of New York/ESF	Environmental and Resource Engineering	Environmental and Resource Engineering	Construction Management and Wood Products Eng.
Temple University (Pennsylvania)	Engineering	Civil Engineering	Civil & Construction Engineering Tech.
Georgia Institute of Technology	Building Construction	Building Construction	Building Construction
University of Florida	Building Construction	Building Construction	Building Construction
Virginia Polytechnic Institute & State U.	Architecture	Architecture - Construction Management Option	Building Construction
Bowling Green State University (Ohio)	Technology Management	Industrial Technology	Industrial Technology
Purdue University (BCM) (Indiana)	Education	Technology	Building Construction Management
Purdue University (CEM) (Indiana)	Civil Engineering	Civil Engineering	Construction Engineering and Mgt.
Central Missouri State University	Technology Management	Industrial Management	Construction Management
Iowa State University	Civil Engineering - Construction Engineering & Mgt.	Civil Engineering - Construction Engineering & Mgt.	Construction Engineering
University of Northern Iowa	Industrial Technology	Technology	Construction Management
Texas A & M University	#1 Architecture or #2 Urban and Regional Planning	Construction Management	Construction Science
Colorado State University	Interdisciplinary Education	Construction Management	Construction Management
Stanford University (CA)	Civil and Environmental Engineering – Const.	Construction Engineering and Management	Civil and Environmental Engineering

(Associated Schools of Construction, 2004)

The Ph.D. degree titles for these 15 programs include Civil Engineering, Environmental and Resource Engineering, Architecture, Technology Management, Construction Engineering and Management, Civil and Environment Engineering, Education, Interdisciplinary Education, and Building Construction. Refer to Table 5 for a complete list of these self-reported programs along with their undergraduate, master's, and Ph.D. program titles.

All of the doctoral programs listed in Table 5 are construction related doctoral programs. The focus of these programs may be in construction management, construction engineering, or construction education among others, but the actual doctorate is in Engineering, Architecture, Technology, or Education. The majority of professors teaching in construction management education received their doctorates from programs with degree titles such as these. Records from the Associated Schools of Construction in 2002 indicate that of 429 instructors teaching in construction management education, 209 faculty members (48.7%) have Ph.D.s, 61 faculty members (14.2%) have an Ed.D., and the remaining 159 faculty members (37.1%) have a master's degree as the highest degree they have attained (Badger, 2002).

CHAPTER 3: RESEARCH METHODOLOGY

Research Design

There are many ways in which needs assessment research has been defined. For the purposes of this study, the definition of needs assessment provided by Reviere, Berkowitz, Carter, and Ferguson (1996) is appropriate. They state that needs assessment is "a systematic and ongoing process of providing usable and useful information about the needs of the target population – to those who can and will utilize it to make judgments about policy and programs" (p. 6).

The selected research design for this needs assessment is mixed methods. "This is a type of research design in which qualitative and quantitative approaches are used in types of questions, research methods, data collection and analysis procedures, and/or inferences" (Tashakkori & Teddlie, 2003, p. 711). A short history of mixed methods research is presented followed by definitions of the different variations of mixed methods research. The last part of this section presents the mixed methods design and its justification for this study.

History of Mixed Methods Research

Mixed methods research is not a new idea. As a research methodology it existed more than 40 years ago, and existed long before it was identified or labeled. Rocco, Bliss, Gallagher, and Perez-Prado (2003) state:

> Qualitative researchers Campbell and Fiske (1959) suggested mixing methods to accurately measure a psychological trait. Their call for multiple methods "to ensure that the variance was reflected in the trait and not the method" (Creswell,

1994, p. 174) later expanded into what Denzin (1978) dubbed "triangulation." (p. 19)

During the period between 1970 and 1990 several events occurred that promoted the growth of mixed methodology. Tashakkori and Teddlie (2003) identify four events that facilitated the growth of mixed methodology during this time frame:

1. qualitative methods and constructivism grew quite rapidly in popularity;
2. the paradigm wars were launched based largely on the incompatibility thesis;
3. mixed methods studies were introduced in conjunction with writings on triangulation;
4. important mixed methods studies and syntheses appeared. (p. 7)

The credibility of mixed method design research has been questioned by proponents of both quantitative and qualitative research. The term "incompatibility theses" refers to the opinion held by some researchers that it is "inappropriate to mix quantitative and qualitative methods" (Tashakkori & Teddlie, 2003, p. 5). It should be noted that the "incompatibility thesis has now been largely discredited, partially because scholars demonstrated that they had successfully employed mixed methods in their research" (Tashakkori & Teddlie, 2003, p. 19). Triangulation has "evolved to include using multiple data collection and analysis methods, multiple data sources, multiple analyses, and multiple perspectives (Patton, 2002)" to reduce bias and to test for consistency (Rocco et al., 2003, p. 20). Greene and Caracelli (2003) agree that triangulation is one of the advantages of mixed methods. They state that triangulation among the data sources organized by "program element rather than by methods" (p. 104) facilitates triangulation of the data. Greene and Caracelli recommend that research results be organized by the questions being answered rather than by the type of research methodology, qualitative or quantitative. A more detailed look at mixed method research design follows.

Mixed Methods Research Designs

There is no one definitive mixed methods research design. Several authors and researchers have identified some typical designs (Brewer, 2001; Creswell, 2003; Roco et al., 2003; Tashakkori & Teddlie, 1998; 2003). All of these researchers contend that there may be variations to the mixed methods designs they have presented. Tashakkori and Teddlie (1998) identified the following five different types of mixed method research designs:

- Sequential studies: The researcher first conducts a qualitative phase of a study and then a quantitative phase, or vice versa. The two phases are separate.
- Parallel/simultaneous studies: The researcher conducts the qualitative and quantitative phase at the same time.
- Equivalent status designs: The researcher conducts the study using both the quantitative and the qualitative approaches about equally to understand the phenomenon under study.
- Dominant-less dominant studies: The researcher conducts the study within a single dominant paradigm with a small component of the overall study drawn from an alternative design.
- Designs with multileveled use of approaches: Researchers use different types of methods at different levels of aggregation. For example, data could be analyzed quantitatively at the student level, qualitatively at the class level, quantitatively at the school level, and qualitatively at the district level. (p. 18)

Creswell, Clark, Gutmann, and Hanson (2003) have advanced theories of mixed method research to include six types of designs. Table 6 summarizes these types of design using three criteria.

In Table 6, implementation refers to the sequence of data collection. Priority is the weight or attention given to qualitative or quantitative research during all phases of the research. Integration refers to the stage at which the researcher brings the qualitative and quantitative methodology together: within the research questions, during data collection, during data analysis, or during interpretation. Theoretical perspectives include

the researcher's assumptions and opinions and, although not included in Table 6, it should be noted that they may be present in each of the mixed method design types.

Table 6 *Mixed Method Research Design Types*

Design Type	Implementation	Priority	Stage of Integration
Sequential explanatory	Quantitative followed by qualitative	Usually quantitative; can be qualitative or equal	Interpretation phase
Sequential exploratory	Qualitative followed by quantitative	Usually qualitative; can be quantitative or equal	Interpretation phase
Sequential transformative	Either qualitative followed by quantitative or qualitative followed by quantitative	Quantitative, qualitative, or equal	Interpretation phase
Concurrent triangulation	Concurrent collection of quantitative and qualitative data	Preferably equal; can be quantitative or qualitative	Interpretation phase or analysis phase
Concurrent nested	Concurrent collection of quantitative and qualitative data	Quantitative or qualitative	Analysis phase
Concurrent transformative	Concurrent collection of quantitative and qualitative data	Quantitative, qualitative, or equal	Usually analysis phase; can be during interpretation phase

(Creswell et al., 2003, p. 224)

At this point it is important to differentiate between a mixed method design and a multi-method design. Morse (2003) provides the following definitions:

> Mixed Method Designs: This is the incorporation of various qualitative or quantitative strategies within a single project that may have either a qualitative or a quantitative theoretical drive. The "imported" strategies are supplemental to the major or core method and serve to enlighten or provide clues that are followed within the core method.
> Multimethod design: This is the conduct of two or more research methods, each conducted rigorously and complete in itself, in one project. The results are triangulated to form a comprehensive whole. (p. 190)

Morse (2003) then goes on to summarize the major difference between the two terms when she states, "The major difference between a single study using multiple strategies (mixed methods design) and a research program using multiple methods is that

in the single study the less dominant strategies do not have to be complete studies in themselves" (p. 195). This differentiation leads to the specific mixed methods research design that will be recommended for this project.

All research projects involve some personal challenges and some principles that should guide the research process. Brewer (2001) quotes Reinhard who has identified five personal challenges in research design:

1. Orderly thinking: Faithful systematic research requires an organized approach.
2. Clear writing: Communicating a complex design to others (e.g., funding sponsors, research participants, consumers) requires precise, organized writing.
3. Objectivity: A lack of prejudice for one research technique over another is necessary to proceed with objectivity.
4. Organization and orderly process: A need exists for orderly thinking and clear writing.
5. Astute reasoning in developing the research methods: Logic is necessary for effective, complex designs. (p. 122)

In addition to the personal challenges associated with good research design, every research method has advantages and disadvantages. The disadvantages of mixed method research design include the following:

1. The process is time and labor intensive.
2. Conducting two types of research can be doubly expensive.
3. The (doctoral) candidate may lack adequate research skills for the two methods.
4. The (doctoral) candidate's committee may raise more questions concerning results. (Brewer, 2001, p. 123)

Several authors have identified some of the advantages of a mixed methods research design and they include:

- Complements other findings: Research results from different methods may complement each other (Brewer, 2001). This is often referred to as triangulation by other authors (Creswell, 2003; Green & Caracelli, 1997; Tashakkori &

Teddlie, 2003). Greene and Caracelli (2003) state, "Triangulation among sources intended to address a particular program element was facilitated, and consistency of findings from different sources and methods could be examined" (p. 104). But triangulation may not always be an advantage. Morse (2003) states:

> Some authors have considered triangulation as a form of convergent validity, somewhat resembling a test for constructing validity (Zeller & Carmines, 1980). This is a very poor reason for triangulation; two strong studies do not necessarily give a project more credence than does one study, and they require twice as much work. (p. 206)

- Expanded information: Results of mixed studies may increase the scope of knowledge about the research problem.
- Overcome bias: Qualitative research methods used in isolation are open to bias, and this weakness is overcome by using quantitative data as a balance. Even though qualitative research is known to be subject to researcher bias, it is Brewer's (2001) opinion that any research can be subject to bias. Including a researcher perspective for most research projects may increase the credibility of the study.
- Tashakkori and Teddlie (2003) state that qualitative research is thought to be primarily exploratory and that quantitative research is primarily confirmatory. They state, "A major advantage of mixed methods research is that it enables the researcher to simultaneously answer confirmatory and exploratory questions, and therefore verify and generate theory in the same study" (p. 15).
- Uncover the need for further study: In a research project that uses only one type of inquiry, there is a need to assess findings for strength and stability. In a multiple phase research design this weakness is minimized. It will also be seen

below in the research design recommended for this project that the qualitative will inform the quantitative. Mixed methods research may also uncover aspects of the study that may not have been uncovered in a single phase research design (Brewer, 2001).

- Add texture: "Findings from one research technique may be enriched by those of the alternate technique – uncovering paradoxes, contradictory findings, or other information" (Brewer, 2001, p. 124).

With all of the advantages and disadvantages of mixed methods research design taken into consideration, the following research design emerged as appropriate for this study.

Research Design for this Study

This "sequential exploratory" (Creswell et al., 2003, p. 227) mixed methods design started with interviews with construction management (CM) current department heads. Open ended questions were asked to allow themes surrounding the need for CM faculty and the qualifications for faculty to emerge. An open ended question about the need for CM doctoral programs was also asked. The data from the open ended interviews were coded using open, axial, and selective codes using a combined deductive and inductive approach. Patton (2002) states, "Discovery and verification mean moving back and forth between induction and deduction, between experience and reflection on experience, and between greater and lesser degrees of naturalistic inquiry" (p. 67). A constant comparative approach (Bogdan & Biklen, 2003) was used after each interview was coded to "look for key issues, recurrent events, or activities in the data that become categories of focus" (p. 67). These categories of focus became central in subsequent

interviews to check for consistency in the themes that emerged. The primary objective of these questions was to inform the quantitative phase of the research. Based on Morse's (2003) definition, because the qualitative phase of this research design may not be a stand alone study, this is a mixed methods research design rather than a multimethod design.

The quantitative aspect of the mixed methods research design utilized a survey instrument based, in part, on the themes that emerged from the interviews. As stated by Creswell et al. (2003), the qualitative data collection is intended to "identify and narrow the variables" (p. 228). Faculty members teaching in ACCE accredited CM programs received the survey instrument. The results of the survey instrument quantified the opinions surrounding CM doctoral education from the perspectives of faculty teaching in CM programs (part of the supply side of this construct). In addition to the descriptive data that were collected and analyzed, there were some relationships between the variables that helped identify explanations given for why there is or is not a need for doctoral programs focused solely on construction management. These variables include: faculty age; faculty turnover and reason; educational background of faculty; perceived need for CM doctoral degree; perceptions of value added by CM doctoral programs; perception of faculty shortage at their institution; perception of faculty shortage at other institutions; and perception of the required qualifications for a qualified faculty.

These are a sample of the variables that were identified prior to the qualitative interviews with CM department heads. The data from the interviews did not substantially change these variables, but did add several questions to the survey instrument. The qualitative data also provided verification of the results of the quantitative data analysis and provided rich descriptive text to better explain these results. The qualitative data that

were collected from document analysis and interviews were used with the quantitative data to provide triangulation. Triangulation is the use of "multiple investigators, sources of data, or data collection methods to confirm emerging findings" (Merriam, 2002, p. 31).

Research Implementation

This sequential exploratory mixed methods research design was implemented in two phases. An explanation of the implementation procedures for the first phase is presented followed by an explanation of the implementation procedures for the second phase. A goal of this research design is to provide triangulation which is one strategy "for providing validity and reliability" (Merriam, 2002, p. 31). Refer to Figure 1.

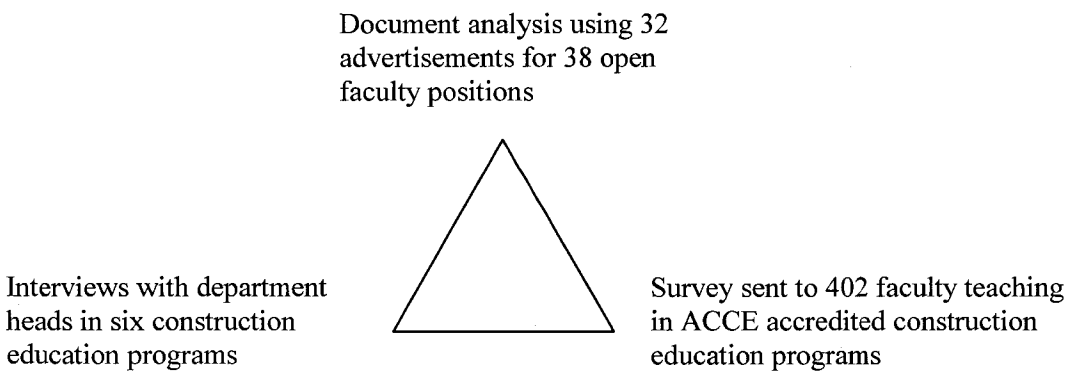

Figure 1. Triangulation uses "multiple investigators, sources of data, or data collection methods to confirm emerging findings" (Merriam, 2002, p. 31).

Phase I

The first part of the Phase I data collection process was document analysis. The classified advertisements posted on the ASC web site were analyzed with respect to the number of vacant construction education faculty positions during the 2004 – 2005 school year from the middle of August 2004 through the end of May 2005. Also included in the first phase of this research design were interviews with CM department heads. Several strategies for promoting validity and reliability were used to establish trustworthiness. In

addition to the triangulation described above, the researcher's position has been acknowledged, and maximum variation has been included in the participant selection. Maximum variation is "purposefully seeking variation or diversity in sample selection to allow for greater range of application of the findings by consumers of the research" (Merriam, 2002, p. 31). The purposeful criteria selection process is further detailed in the data collection section. An audit trail was also developed to increase trustworthiness. The audit trail consists of the open coded interviews and an Excel spreadsheet showing how the open codes were grouped into axial codes. The following will describe the participants, the data collection, and the data analysis procedures in Phase I of this research design.

Participants.

The participants in the qualitative first phase of this study were purposefully selected current department heads in construction management programs. These six individuals were from construction management programs accredited by the American Council of Construction Education (ACCE). Each individual selected for an interview had in excess of 10 years teaching experience in a CM program. The programs were narrowed to those that are ACCE accredited because there are many different types of construction education programs that may have various emphasis areas as evidenced by their accreditation through organizations other than ACCE. For example, there are construction education programs that have received accreditation through the Accreditation Board for Engineering and Technology (ABET) or the National Association of Industrial Technology (NAIT). Academic programs that are accredited through ABET have an engineering emphasis, and programs that are accredited through

NAIT have a technology emphasis. The Department of Education's Classification of Instructional Programs (CIP) for Construction Management resides under CIP #52, Business, Management, Marketing, and Related Support Services, thereby putting the emphasis on management rather than engineering or technology. The department heads were purposefully selected so that the participants were from both large and smaller programs, and from different parts of the United States. The intent was to interview department heads from a cross-section of construction education programs based on size (number of undergraduates), geographic region, and institutional emphasis (whether the university had a teaching or research emphasis).

Data collection.

The first part of the Phase I data collection process was a document analysis of the classified advertisements for vacant construction education faculty positions posted on the ASC web site during the 2004 – 2005 school year from the middle of August 2004 through the end of May 2005. The ASC sends an e-mail notification to all ASC faculty members announcing new advertisements for vacant faculty positions. These advertisements were printed and collected during the 2004 – 2005 school year. A spreadsheet with information from these advertisements was created to assist in data analysis and is included in Appendix D.

The telephone interviews with department heads in ACCE construction education programs were recorded and transcribed. The transcribed interviews were coded using open, axial, and selective coding using a combined deductive and inductive approach to allow themes to emerge. These emergent themes were tested in the quantitative phase of data collection to see if the opinions and perceptions held by these department heads are

consistent with the opinions and perceptions held by existing faculty members. The themes that emerged in the interviews provided questions that were asked in the primarily quantitative survey instrument sent to faculty members in ACCE accredited construction management programs.

Data analysis.

As stated, the data gathered in the recorded and transcribed interviews were coded using open, axial, and selective coding to allow themes to emerge. A constant comparative method of analysis was used to guide subsequent interviews. Coded categories allowed themes to emerge. These categories include perspectives held by participants, process codes, activity codes, event codes, strategy codes, or relationship codes as examples (Bogdan & Biklen, 2003). The opinions and perceptions of the participants in the qualitative phase of the study form the emergent themes that helped guide the creation and modification of questions asked in the quantitative phase of the research. After analyzing the data from the fifth of six interviews, it became apparent that saturation was being reached. Creswell (1998) states that the information coming from the data analysis becomes saturated when the data being collected become repetitive. The data analysis from the sixth interview confirmed that the information being gathered had become saturated. Member checking was done when requested by the participants. Member checking is "taking the data and tentative interpretations back to the people from whom they were derived and asking if they were plausible" (Merriam, 2002, p. 31).

Phase II

The second phase of this research design was a questionnaire sent to all 402 faculty members teaching in ACCE accredited programs. The following describes the Phase II participants, the Phase II data collection, and the Phase II data analysis procedures.

Participants.

The target population for the quantitative phase of the research was the 402 faculty members in ACCE accredited construction management programs. The list of individual faculty members in these ACCE accredited programs was developed by going through the self-reported data on the ASC web site and cross checking the information by going to the web site of each of the CM programs and the link with their faculty members. The sample selected to receive a survey was the entire target population. The design used a web based survey instrument, SurveyMonkey, with an e-mail sent to all faculty members in ACCE accredited programs notifying them of this survey.

Data collection.

The survey was web-based. An e-mail was sent to participants informing them of the survey and its purpose. The e-mail included a link to the SurveyMonkey website. The e-mail script and the survey are included in Appendix B. The potential participants included the 402 faculty members in ACCE accredited programs. Two reminder e-mails were sent to faculty members who had not yet responded to the survey. Microsoft Excel and SPSS files were used to collect and store the data until analysis began.

Data analysis.

The data from the returned survey instruments were collected by SurveyMonkey, quantified using Microsoft Excel and/or SPSS, and presented as descriptive and associational statistics. Descriptive statistics were most useful in determining the perceived need for CM doctoral programs. Checking for possible relationships among variables was also helpful in developing an understanding of the descriptive statistics.

Answering the Research Questions

Both qualitative and quantitative data analysis methodologies were used to answer the research questions. The specific approaches to answering each of the research questions are presented in Table 7. These data analysis methods and the results are described in detail in Chapter 4.

Table 7 *Answering the Research Questions*

Research Questions	Method of Answering the Questions
What is the extent or magnitude of demand for faculty in construction management programs?	Qualitative data from the interviews and descriptive statistics from the survey are presented.
What are the required and/or desired qualifications of these faculty positions?	Qualitative data from the interviews and from the document analysis (ASC Advertisements for faculty).
How are the responsibilities of unfilled construction management faculty positions met?	Qualitative data from the interviews and descriptive statistics from the survey are presented.
Is there a need for doctoral degree programs to prepare individuals to teach and do research in the interdisciplinary academic discipline called construction management?	Qualitative data from the interviews and descriptive statistics from the survey are presented.
How would the creation of these doctoral degree programs impact the availability of construction management faculty?	Qualitative data from the interviews and from the document analysis (ASC Advertisements for faculty).

Is there a difference between the size of the programs in which the faculty members teach and the perceived need for construction management faculty in the program in which they are teaching? And perceived need for faculty in the United States?	1. One-way ANOVA with shortage of faculty in dept. (all 5 levels) and size of the program (# of students). 2. Kruskal-Wallis test with shortage of faculty in U.S. (all 5 levels) and size of the program.
Is there a difference between the responding faculty members' current teaching appointment (tenured, tenure-track, special appointment, adjunct, etc.) and the perceived need for construction management faculty in the department in which they are teaching? And perceived need for faculty in the United States?	1. One-way ANOVA with shortage of faculty in dept. (all 5 levels) and size of the program (# of students). 2. Kruskal-Wallis test with shortage of faculty in U.S. (all 5 levels) and size of the program.
Is there an association between the perceived need for construction management faculty and the length of time they plan to continue teaching in any construction education program?	Pearson (r) and Spearman statistics with shortage of faculty in dept., shortage of faculty in U.S. and length of time they plan to continue teaching (all 5 levels).
Is there a difference between the academic degrees earned by current faculty members and the perceived need for construction management faculty in the department in which they are teaching? And perceived need for faculty in the United States?	1. t-test with shortage of faculty in dept. and if they have a master's or a PhD. 2. Mann-Whitney U test with shortage of faculty in U.S. and if they have a master's or a PhD.
Is there an association between the perceived need for construction management faculty and the number of years that they have taught in construction education?	Pearson (r) and Spearman statistics with shortage of faculty in dept., shortage of faculty in U.S. and number of years that they have taught (all 5 levels)
Is there an association between the perceived need for construction management faculty and the amount of the faculty's construction industry experience?	Pearson (r) and Spearman statistics with shortage of faculty in dept., shortage of faculty in U.S. and amount of the faculty's construction industry experience (all 5 levels)

Pilot Testing

The importance of conducting a pilot test is well documented (Dillman, 2000; Gliner & Morgan, 2000; Thomas, 2004). Thomas (2004) states, "This step [pilot testing]

is so critical that if you don't have time and resources to conduct a pilot test on all pieces of your survey project, then you probably should not be doing the project" (p. 108).

Pilot testing involves trying out the research procedures "or fine-tuning a questionnaire" with persons knowledgeable in the subject being studied (Gliner & Morgan, 2000, p. 353). A pilot test differs from a pilot study. Gliner and Morgan (2000) state that a pilot study occurs when "formal data are collected and analyzed" (p. 353). A pilot study requires approval from an institutional review board because the data collected is used in a study. A pilot test does not require review and approval from an institutional review board because the data collected will not be used in the study. The data from the pilot tests in this study were only used to improve the questionnaire, and were not incorporated into the final results.

Phase I Pilot Test Design

The population for the qualitative first phase of the research design was department heads in CM programs. The pilot test interviews were conducted with a department head and an associate department head in a CM program.

Phase I Pilot Test Implementation

The qualitative first phase of the study was pilot tested in separate interviews with the Department Head and Associate Department Head of the Department of Construction Management at Colorado State University (CSU). Both of these individuals have been teaching in construction management education in excess of 20 years. The data from these interviews were not used in the final study, but were used to verify that the interview questions were sufficient to draw out the data needed for this study. These

individuals represent the greatest source of potential bias since they are my direct supervisors.

Phase I Pilot Test Results

The qualitative pilot test interviews were conducted prior to applying to the CSU Human Research Committee for research approval. Data from the pilot test interviews were coded to allow themes to emerge. The Phase II Pilot Test Results were used to import and develop the pilot quantitative questionnaire.

Phase II Pilot Test Design

The target population for this study is all faculty teaching in ACCE accredited construction management programs. A subset of this population is the faculty teaching in the Department of Construction Management at CSU. This group of faculty was used to pilot test the questionnaire and are described by employment position in Table 8.

Table 8 *Construction Management Faculty at CSU*

Faculty Employment Position	Number of Faculty Members
Tenured	5
Tenure-track	3
Special appointment	6
Adjunct	2
Lecturers	2
Administrator	1

These pilot test data were not used in the final study and these individuals were not sent the instrument in its final form.

Phase II Pilot Test Implementation

An e-mail was sent to participants informing them of the pilot study and its purpose. The e-mail included a link to the SurveyMonkey website. The participants included faculty members from the ACCE accredited construction management (CM) program at CSU shown in Table 8. These faculty members were selected because they

are teaching in an ACCE accredited program which is part of the target population and were available to provide feedback on the instrument. The CM faculty at CSU represents the greatest source of potential bias because I am also a member of this same group. A follow up e-mail was sent after 5 days to increase the response rate. The data gathered in the pilot study was not included in the final results of this project.

Phase II Pilot Test Results

The response rate to the pilot test was 79% with 15 of 19 faculty members responding to the survey. One of the respondents did not answer the majority of the questions which dropped the useable response rate to 74%.

Comments from some of the respondents indicated that the semantic differential questions included in the pilot survey needed to have a response option "I don't know" because some of the respondents simply do not know how to respond to the options. This may have been a major reason that there were a lot of 4s selected in the 1 to 7 semantic differential scale. Other comments indicated that the semantic differential items were confusing. This indicated the need to replace the semantic differential items with Likert scale items and response options. The survey in its final form in SurveyMonkey is in Appendix B.

Data from the pilot test were analyzed using Excel and Statistical Package for the Social Sciences (SPSS). Descriptive statistics including means, standard deviations, and frequency distributions was analyzed for each of the responses. Instrument validity was established using face validity, content validity, and construct validity.

Institutional Review Board Approval

An application to do research involving human participants was sent to the Colorado State University Human Research Committee on January 26, 2005. Approval to proceed with the data collection was received on February 11, 2005. A copy of the approval from the Human Research Committee is provided in Appendix C.

CHAPTER 4: RESULTS

The data collection methodology used in this sequential exploratory mixed methods research design is presented for each phase of the data collection. This is followed by the sequential answering of the research questions presented in Table 7 in Chapter 3. Four additional difference questions emerged during data analysis and are also presented in this chapter. These four questions are answered using statistical analysis to identify the possible differences.

The first phase of the qualitative data collection was the document analysis of advertisements for 38 open faculty positions during the 2004 – 2005 academic year from the middle of August 2004 to the end of May 2005. The document analysis was performed on advertisements posted by 32 universities searching to fill 38 open faculty positions in construction education programs. The primary goal of this document analysis was to quantify the required and preferred qualifications of candidates seeking to fill these open positions. The data collected from this document analysis is included in Appendix D.

In the second phase of the qualitative data collection, data were collected from taped telephone interviews with department heads in construction education programs. The six transcribed interviews were coded using open and axial coding in a deductive framework while being open to themes which may emerge. Patton (2002) indicates that in qualitative data analysis inductive and deductive approaches "are often combined" (p.

56). These data were analyzed to help answer some of the research questions and to assist in determining the content of the survey being sent to current faculty teaching in ACCE accredited construction education programs.

A total of 402 surveys were sent via the web-based survey tool SurveyMonkey. After the initial e-mail was sent to the target population, two e-mail reminders were sent to faculty members who had not yet responded. The final survey response rate was 22.64% (N = 91). Current research indicates that this is an acceptable response rate (Kaplowitz, Hadlock, & Levine, 2004; Mertle, 2003; Porter & Whitcomb, 2003). Mertler (2003) focused research on response rates from teachers to traditional and web surveys and found the "return rate for the total survey was equal to 17%; the return rate for the paper-and-pencil administration was equal to 21%, while that for the Web administered was equal to 11%" (p. 9). The response rate for the web-based survey associated with this project was twice that of the Mertler project. Porter and Whitcomb (2003) experienced a 14.8% response rate when researching the impact the type of contact has on web-based surveys with their target population being high school students. This project used reminders (two follow-up e-mails to non-respondents), a method similar to the methodology used by Porter and Whitcomb (2003). Kaplowitz, Hadlock, and Levine (2004) experienced a 20.7% response rate for the e-mail only survey when they did a comparison of web-based and mail surveys. Their target population was university students. These students have free access to the internet in the same way the target population, faculty members teaching in ACCE accredited construction education programs, have unlimited access to the internet and e-mail. Based on the aforementioned

research focused on web-based survey response rates, the response rate of 22.64% achieved in this survey is acceptable.

The quantitative data collected from the responses to the survey were analyzed using Excel and SPSS, Release 13.0. The open-ended questions in the web-based survey were coded using open, axial, and selective coding to allow themes to emerge which was the same method of analysis used for the interviews.

Answering the Research Questions

Each of the research questions identified in Chapter 1 and in Table 7 in Chapter 3 are answered individually. As presented in Table 7 there were 11 original research questions. The first five research questions were answered using a combination of qualitative and quantitative data. The last six questions are answered using statistical analysis to identify differences and associations. In addition, there are answers to four questions, not asked in the initial research design, which are answered by the data analyses and presented in this chapter. These unintended findings emerged during the data analysis.

Magnitude of Demand for Construction Management Faculty

The demand for faculty to teach in construction education or construction management (CM) programs was identified in the interviews with CM department heads, in the survey responses from CM faculty, and in the document analysis of advertisements for faculty positions posted on the Associated Schools of Construction (ASC) web site.

During the interviews with six CM department heads there were 17 comments that referred to the shortage of candidates for CM faculty positions. One department head stated, "The demand for construction management faculty has just gone through the

roof." This individual stated that recently they were unsuccessful in a search to fill a faculty position and had to start the search over again. Another department head stated, "There is a desperate shortage" of CM faculty. And yet another department head stated that the need for CM faculty is high, constant, and does not seem to be subsiding.

One of the department heads quantified the need for CM faculty stating, "There is a need for about 50 Ph.D. graduates each year." Another department head indicated that the high need for faculty is impacting the qualifications of candidates. This individual stated that the high need for faculty necessitates accepting faculty with less experience in the construction industry.

Faculty teaching in ACCE accredited CM programs agreed that there is a shortage of candidates to fill CM faculty positions with 77.3% agree or strongly agree with the statement: There is a shortage of faculty to fill open positions in my department. A total of 13.6% of faculty responding to the survey either disagreed or strongly disagreed with this statement, and 9.1% neither agreed nor disagreed with the statement. Of the responding faculty, 82.5% agreed or strongly agreed with the statement: There is a shortage of faculty to fill open positions at other construction education programs in the United States. Only 10% disagreed or strongly disagreed with this statement, and 7.5% neither agreed nor disagreed. If the individuals who responded "Neither Agree Nor Disagree" are omitted from the respondents, a total of 89.2% of the respondents either agree or strongly agree that there is a shortage of CM faculty in the United States.

During the 2004 – 2005 school year from the last half of August 2004 through the end of May 2005 there were 32 postsecondary construction education programs that advertised through the ASC for candidates to fill 38 open faculty positions. The number

of advertisements also helps to quantify how much current demand exists for faculty to teach in CM programs.

Required or Preferred Qualifications of Construction Management Faculty

The qualifications of faculty teaching in CM programs are identified in the interviews with CM department heads, in the survey responses from CM faculty, and in the document analysis of advertisements for faculty positions posted on the ASC web site. These qualifications fall into four basic categories: earned academic degree, experience in the construction industry, the ability to be a good teacher, and the ability to do research. A preferred qualification of a faculty candidate that was specified in the advertisements but not mentioned in the interviews with department heads or survey responses was professional registration or certification.

Academic degree earned.

One of the interviewed CM department heads stated, "If you want to compete within academic circles, having a Ph.D. I think is mandatory." Another department head stated that if [CM] faculty do not have a Ph.D. they are not an equal in academia." One department head stated that in academia "you'll always be a second class citizen unless you have a Ph.D." Several of the interviewed department heads indicated that in most cases a faculty member needs to have a doctoral degree to be hired into a tenure-track position. They indicated that a faculty member who had only a master's degree would be hired as a lecturer in a special appointment rather than into a tenure-track line. This was not unanimous since one department head stated that a master's degree was the terminal degree for CM faculty at that university. However, this individual also felt that a Ph.D. was required for faculty in most other CM programs.

One of the department heads felt that having a "Ph.D. in Education is good if they are going to teach." This was the opinion of another department head when he stated that new faculty with industry experience need to know how to teach and understand pedagogy, and "they could learn [this] in an educational doctorate program to become a better professor." These opinions may have been summarized by the department head who stated, "I'm probably just as impressed with someone getting the Ph.D. in Education as I am with a Ph.D. in Civil Engineering or Construction Management." But another department head felt that an individual with a Ph.D. in Construction or Civil Engineering would be in high demand. And yet another department head stated that faculty should have a Ph.D. but it "should be in Education, Business, Engineering, or Architecture."

A total of 71.1% of the faculty teaching in ACCE accredited CM programs who responded to the survey agree or strongly agree with the statement: The department at the institution in which I teach prefers to have faculty with a doctoral degree. The results of the survey responses to these two statements are shown in Table 9.

Table 9 *The Department in which I teach prefers faculty with a doctoral degree*

Response Option	Frequency	Valid Percent
Strongly Disagree	3	3.3
Disagree	12	13.3
Neither Agree nor Disagree	11	12.2
Agree	21	23.3
Strongly Agree	43	47.8
Total	90	100.0

A total of 70.9% respondents agreed or strongly agreed with the statement: Other construction education programs in the United States prefer to have faculty with a doctoral degree. This is not consistent with the response to another question about a doctoral degree being a requirement for faculty members. Participants were asked to respond to the statement: A qualification to teach in a construction education program

should be a doctoral degree. A total of 52.3% disagreed or strongly disagreed compared to 27.9% who agreed or strongly agreed as shown in Table 11.

The responding faculty members also believe that other construction education programs in the United States required candidates for faculty positions to have a doctoral degree. These results are presented in Table 10.

Table 10 *Other CM programs in the U.S. prefer faculty with a doctoral degree*

Response Option	Frequency	Valid Percent
Strongly Disagree	0	0.0
Disagree	7	8.9
Neither Agree nor Disagree	16	20.3
Agree	42	53.2
Strongly Agree	14	17.7
Total	79	100.0

But these responding faculty members disagree with the requirement for faculty to have a doctoral degree. Table 11 shows that 52.3% of faculty responded that they disagree or strongly disagree with the statement: A qualification to teach in a construction education program should be a doctoral degree. Only 27.9% of the responding faculty agree or strongly agree with this statement.

Table 11 *A qualification to teach in a CM program should be a doctoral degree*

Response Option	Frequency	Valid Percent
Strongly Disagree	14	16.3
Disagree	31	36.0
Neither Agree nor Disagree	17	19.8
Agree	18	20.9
Strongly Agree	6	7.0
Total	86	100.0

Even though faculty members may not agree with the requirement for faculty to have a doctoral degree, 100% of the advertisements for 38 CM faculty positions, posted by 32 programs through the ASC, preferred or required the candidate to have a doctoral degree. There were 23 (60.5%) of the advertisements that required the candidate to have

a doctoral degree, and 15 (39.5%) of the advertisements preferred that the candidate have a doctoral degree.

The fact that 100% of these advertisements preferred or required the candidate to have a doctoral degree is very indicative of the university requirements being passed on to the CM departments. This was emphasized by one department head who stated, "We look for teaching ability, we look for some relevant experience, and unfortunately our [university] president and our provost look for a Ph.D. in the end." One of the faculty qualifications that is desired, but has become harder to find in candidates for faculty positions, is experience in the construction industry.

Experience in the construction industry.

There were 13 comments made during the interviews with the six CM department heads that focused on the requirement for faculty members to have experience in the construction industry. Six of the comments reflected the opinion that the candidate should have at least 5 years of industry experience. The importance of industry experience was emphasized when one department head stated, "The bottom line is we'll hire somebody with a master's level who's got experience before we'll hire a Ph.D. without experience." Another department head felt that industry experience could come after employment in the CM department stating that the experience could be consulting on a part-time basis "as opposed to full time employment." This department head also stated that maintaining "current relations with industry are as important as having had previous experience in industry."

Only 9.1% of the faculty teaching in ACCE accredited programs who responded to the survey disagreed or strongly disagree with the statement: "The department at the

institution in which I teach prefers to have faculty with construction industry experience." The results of the responses to this statement are shown in Table 12. These results indicate that 85.3% of faculty responding to the survey agree or strongly agree that the department in which they are teaching prefer faculty with construction experience.

Table 12 *The department in which I teach prefers faculty with industry experience*

Response Option	Frequency	Valid Percent
Strongly Disagree	5	5.7
Disagree	3	3.4
Neither Agree nor Disagree	5	5.7
Agree	29	33.0
Strongly Agree	46	52.3
Total	88	100.0

This is similar to the opinions that these faculty members had about the industry experience requirements at other construction education programs. Only 3.8% of the respondents disagreed or strong disagreed with the statement: "Other construction education programs in the United States prefer to have faculty with construction industry experience." The results of the responses to this statement are provided in Table 13.

Table 13 *Other CM programs in the U.S. want faculty with industry experience*

Response Option	Frequency	Valid Percent
Strongly Disagree	1	1.3
Disagree	2	2.5
Neither Agree nor Disagree	15	18.8
Agree	46	57.5
Strongly Agree	16	20.0
Total	80	100.0

The current CM faculty members responding to the survey overwhelmingly believe that construction education programs want faculty with industry experience. This was confirmed by the document analysis of the advertisements for candidates to fill 38 open faculty positions posted by 32 secondary construction education programs during the 2004 – 2005 school year from the last half of August 2004 through the end of May

2005. Twenty of the open position announcements required or preferred an average of 4.5 years of experience in the construction industry. The majority of the other open position announcements stated that having construction industry experience was a preference but did not specify an amount. Only three advertisements for open faculty positions did not indicate that experience in the construction industry was either required or preferred for the successful candidate.

A good teacher.

The need for faculty members with construction experience seemed to translate into another required or preferred quality in a candidate for CM faculty positions. Being a good teacher was very important to CM department heads, surveyed faculty members, and was specified in many of the advertisements for open faculty positions.

One of the department heads stated that the qualities of a good teacher include having construction experience, being entertaining, and having energy. This individual also thought that being organized and conscientious are qualities for a good teacher. Another CM department head stated, "I think that first and foremost the person (new faculty member) has to be an educator in terms of a communicative person that can get the content across." This person also felt that having construction experience helps make an individual a better teacher stating, "Certainly having some experience in the field and real life operations are beneficial to add to the ability to deliver content." Yet another CM department head stated, "I think that a person, to be a good teacher, has to be interested in teaching, he has to be interested in students, and I think that someone in the classroom – it's more of their interest [in teaching] than the degree that they would have."

Several of the department heads indicated that having a doctoral degree did not necessarily make a person a better teacher. Although one department head stated:

> I don't know that the Ph.D. makes them better faculty, I think it gives them some additional depth and areas of interest. In my case, some of the very things I learned while doing my doctorate have become the basis of my research, my teaching, and some of my consulting work.

The need for a new faculty member to be a good teacher was reflected in the responses from existing CM faculty members to the open-ended question: What is (are) your long term goals as a faculty member teaching in a construction education program? Twenty-three faculty members responded that their long term goals were to improve teaching and learning. One faculty member stated, "I think primarily it would be to continue improving the classes to the point that they always reflect real industry experiences to the extent possible for the students." This attitude was aligned with 16 comments made by faculty focused on the goal of improving graduates. This same faculty member went on to say, "Anything I can do to help the students hit the ground running would satisfy me." Another faculty member stated a personal goal was, "to produce graduates capable of serving both the [construction] industry and the academia efficiently." This was echoed by another faculty member who stated he/she wanted to "focus on developing students as constructors as well as leaders for the industry." And yet another faculty member stated a personal goal was to "help students grow in their learning abilities especially in preparation for construction management." One faculty member summarized the goals of several other faculty members stating that his/her goal was to "produce quality graduates."

The document analysis of the advertisements for 38 CM faculty positions indicated that teaching ability and teaching experience was a requirement for candidates

for a majority of the open positions (20 out of 32 advertisements). One advertisement stated that the candidate "must demonstrate a strong commitment to excellence in teaching, advising students, [and] scholarly activity." Another advertisement stated: "The candidate will have exceptional promise in both undergraduate and graduate teaching and research mentorship." Some of the advertisements required the candidate to have skill sets consistent with course content as evidenced by one advertisement that wanted the candidate to have "demonstrated excellence in project scheduling, estimating, and cost management." Another advertisement stated that the preferred qualifications for the candidate include "previous teaching and work experience in the areas of construction methods, construction management, contract documents, concrete technology, and/or mechanical and electrical systems." The requirement for a combination of teaching experience and experience in the construction industry was also a common theme that emerged from the document analysis. One advertisement stated that the program preferred the candidate to have "a combination of teaching at the university level and a minimum of five years of recent relevant industry experience at the project management level."

A good researcher.

Another theme that emerged from the interviews with CM department heads, from faculty responses to open-ended questions, and the document analysis was that candidates for open faculty positions should be good researchers. Several of the department heads referred to the relationship between a faculty member having a doctoral degree and the ability to do research. One department head stated:

> A true professor is creating new knowledge, and you can create new knowledge in teaching or you create new knowledge in research. And if you want to transfer that new knowledge to students, other professors, to industry, you've got to write.

This individual went on to make the connection between having a doctoral degree and doing research stating:

> The doctoral degree means that you probably did a dissertation, you had to do research to get the dissertation, and if you did research and the dissertation, you had to demonstrate that you created some new knowledge that's exclusively yours. So that means that if you have a Ph.D. you probably understand the art of doing research, the science of doing research.

Another department head stated the existing faculty members want new faculty members to help with research.

The need to do research and publish was reflected in the responses from existing CM faculty members to the open-ended question: What is (are) your long term goals as a faculty member teaching in a construction education program? Twenty faculty members responded that their long term goals were to do research and/or publish. Several of the responses indicated specifically the research agendas that these faculty members want to pursue. One respondent stated, "I will be completing a Ph.D. in Education Technology and will continue to publish and present papers related to construction management and educational type research." Another respondent stated that he/she wants to "publish articles [and] publish a textbook." Some respondents were less specific such as the response from one faculty member who stated the goal was "to develop a strong research agenda."

The document analysis of the advertisements for 38 CM faculty positions indicates that research ability is a preferred qualification for candidates for 10 out of the 32 advertisements for open positions. One advertisement stated that the candidate must

"develop an agenda in construction research." Another advertisement stated that the candidate must have "demonstrated research and scholarly achievements." The need for funding to support research was specified by the advertisement that stated: "Candidates are expected to secure research funding and are expected to compliment and diversify current research." Another advertisement wanted the candidate to have the "ability to conduct research and scholarly activities."

Professional registration or certification.

One of the preferred qualifications for a candidate for an open faculty position specified in 12 of the 38 advertisements was that of professional registration or certification. One of the advertisements specifically stated: "The successful candidate must possess, or obtain within 5 years, registration as a Professional Engineer or a Certified Professional Constructor." Another advertisement stated that the candidate must be "licensed as Architect, Professional Engineer, or Certified Professional Constructor within two years of employment as a condition of continued employment." Another advertisement stated that the candidate must obtain "registration as a Certified Professional Constructor or Professional Engineer within one year from the date of employment."

The requirement for professional registration or certification was not mentioned in the interviews with CM department heads or in survey responses by existing CM faculty. The interviews indicated that not all searches for candidates to fill open faculty positions were successful. The department heads indicated that the teaching responsibilities had to be fulfilled in other ways.

How the Responsibilities of Unfilled Faculty Positions are Fulfilled

The single most common response from CM department heads when asked how the teaching responsibilities are fulfilled when an open teaching position goes unfilled was that the departments hire adjunct faculty, typically from the construction industry, to do the teaching. One department headed stated, "A lot of places have more flexibility, than we do anyway, to use instructors and adjuncts, and I think that's a really good way to do it. You get more of an infusion of industry, real time case studies, and things like that – people bring into the classroom." Another department head at a university located close to two large metropolitan areas stated, "We have a great resource from industry for adjunct faculty. We have some excellent people who are practitioners who come in and teach with the minimum requirement as a master's degree to do the adjunct work." This approach was confirmed by another department head who indicated that they use adjunct professors to teach when a teaching position is unfilled. This individual stated, "For example, this year we had an unfilled position and we hired four additional people from industry to help fill it." And yet another department head stated, "When we have faculty positions that aren't filled, the teaching requirements are handled by part-time faculty."

But this department head also indicated that there are potential problems with using adjunct faculty stating:

> It's a challenge because people from the industry perceive all you do is come in and teach a class. And we all know there's a whole lot of preparation, there's a whole lot of grading, there's a whole lot of thought structure in teaching. And so getting the right kind of industry person who has that discipline and understanding is often a challenge.

Another potential problem is if the academic institution is too far from a source for adjunct faculty as one department head stated, "If your distance from a major

metropolitan area is more than 20-25 minutes [you] just can't draw the people to serve that way."

Need for the Creation of Doctoral Degree Programs

The qualifications of candidates for open faculty positions provide a foundation upon which a discussion about the potential need to create doctoral programs focused solely on construction management can be initiated. Each of the interviewed CM department heads and the faculty members who responded to the survey addressed the question about whether or not there is a need to create doctoral programs focused solely on construction management.

Each one of the interviewed department heads stated that there is a need to create doctoral programs in construction management. One of the department heads stated, "I think there is a need, long-term, for the profession of construction management to have a full range of degrees." Another department head addressed the hiring of new faculty and their qualifications stating:

> The profession [construction management] is growing and right now we try to meet these requirements of the Ph.D., and we invariably have to hire a civil engineer because that is what they can get a Ph.D. in, or architecture, I suppose. But right now the profession needs to recognize that we are different than civil engineering and that we need to have a senior level degree to meet our faculty needs.

The focus on the need for faculty to teach in construction education programs was addressed by another department head responding to the question about the need to create doctoral programs in construction management when he/she stated:

> I think they do [need to be created]. I don't know that every school need to have one [a CM doctoral program] but I think there needs to be a core [number of programs offering a doctoral degree in construction management] just so that we have people that are ready and prepared to become teachers in the university setting.

Of the faculty who responded to the survey, 61.9% agreed or strongly agreed with the statement: There is a need to create doctoral programs in construction management. Only 14.5% disagreed or strongly disagreed with this statement, and 22.6% indicated that they neither agreed nor disagreed. If the individuals who neither agree nor disagree are removed from the respondents, 80.0% of the responding faculty members with an opinion agree that doctoral programs in construction management need to be created. One of the faculty members responding to the open-ended question about their long term goals as a faculty member teaching in a construction management education program stated he/she wanted to "establish a doctoral program in construction management."

The apparent need to create doctoral programs in construction management, as identified by department heads and faculty members, leads directly to the next research question which asked how the creation of doctoral programs in construction management would impact the supply of faculty members available to teach in construction education programs.

Impact that New Doctoral Degree Programs would have on Faculty Supply

Since the only doctoral program focused solely on construction management just came into existence in July 2005 (refer to the last section in this chapter), no one can accurately predict how the creation of more doctoral programs in construction management will impact the availability of individuals to fill open faculty position in construction education programs. However, the interviews with CM department heads and the survey results indicate that the creation of doctoral programs in construction management would provide more potential faculty members.

First, there is a shortage of individuals with the required or desired qualifications to fill open faculty positions. These qualifications as identified by the CM department heads, existing faculty members, and the document analysis of advertisements for candidates to fill open positions in construction education include: a doctoral degree, experience in the construction industry, the ability to be a good teacher, the ability to be a good researcher, and professional registration or certification.

Second, since 100% of the advertisements for CM faculty require or prefer the candidate to have a doctoral degree, without more construction management doctoral programs available, the only individuals who can meet the qualification have a doctoral degree in engineering, architecture, technology, or education among others. There are benefits to getting faculty from different disciplines because construction management is an interdisciplinary degree. As one CM department head stated:

> I think that we can draw from a broad array of population [for faculty positions] too, that we shouldn't just look at someone who's necessarily done undergraduate CM, but we should draw upon some civils and other people, maybe in a business background but found their way to construction management as their form of business.

This same department head, as quoted earlier, also stated:

> The profession [construction management] is growing and right now we try to meet these requirements of the Ph.D., and we invariably have to hire a civil engineer because that is what they can get a Ph.D. in, or architecture, I suppose. But right now the profession needs to recognize that we are different than civil engineering and that we need to have a senior level degree to meet our faculty needs.

It is apparent that department heads and existing faculty in construction programs believe that creating doctoral degree programs in construction management will produce graduates to fill open faculty positions. Since one of the qualifications for candidates to fill open faculty positions in construction education is experience in the construction

industry, these new doctoral programs, if created, may need to have a specific amount of experience as an admission requirement.

Relationship Questions

There were several research questions that focused on whether or not there is a relationship between variables. Six questions used the existing faculty members' perceived need for more faculty members to teach in construction education programs as the dependent variable. The six independent variables included: the size of the construction education program in which existing faculty members are teaching; existing faculty members' current teaching appointment; the length of time current faculty members plan to continue teaching in construction education; academic degrees earned by existing faculty; the numbers of years existing faculty members have taught in construction education; and the amount of faculty members' experience in the construction industry.

Size of the programs and perceived need for faculty.

There are two questions addressed in this section: (a) Is there a difference between the size of the programs in which the faculty members teach and the perceived need for construction management faculty in the program in which they are teaching? (b) Is there a difference between the size of the programs in which the faculty members teach and the perceived need for faculty in the United States? Existing faculty indicated their agreement with the statements using a 5-point Likert-type scale ranging from 1 (strongly disagree) to 5 (strongly agree). The three levels of program size were arbitrarily set at "less than 100 undergraduate students" (N = 3), "between 100 and 350 undergraduate students" (N = 45), and "more than 350 undergraduate students" (N = 27).

To assess the difference between responses from CM faculty teaching in programs of differing size and answer the first question, a one-way analysis of variance (ANOVA) was performed. The one-way ANOVA indicated that there is no significant difference in the perceived need for CM faculty in the responding faculty members' departments in which they are teaching across the three levels of program size (F = 1.245, df = 2/77, p = .294). There is no difference in the responses from faculty with different teaching appointments regarding their perception of the shortage of faculty to teach in their CM program.

A Kruskal-Wallis non-parametric ANOVA test revealed that there is no significant difference in the responding faculty members' perceived need for CM faculty in other construction education programs in the United States across the three levels of size of program in which the responding faculty members are teaching ($K\text{-}W^2$ = 0.143, p = .931). There is no difference in the responses from faculty with different teaching appointments regarding their perception of the shortage of faculty to teach in other CM programs in the United States.

Faculty members' current teaching appointment and perceived need for faculty.

This section also has two questions being addressed: (a) Is there a difference between the responding faculty member's current teaching appointment and the perceived need for construction management faculty in the program in which they are teaching? (b) Is there a difference between the responding faculty member's current teaching appointment and the perceived need for faculty in the United States? Existing faculty indicated their agreement with the statements using a 5-point Likert-type scale ranging from 1 (strongly disagree) to 5 (strongly agree). The three levels of teaching

appointment are "tenured" (N = 46), "tenure-track" (N = 19), and "other" which includes special appointment, adjunct faculty, etc. (N = 18).

To assess the difference between responses from CM faculty across the three levels of teaching appointment and answer the first question, a one-way ANOVA was performed. The one-way ANOVA indicated that there is no significant difference in the perceived need for CM faculty in the responding faculty members' departments in which they are teaching across the three levels of teaching appointment ($F = 2.583$, $df = 2/77$, $p = .082$).

A Kruskal-Wallis test revealed that there is no significant difference in the responding faculty members' perceived need for CM faculty in other construction education programs in the United States across the three levels of teaching appointment ($K\text{-}W = 5.112$, $p = .078$).

Perceived need for faculty and length of time faculty plan to teach.

The two statements to which the participants responded using a 5-point Likert-type scale ranging from 1 (strongly disagree) to 5 (strongly agree) were: (a) There is a shortage of faculty to fill open positions in my department, and (b) There is a shortage of faculty to fill open positions at other construction education programs in the United States. The levels of time the participants anticipate continuing to teach in a construction education program were set at 1 – 5 years (N = 16), 6 – 10 years (N = 27), 11 – 15 years (N = 16), 16 – 20 years (N = 11), and more than 20 years (N = 11).

Both the Pearson correlation table and the Spearman correlation table show no correlation between the number of years the participant anticipates continuing to teach in a construction education programs and either perceived shortage of faculty in the

department in which the participant is teaching (Pearson r = -.218, n = 78, p = .056) and the perceived shortage of faculty to teach in other construction education programs in the United States (Spearman r = .081, n = 73, p = .496).

It is not surprising that there was a positive correlation between the perceived shortage of faculty in the department in which the participant is teaching and the perceived shortage of faculty to teach in other construction education programs in the United States (Spearman r = .661, n = 78, p < .0001).

Perceived need for faculty and faculty's academic degrees earned.

There are two questions addressed in this section: (a) Is there a difference between academic degrees earned by the participants and their perceived need for construction management faculty in the program in which they are teaching? (b) Is there a difference between academic degrees earned by the participants and their perceived need for faculty in the United States? Existing faculty indicated their agreement with the statements using a 5-point Likert-type scale ranging from 1 (strongly disagree) to 5 (strongly agree). There were two academic degrees earned categories: master's degree (N = 38) or doctoral degree (N = 35).

An independent groups t test revealed that the master's degree group (M = 3.98, SD = 1.050) did not differ from the doctoral degree group (M = 4.35, SD = .919), t (df) = -1.668, p = .100, Mean Difference = -.376, for their perceived need for construction management faculty in the program in which they are teaching.

The Mann-Whitney U analyses revealed significant difference between responses from participants with a master's degree and participants with a doctoral degree. The sum of the average ranks that participants with a doctoral perceived a need for faculty at

other construction education programs in the United States was significantly higher (M rank = 43.83, n = 35) than the average ranks of participants with a master's degree (M rank = 30.71, n = 38) z = -2.881, $p < .01$. Generally, faculty members with a doctoral degree perceive the need for faculty at other construction educations in the United States as higher than how faculty members with a master's degree perceive that same need.

Perceived need for faculty and numbers of years that faculty has taught.

The research question asks, "Is there an association between the perceived need for construction management faculty and the number of years that they have taught in construction education?" Participants responded with the number of years they have taught full-time in construction education. The minimum amount of time taught was 1 year, and the maximum amount of time taught was 32 years (M = 12.46, SD = 7.604, n = 78). The two statements to which the participants responded using a 5-point Likert-type scale ranging from 1 (strongly disagree) to 5 (strongly agree) were: (a) There is a shortage of faculty to fill open positions in my department, and (b) There is a shortage of faculty to fill open positions at other construction education programs in the United States.

Both the Pearson correlation table and the Spearman correlation table show no correlation between the number of years the participants have taught in construction education and either perceived shortage of faculty in the department in which the participant is teaching (Pearson r = .189, n = 75, p = .104) and the perceived shortage of faculty to teach in other construction education programs in the United States (Spearman r = .194, n = 70, p = .108).

Perceived need for faculty and the amount of faculty's industry experience.

The research question asks, "Is there an association between the perceived need for construction management faculty and the amount of the faculty's construction industry experience?" Participants responded with the number of years they have worked full-time in the construction industry. The minimum amount of time worked in the construction industry was 2 years, and the maximum amount of time worked was 45 years ($M = 17.36$, $SD = 9.952$, $n = 84$). The two statements to which the participants responded using a 5-point Likert-type scale ranging from 1 (strongly disagree) to 5 (strongly agree) were: (a) There is a shortage of faculty to fill open positions in my department, and (b) There is a shortage of faculty to fill open positions at other construction education programs in the United States.

The Pearson correlation table shows no correlation between the number of years the participants have worked in the construction industry and their perceived shortage of faculty in the department in which the participant is teaching (Pearson $r = -.046$, $n = 81$, $p = .686$). The Spearman correlation table shows a correlation between the number of years the participant has worked in the construction industry and the perceived shortage of faculty to teach in other construction education programs in the United States (Spearman $r = -.256$, $n = 76$, $p = .026$). The effect size equals .256. The correlation is medium or typical. It seems the more years of construction experience that a faculty member has the less aware they are of the need for faculty to teach in other construction education programs, or the fewer years of experience that these faculty members have the more aware they are of the need. A Pearson correlation table was created to check if there is a negative correlation between the number of years a faculty member has taught

and the number of years of construction experience they have (Pearson $r = -.379$, $n = 78$, $p = .001$). The correlation is significant at the 0.01 level. The effect size is .379 so the negative correlation is medium or typical. Generally, the more teaching experience faculty members have, the less construction experience they have. The fewer number of years they have taught in construction education, the less aware they are of the need for faculty to teach in other construction education programs.

Additional Analysis

During the course of data analysis it became apparent that there are several research questions that have been answered by these data but were not asked in the original research design. Table 14 provides a list of additional research questions the data collected is able to address with the proposed statistical method of answering the question.

Table 14 *Additional research questions*

Additional Research Question	Method of Answering the Question
Is there a difference between the academic degrees earned by current faculty members and whether or not they believe that a requirement to teach in a construction education program should be a doctoral degree?	Independent groups t test. If there is a significant difference then effect size will be calculated.
Is there a difference between the academic degrees earned by current faculty members and the perceived need to create doctoral programs focused solely on construction management?	Independent groups t test. Effect size will be calculated if there is a significant difference.
Is there a difference between the type of doctoral degree earned and the perceived need to create doctoral programs focused solely on construction management?	One way ANOVA. Effect size will be calculated if there is a significant difference.
Is there a difference between the academic degrees earned by current faculty members and whether or not they believe that a requirement to teach in a construction education program should be a minimum of 5 years of construction experience?	Mann-Whitney U test.

There are other questions that could be answered by the data collected as part of this research, but they may not help determine if there is a need for the creation of doctoral degree programs focused solely on construction management. The four additional questions help determine the results of this needs assessment.

Relationship between Doctoral Degree Required to Teach and Degree Earned

When asked to respond to the statement, "A qualification to teach in a construction education program should be a doctoral degree," participants responded using a 5-point Likert-type scale ranging from 1 (strongly disagree) to 5 (strongly agree). An independent groups *t* test revealed that Group 1, participants with a master's degree ($M = 2.00$, $SD = 1.012$, $n = 42$), differ from Group 2, participants with a doctoral degree ($M = 3.37$, $SD = .998$, $n = 38$), t (df) $= -6.079$, $p < .001$. Calculations reveal the effect size equals 1.37 which means the strength of the relationship is large or larger than typical. Faculty members with a doctoral degree are more likely than faculty members with a master's degree to believe that having a doctoral degree should be a qualification of candidates for faculty positions.

Need to Create CM Doctoral Degree Programs and the Degree Earned

Participants were asked to respond to the statement, "There is a need to create doctoral degree programs in construction management" using a 5-point Likert-type scale ranging from 1 (strongly disagree) to 5 (strongly agree). An independent groups *t* test revealed that Group 1, participants with a master's degree ($M = 3.44$, $SD = 1.119$, $n = 37$), do not differ from Group 2, participants with a doctoral degree ($M = 3.70$, $SD = 1.102$, $n = 38$), t (df) $= -1.047$, $p = .299$. With no significant difference between the groups, the effect size was not calculated. Faculty members with a master's degree are

just as likely to believe there is a need to create construction a management doctoral degree programs as are faculty with a doctoral degree.

Need to Create CM Doctoral Degree Programs and Type of Doctoral Degree

If the participants had a doctoral degree, they were asked where that degree resides with the options being: engineering (n = 14), architecture (n = 8), education (n = 7), and other (n = 7). These participants were asked to respond to the statement, "There is a need to create doctoral degree programs in construction management" using a 5-point Likert-type scale ranging from 1 (strongly disagree) to 5 (strongly agree).

To assess the difference between responses from participants with a doctoral degree across the four levels of doctoral degree types, and answer the research question "Is there a difference between the type of doctoral degree earned and the perceived need to create doctoral programs focused solely on construction management?" a one-way ANOVA was performed. The one-way ANOVA indicated that there is no significant difference in the perceived need to create doctoral programs in CM across the four levels of participants' doctoral degree types (F = 2.819, df = 3/30, p = .056). With no significant difference between the groups, the effect size was not calculated. Participants with a doctoral degree are just as likely to believe there is a need to create doctoral programs focused solely on construction management regardless of whether their Ph.D. is in engineering, architecture, education, or other.

Relationship between Construction Experience Required to Teach and Degree Earned

Another research question that emerged from the data analysis was: Is there a difference between the academic degrees earned by current faculty members and whether

or not they believe that a requirement to teach in a construction education program should be a minimum of 5 years of construction experience?

The Mann-Whitney U analyses revealed significant difference between responses from participants with a master's degree and participants with a doctoral degree. The sum of the average ranks that participants with a master's degree believe that a requirement to teach in construction education programs should be a minimum of 5 years of construction experience was significantly higher (M rank = 46.65, n = 42) than the average ranks of participants with a doctoral degree ($M = 33.70$, $n = 38$) $z = -2.688$, $p <$ .01. Faculty members with a master's degree are more likely than faculty with a doctoral degree to believe that a qualification for a candidate to teach in construction education programs should be a minimum of 5 years of construction experience.

While construction management programs are interdisciplinary in their content drawing on engineering, architecture, technology, and business, they are a unique discipline. Even the Department of Educational Statistics classifies Construction Management as a distinctive program in their Classification of Instructional Programs under category 52 (Business, Management, Marketing, and Related Support Services). During the 2004 – 2005 academic year between August 2004 and May 2005, 100% of the Associated Schools of Construction advertisements for open construction education faculty positions required or preferred the candidate to have a doctoral degree. Many of the open positions go unfilled because the demand for faculty members to teach in construction education programs exceeds the available supply.

There are five primary qualification areas for candidates around which search committees evaluate individuals to fill open faculty positions in construction education:

doctoral degree; experience in the construction industry; the ability to be a good teacher; the ability to be a good researcher; and professional registration or certification. This research confirms what is found in existing literature: about half of faculty members teaching in construction education programs have a doctoral degree and meet the current qualification requirements.

CHAPTER 5: DISCUSSION

Data analyzed for this research project focused on three primary aspects of construction education: the demand for faculty; the qualifications for individuals to fill open faculty positions; and the need to create construction management doctoral programs. But before a discussion about these topics is initiated, a summary of the answers to the research questions will be presented.

Summary of Answers to the Research Questions

There were 11 original research questions and four additional questions that emerged from the data analyses. The first five original questions were answered using the qualitative and quantitative data. The last six original questions were relationship questions focusing on the association or difference between independent variables and dependant variables; these questions were answered using quantitative data.

Demand for Faculty in Construction Education Programs

The first research question was: What is the extent or magnitude of demand for faculty in construction management programs?

The results of the qualitative and quantitative data analyses indicate that at the current time, and for the past several years, the demand for qualified individuals to teach in construction education programs exceeds the available supply. As one department head stated, "There is a desperate shortage" of construction management (CM) faculty. The CM program in which this department head works had 11 individuals in the pool of

candidates for an open tenure-track position, and from August 2004 through May 2005 there were 32 construction education programs advertising for 38 open positions. There are more open positions than there are candidates applying for those positions. Another department head stated, "There is a constant need [for CM faculty, and] has been for probably 4 – 6 years. I don't see that subsiding at all. It is a constant need at a high level." This department head is of the opinion that other disciplines have more than twice as many candidates in their pool of applicants as do CM programs searching for faculty members. Another department head quantified the need for faculty in construction education programs stating, "It appears to me that we need about 50 Ph.D.'s in construction management every year. We have a shortage" of CM faculty. This department head is of the opinion that the need for CM faculty has another component unique to construction education. Many of the faculty teaching in construction education are second-career individuals. They had a career in the military or in the construction industry, "and then later decided to get a master's or a Ph.D. and come over and teach. That means, age-wise, our faculty looks older and dog-eared where their [other disciplines'] faculty looks younger. Faculty on the CM side is old and retiring."

There are more open positions than there are candidates applying for those positions and, as one department head indicated, "A lot of those people in that pool, probably half of them, don't meet our requirements for the position."

Qualifications of Faculty to Teach in Construction Education Programs

The second research question asked: What are the required and/or desired qualifications for construction management faculty positions?

These data yield five primary areas around which the term "qualified" is defined. There are no absolutes or minimums when search committees evaluate individuals to fill open faculty positions. But these five areas seem to be the focus for evaluating candidates applying for these open positions. These required or preferred qualifications include: doctoral degree; experience in the construction industry; the ability to be a good teacher; the ability to be a good researcher; and professional registration or certification. Even though 16.6% of faculty members responding to the survey disagreed or strongly disagreed with the statement, "The department at the institution in which I teach prefers to have faculty with a doctoral degree," 100% of the advertisements for 38 open faculty positions required or preferred the candidates to have a doctoral degree. It seems that faculty members teaching with a master's degree do not want to see construction education programs making the transition to a doctoral degree being a requirement for a tenure-track position. There is a large significant difference between faculty with a master's degree and faculty with a doctoral degree and how they feel about a doctoral degree being a required qualification for faculty teaching in construction education. In general, participants with a master's degree do not believe that a requirement to teach in construction education should be a doctoral degree. Conversely, participants with a doctoral degree believe that a requirement to teach in construction education should be a doctoral degree.

Responsibilities of Unfilled Faculty Positions

The third research question asked: How are the responsibilities of unfilled construction management faculty positions met?

The majority of construction education programs use adjunct professors to meet the teaching requirements of those programs if open faculty positions go unfilled. These adjunct professors typically come from the construction industry. Although they bring construction experience into the classroom, they may or may not be good teachers, and they do not contribute to the scholarly efforts (research and publication) of the faculty as a whole. With regard to teaching ability adjunct faculty members bring to the department, one department head stated:

> It's a challenge because people from the industry perceive all you do is come in and teach a class. And we all know there's a whole lot of preparation, there's a whole lot of grading, there's a whole lot of thought structure in teaching. And so getting the right kind of industry person who has that discipline and understanding is often a challenge.

With respect to adding to the scholarly efforts of the department another department head stated, "A true professor is creating new knowledge, and you can create new knowledge in teaching or you create new knowledge in research." These adjunct professors fill the teaching requirements associated with unfilled faculty positions, but there are still voids that remain unfilled.

Need for Construction Management Doctoral Programs

The fourth research question asked: Is there a need for doctoral degree programs to prepare individuals to teach and do research in the interdisciplinary academic discipline called construction management?

A total of 80% of the faculty members responding to the survey who had an opinion agreed that CM doctoral programs should be created. As one department head stated:

> The profession [construction management] is growing and right now we try to meet these requirements of the Ph.D. and we invariably have to hire a civil

> engineer because that is what they can get a Ph.D. in, or architecture, I suppose. But right now the profession needs to recognize that we are different than civil engineering and that we need to have a senior level degree to meet our faculty needs.

The discipline, or profession, of construction management is growing and maturing. Many of the construction management programs are over 50 years old, and many have offered master's degrees in construction management for more than 25 years. The demand for CM undergraduates continues to be very strong with almost all of the over 100 construction education programs reporting a placement rate between 95% and 100% (Bilbo et al., 2000; Gunderson et al., 2002; Rosenbaum & Rubin, 2001). Providing a strong education for students enrolled in these programs requires faculty members who have construction experience to bring into the classroom and can be good teachers. For these CM programs to be respected in academia, the faculty needs to be engaged in scholarly productivity (funded research and published works), and they need to have the qualifications of other faculty in the academy, including a doctoral degree.

A more complete and detailed discussion on the need for doctoral programs focused solely on construction management continues on page 94 of this chapter.

The Creation of CM Doctoral Programs and the Impact of Faculty Availability

The fifth research question asked: How would the creation of construction management doctoral programs impact the availability of construction management faculty?

The department heads who were interviewed believe that creating CM doctoral degree programs would increase faculty availability. One department head stated that there are two groups of individuals who are affected as CM programs shift to a "Ph.D. required" for faculty members, "One group of people are people that are yet to be hired,

the people you bring in under the understanding they have to have a Ph.D. or they have to get it within so many years in order to be viable for tenure. The second group of people are those who are already with tenure when the rules change mid-stream on them. The big thing that's a problem to them is the ability to be a full professor." Tenured faculty members without a doctoral degree are in this situation whether or not CM doctoral programs are created. In general, universities are requiring all departments to hire faculty members with doctoral degrees.

The fifth research question leads to more questions that the research and data analysis did not answer. If several CM doctoral degree programs existed, would there be enough doctoral students to fill the new programs? Anecdotal information indicates that individuals who have focused their doctoral studies on construction management at one of the universities with CM emphasis option in engineering, architecture, or education programs for example, may have enrolled in these new CM doctoral degree programs. Some of the existing faculty with master's degrees may be interested in working on a CM doctoral degree. A limitation of this research design is that potential CM doctoral students were not specifically identified.

Another question that emerges from this discussion is how many of the graduates from a CM doctoral program would work in the construction industry rather than accepting faculty positions in construction education programs? Research indicates the salaries in academia are much less than in industry (Burt & Choudhury, 2002). Would the challenges, intellectual stimulation, and opportunity to create new knowledge be enough to keep these CM doctoral graduates in academia? Is the quality of life in academia enough to lure candidates from the construction industry?

Relationship Questions: A Search for Differences and Associations

The answers to the six original association or difference questions indicate that, in general, faculty members are aware of the need for faculty to teach in their construction education programs. There were no differences or associations found in the various independent variables and the dependent variable, the perceived need for faculty in the department in which the participants are teaching. It certainly makes sense that faculty members are aware of an ongoing search to fill an open faculty position in the department in which they are teaching, and they are also aware if the search fails.

Two of the questions in which the dependent variable is the perceived need for faculty to teach at other construction education programs yielded a difference. The statistical analysis of the second part of the ninth question found a difference in the independent variable. Participants with a doctoral degree perceive the need for faculty at other construction education programs as higher than do faculty with a master's degree. In the second part of the eleventh question, an association was discovered between the number of years of construction industry experience participants have and whether or not they perceive a need for faculty to teach at other construction education programs in the United States. The more years of construction industry experience faculty members have, the less likely they are to be aware of the need for faculty in other departments.

This statistical association leads to another association. There is a negative correlation between the number of years of experience in the construction industry and the number of years taught in construction education. In general, the more years of experience in the construction industry a person has, the fewer years they have taught.

Each of the difference or association questions are addressed separately in the subsections that follow.

The statistical difference and association found and reported above may be attributable to the insular aspect of teaching. This is referred to as academic isolation, teacher isolation, or professional isolation, and is defined as the physical and social isolation experienced by many teachers and is found at all levels of teaching (Fullan & Hargeaves, 1996; Norrell & Ingoldsby, 1991; Rogers & Babinski, 2002; Slater & Trowbridge, 2000). As Fullan and Hardreaves (1996) state:

> Professional isolation of teachers limits access to new ideas and better solutions, drives stress inward to fester and accumulate, fail to recognize and praise success, and permits incompetence to exist and persist to the detriment of students, colleagues and the teachers themselves. p. 5

This isolation may prevent faculty members teaching in construction education programs from being aware of what is happening in other construction programs at other universities. Because of the tendency to gravitate toward academic isolation, if faculty members are aware of faculty shortages at other construction programs, then the need for faculty is very apparent to almost everyone in the discipline.

Difference in the size of the CM program and perceived need for faculty.

The sixth research question has two parts: Is there a difference between the sizes of the programs in which the faculty members teach and their perceived need for construction management faculty in the program in which they are teaching? Is there a difference between the sizes of the programs in which the faculty members teach and perceived need for faculty in the United States?

There was no difference in the responses to either question from faculty teaching in programs of differing size. Most faculty members responding to the survey believe

that there is a shortage of faculty to teach in construction education programs regardless of the size of the program in which they are teaching.

There was the possibility that larger programs, or smaller programs, have found it less difficult to find faculty to teach in these construction education programs. This is not the case; faculty teaching in all sizes of construction education programs, based on the number of undergraduates, have the perception that there has been a shortage of qualified candidates to fill open faculty positions at their program and at other programs across the country.

Difference between teaching appointment and perceived need for faculty.

The seventh research question also has two parts: Is there a difference between the responding faculty members' current teaching appointment (tenured, tenure-track, special appointment, adjunct, etc.) and their perceived need for construction management faculty in the program in which they are teaching? Is there a difference between the responding faculty members' current teaching appointment and perceived need for faculty in the United States?

There was no difference in the responses from faculty with different teaching appointments to either question. Most faculty members responding to the survey, regardless of their teaching appointment, believe that there is a shortage of faculty to teach in construction education programs.

It was anticipated that adjunct professors or individuals teaching under a special appointment would be less aware of the faculty needs at other construction programs. It is surprising that regardless of teaching appointment, most faculty members are aware of the shortage of qualified individuals to fill open faculty positions.

Association between perceived need for faculty and time continuing to teach.

The eighth research question asked: Is there an association between the perceived need for construction management faculty and the length of time they plan to continue teaching in any construction education program?

There was no association between the perceived need for CM faculty and the length of time the faculty responding to the survey plan to continue teaching. Here again, most faculty members believe that there is a shortage of faculty to teach in construction education programs regardless of the length of time they plan to continue teaching. It is not surprising that if there is no difference in the perceptions of faculty with different teaching appointments, there would be no difference in the perceptions of faculty regardless of the length of time they plan to continue teaching in construction education.

Difference between degrees earned and perceived need for faculty.

The ninth research question has two parts: Is there a difference between the academic degrees earned by current faculty members and their perceived need for construction management faculty in the program in which they are teaching? Is there a difference between the academic degrees earned by current faculty members and perceived need for faculty in the United States?

There was no difference in the responses from faculty with a master's degree or a doctoral degree with respect to the program in which they are teaching. Most faculty members responding to the survey believe that there is a shortage of faculty to teach in the construction education programs in their department.

But participants with a doctoral degree perceive the shortage of faculty at other programs as higher than do the participants with a master's degree. It is possible that

faculty with a doctoral degree are more engaged with faculty in other programs as they collaborate on scholarly pursuits and are, therefore, more aware of the need for faculty in all programs. Faculty without a doctoral degree may be in special or adjunct appointments with no time allotment for research and collaboration with faculty in other programs. This may be where academic isolation can be identified. Faculty with a master's degree may be doing more teaching and have less time to collaborate with faculty members from other construction education programs. This isolation could reduce their awareness of what is happening at other construction education programs.

Association between perceived need for faculty and years taught.

The tenth research question asked: Is there an association between the perceived need for construction management faculty and the number of years they have taught in construction education?

There was no association between the perceived need for CM faculty and the length of time the faculty responding to the survey have taught in construction education. Regardless of the number of years that participants have taught, most faculty members believe that there is a shortage of faculty to teach in construction education programs.

This is surprising since new teachers are more prone to academic isolation (Fullan & Hargeaves, 1996; Norrell & Ingoldsby, 1991; Rogers & Babinski, 2002; Slater & Trowbridge, 2000). It was anticipated that faculty members who have been teaching a short amount of time would be unaware of the needs of other construction education programs in the United States. This is especially interesting since it was found that there was an association between the number of years the participants have worked in the construction industry and their perceived need for faculty to teach in other construction

education programs in the United States. It was also found that there is a larger than typical negative correlation between the number of years of experience in the construction industry and the number of years that faculty members have taught in construction education.

Association between perceived need for faculty and construction experience.

The eleventh research question asked: Is there an association between the perceived need for construction management faculty and the amount of the faculty members' construction industry experience?

There was no association between the number of years the participants have worked in the construction industry and their perceived need for faculty to teach in the department in which they are teaching. Regardless of the years of experience they have before transitioning to academia, current faculty members are aware of the need for faculty in their department.

There was an association between the number of years the participants have worked in the construction industry and their perceived need for faculty to teach in other construction education programs in the United States. The more experience in the construction industry that faculty members have, the less aware they may be of the need for faculty in other construction education programs. There is also a larger than typical negative correlation between the number of years of experience in the construction industry and the number of years that faculty members have taught in construction education. This makes sense; the longer faculty members have worked in the construction industry, the less time they would have had available to teach, and they might be less aware of faculty shortages in other departments.

Additional Research Questions

There were more statistical differences and associations found in the four additional research questions that emerged from the data analyses. These questions had not been identified prior to the research design being developed.

Difference between degree earned and doctoral degree qualification.

The first additional research question asked: Is there a difference between the academic degrees earned by current faculty members and whether or not they believe that a requirement to teach in a construction education program should be a doctoral degree?

There is a large significant difference between faculty with a master's degree and faculty with a doctoral degree and how they feel about a doctoral degree being a required qualification for faculty teaching in construction education. In general, participants with a master's degree do not believe that a requirement to teach in construction education should be a doctoral degree. Conversely, participants with a doctoral degree believe that a requirement to teach in construction education should be a doctoral degree.

Difference between degrees earned and need to create a CM doctoral degree.

The second additional research question asked: Is there a difference between the academic degrees earned by current faculty members and their perceived need to create doctoral degree programs focused solely on construction management?

There was no significant difference found between faculty with a master's degree and faculty with a doctoral degree and how they feel about the need to create doctoral programs focused solely on construction management. In general, both groups of participants, faculty with a master's degree and faculty with a doctoral degree, believe there is a need to create doctoral programs focused solely on construction management.

Difference between type of doctorate and need to create a CM doctoral degree.

The third additional research question asked: Is there a difference between the type of doctoral degree earned by current faculty members and their perceived need to create doctoral degree programs focused solely on construction management?

There was no significant difference in the opinions of participants with a doctoral degree when they are separated by the type of doctoral degree and whether or not they believe there is a need to create doctoral degree programs focused solely on construction management. It is just as likely that a participant with a doctoral degree in engineering will believe there is a need to create CM focused doctoral degree programs as does a person with a doctoral degree in architecture or in education.

This is a little surprising. It was expected that individuals with a doctoral degree in engineering and/or architecture would believe that that since doctoral degree programs in their discipline already exist, there is no need to create more doctoral degree programs. This may indicate that construction management has matured as an academic discipline and a profession and is being accepted as such by individuals from other disciplines, at least those teaching in construction education.

Difference between degrees earned and construction experience qualification.

The fourth additional research question asked: Is there a difference between the academic degrees earned by current faculty members and whether or not they believe that a requirement to teach in a construction education program should be a minimum of 5 years of construction experience?

There was a significant difference in the opinions of faculty with a master's degree and faculty with a doctoral degree with respect to a required qualification for

candidates seeking to fill open faculty positions to have at least five years of experience in the construction industry. Faculty members with a master's rated this requirement higher than faculty with a doctoral degree. Participants with a master's degree have an average of 4 more years of experience working in the construction industry than participants with a doctoral degree. It should be noted that the average number of years of industry experience is high for both groups. Respondents with a master's degree had an average of 18.55 years of construction experience, and respondents with a doctoral degree had an average of 14.87 years of experience. Since the standard deviations are 8.52 years and 9.87 years respectively, there is a broad range of levels of experience among the participants. But the high means indicate that many of the participants teaching in construction education are second career individuals.

It seems that faculty members without a doctoral degree feel that of the required and preferred qualifications for faculty members, having construction experience is very important. Since both groups of faculty members, those with a master's and those with a doctorate, have a substantial amount of experience in the construction industry, it may be that faculty members without one of the required or preferred qualifications, a doctoral degree, want the experience qualification to be most important.

Additional Findings

The First Construction Management Ph.D. Program

When this research project started about two years ago, and up to the completion of this dissertation, there have been department heads and faculty members in several construction education programs talking about trying to create a doctoral degree program in construction management in their universities. But up until just 6 months ago, none of

these programs had received approval from their administrations to actually create the first doctoral degree program in construction management (CM) in the United States. In the course of doing research it was discovered that a university, not known by the author to be among the aforementioned group of prospective universities, had received administrative approval to start a doctoral degree program in CM. On July 1, 2005, Michigan State University started the first doctoral degree program in CM in the United States. Dr. Matt Syal, Graduate Program Coordinator for the CM master's program and now the new Ph.D. program at Michigan State University identified three reasons why a Ph.D. program is needed in CM:

- To be a respected discipline in academia;
- To produce CM faculty needed across the country; and
- To increase the amount of research and publications coming out of the CM faculty.

Ingredients for Creating a Construction Management Doctoral Program

Dr. Syal stated that for any program to be respected in academia you "must contribute in teaching, in outreach, and in the entire scholarly production of the campus. To be respected you must offer a bachelor's, a master's, and a Ph.D." After referring to the shortage of faculty to teach in construction management programs and the fact that most programs want faculty with a Ph.D., Dr. Syal identified six criteria for developing the new Ph.D. in construction management at Michigan State University.

1. The CM program has to be its own department or school.
2. The CM master's program must be strong and must be doing a lot of research. They showed the administration the research being done at the master's level.

3. The faculty needs to be doing funded research. They were receiving many competitive grants including National Science Foundation (NSF), National Institute of Occupational Safety and Health (NIOSH), U.S. Department of Energy, Michigan Department of Transportation, etc., and they showed administration that having a Ph.D. program would help get more of these grants.
4. These faculty need to be publishing their research.
5. Alumni support is needed to convince the administration that "CM has arrived as a profession".
6. Colleagues from engineering, urban planning, and other schools need to support the creation of a Ph.D. in CM.

This recipe seems to contain the logical ingredients required for the creation of a new CM doctoral program at most universities. Michigan State University has paved the way for other CM departments or schools to create their own doctoral programs.

Conclusions and Discussion

Several of the discoveries in this research warrant additional discussion. The first issues to be discussed are the requirements for faculty in construction education: doctoral degree and construction experience. Then theory-based disciplines and applied disciplines are compared and discussed. The next section focuses on a discussion about the interdisciplinary nature of construction. The last section discusses the need for doctoral degrees focused solely on construction management.

Doctoral Degree Required; Construction Experience Required

The fact that 16.6% of faculty responding to the survey disagree or strongly disagree with the statement, "The department at the institution in which I teach prefers to have faculty with a doctoral degree," and the fact that 100% of the advertisements for 38 open faculty positions require or prefer candidates with a doctoral degree, deserves some discussion.

There is another aspect of the data that is not consistent with the fact that 100% of the advertisements for open faculty positions require or prefer candidates with a doctoral degree. Participants were asked to respond to the statement, "A qualification to teach in a construction education program should be a doctoral degree." A total of 52.3% disagreed or strongly disagreed compared to 27.9% who agreed or strongly agreed. This seems to mean that current faculty members teaching in construction education prefer to have new faculty with construction experience rather than someone with a doctoral degree. These faculty members seem to value the doctoral degree less than do university administrators.

Traditionally, faculty members teaching in construction education have come from careers in the construction industry or the military. They have been second career individuals. A master's degree was often the terminal degree for these educators and remains the status quo in some CM programs. As CM programs have matured and grown, they have become more accepted in mainstream academia and, therefore, the faculty teaching in these CM programs must have the same qualifications of faculty teaching in other disciplines. These qualifications include having a doctoral degree. But having a doctoral degree is usually not enough for faculty teaching in construction education. Having experience in the construction industry is typically a preferred or

required qualification for teaching in construction education. Based on information from the respondents (N = 84) the current faculty teaching in ACCE accredited CM programs have an average of 17.36 years of experience in the construction industry. The importance of having industry experience to teach in construction education may be the reason why the majority of faculty members do not believe that a doctoral degree should be a required qualification to teach in these programs. A total of 75.6% of responding faculty agree or strongly agree with the statement: A qualification to teach in a construction education program should be a minimum of 5 years of construction experience. Of the total faculty responding (N = 86) to this statement, 46.5% strongly agree with that statement, whereas only 16.3% disagree or strongly disagree. The difference between the requirements delineated in the advertisements for open construction education faculty positions and the beliefs of current faculty members may be the fact that most universities are aided in gaining accreditation by having faculty members with doctoral degrees, and in construction education having industry experience is important.

Construction education has matured during the past 60 years. Undergraduate programs are pursuing accreditation from ACCE, ABET or NAIT. As of 2004, thirty-one (55.4%) of the 56 ACCE accredited construction education programs offer a master's degree. The maturing of construction education means that all three degrees, bachelor's, master's and doctoral degrees should be offered. As one of the department heads stated, "I think there is a need, long-term, for the profession of construction management to have a full range of degrees."

The emphasis on the requirement for faculty members to have a doctoral degree comes from the top echelons of administration. As one department head stated, "Our president and provost look for the Ph.D. [in the candidates for open positions] in the end." These administrators do not seem to put the same emphasis on faculty members having experience in the construction industry as do current faculty members. This may be because these administrators do not understand that construction education is an applied rather than a theory-based discipline.

The level of faculty confidence in their knowledge.

This research project has reported the perceptions of existing faculty members who responded to the survey. Figure 2 shows that faculty members are more confident in

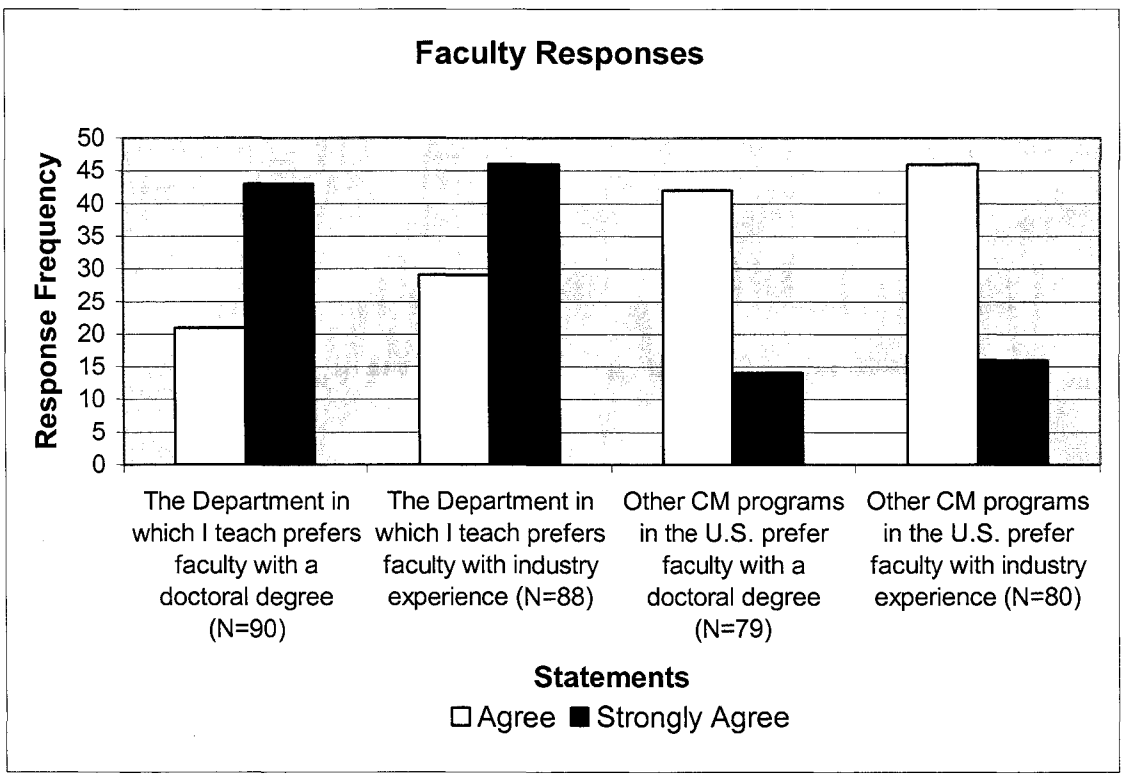

Figure 2, Faculty responses to statements about the program in which they are teaching and about other construction education programs in the United States.

their knowledge about the program in which they are teaching than in their knowledge about other construction education programs in the United States. These faculty members were asked to respond to statements about the department in which they are teaching and about other construction education programs in the United States using a 5-point Likert-type scale ranging from 1 (strongly disagree) to 5 (strongly agree).

Theory-Based Disciplines and Applied Disciplines

Engineering and architecture are theory-based disciplines; faculty members teaching in engineering or architecture are not usually required to have industry experience. One CM department head was referring to this difference between construction education and civil engineering when stating, "...the profession [construction management] needs to recognize that we are different than civil engineering and that we need to have a senior level degree to meet our faculty needs." This department head understands the difference between theory-based disciplines and applied disciplines. Construction management is an applied discipline, similar to medicine and law. Construction education is similar to medical and law schools wherein most individuals teaching in a medical school or a law school have practiced as a medical doctor or as an attorney.

It is important for the majority of faculty teaching in construction education programs to have experience in the construction industry so actual experiences can be used to emphasize concepts being taught. Faculty must also build and maintain relationships with construction contractors and associations to help insure the concepts being taught are aligned with current construction practices, materials, and methods. As

one department head stated, "Certainly maintaining current relations with industry is as important as having had previous experience in industry."

Construction Education: An Interdisciplinary Profession

One aspect of construction education that differentiates it from the design disciplines, engineering and architecture, is that it is an interdisciplinary degree. The CM profession draws upon several academic disciplines to develop its knowledge foundation. Construction education as defined by the ACCE (2000) accreditation requirements draws upon the following: engineering and architecture, referred to as construction science by ACCE, and business, in addition to the basics of knowledge that resides in the construction discipline. Construction discipline courses include estimating, planning and scheduling, construction accounting and finance, construction law, safety, and project management (ACCE, 2000). These courses may have a variety of titles but the basic course content includes these basic elements in order for the construction education bachelor's degree programs to be accredited.

As an interdisciplinary field of study, faculty teaching in these programs should come from construction related disciplines such as engineering, architecture, business, law, and construction management among others. Since the construction industry rates oral and written communication skill sets as the number one desired trait in entry-level employees (Gunderson et al., 2002; Mead & Gehrig, 1997), faculty members with these skills sets are very important. The minimum ACCE requirement for course work in oral and written communication skills is 8 semester hours. ACCE (2000) states, "Construction is concerned with people and their relationships. Thus, the ability to communicate, both orally and in writing, and the understanding of human behavior are

essential assets to the constructor. In addition [to the required 8 semester hours of oral and written communication skills], oral presentation, business writing and ethics must be integrated throughout the construction-specific curriculum" (p. 8). This indicates the importance of having faculty members who can teach these skill sets and/or draw upon other disciplines such as technical writing or business communication.

The Need for Construction Management Doctoral Degree Programs

There is a shortage of qualified individuals to teach in construction education programs. In most cases, qualifications for faculty members in these programs included having a doctoral degree, having experience in the construction industry, the ability to become a good teacher and, at some institutions, professional registration or certification. Individuals with construction experience and a doctoral degree in engineering, architecture, technology, education, or other disciplines could fill open faculty positions. If there were several doctoral degree programs focused on construction management and/or construction education, graduates from those programs would be available to fill open faculty positions in construction education programs.

The creation of doctoral programs focused solely on construction management would also increase the amount of research being done in this field. The profession of construction management could be improved with more research, both applied and theory-based research.

Retiring faculty in construction education.

Since 43 out of 81 (53.1%) faculty members who responded to the survey will continue teaching in construction education for just 1 – 10 more years, the need for

faculty replacements will continue. Refer to Table 15 for more information on how long the current faculty in construction education plan on continuing to teach.

These retirement projections support statements by CM department heads which indicated that the shortage of faculty to teach in construction education will continue in the foreseeable future. This also supports the need to create doctoral programs focused solely on construction management.

Table 15 *Number of years CM faculty plan to continue teaching*

Number of Years Faculty Members Plan to Continue Teaching	Response Frequency	Valid Percentage
1 – 5 years	16	19.8%
6 -10 years	27	33.3%
11 -15 years	16	19.8%
16 – 20 years	11	13.6%
More than 20 years	11	13.6%
Total	81	100.0%

Concluding Remarks

Construction education and, more specifically, construction management postsecondary programs have matured since they were first created almost 80 years ago. With many of the existing CM programs having been created about 60 years ago, the level of maturity warrants the creation of doctoral degree programs focused solely on CM. As one CM department head stated, "There is a need, long-term, for construction management to have a full range of degrees." The Associated Schools of Construction representing construction education programs publishes the *International Journal of Construction Education and Research* providing faculty members a forum for peer reviewed journal articles. The number of ACCE accredited construction education programs offering a master's (31 out of 56 programs) is another indicator of the maturity that has been reached by the construction education discipline.

The results of this study indicate there is a shortage of faculty to teach in construction education; one of the required or preferred qualifications for candidates to fill open faculty positions is a doctoral degree; there is a need to create doctoral degrees focused solely on construction management; and existing faculty members are approaching retirement. Since existing literature indicates that the demand for graduates from construction education programs will continue to remain constant and will most likely increase, the demand for faculty to teach in these programs will remain constant.

Suggested Additional Research

The most significant aspect of this research design that I would change in hindsight is the addition of another research phase. I would interview current faculty members who have expressed an interest in getting a doctoral degree and current students in engineering, architecture, technology, and/or education doctoral programs with a construction emphasis. I would try to determine if these people would prefer being in a doctoral program focused solely on construction management.

This research confirms the need for the creation of doctoral degree programs focused solely on construction management. The next step may be to determine what curricula should be developed for these new doctoral programs. The curricula might be focused in different aspects of CM including education or engineering as suggested by some department heads and faculty members in CM programs. The answers may lie in determining the body of knowledge for construction management. As an interdisciplinary degree or profession, can the body of knowledge be defined or is it fluid depending on the needs of the profession? This may be determined by finding out where graduates from these programs will work. Will all of the graduates with a CM doctoral

degree teach in CM programs or will a large percentage of the graduates go back into the construction industry?

Anecdotal information indicates that the Ph.D. is perceived to be a research degree and other doctoral degrees such as Eng.D., Ed.D., M.D., Au.D. D.A. or J.D. are considered to be a professional degree with less emphasis on research. This may be an incorrect perception. Since it is the university presidents and provosts that require candidates for open faculty positions to have a doctoral degree, it should be determined which types of doctoral degrees are acceptable to these administrators. It would also be very helpful in designing doctoral programs if the perceptions of these administrators (deans, provosts, presidents, etc.) surrounding doctoral degrees were known. The perceptions of these administrators will be a key to the success or failure of efforts to create doctoral programs focused solely on construction management.

There are questions that emerge from this discussion. If the new CM programs confer Ph.D. degrees, should they be modeled after research curricula found in engineering Ph.D. programs or after social science Ph.D. research curricula? If universities consider offering a doctorate in construction management, a professional degree, will this degree be acceptable to the administration at other institutions?

These questions need to be answered before the curricula can be determined and developed. The perceptions of deans, provosts, university curriculum committees, and university presidents will determine the success of new degree creation. There are several research projects embedded in these questions.

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Appendix A

On March 19 and 20, 1965, fourteen representatives from nine postgraduate institutions met at the University of Florida to consider the formation of what was to become the ASC (Associated Schools of Construction, May 9, 2001). Those 14 individuals unanimously agreed on the following:

> Building construction is a legitimate and unique area of study of sufficient professional stature and academic level to justify four-year-degree programs at universities.
>
> One of the greatest needs of such programs is that of clear identity and recognition by other allied disciplines (such as engineering and architecture), the building construction industry, and student candidates.
>
> An association of universities is desirable and necessary to coordinate the aims and goals of building construction education in universities.
> Subsequent to the above, the group officially formed an association to be called the "Associated Schools of Construction" with the following membership requirements:
>
> 1. Educational institution members only
> 2. Accredited colleges or universities offering four-year (min.) degree programs having major emphasis on building construction. Only one unit (college, department, etc.) to officially represent each university.
> 3. "Building construction" to be defined and identified as other than presently recognized allied fields of engineering, architecture, urban planning and other professional disciplines, per se. This does not mean, of course, that specific curricula within such areas which are "building construction" are not eligible.
> 4. All institutions represented at the meeting agreed to become active members, except the University of Minnesota, and the University of Nebraska. These two institutions did not have a curriculum in construction at that time, and consequently disqualified themselves.
>
> Further discussion resulted in unanimous agreement upon the following purposes and objectives of the association:
>
> 1. To establish the objectives and goals for the development of construction education.
> 2. To assist institutions of higher learning in the establishment and development of these stated objectives, standards, and goals pertaining to construction education within their respective universities.
> 3. To establish professional recognition (and identity) of the educational programs offered by the collective members of the association.
> 4. To promote closer cooperation and understanding between construction education and those areas of industry identified in the field. (Associated Schools of Construction, May 9, 2001, ¶ 4)

Appendix B

The survey sent to all faculty members teaching in ACCE accredited construction education programs was sent via the web-base survey software SurveyMonkey. SurveyMonkey, located at http://www.surveymonkey.com/, was used to invited faculty to participate in the survey, collect the responses from participants, and download the results in to an Excel spreadsheet.

The first e-mail sent to faculty stated:

> You have been selected to participate in an online survey focused on the need for doctoral degree programs in construction management. Your participation is completely voluntary. The survey should take approximately 15 minutes to complete. This project is sponsored by Colorado State University.
>
> Please click on the following link to participate.

The first reminder e-mail sent to faculty stated:

> This message is a reminder of your selection to participate in the web-based survey of faculty teaching in ACCE accredited programs. The survey focuses on the need for construction management doctoral degree programs in the United States. If you have already completed the survey I would like to express my appreciation for your participation.
>
> As noted before, your participation is completely voluntary. The survey will take approximately 15 minutes to complete. If you have not completed the survey please click on the link below to learn more and participate. This project is sponsored by Colorado State University.

The last reminder e-mail sent to faculty stated:

> For those who have already completed the survey I would like to express my sincere appreciation. This message is one last reminder of your selection to participate in the web survey focused on the need for construction management doctoral degree programs in the United States.
>
> If you have not participated as of yet, your participation is completely voluntary. If you choose to participate the survey will take approximately 15 minutes to complete. This project is sponsored by Colorado State University.
>
> Please click on the link below to learn more and participate.

Following is the survey similar to how it appeared in SurveyMonkey:

Colorado State University
Knowledge to Go Places

Exit this survey >>

Construction Management Programs Survey

Date: April 14, 2005

To: Faculty teaching in ACCE accredited programs

Re: An invitation to participate in research on the need for construction management doctoral programs

Dear Faculty:

I am a doctoral candidate in the Interdisciplinary program in the School of Education at Colorado State University. My doctoral research focuses on the level of need for construction management doctoral programs in the United States. I have chosen faculty teaching in ACCE accredited programs as participants because these programs are focused on the interdisciplinary discipline of construction management.

The title of my study is "Needs Assessment: Construction Management Doctoral Programs in the United States". I am asking for your assistance in this study to understand the perceived need for these doctoral programs. Your response to this survey will greatly enhance our understanding of the need for construction management doctoral programs in the United States.

The survey is being conducted via a secure web site and will take approximately 15 minutes for you to complete. If you choose to participate your participation in this research is voluntary. Your confidentiality and anonymity are ensured. You will not be individually identified with your questionnaire or responses. All collected data will be aggregated and grouped.

There are no known risks associated with participating in this study. Your responses to the survey may contribute to the possible identification of the need for construction management doctoral programs in the United States. If you have any questions or comments about this study, or if you would prefer to receive a paper copy of this survey, you may contact us using the information provided. By completing the survey you are agreeing to

participate in the study. Questions about participants' rights may be directed to the Colorado State University Regulatory Compliance Office at (970) 491-1563.

Thank you for your interest and participation in this research. The results of this study will be available at the following link during the Fall Semester, 2005.

To participate in the survey please click on the "Next" button below

Adviser:
Gene Gloeckner, Ph.D.
Associate Professor
(970) 491-7661
gloeck@cahs.colostate.edu

David E. Gunderson, CPC
Ph.D. Candidate
(970) 491-7960
gunderson@cahs.colostate.edu

Next >>

Colorado State University
Knowledge to Go Places

Exit this survey >>

Construction Management Programs Survey

Respond to the following statements based on your opinions about the construction management education program in which you teach.

Please click on the most appropriate response.

	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree	Do Not Know
1. There is a shortage of faculty to fill open positions in my department.	◡	◡	◡	◡	◡	◡
2. The majority of faculty in my department are doing construction management related research.	◡	◡	◡	◡	◡	◡
3. The majority of faculty in my department are publishing articles about their construction management related research.	◡	◡	◡	◡	◡	◡
4. There is an ample supply of faculty to fill open positions in my department.	◡	◡	◡	◡	◡	◡
5. The department at the institution in which I teach prefers to have	◡	◡	◡	◡	◡	◡

faculty with a doctoral degree.

6. The department at the institution in which I teach prefers to have faculty with construction industry experience.

7. It is difficult for the department in which I teach to fill vacant faculty positions.

8. What is (are) your long term goals(s) as a faculty member teaching in a construction management education program?

9. How much money (total sum) in research funding have you secured over the past five (5) years?

10. How many refereed journal articles have you had published in the past five years? (Include only articles on which you are the first author.)

<< Prev **Next >>**

Colorado State University
Knowledge to Go Places

Exit this survey >>

Construction Management Programs Survey

Respond to the following statements based on your opinions about construction management education programs in the United States.

Please click on the most appropriate response.

	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree	Do Not Know
1. There is a shortage of faculty to fill open positions at other construction education programs in the United States.	○	○	○	○	○	○
2. The majority of	○	○	○	○	○	○

faculty in other departments are doing *construction* management related research.						
3. The majority of faculty in other departments are publishing articles about their construction management related research.						
4. There is an ample supply of faculty to fill open positions at other construction education programs in the United States.						
5. Other construction education programs in the United States prefer to have faculty with a doctoral degree.						
6. Other construction education programs in the United States prefer to have faculty with						

construction industry experience.						
7. It is difficult for other construction education programs in the United States to fill vacant positions.						
8. In academia, you will always be a second class citizen unless you have a Ph.D.						

<< Prev **Next >>**

Colorado State University
Knowledge to Go Places

Exit this survey >>

Construction Management Programs Survey

Respond to the following statements based on your opinions about construction management education programs in the United States. (Please select only one box per statement.)

	Strongly Disagree	Disagree	Neither Agree or Disagree	Agree	Strongly Agree
1. In general, demand					

exceeds supply of qualified individuals to fill faculty positions in construction education programs.					
2. A qualification to teach in a construction education program should be a minimum of 5 years of construction experience.					
3. A qualification to teach in a construction education program should be a doctoral degree.					
4. Having a doctoral degree is more important than having construction experience for teaching in construction education programs.					
5. There is a need to increase construction related research and its publication in construction education programs.					

6. Currently there are colleges or universities that confer a doctoral degree that states that the degree is in construction management.					
7. Currently there are no doctoral programs focused solely on construction management (that include "Construction" on the diploma).					
8. There is a need to create doctoral programs in construction management (that include "Construction" on the diploma).					
9. If there were a doctoral program in the department in which I teach, I would be willing to take the time to serve on doctoral committees.					
10. Having a doctoral degree helps an individual to be a better teacher.					

11. Teaching in a department that has a doctoral program in construction management would help me grow as an educator and/or professionally.	◡	◡	◡	◡	◡
12. I am willing to accept the responsibility of acquiring research and some of the funding to support doctoral students and a doctoral program.	◡	◡	◡	◡	◡

13. If you had a Construction Management doctoral program in your department, who are the top three authors that would be required reading?

<< Prev **Next >>**

Colorado State University
Knowledge to Go Places

Exit this survey >>

Construction Management Programs Survey

Please answer the following.

Which academic degrees have you earned?
(Check all that apply, indicating your major.)

1. Bachelor's
   - 1a. Major in: _____
   - 2nd Major: _____

2. Master's
   - 2a. Major in: _____
   - 2nd Master's: _____

3. Ph. D.
   - 3a. Conferred in what academic department: _____
   - 3b: Emphasis: _____

4. Ed.D.
   - 4a. Conferred in what academic department _____
   - 4b. Emphasis _____

5. Other

5a. Degree:

Department:

6. Currently working on a degree

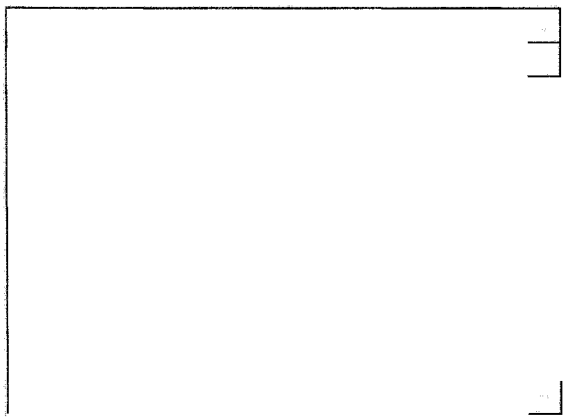
6a. Degree:

Department:

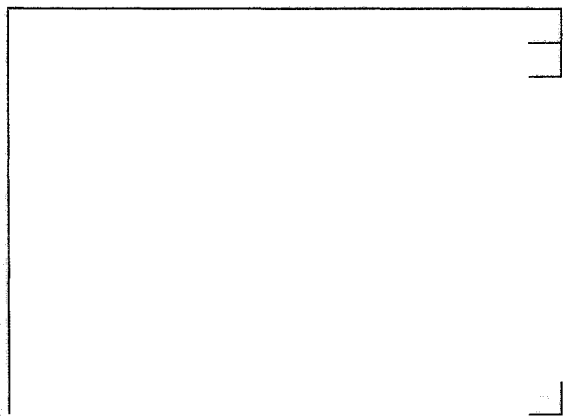
Emphasis:

7. Comments on degrees received:

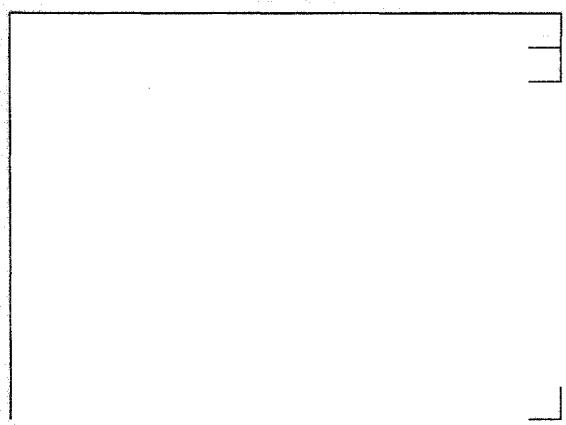
8. If you have a doctoral degree, what have you found most beneficial about having that degree?



9. If you have a doctoral degree, what have you found least beneficial about having that degree?



10. If you have a doctoral degree, how has having that degree been instrumental for your success in the classroom?



11. How many years have you taught in construction education?

Years (full time): _____

Years (part time): _____

12. Check the one that best descibes your current teaching position.

- Tenured
- Tenure-track
- Special appointment (year to year or multiple year)
- Adjunct faculty
- Other (please specify) _____

13. What is your best estimate of how many more years you plan on teaching in a construction education program?

1-5	6-10	11-15	16-20	More than 20
◡	◡	◡	◡	◡

14. When you leave teaching in construction education, why will you most likely leave?

- Retirement
- Work in the construction industry
- Another career
- Other (please specify) _____

<< Prev **Next >>**

Colorado State University
Knowledge to Go Places

Exit this survey >>

Construction Management Programs Survey

1. The construction education program in which I am teaching is:

- Less than 100 students at the bachelor's level
- Between 100 and 350 students at the bachelor's level
- More than 350 students at the bachelor's level

2. The construction education program in which I am teaching:

- Offers a master's degree with a construction management focus
- Does not offer a master's degree with a construction management focus at this time

3. I teach at:

- A Carnegie Research University I
- A Carnegie Research University II
- An institution with a teaching focus
- Other (please specify)

<< Prev **Next >>**

Colorado State University
Knowledge to Go Places

Exit this survey >>

Construction Management Programs Survey

1. What is your gender?

Female ( ) Male ( )

2. In what year were you born?

3. How many years of construction experience do you have?

Years (full time):

Years (part time):

Comments on this survey or this topic:

<< Prev **Done >>**

Appendix C

Approval from the Institutional Review Board

Colorado State University

Office of Regulatory Compliance
Office of Vice President for Research
and Information Technology
Fort Collins, CO 80523-2011
(970) 491-1553
FAX: (970) 491-2293

MEMORANDUM

TO: Gene Gloeckner, School of Education, 1588

FROM: Janell A. Meldrem, Administrator
Human Research Committee

SUBJECT: **PROJECT APPROVAL**
Title: Needs Assessment: Construction Management Doctoral Programs in the U.S.
Protocol No.: 05-014H
Funding Agency: N/A

DATE: February 11, 2005

The above-referenced project was approved by the Human Research Committee on February 8, 2005 for the period February 8, 2005 to February 3, 2006 with the condition that for the interviews, the attached consent form is signed by the subjects and each subject is given a copy of the form. It is the investigator's responsibility to obtain this consent form from all subjects. *NO changes may be made to this document without first obtaining the approval of the Committee.*

Because of the nature of the survey research, it will not be necessary to obtain a signed consent form. However, all subjects must receive a copy of the approved cover letter printed on department letterhead. The requirement of documentation of a consent form is waived under § __.117(c)(2).

Approval is to conduct 20 interviews using the approved consent form and 500 surveys using the approved cover letter.

A status report of this project will be required within a 12-month period from the date of approval. Renewal is the Principal Investigator's responsibility, but as a courtesy, you will be sent a reminder approximately two months before the protocol expires. The Principal Investigator will report on the numbers of subjects who have participated this year and project-to-date, about problems encountered, and provide a verifying copy of the consent form or cover letter used. The necessary form (H-101) is available from the Regulatory Compliance web page (see below). Should the protocol not be renewed before expiration, all activities must cease until the protocol has been re-reviewed.

It is the responsibility of the investigator to immediately inform the Committee of any serious complications, unexpected risks, or injuries resulting from this research. It is also the investigator's responsibility to notify the Committee of any changes in experimental design, participant population, or consent procedures or documents. This can be done with a memo which completely describes the changes and their consequences (new consent form or cover letter, or altered survey instrument, for example). Students serving as Co-Principal Investigators may not alter projects without first obtaining PI approval. The PI is ultimately responsible for the conduct of the project. Upon completion of the project, an H-101 should be submitted as a close-out report.

This approval is issued under Colorado State University's OHRP Federal Wide Assurance 00000647. If approval did not accompany a proposal when it was submitted to a sponsor, it is the researcher's responsibility to provide the sponsor with the approval notice.

Please direct any questions about the Committee's action on this project to me for routing to the Committee.

Attachment
cc: David Gunderson w/attachment

Appendix D

An analysis of all of the advertisements for open faculty positions in construction education programs was done to quantify the required and preferred qualification for candidates for those open positions. The advertisements were sent during the 2004 – 2005 school from the middle of August 2004 through the middle of May 2005 via the Associated Schools of Construction (ASC) web-mail system, posted on the ASC website, or both.

The document analysis is presented in its entirety on the following pages.

Number of CM Faculty Positions Announced	Date Advertise-ment Received	Closing Date	Appoint-ment Date	University or College Placing the Advertisement	Position Description	Position Qualifications: Doctorate	Doctorate Required	Doctorate Prefered	Position Qualification: Experience	Years of Experience Required	Years of Experience Preferred	*Position Qualifications: Other*
1	4/29/05	6/1/05	Fall 2005	Middle Tennessee State University	Full-Time Tenure Track	Earned doctorate with an emphasis in construction management or closely related field required for tenure	1		none listed			Must demonstrate a strong commitment to excellence in teaching, advising students, scholarly activity; have excellent interpersonal skills; have the ability to interact with local and national technical/professional communities; and have the ability and willingness to obtain external funding
1	4/19/2005 and 2/22/2005		8/18/05	Pennsylvania College of Technology	Faculty	Minimum qualifications include a Master's Degree in Construction Management or a related discipline. An earned Doctorate and college-level teaching experience are desired.		1	Six years of professional experience in the management of construction projects, with a minimum of four years in commercial, civil, and/or industrial sectors	6		College-level teaching experience desired; active membership in construction associations or organizations; and experience with construction management computer applications.
1	3/24/05	4/15/05	Fall 2005	San Diego State University	Full-Time Tenure Track at the rank of Assistant or Associate Professor	A Ph.D. in Civil Engineering, Construction Engineering, Construction Management, or a closely related field is required, with the Ph.D. completed at the time of appointment.	1		Industry experience in construction is desirable.		5	The candidate will have exceptional promise in both undergraduate and graduate teaching and research mentorship. The successful candidate must possess, or obtain within 5 years, registration as a Professional Engineer or Certified Professional Constructor. The candidate must demonstrate potential to develop and sustain extramurally funded research in construction both individually and as part of multidisciplinary project teams.

1	2/23/05	3/18/05	Fall 2005	Humbolt State University	Assistant Professor	An earned doctorate in industrial technology, construction management, industrial *education, or related* discipline from an accredited college or university, but consideration will be given to those with a master's degree combined with equivalent educational and professional experience.	1		Relevant teaching, scholarship, and construction industry experience.			Relevant teaching, scholarship, and construction industry experience. Evidence of experience in program and/or curriculum development. Ability to teach a broad range of construction related courses to diverse students in the major as well as general education students.
1	2/21/05	4/1/05	8/10/05	Virginia Polytechnic Institute and State University	Assistant/Associate Professor	Candidates are expected to possess a Ph.D. in Building Construction, Engineering, Architecture, or another related field.	1					Develop an agenda in construction research
1	2/21/05	4/1/05	Fall 2005	University of Louisiana at Monroe	Tenure-Track Assistant Professor	Minimum requirements include a master's degree in construction or a closely related field. Preference will be given to applicants with an earned doctorate.		1	Five-years experience in the U.S. construction industry	5		Preference for professional registration
1	2/10/05		Fall 2005	Drexel University	Full-Time Faculty	Minimum Qualifications: Master's degree in construction management or related discipline; Ph.D. in construction management or related discipline		1	Five years of professional experience in the US in a project management capacity	5		Demonstrated excellence in project scheduling, estimating, and cost management. Desirable Qualifications: demonstrated research and scholarly achievements

1	2/4/05	3/1/05	August 2005	University of Nebraska - Kearney	Tenure-Track Assistant/Associate Professor	Required: An earned doctorate in Industrial Technology or other appropriate terminal degree in the area of study is preferred; however, candidates who are ABD with substantial progress toward completion of the dissertation may be considered.	1		none listed			Preferred: Documented successful teaching ability at the university level. Industrial experience highly desirable, including technical CADD experience.
1	2/2/05	3/1/05	August 2005	University of Nebraska - Lincoln	Tenure-Leading Assistant/Associate Professor	The successful candidate will possess a Doctorate in Construction Engineering or a related engineering field. Exceptional candidates very near completion of a terminal degree may be considered.	1		Preference will be given to candidates with construction industry and/or teaching experience. Last search had a 5+ year requirement but could fill the position.			Preference will be given to candidates with construction industry and/or teaching experience.
1	1/31/05	3/15/05	Fall 2005	Texas A & M University	Assistant Professor	Requirements include a Ph.D. in Construction Management or closely related field. Candidates nearing completion of the doctorate (ABD) may be considered.	1		A minimum of five (5) years of relevant professional experience employed in an increasingly responsible position primarily in the US construction or comparable industry.	5		Two years of teaching experience may be substituted for one year of professional experience.
1	1/20/05	1/5/05	8/22/05	East Carolina University	Full-time Tenure-Track and/or Fixed Term positions	A doctorate is required for tenure-track appointment.	1		A combination of teaching at the university level and a minimum of five years of recent relevant industry experience at the project management level are preferred.		5	A combination of teaching at the university level and a minimum of five years of recent relevant industry experience at the project management level are preferred.

2	1/7/05	3/1/05	Fall 2005	California Polytechnic University - San Luis Obispo	Full-Time, Academic Year, Tenure Track Positions	Ph.D. is preferred		2	A minimum of five (5) years of relevant professional experience employed in the U.S. construction or comparable industry.	5		Preferred qualifications include: previous teaching and work experience in the areas of construction methods, construction management, contract documents, concrete technology, and/or mechanical and electrical systems
2	1/3/05	2/1/05	8/29/05	University of Wisconsin - Stout	Full-Time Tenure Track	Doctorate degree required prior to tenure decision	2		none listed			Licensed as Architect, Professional Engineer, or Certified Professional Constructor within two years of employment as condition for continued employment
1	1/3/05	2/1/05	8/29/05	University of Wisconsin - Stout	Full-Time Tenure Track	Master's Required, doctorate prefered		1	none listed			
2	12/10/04	3/1/05	8/15/05	Montana State University	Tenure-Track Assistant Professor	Required Qualifications: Master of Science in Construction Engineering. Prefered Qualifications: PhD in Construction Engineering or related field.		2	Increasingly responsible project management experience in the U.S. construction industry	5		Registration as a Certified Professional Constructor or Professional Engineer within one year from date of employment.
1	12/7/04	1/15/05	Fall 2005	Eastern Michigan University	Academic rank is commensurate with qualifications	An earned doctorate is preferred.		1	Relevant university teaching and construction industry experience are required.			Relevant university teaching and construction industry experience are required.
1	12/6/04	1/25/05	Fall 2005	Virginia Polytechnic Institute and State University	tenure track position at the associate/full professor level	Candidates are expected to possess a Ph.D. in Building Construction, Engineering, Architecture, or a related field.	1		none listed			Candidates are expected to secure research funding and are expected to compliment and diversify current research

1	12/3/04	1/10/05	Fall 2005	Western Carolina University	Tenure track Assistant/Associate Professor	Preferred qualifications include a Ph.D./Ed.D./D.Eng. degree from an accredited institution in engineering, technology, science, education, or related field. Candidates with a master's degree in CM & professional certification may be considered, however, willingness to secure terminal degree would be part of the requirement for tenure.	1		A minimum of three years of professional experience in U.S. construction is required, preferably at the management level.	3		Teaching experience at the college level is desirable.
1		1/15/05	8/15/05	California State University - Fresno	Tenure track Assistant/Associate Professor	An earned doctorate in Construction Management, Architecture, or Civil/Construction Engineering with an emphasis in construction is required for appointment to a tenure track position.	1		Relevant construction-oriented computer experience and full time construction management, architectural or engineering experience with a U. S. firm is preferred.			It is desirable that the successful candidate be a licensed contractor, registered architect or a registered professional engineer.
1		12/31/05	8/1/05	Georgia Southern University	Tenure-track Assistant Professor	Applicants must hold an earned Ph.D. or equivalent in Construction, Civil Engineering, or a closely related field by the start date.	1		A minimum of three years of relevant construction industry experience is required.	3		Applicants with registration as a Professional Engineer (P.E.) and prior teaching experience at the university level are preferred.
1		1/15/05	8/1/05	Northern Arizona University	non-tenure track instructor	Appointment Preferences: Candidates who are enrolled in a technical PhD program, or willing to acquire a PhD within the next five years		1	Two or more years of industry related experience and Extensive knowledge of U.S. Residential or Commercial building practice	2		Appointment Preferences: Experience teaching technical courses at the collegiate level

1		3/1/05	8/15/05	Purdue University	Tenure Track	Earned Ph.D. preferred. Successful candidate may be working on a Ph.D.	1		Professional construction industry experience in a free market economy is required.			
1		12/17/05	8/16/05	Southern Illinois University Edwardsville	Tenure-Track Assistant/Associate Professor/Professor	A Ph.D. in Construction Management or closely related field	1		At least five years of significant U.S. experience managing construction may be considered for appointment at the rank of Assistant Professor	5		Research in construction resulting in publications is expected in order to be considered for appointment at the rank of Associate Professor or Professor.
2		1/7/05	8/15/05	University of Florida	Tenure-track Assistant Professor	PhD in a construction-related field	2		At least five years of construction industry experience	5		Preferred credentials include: University-level teaching experience; Computer skills appropriate for area of expertise; and Appropriate licensure and professional registration
1		2/15/05	8/1/05	University of Southern Mississippi	Full-Time Tenure Track Assistant Professor	Preference will be given to candidates with an earned doctorate		1	Appointment Qualifications: Three years' nonacademic professional industrial experience Appointment Preferences: Five years' relevant industrial experience	3	5	Appointment Preferences: Professional registration, university-level teaching experience, and demonstrated potential to develop research.
1		2/15/05	8/16/05	Washington State University	Tenure-Track Assistant/Associate Professor/Professor	Appointment Preferences: PhD in Construction Management or related discipline		1	Appointment Qualifications: Five years professional experience in the United States in project management capacity	5		Ability to conduct research and scholarly activities.
1	12/17/04	1/7/05		Southern Polytechnic University	Tenure-Track Assistant Professor	Applicants must have an earnerd doctorate in Construction Management/Engineering or a closely related field.	1		Must have 5 years of experience in the US construction industry.	5		Preference will be given to candidates with professional registration and teaching experience.

1	10/15/04		1/1/05	Michigan State University		A Master's or PhD degree in Construction Management, Construction Engineering and Management, Architecture, Architectural Engineering, Civil Engineering, or a closely related field		1	Five years or more of relevant professional experience in construction project management, estimating, and, scheduling	5		Strong communication and computer skills; Demonstrable ability to teach at the undergraduate level is required in *several of the following areas:* construction cost estimating; construction project management and administration, construction project scheduling, construction technology, construction materials and methods, construction graphics with emphasis on computer-aided-design; A potential for conducting applied research; (6) Relevant professional licensing or certification is desirable.
1	11/28/04		8/116/05	Illinois State University	Assistant Professor	Earned doctorate in Construction Management, Civil Engineering, Architecture, or Industrial Technology-related area	1		Three to five years construction management experience in the U.S. highly desirable.	3	5	Teaching experience in an American Council of Construction Education (ACCE) accredited program preferred. Certified Professional Constructor (CPC) preferred.
1	11/29/04		8/29/05	Roger Williams University	Assistant/Associate Professor	An advanced degree in Construction Management or Construction Engineering (Ph.D. preferred),		1	Professional experience and registration as a Certified Professional Constructor or Professional Engineer preferred.			University-level teaching experience, demonstrated record of scholarly achievement, and excellent oral and written English communication skills required. Professional experience and registration as a Certified Professional Constructor or Professional Engineer preferred.
1	8/31/04		1/1/05	University of Cincinnati	Assistant Professor Tenure Track	Required qualifications include a PhD degree in Civil Engineering, Construction Management, or a related engineering discipline.	1		Professional registration, industry experience and teaching experience are desirable.			Professional registration, industry experience and teaching experience are desirable.

1	10/4/04		9/1/05	Milwaukee School of Engineering	commensurate with skills and experience	Minimum of a Masters degree from an accredited construction management or engineering (civil/mechanical) program. I called and talked to the Program Director and was told that a candidate with a doctoral degree was preferred.		1	Candidates with an engineering degree should also have some relevant work experience in the building construction field.			
38							23	15		4.375	5.00	
Positions for 32 Universities									Programs that quantify industry experience =	16	4	

Department Chair or Head Position	Date Advertise-ment Received	Closing Date	Appoint-ment Date	University or College Placing the Advertisement	Position Description	Position Qualifications: Doctorate	Doctorate Required	Doctorate Prefered	Position Qualification: Experience	Years of Experience Required	Years of Experience Preferred	Position Qualifications: Other
1		1/10/05	8/15/05	Boise State University	Chair, Construction Management Department at the Full or Associate Professor Level	Requirements for the position include an earned Ph.D. in construction management or a closely related field and five or more years of managerial or supervisory experience in the construction industry.	1		Requirements for the position include an earned Ph.D. in construction management or a closely related field and five or more years of managerial or supervisory experience in the construction industry.	5		Significant experience in academics is strongly desired. Those with an Ed.D. and the required experience in the construction industry will be given equal consideration.

1	1/26/05	1/31/05	Fall 2005	Arizona State University	Director, Del E. Webb School of Construction	Desired: PhD in a related discipline		1	Significant professional experience related to the construction industry			Research and teaching experience appropriate to the rank of Professor or significant construction industry leadership experience and interaction with higher education; evidence of facilitating transdisciplinary relationships with other disciplines (e.g. business, architecture, law, and other disciplines within engineering); and success and achievement in collaborative leadership that promotes high-level innovation, creativity, scholarship and diversity.
1	3/4/05	4/22/05	8/1/05	Indiana University - Purdue University, Indianapolis	Chair, Department of Construction Technology, and Full Professor	Preferred Ph.D. degree, in Design, Management, Engineering and/or Technology		1	Five or more years of managerial or supervisory experience in the construction industry	5		Expertise is sought in one or more of the following areas: Project Management, Surveying, Site Development, Field Operations, Construction Scheduling, Cost and Contract Administration, Ethics, Safety and/or Estimating.
1		2/15/05	Fall 2005	Pudue University	Professor and Head, Division of Construction Engineering and Management	Candidates for this position must hold a Ph..D. degree in engineering or a related field.	1					National distinction and international prominence in the scholarly field of construction engineering and management are required. The successful candidate must have strong ties to the construction industry in the United States.
4	Chair Positions						2	2		5		