WOMEN IN CONSTRUCTION MANAGEMENT: IDENTIFICATION OF THE MOST EFFECTIVE FACTORS IN ATTRACTING AND RETAINING FRESHMEN AND SOPHOMORE LEVEL STUDENTS

A Thesis

by

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ABSTRACT

Despite the several initiatives developed to encourage women to enter and remain in Construction Management (CM) programs, the percentage of women in CM continues to be low. This study was focused on identifying the factors and programs which are most effective in attracting and retaining female students in CM degree programs based on surveys administered to 40 female CM freshmen and sophomore students in five selected universities.

Awareness of career opportunities in the construction industry, internships completed before entering the degree program, and field trips to job sites were reported by students to be the three factors which were the most positively influential in their decision to enter the construction management programs. Similarly, construction lab classes, scholarships and fellowships, and internships were identified as the most effective in retaining female CM students.

The study also supports existing literature that there is a general lack of knowledge among high school students about the career opportunities and educational qualifications required in the construction industry. Several study participants advocated the need for high school initiatives such as shadowing programs to Construction Science classes and schools, mentoring programs, and workshops for high school students; and better advertisement.

Finally, some guidelines on how to improve advertisement of the industry to recruit females into CM programs are also provided. Based on the results obtained, advertisements must emphasize career opportunities in the Commercial and Residential sectors of the industry in terms of job profiles (both field and office) and job security. Similarly, the target population should be made aware of the coursework of CM degree programs and the educational qualifications required for a career in the industry. Scholarships and fellowships offered should also be emphasized.

DEDICATION

To my father for instilling in me the love for Construction, for demonstrating through his own life, that hard work and satisfaction come hand in hand and for constantly supporting me in all my endeavors.

To my mother, the most amazing woman I know, for always trusting me to take the right decisions and for all the sacrifices you have made to offer us the very best.

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NOMENCLATURE

ASU	Arizona State University
AU	Auburn University
CM	Construction Management
N/A	Not Applicable
NAWIC	National Association of Women in Construction
PU	Purdue University
STEM	Science, Technology, Engineering and Mathematics
TAMU	Texas A&M University

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CHAPTER I

INTRODUCTION

According to the Bureau of Labor Statistics (BLS), among 20 different industries, construction is the nation's fifth-largest contributor to job creation, generating more than 300,000 jobs from 2009 through 2012 (Clayton, Sadeghi, Spletzer, & Talan, 2013). Unfortunately, the industry suffers from a shortage of skilled employees at various levels just like most of the other Science, Technology, Engineering and Mathematics (STEM) disciplines. To counteract this shortage, the US has been encouraged to increase the diversity in these disciplines in order to remain globally competitive (National Academy of Sciences, 2007).

"We've all heard about the glass ceiling, but it looks the concrete one might be harder to crack" (Shanker, 2013, para. 1). Despite several efforts such as the Federal Contract Compliance Program and "President Obama's 'Educate to Innovate' campaign, which cites as one of its three goals to '… expand STEM education and career opportunities for underrepresented groups, including women and girls'" (Milgram, 2011, p.1), women continue to be a distinct minority in STEM disciplines such as construction. According to the National Women's Law Center (NWLC) (2012), the percentage of the U.S construction jobs held by women (2.6%) in 1983 remained the same in 2010. Just like many others, NWLC (2012) reports barriers such as gender stereotypes, sexual

harassment, lack of awareness about opportunities in construction, and insufficient instruction as being the major causes for this shortage.

Although, the overall percentage of women in the construction industry has grown slightly over the years, women in the field of Construction Management (CM) are in the distinct minority (Lopez del Puerto, Guggemos & Shane, 2011). In addition, the 2013 Household Data report by the BLS states that out of 821,000 construction managers in North America, only 7.3% are women.

The obviously low ratio of women to men in construction management emerges right at the initial stage of the career selection process, i.e., at the university level (Planty, Kena, & Hannes, 2009). Very few females choose a CM degree program, when compared to males. Furthermore, some female students enrolled in CM degree programs might change their major at a later stage.

> The decline in STEM enrollments along with retention problems raise concerns about the "shrinking" and "leaking" pipeline, the metaphor most often used to describe declining enrollments and the differential retention of women in STEM fields (e.g. Camp, 2002). As enrollments of women in STEM majors continue to decline, the pipeline "supplying" them to these fields is said to be shrinking (Camp, 2002). (Morganson, Jones & Major, 2010, p. 1)

So it is important to identify the factors that influence the construction career choice of women at this level to understand how to design recruitment and retention programs

aimed at attracting and retaining women in CM programs which will subsequently lead to an increase in participation of women in the construction industry.

Problem Statement

Therefore, in this study, surveys were administered to female CM freshmen and sophomore students to identify the factors and initiatives that are most effective in attracting and retaining female students to CM higher education programs.

Research Questions

In particular, the following research questions were addressed by this study:

Which programs/ initiatives are most effective in attracting female freshmen and sophomore students to CM degree programs?

Which programs/ initiatives are most effective in retaining female freshmen and sophomore students in CM degree programs?

Delimitations

Apart from Texas A&M University (TAMU), currently there are only six universities in USA which have a CM student enrollment of 340 or more and a minimum of 5% female CM enrollment. Although all of these universities were invited to participate in the study, only four universities namely, Colorado State University (CSU), Purdue University (PU), Arizona State University (ASU) and Auburn University (AU) responded positively. Therefore, the target population of the study consisted of all the

current female freshmen and sophomore students enrolled in CM or CM related undergraduate programs in these above mentioned four universities and TAMU.

Definitions

"Community service" refers to any construction related work as a volunteer with an organization such as Habitat for Humanity which is involved in providing building related service to underprivileged communities.

"Construction lab classes" include all non-theoretical classes incorporated in CM undergraduate degree program curriculums such as Construction Surveying which are aimed at exposing the students to the practical applications and software used in the industry.

"Construction Management Programs" represents all bachelor's degree programs which feature the management aspect of construction rather than the design or engineering aspects and equips students to manage, coordinate and supervise construction projects at the upper level management positions.

"In-classroom innovation" refers to active learning strategies such as use of videos, student group activities and better integration of technology.

"Internship" is defined as an opportunity offered by construction companies to provide a novice, practical experience in the construction industry for a limited period of time during which he or she is paid or unpaid.

“Marketing initiatives” constitute a total of all the activities which increase the awareness about construction industry and construction management programs among people in the community.

“Mentoring” refers to formal mentoring programs in high schools.

“Non- internship work experience” depicts any work experience in the construction industry, that did not include the title of intern,

Assumptions

It is assumed that the participants have answered truthfully and accurately. It is also assumed that the actual study sample was representative of the female CM population of the five selected universities.

Significance of the Study

Unlike other studies which have been carried out, this study relies on surveys administered directly to freshmen and sophomore level female students enrolled in CM degree programs in the United States. This study is also unique because it yields quantitative data to learn if existing programs designed to attract girls to construction education actually work and provide evidence of what factors should be focused on in the development of new programs. Since, a similar study identifying the most effective initiatives has never been carried out; the results of this study can significantly contribute to design of successful initiatives to recruit and retain women in CM degree programs and is of great value to academia and the industry.

CHAPTER II

LITERATURE REVIEW

A 2005 Report by Augustine, "Rising Above the Gathering Storm", cited alarming trends in the number of U.S. undergraduate degrees in science and engineering confirming the shortage of qualified science, technology, engineering, and math (STEM) professionals in the United States. Since then, there has been considerable interest in increasing the STEM workforce in the United States. However, we have not yet benefitted from the full potential of the female population.

> The absence of women from STEM education and careers affects more than the women; it is a missed opportunity for those fields. Women bring a different perspective that shapes and influences STEM disciplines. Having more women in the picture will not only help women themselves, it will also help society benefit from their expertise… In addition, women should not miss out on fulfilling, rewarding careers in science technology engineering or mathematics. (Milgram, 2011, p. 5)

Problematic Pipeline

Today, women constitute more than half of university and college populations (Morganson et al, 2010). However, they continue to be underrepresented in science, technology, engineering, and mathematics (STEM) fields (Planty et al, 2009). The

metaphors “shrinking" and "leaking" pipeline are often used to describe declining enrollments and the differential retention of women in STEM fields (Morganson et al., 2010). Some researchers have also added that “the rates of science and engineering course taking for girls/women shift at the undergraduate level and gender disparities begin to emerge, especially for minority women (Freeman, 2004; Planty et al., 2009).

Women in Construction

The Women’s Bureau of the Department of Labor defines a non-traditional or male-dominated industry or occupation as one which contains 25% or fewer women in total employment. While women have made headway into certain industries and occupations, there is still a great gap between women and men in many male dominated industries and occupations such as construction which present a major challenge for equal opportunities for women.

The 2012 Catalyst Census provides some interesting statistics on the representation of women in the construction industry. Out of the ten most male dominated occupations in the US, seven are construction related and less than 2% of the employees in all of these occupations are women.

Women in Construction Management

Although the percentage of women in the workforce has increased from approximately 48% to 49.8% since 2000, the women in the field of Construction Management are in the distinct minority (Lopez del Puerto et al., 2011). Furthermore, according to the

Household Data report by Bureau of Labor Statistics in 2013, out of 821,000 construction managers in North America, only 7.3% are women.

Barriers to Women's Participation in the Industry

> Those who oppose taking affirmative steps to end gender discrimination in construction may argue that women's low participation reflects a lack of ability or willingness to perform "dirty and dangerous" jobs. However, such assertions are not founded on reality. In fact, women's representation in many "dirty and dangerous" jobs comparable to construction has increased over the past 30 years. (Lenhoff, 2013, para. 2).

There are several studies which discuss the position of women in construction and many of these studies consider the problems faced by women to enter and remain in the construction industry as it is primarily these barriers which lead to a lower participation rate of women in the construction industry (Amaratunga, Haigh, Lee, Shanmugam, & Elvitigala, 2006). Therefore, it is vital to look into the problems faced by women entering construction education.

Image of the Industry

The image of the industry (Sewalk & Nietfield, 2013; Menches & Abraham, 2007; Moore, 2006; Fielden et al, 2000; Bennett, Davidson & Gale, 1999) has been identified as one of the major barriers to increased participation by women.

The image of the construction industry is typically portrayed as promoting adversarial business relationships, poor working practices, environmental insensitivity and a reputation for under performance (Construction Industry Board, 1996). The 'image' makes both men and women reluctant or uninterested in the industry (Bennett et al, 1999; Fielden et al, 2000).... The predominant image of construction is that of a male-dominated industry requiring brute strength and a good tolerance for outdoor conditions, inclement weather and bad language (Agapiou, 2002). It is principally this image that makes women uninterested in the industry. Gale (1994a) has found through his research that male school students are five times more likely than their female counterparts to consider a career in the construction industry. Therefore the image of the construction industry may be an important factor in the career selection process of young men and women (Gale, 1994a)… Dainty et al (2000) found that women may not remain in the industry after education, due to the incorrect picture of the industry portrayed by recent recruitment initiatives. Their research found that women are more likely to be attracted to the industry by such targeted recruitment campaigns, and they noted that women who had entered the industry due to such initiatives 'have a poor initial understanding of the culture of the industry and the inherent difficulties of working in such a male dominated environment'. (Amaratunga et al., 2006, p. 562)

Career Knowledge

Adding to the image problem is the general lack of knowledge and information about the industry, the career opportunities it can offer and the qualifications that are required (Sewalk & Netfield, 2013; Agaipou, 2002; Fielden et al, 2000; Gale, 1994). This is mainly due to the fact that teachers, parents and career advisors have only a vague, superficial knowledge of the industry and this is what is conveyed to the students (Amaratunga et al, 2006).

Sexual Stereotyping

Negative attitudes are caused toward science and engineering professions among women due to the persistent view of society that these professions are "male-dominated" (Knight, Ellen & Knight, 2011; Cunningham, Lachapelle & Lindgren- Streicher. 2005; Agapiou, 2002). This phenomenon is an example of gender stereotyping or sexual stereotyping.

> Relative to men, women tend to have less overall interest and perceive fewer educational and career benefits by pursuing these areas (NRC 2006). Despite an overall weak understanding of what engineers actually do by the general public (e.g., Cunningham et al. 2005; Cunningham and Knight 2004; NAE 2008), the sexual stereotyping of the "white male" engineering profession still begins at a young age and is carried throughout life, making it discouraging for women to enroll in programs once they reach college (Metz and Samuelsen 2000). Perhaps

> the field has sustained this stigma within the general public because it has always been dominated by white males, but the literature has not resolved the cause of the perception. (Knight et al., 2011, p. 4)

Culture and Work Environment

The construction industry displays a macho culture where relationships are characterized by argument, conflict and crisis (Gale, 1994b). As a result, employees (male and female) find that they are exposed to an extremely hostile environment.

Science/Engineering Culture of Construction Education

According to Knight et al. (2011), the construction industry culture is "dominated by high quantitative and computer skills, high levels of collaboration with peers, a focus on problem solving, and a pervasive interest in obtaining high-paying and prestigious jobs" (p. 3).

> On average, males prefer such structured, goal-oriented subjects (Abu El-Haj 2003), and STEM courses have traditionally been (Donald, 2002) and largely still are (Lattuca and Stark, 2009) arranged in a sequence-driven, hierarchical manner based on continuously building information from a foundation of concepts, though some recent, select efforts have experimented with more innovative curricula (e.g., Beichner et al. 2007). (Knight et al, 2011, p. 5)

> [On the other hand], women tend to gravitate toward the soft, pure, life fields (NSB 2010). Academic major choice theory with respect to STEM suggests that

> women may be underrepresented because they are simply uninspired by potential coursework, suggesting that shifts in pedagogical techniques could potentially influence recruitment. (Knight et al., 2011, p. 5)

Self Confidence

> There is some evidence that men and women in STEM fields have differing levels of self-confidence. Despite entering college with achievement and confidence levels similar to men, women in STEM fields tend to lose that confidence upon matriculation, potentially because of feelings of isolation when they are underrepresented in certain disciplines (Seymour 1995; Whitt et al. 2003). Interactions with male peers who believe women enrolled in STEM fields can either be smart or attractive, but not both, can also be harmful to their confidence and retention within the field (Seymour 1995). If a female is perceived to be smarter than her male counterparts, she will often be omitted from study groups and lose access to an encouraging peer network (Stake and Nickens 2005). (Knight et al, 2011, p. 5)

Initiatives and Programs Designed to Attract and Retain Women

Considerable efforts already have been made to combat some of these barriers and recruit and retain female students in STEM (Plumb & Reis 2007).

Undergraduate Mentoring

> Individual institutions of higher education have made substantial efforts to address the chilly climate amongst peers through undergraduate mentoring programs intended for women (e.g., Campbell and Skoog 2004) and STEM learning communities for women (e.g., Kahveci 2006). Kahveci (2006) reported that building a sense of community results in positive outcomes for women students and effectively addresses some of the STEM gender difficulties previously outlined. (Knight et al, 2011, p. 5)

Additionally, Lopez del Puerto et al. (2011), reports that the key behind a successful mentoring program is a good program coordinator who could match mentees with the appropriate mentors. In construction management programs, mentors can either be female faculty or peer mentors. When junior and senior female students are paired with freshman and sophomore female students, the older students can act as mentors and role models to younger students.

Targeting the Audience and Community

According to Lopez del Puerto, marketing approaches for construction management education programs should be modified to suit the interests of the prospective female students. Emphasizing on opportunities for research and enquiry and contributing to the well-being of their community and society as a whole can attract females to the construction management program. Milgram (2011) also encourages the emphasis of

how the program focuses on teamwork and collaboration, another area which attracts females. In addition, Lopez del Puerto et al (2011) states that "worldviews and career selection develop early in a student's life, it is important to reach out to grade school and middle school children. By the time students are in high school, they have already made their selection." (p.2).

Milgram (2011) also reports:

> The secret to recruiting women and girls to STEM classrooms is by sending the message that women can work in STEM careers and be successful and fulfilled in their work life while still having a personal life, and they need to receive this message repeatedly by showing female role models in the workplace that look like them. (p. 8)

Hire Female Faculty

Lopez del Puerto et al in their study (2011) also stated that "female construction management faculty can serve as role models to female students and influence both male and female construction management students' perception of who is a construction management professional" (p. 3). Study by Moore (2006) also show similar findings.

Recruitment by Female Faculty

Furthermore, many studies show that recruitment efforts are more effective if students can relate to someone like them. Therefore, Lopez del Puerto et al. (2011) recommends female construction management faculty to go to schools and share their experiences

with the female grade school, middle school, and high school students as this could potentially increase their chances of wanting to pursue construction management degrees.

Establish Clubs for Women in Construction

Lopez el Puerto et al. (2011) also encourages clubs that support "both the professional and social needs of female construction management students by providing an environment of camaraderie in which students can invite speakers to discuss issues that interest them, enjoy a ladies' night out, participate in construction jobsite visits, etc." (p. 3)

Camps for Prospective Female Students

Camp experiences could also motivate and attract prospective students to the construction management field (Lopez del Puerto et al., 2011; Jacobs- Rose, 2010; Amaratunga et al., 2006). Camps can not only answer prospective students' and parents' questions and concerns, but can also help them make educated decisions about the students' career choices.

Promote the Program to High School Advisors

Bilbo, Lavy, and Waseem (2009) reported that careers advisors not only have limited knowledge about the various construction programs, but also carry a negative image of the industry.

Lopez del Puerto et al (2011) attests this:

> High school advisors often share the common misconception that the construction management industry is not suited for females. In order to counter this negative stereotype, construction management programs and construction management companies must be proactive and educate advisors about the difference between construction labor and construction management. Increasing understanding among high school advisors regarding the construction management profession may lead to more high school advisors recommending construction management degrees to their advisees. (p. 4)

Modifying Construction Management Programs

> Empirical work in both secondary and postsecondary settings supports theories that suggest females are more interested in topics related to their lives, society, and broader concepts than males (Brotman & Moore 2008). Therefore, adjusting course-level practices to align with these findings may cause the discipline to become more attractive for females leading them to diversify by gender (Shulman 1997). For women especially, research shows that contextualizing math and science skills via a practical problem effectually sparks and can sustain a long-term interest in STEM subjects (Halpern et al. 2007). (Knight et al, 2011, p. 6)

Hands- on Experience

Cognitive theories indicate that women tend to approach problems and process information contextually from a personal experience….Several empirical studies have supported these theories through surveys or observations of classrooms in both K–12 and higher education settings. Research by Clewell and Campbell (2002) showed that hands-on learning for fourth and eighth graders yielded higher achievement in STEM, especially for females in physical science labs. Instead of typical weed-out introductory courses, increasing hands-on activities early in the course sequence promotes the recruitment and retention of women students (O'Callaghan and Enright Jerger 2006). " (Knight et al., 2011, p. 6)

In- Classroom Innovation

Terenzini et al. (2001) compared student learning outcomes between active and traditional learning techniques in engineering schools. They found that students in active learning settings have statistically significant advantages in learning outcomes, specifically in design skills, communication skills, and group skills. Similarly, in a meta-analysis of research on undergraduate education, Springer et al. (1999) found that this collaborative learning style yielded increases in student persistence for STEM fields in particular. In STEM courses, instructors still tend to rely on teacher-centered pedagogies. Students completing a survey in each of their first four semesters of college indicated that science courses typically rely on standard transmission-lecture techniques. There has been a slow realization

> among STEM faculty members that instructional methods should be retooled, and interactively designed courses that begin with questions relevant to everyday life have seen more recent success (Seymour 2002). (Knight et al, 2011, p. 6)

ACE Mentoring Program

In order to increase awareness and interest in engineering and construction careers among grade-school and high-school female students, a significant effort has been made by industry professionals to promote career opportunities in the construction industry. The ACE Mentor program, a not-for-profit organization that began in New York City in 1995, brings together practitioners from the construction industry, including architects, contractors, and engineers (ACE), to encourage high schools students interested in entering careers in construction and design-related fields. This program has now expanded to more than 20 sites across the United States. In the ACE Mentor model, architecture, engineering, and construction firms organize themselves similarly to the typical design and construction team, and then "adopt" local high school students. The ACE mentors introduce the students to various design professions and identify the role that each profession performs in planning, designing, and constructing a project. Students also tour their mentors' offices and visit construction sites (ACE Mentor 2007).

Internships

"The possibilities of travel opportunities, working in teams to "build something significant," and the opportunity to rise to positions of leadership have often been listed

by students in construction engineering programs as key reasons for selecting construction as a career" (Menches & Abraham, 2007). Internship opportunities for high school students on construction projects often provide to many female students the unique opportunity of exploring construction as a potential career choice and to become familiar with the range of work opportunities and rewards available in the industry.

Programs Based on an Integrated Approach

> Girls Excited about Engineering, Mathematics, and Computer Science (GE2McS) is a program designed to: nurture girls' enthusiasm for technology and engineering; encourage their continued participation in these fields in high school and college; and increase their awareness of the array of career opportunities within these fields. It consists of two sets of one-hour hands-on workshops for students, a discussion of gender issues in the Science, Technology, Engineering, and Mathematics (STEM) classrooms for teachers and guidance counselors, and a joint student and career panel. (Lawrence & Tancuso, 2012, p. 1)

A similar program at University level is the Women in Engineering Program (WEP) at the University of Texas at Austin, which hosts events every week in an effort to attract and retain women students in the College of Engineering. Significant events include: (1) Options Conference, in which industry professionals meet with engineering juniors and seniors to discuss various career options, such as design engineering, construction management, or research; and (2) First Year Initiative (FYI) which pairs first-year female engineering students with seniors who provide mentoring during the year.

Other Initiatives

Fielden et al. (2000) have proposed a multi-track, multi-agent approach beginning early in the educational system. Their proposal aims at "sowing the seeds for change" within the construction industry, and includes steps such as:

(1) visits and discussions at grade schools and at career events about opportunities in construction;
(2) organizing site visits to school age children;
(3) company sponsorships for college students considering careers in construction; and
(4) "take your son or daughter to work" days.

As can be seen, there is no dearth in the literature on barriers to entry and retention of women in construction. However, despite this wealth of information and a huge array of initiatives aimed at increasing the enrollment of women in construction management programs, women are still underrepresented. Therefore, it is very important to explore why we are still lacking women in construction management. This can only be clarified by directly finding out from the target population which among these initiatives actually reached them and were influential in making their decision to enter and remain in a construction management program.

CHAPTER III

METHODOLOGY

This research was designed to identify the programs and initiatives which are most effective in attracting and retaining female students in CM degree programs. To accomplish this, a mixed methods approach was used to evaluate the female CM students' understanding and perceptions of these initiatives.

Study Design

According to Gliner, Morgan, and Leech (2009), for studies such as this which identify the characteristics of an observed phenomenon, descriptive research must be employed. As a critical first step to this approach, an extensive literature review was carried out to find the factors previously stated by researchers, as influential to the construction education decision making process, as well as programs or initiatives aimed at attracting and retaining women in CM degree programs.

A survey which employs a Likert scale was developed utilizing the factors identified in the literature review, to explore which among these initiatives or factors identified in the literature were most effective in the students' decision to enter and remain in construction management programs. The survey questionnaire also included some open ended questions in order to further explore the student perceptions and to discover factors which have not already been identified in existing literature. The resulting survey

questionnaire (see Appendix B) took about 10 minutes to complete. The responses from the survey effectively answered the following questions:

- Are the female freshmen and sophomore CM students aware of these initiatives?
- If yes, how did it impact their degree program selection as well as their decision to continue in the CM degree program?
- Apart from these initiatives, what other factors influenced their decision to enter and remain in the CM degree programs?

Sample Selection

The sample came from the list of female undergraduate CM students at Texas A&M University (TAMU), Colorado State University (CSU), Auburn University (AU), Arizona State University (ASU) and Purdue University (PU). The total number of female freshmen and sophomore students enrolled in these CM programs is approximately 54. An additional sample consisting of student members of the National Association of Women in Construction (NAWIC) was also chosen. The purpose of this sample was to facilitate comparison of the results of this study with perceptions of female students enrolled in other CM or CM related programs in other universities and to compare the results of this study with the larger population.

Internal Validity

Once the survey questionnaire was developed, a focus group was carried out at TAMU, to modify the survey if necessary, to fit the context of the survey population prior to administering the survey to the actual sample. A total of fifteen Texas A&M female CM undergraduates participated in the focus group in two separate sessions. The purpose of this focus group was to identify the questions which the actual respondents will have difficulty understanding or could potentially interpret differently than the researcher intended. The participants of the focus group were asked to first take the survey and were requested to make side notes while taking the survey if they wanted clarification on any question or were confused about the intent of certain questions. After all the participants completed the survey, a debriefing session was held. During this session, the participants described problems they encountered (e.g. identifying questions requiring further explanation or wording that was confusing or difficult to read) and their impressions of the respondents' experiences in answering the questions. Using their valuable suggestions, the survey questionnaire was then improved. These focus group sessions helped mitigate threats to internal validity.

Data Collection

Once the changes recommended by the focus group participants were made to the survey questionnaire, the surveys were administered in person at TAMU and at CSU at the beginning or end of class sessions. The freshmen and sophomore level classes in both

the universities were chosen in such a way that overlapping was minimal and this way, a robust sample was obtained.

Participants received a packet of information which included the informed consent, the survey questionnaire and a blank note card. Students were informed not to include any personal identifiers on the survey questionnaire. However, it should be noted that the survey was incentivized with the chance to win an Amazon.com gift card valued at $10 each. Students were informed that gift cards will be distributed electronically to randomly selected participants via the email address provided. They were also informed that the email addresses would be used to contact them for future research on the topic. To be entered into the gift card draw, each respondent was given a chance to voluntarily provide contact information, in the form of an email address on the note card. Contact information was limited to student email addresses only. Although they were handed out together, the note cards containing email addresses were never physically connected to survey responses and only the Principal Investigator had access to the survey questionnaires and the note cards.

In addition, the link to the Web-hosted survey site was emailed to the female CM students of AU, ASU and PU by the administrative assistants of the respective schools. Furthermore, the study and its online survey link were brought to the attention of NAWIC student members twice by NAWIC's home office through a Facebook post and their monthly newsletter.

Respondent anonymity was explicitly guaranteed. The NAWIC membership listserv was not shared with any person or entity outside NAWIC. Similarly, the schools did not share their student data with the researchers. No person or entity associated with this study received a list of the students' names or individual e-mail addresses. However, similar to the survey questionnaire, respondents who were willing to share their email address were requested to do so at the end of the online survey. They were also informed that this data will be used for future research on the same topic and also for the gift card drawing.

Once the data collection was completed, it was noted that the number of responses from NAWIC members (1) was not adequate to draw comparisons between the study population and the female students enrolled in other universities. So, it was decided to not use the survey by the NAWIC student member. Fortunately, a 100% response rate was attained on the in-person surveys at TAMU and CSU. On the other hand, as expected, the response rate on the online survey was lower (60%) resulting in a total response rate of 74%.

Data Analysis

According to Gliner, Morgan, and Leech (2009), a descriptive approach summarizes data using descriptive statistics such as averages, percentages and various graphs. So once the responses were collected, the data were analyzed using descriptive statistics to find answers to the research questions. The answers to the open ended questions on the survey were coded using atlas.ti software to search for common themes among

participant perceptions. Additionally, pair-wise deletion was employed to deal with the issue of incomplete surveys.

External Validity

A total of 40 students participated in the study. It is believed that in this case, it is right to say that a strong case for generalization could be made since a sample of 40 was collected from the population of 54.

CHAPTER IV

RESULTS AND DISCUSSION

As explained in the previous chapter, descriptive statistics were calculated from the responses to the quantitative part of the survey, and the answers to the open ended questions (qualitative data) were coded to search for common themes among female CM students. This chapter presents the results of the data analysis and provides discussion based on those results.

The first six questions of the survey questionnaire (Appendix B) were aimed at exploring the general description of the sample such as the participant's university name, student classification, family's socio-economic status etc. The major component of the questionnaire was however the Likert scale- type questions. In addition to the typical response options such as *Highly Positive, Slightly Positive, No Influence, Slightly Negative* and *Highly Negative,* an option *N/A* was included. The response options were coded accordingly: *Highly Positive* (1), *Slightly Positive* (2), *No Influence* (3), *Slightly Negative* (4) and *Highly Negative* (5). The students were requested to check *N/A* if they have not had any experience with the factor mentioned in the sub question or have not been exposed to it.

Since pair wise deletion was utilized to enable using as much data as possible, the number of responses, means and standard deviations were calculated separately for each

question/ sub-question. For calculating means and standard deviations, the sample size (n) was calculated by subtracting the number of *N/A* responses from the number of responses under each question. *N/A* responses were eliminated from the mean and standard deviation calculations as these students did not have any experience with the factor mentioned and therefore factoring in their response to the calculation would not be accurate.

The survey questionnaire also included seven open ended questions. Within the responses to these questions, if the same idea was expressed by more than one respondent, a code was created denoting the theme of the responses. In the following section, the themes that were selected under each open ended question will be explained along with their percentages.

Appendix A contains bar charts and pie diagrams depicting number of responses received under each response option and percentages of the same respectively. However, in this section, only the most relevant quantitative data values (in the form of bar charts) and qualitative data values (in the form of pie charts) are represented.

Sample Distribution

The sample consisted of 16 female CM freshmen and 24 female CM sophomores out of which 19 participants were from TAMU, 3 from CSU, 4 from Auburn, 8 from ASU and 6 from PU (Table 1).

Table 1. **Sample Distribution**

University Name/ Student Classification	No. of participants	Percent of total
Texas A&M University	19	48%
Freshmen	3	8%
Sophomores	16	40%
Colorado State University	3	8%
Freshmen	2	5%
Sophomores	1	3%
Auburn University	4	10%
Freshmen	2	5%
Sophomores	2	5%
Arizona State University	8	20%
Freshmen	5	13%
Sophomores	3	8%
Purdue University	6	15%
Freshmen	4	10%
Sophomores	2	5%
Total	**40**	**100%**

As discussed in the methodology chapter, the surveys were administered in person only in TAMU and CSU. This resulted in higher response rates from these two universities. The majority of the participants were from TAMU due to this and also because TAMU has the largest CM program. Although, it might appear as if the response rate from CSU was low, CSU, at the point of time the surveys were administered, had only 4 CM female students in the freshmen and sophomore levels, out of which 3 participated in this study. However, this does not indicate that the survey results are only representative of the female CM population of TAMU, CSU or both TAMU and CSU. The survey results from AU, ASU and PU, align with the TAMU and CSU survey results. Therefore, it is justified to assume that the study results are representative of the female CM students of all the five universities.

The majority (43%) of the students self-identified themselves to be from middle class families, followed by 28% of the participants who self-reported as being from a lower-middle class background and 25% stating they were from an upper-middle class background (Figure 1). Only 3% of the participants reported to be from upper class families and another 3% reported to be from lower class families.

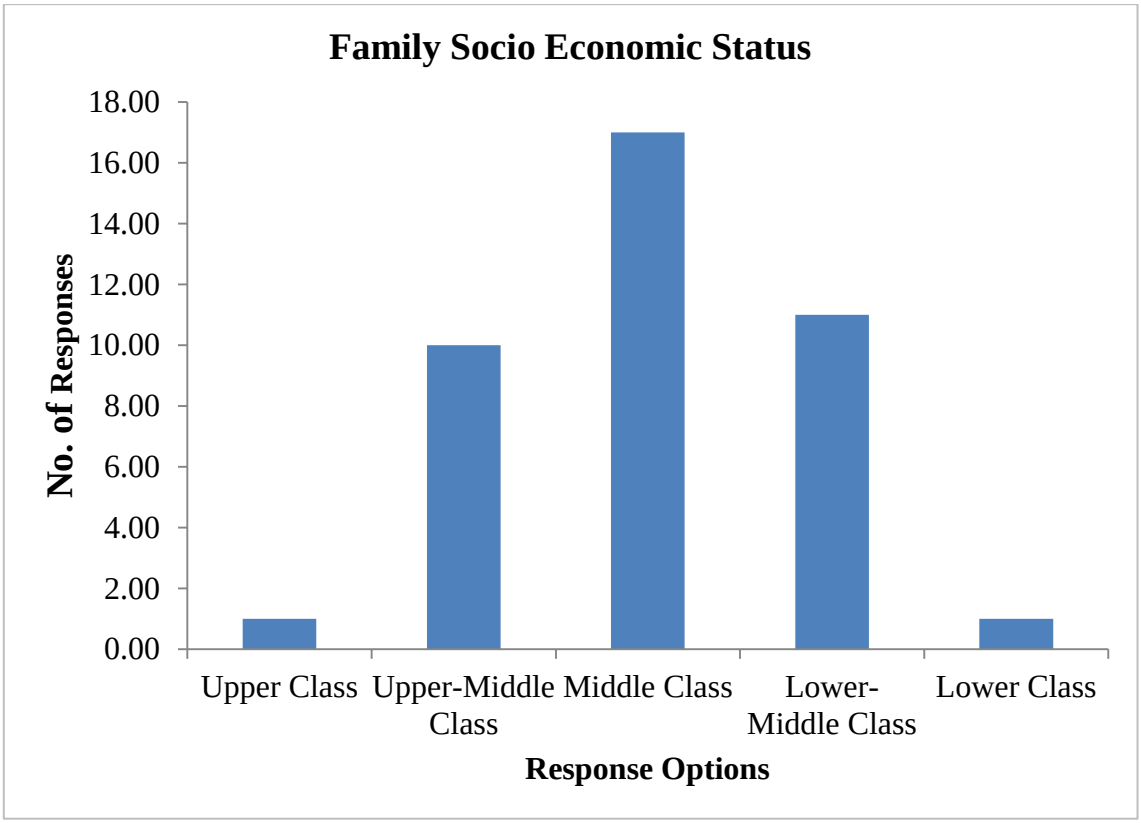

Figure 1. Family Socio Economic Status: Response Options vs. Number of Responses

All the participants stated their intent to continue in the CM major. The majority of the participants (67%) also reported that their perception of the industry had improved after

entering the program (Figure 2). Additionally, all the participants except one indicated that they anticipate working in the construction industry after obtaining their undergraduate degree. The one exception plans to pursue a master's degree. ."

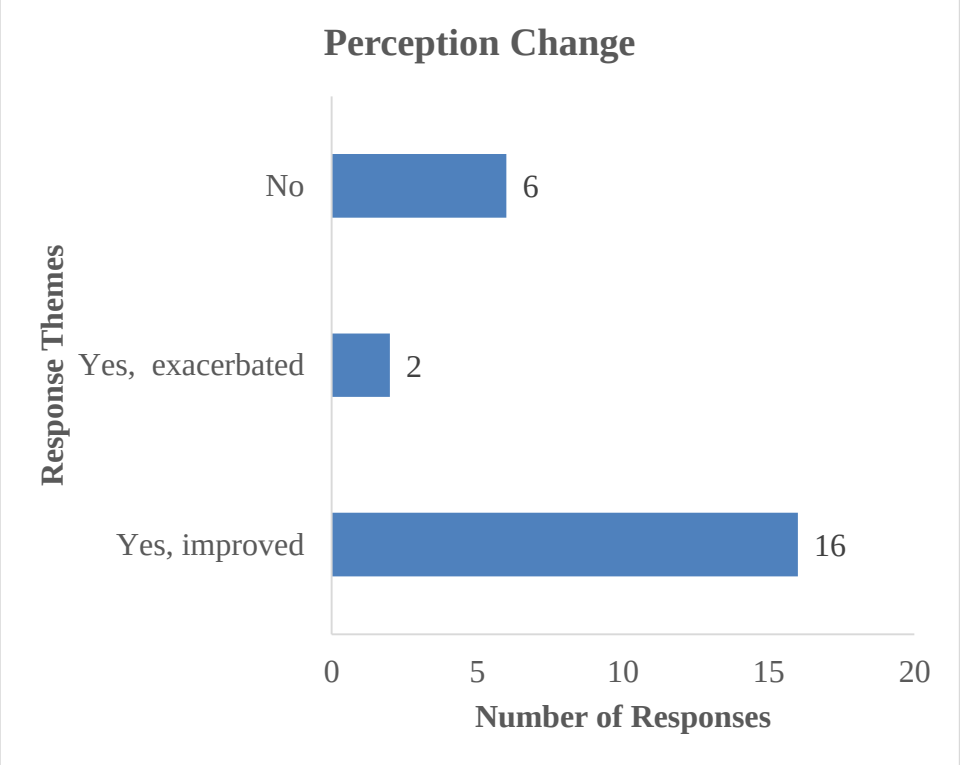

Figure 2. Perception Change after Entering the CM Degree Program

When asked what type of job, i.e., field or office jobs, they preferred, some of them reported both. So the responses were treated as qualitative data and coded. The results interestingly show that the preferences were equally divided, i.e., 50% of the responses indicated interest in field jobs and the other 50% indicated interest in office jobs. The majority of the participants, 60%, also indicated they preferred the Commercial sector

followed by 27% stating they preferred the Residential sector. Very few (7% each) showed interest in Infrastructure and Industrial sectors (Figure 3).

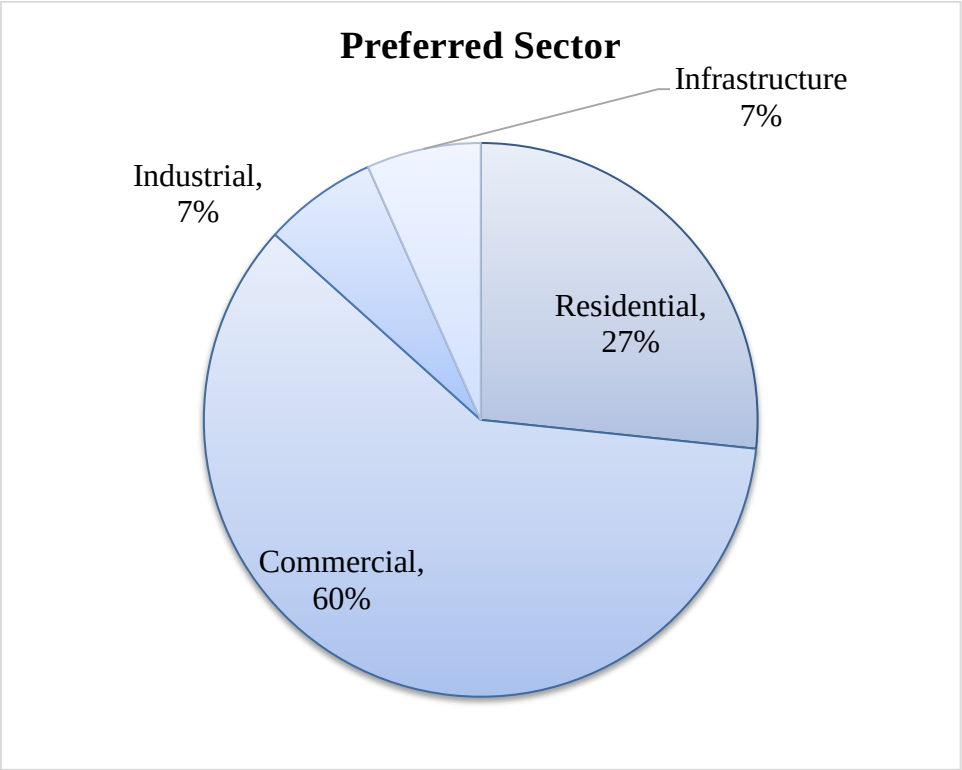

Figure 3. Preferred Sector

Almost half of the respondents (17) were transfer students (Figure 4) - 12 of them transferred from another program at the same university and 5 transferred from a 2-year community college.

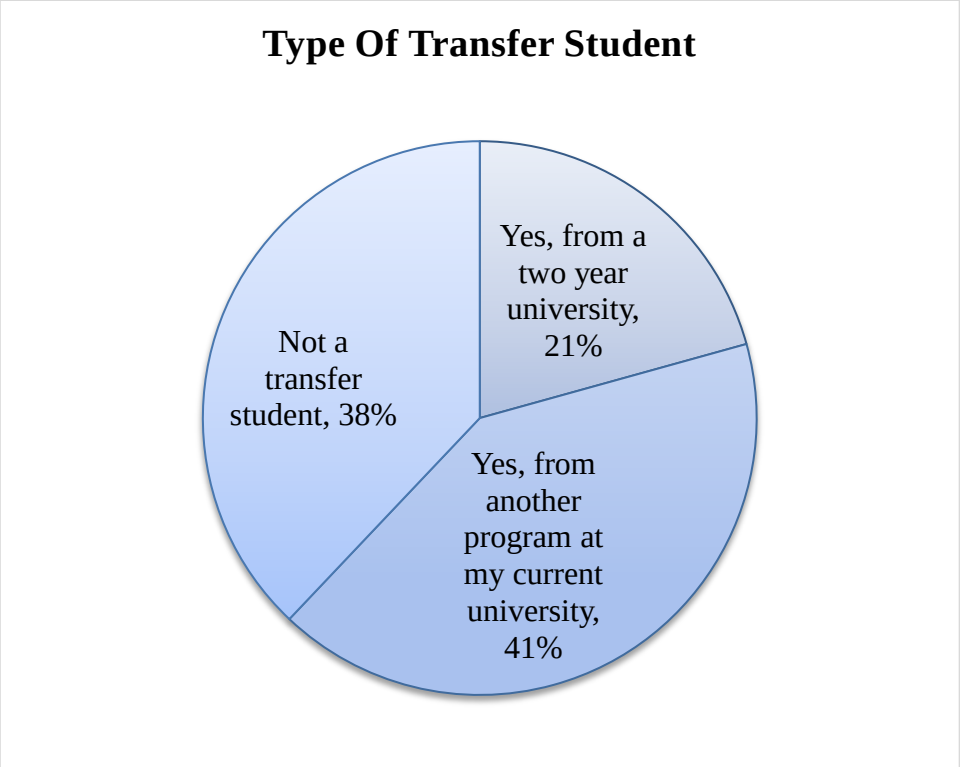

Figure 4. Type of Transfer Student

Factors and Programs that Influence Female Students' Decision to Enter the Construction Management Program

Table 2 presents the means and standard deviations of responses received for each factor, identified in literature to be influential in attracting females to construction degree programs. The means show the effectiveness of each factor as per the students' perspectives. The lower the mean, the more positively influential the factor was where as higher means indicate less positive influence.

Table 2. Factors and Programs that Attract Females to Construction Management Programs (Ranked Order)

RANK	FACTORS AND PROGRAMS	n	MEAN	STANDARD DEVIATION
1	Awareness of career opportunities	34	1.26	0.85
2	Completed Internships	29	1.55	1.14
3	Field trips to job sites	31	1.87	1.06
4	Non- internship work experience	24	1.88	1.49
5	Community service	32	1.91	1.19
6	Father working in the industry	28	1.93	1.39
7	Funding	29	1.97	1.44
8	A male role model	33	2.09	1.22
9	Father taking to work	27	2.11	1.49
10	Mother working in the industry	19	2.32	1.97
11	College advisor	30	2.33	1.56
12	Mother taking to work	21	2.38	1.85
13	A female role model	28	2.39	1.62
14	High school advisor	30	2.77	1.56
15	TV or magazine ads	23	2.83	1.96
16	Mentoring program	22	2.95	2.13

Note: Mean values closer to 1 indicate *Highly Positive* influence, 3 indicate *No Influence and* 5 indicate *Highly Negative* influence.

As we can see in Table 2, none of the factors were identified by students to have had a negative influence on their decision to enter the CM programs. Students reported awareness of career opportunities (mean= 1.26, standard deviation= 0.85) (Figure 5) as the most positively influential factor to their decision to enter a construction management program followed by completed internships (mean= 1.55, standard

deviation= 1.14) (Figure 6) and field trips to job sites (mean= 1.87, standard deviation= 1.06) (Figure 7).

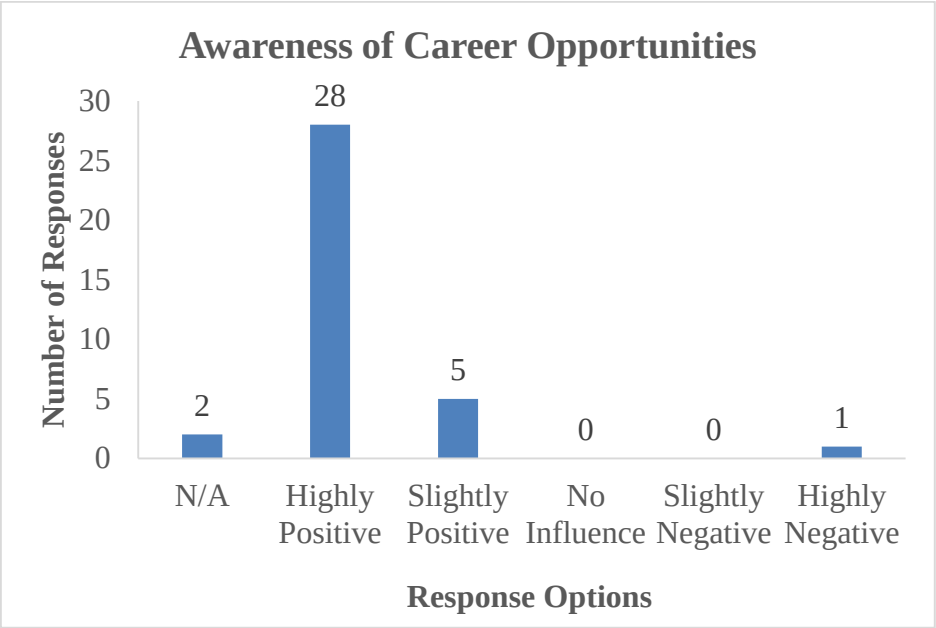

Figure 5. Awareness of Career Opportunities: Response Options vs. Number of Responses

Evidently, female students have high expectations regarding job opportunities before entering the CM degree program and this is a very strong positive influence on their decision to enter the program. This decision is also seen to be augmented by experiences during working in or visiting construction sites; non- internship work experience (mean= 1.88, standard deviation= 1.49); and community service (mean= 1.91, standard deviation= 1.19).

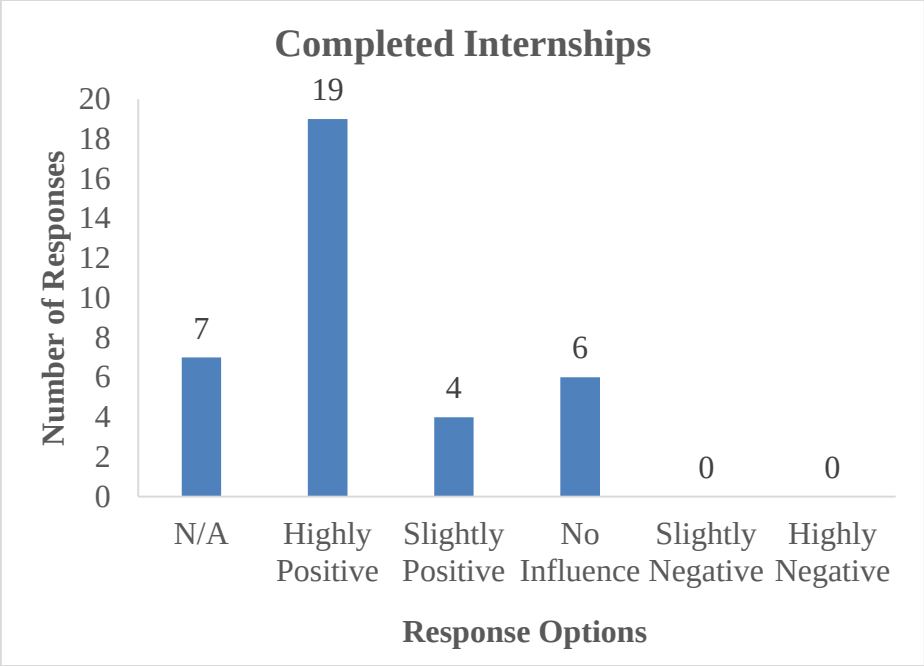

Figure 6. Completed Internships: Response Options vs. Number of Responses

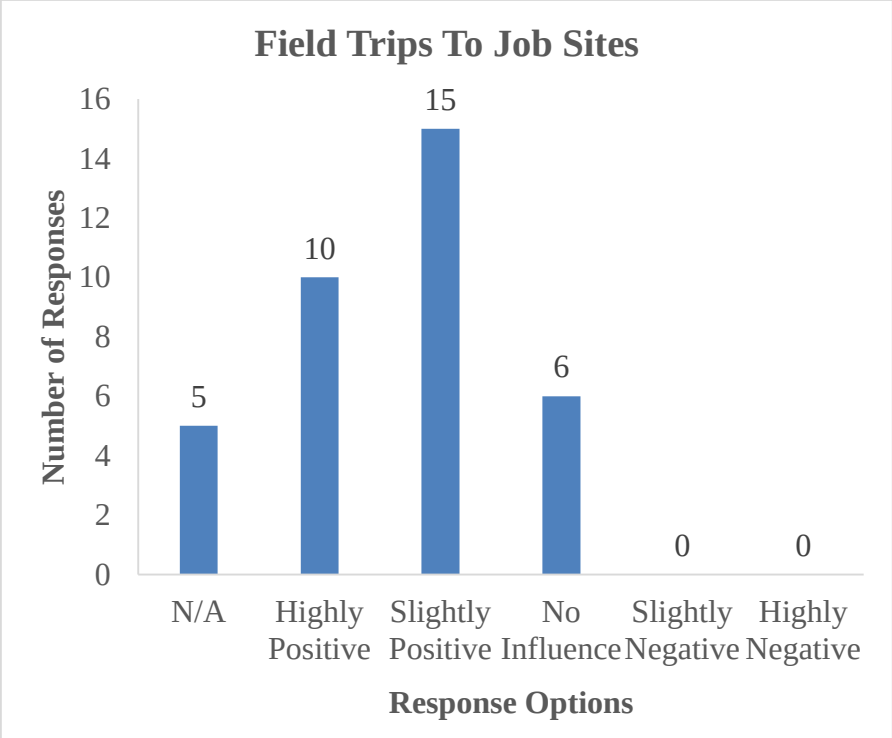

Figure 7. Field Trips to Job Sites: Response Options vs. Number of Responses

In addition, our study also concurs with existing literature and indicates that fathers working in the industry (mean= 1.93, standard deviation= 1.39) is a positive influence on female students' decision to enter a CM degree program.

The factors with the highest means were mentoring programs (mean= 2.95, standard deviation= 2.13) (Figure 8), TV or magazine ads (mean= 2.83, standard deviation= 1.96) (Figure 9) and high school advisors (mean= 2.77, standard deviation= 1.56) (Figure 10).

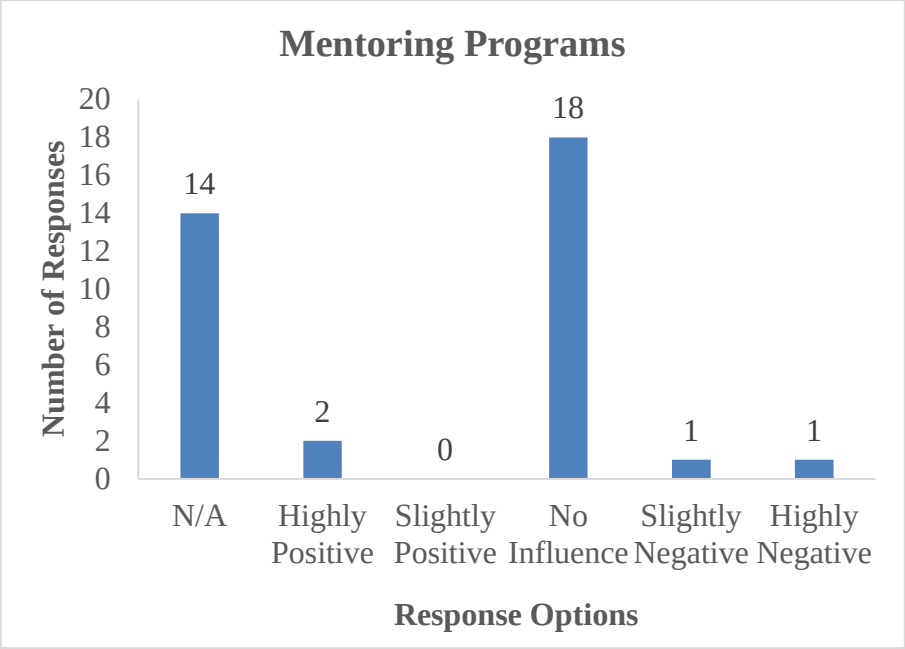

Figure 8. Mentoring Programs: Response Options vs. Number of Responses

The data indicates that these three above factors mostly had *No Influence* on the student's decision to enter the program. This could be due to an array of reasons. As seen in existing literature, high school advisors might not have been aware of the CM

degree programs or might have imparted a negative image of the industry to the female students. TV or magazine ads were probably not essentially targeted at attracting the female student population to the program.

As for mentoring programs, it might be because the mentoring programs, which had *No Influence* or made a negative impact on the students' decision, were not construction related. Only two students specified the name of the mentoring programs they were a part of – "ACE/ Balfour Beatty Mentoring Program" and "BCMentors" of Purdue University. Both of these mentoring programs are for construction students and were reported by both of these students to be *Highly Positive* influences on their decision to enter the program.

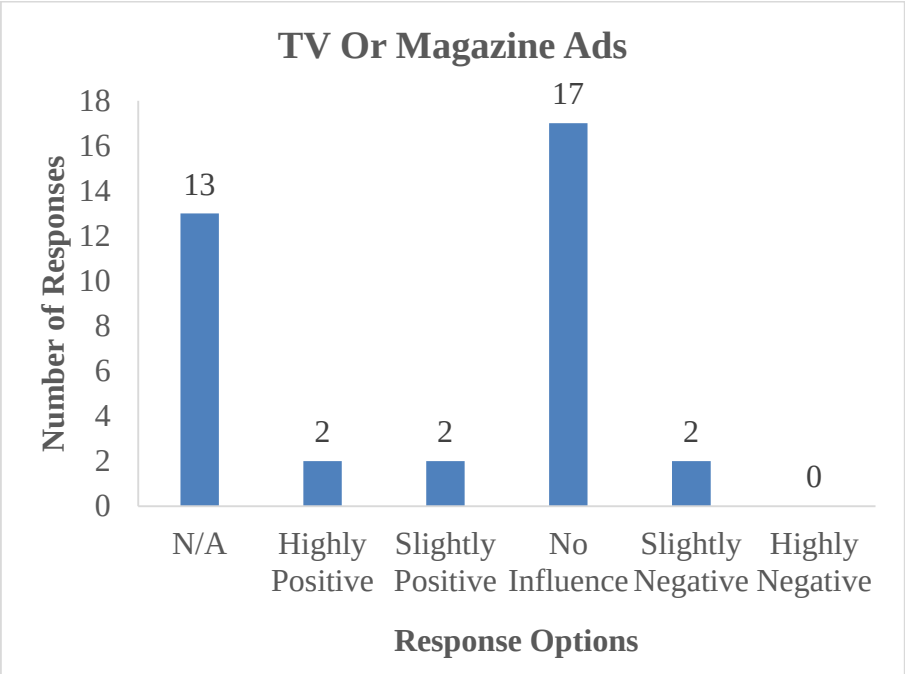

Figure 9. TV or Magazine Ads: Response Options vs. Number of Responses

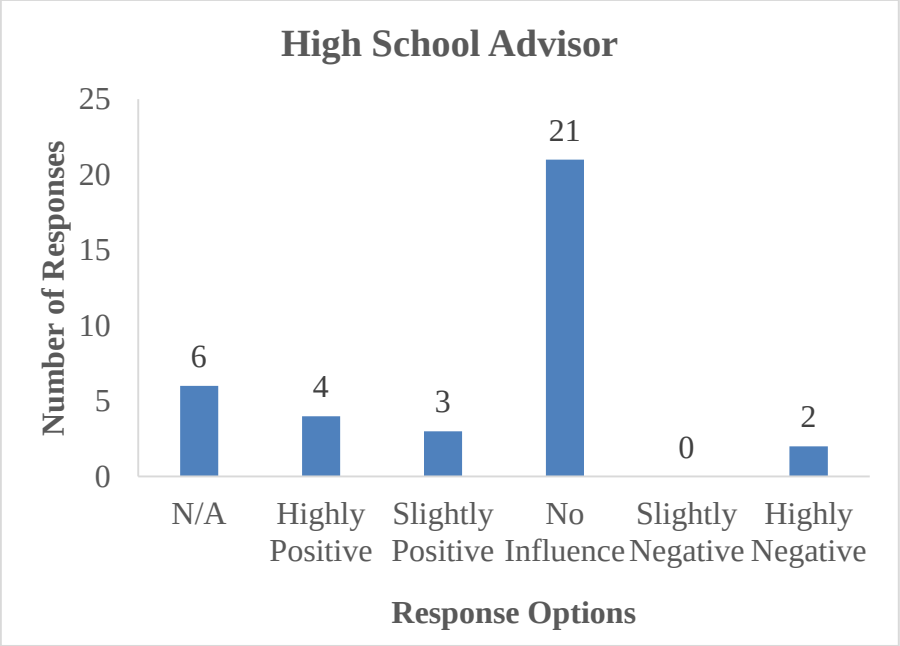

Figure 10. High School Advisor: Response Options vs. Number of Responses

Finally, it is also important to look at the number of *N/A* responses and their percentages (Table 3) as these values indicate that some of these programs are not reaching the female student population.

Apart from mother working in the industry (47%) and mother taking to work (42%), the other factors that had a high number of N/A responses were mentoring program (39%), TV or magazine ads (36%) and non-internship work experience (33%). This reveals that these factors are not reaching many of the female students, as shown above although non-internship work experience has good potential to recruit women into CM degree programs it is not reaching many female students. Another interesting fact is that TV or magazine ads not only had a high number of *N/A* responses, but also had one of the

highest means. This suggests that TV or Magazine ads are firstly not being used to their full potential to market careers in the industry and secondly those participants who were exposed to advertisement about the industry, did not perceive it had any effect on their decision to enter the CM degree program.

It is also important to note the factors that received the lowest number of *N/A* responses, i.e., community service, a male role model and awareness of career opportunities. Since, these are the factors that are reaching of the greatest numbers of the populations, the industry and academia should strive to ensure the effectiveness of these factors.

Table 3. **Ranked Order of Factors the Participants Had Least Exposure to (Recruitment Factors)**

RANK	FACTORS AND	NO. OF *N/A* RESPONSES	NUMBER OF RESPONSES	PERCENTAGE
1	Mother working in the industry	17	36	47%
2	Mother taking to work	15	36	42%
3	Mentoring program	14	36	39%
4	TV or magazine ads	13	36	36%
5	Non- internship work experience	12	36	33%
6	Father taking to work	9	36	25%
7	Father working in the industry	8	36	22%
8	A female role model	8	36	22%
9	Completed Internships	7	36	19%
10	Funding	7	36	19%
11	High school advisor	6	36	17%
12	College advisor	6	36	17%
13	Field trips to job sites	5	36	14%
14	Community service	4	36	11%
15	A male role model	3	36	8%
16	Awareness of career Opportunities	2	36	6%

Other Factors that Attract Females to CM Programs- Participants' Suggestions

A total of 24 participants responded to this question of what other factors could positively influence students' decision to enter the CM program and "interest in the course work" (6), "job security" (5), "job description" (4), "influence of family" (3), "recommendation by faculty" (2), "good alternative to other field of interest" (2), and "mission trips" (2) were the themes identified based on the responses to this question.

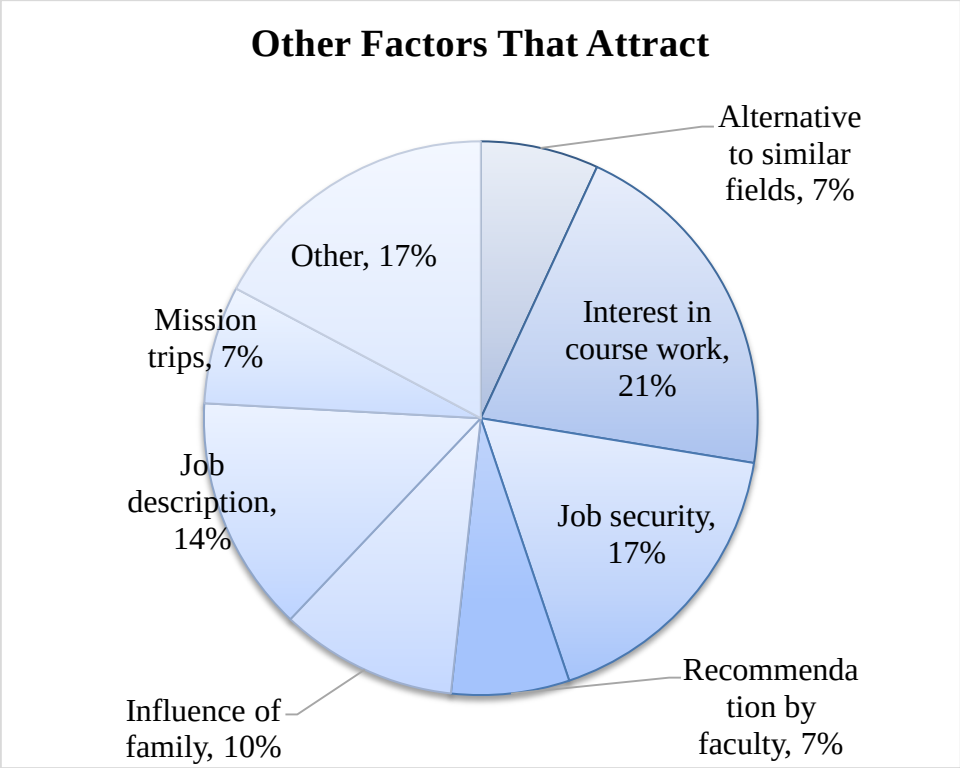

Figure 11. Other factors that Attract- Participants' Suggestions

As seen in Figure 11, the most commonly reported among these factors were the interest in coursework and job security. Interest in course work was most expressed as "My interest in the field", "fact that it deals with estimating and construction safety" and " hands on, I like it" whereas the feeling of job security was conveyed by students when they stated "100% hire rate", " jobs" and "provides a secure job". It is clear from this data that marketing initiatives must emphasize the coursework in CM degree programs as well as job security and job profiles in the industry so that more females are knowledgeable about the industry, the career opportunities it can offer and the educational qualifications that are required. These could potentially improve the overall image of the industry.

Other Programs that Attract Females to CM Degree Programs- Participants' Suggestions

Participants were also asked what other programs could positively influence students' decision to enter the CM degree program. Sixteen participants answered this question and four major themes emerged from their responses (Figure 12) namely "better advertisement" (6), "high school initiatives" (6), "some form of work experience in the industry" (3) and "other" (1).

High school initiatives suggested by students include shadowing programs to Construction Science Classes and Schools, pre-employment architecture and construction program (PACE), mentoring programs and workshops for high school students.

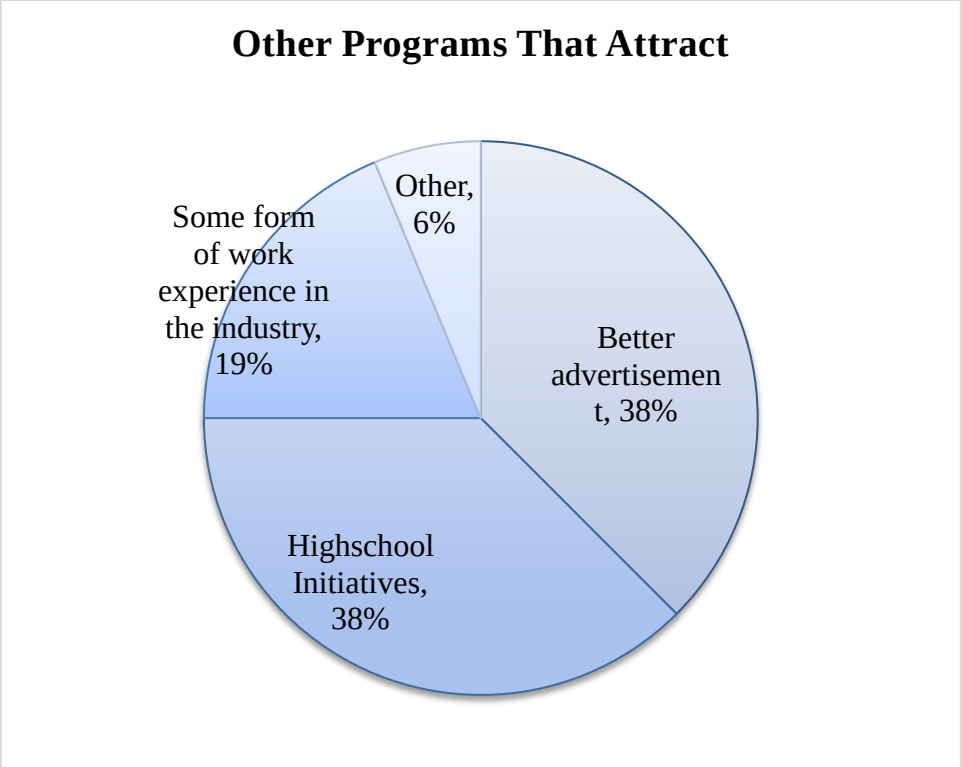

Figure 12. Other Programs that Attract- Participants' Suggestions

In addition, six of them stated that they were not aware that such a program existed and advocated the need for better advertisement. The following were some of the responses which were grouped together under the theme better advertisement.

"Defining what construction management is and what career paths there are. You will not be out there swinging a hammer and you can make more money."

"Showing more women that they belong, and that it's a real job they can do well in would help a lot. It's scary going into a male dominated field."

"More advertisement- I didn't know there was a degree like this. "

The above comments support existing literature in terms of lack of knowledge about the industry. Some of them also added that some form of work experience in the industry could attract female students to CM programs. These work experiences can range from working with Habitat for Humanity to externships and field trips. Finally, one student stated that organizations for women in construction could be an effective program for attracting female students.

Factors and Programs That Influence Female Students' Decision to Remain in the CM Program

Table 4 shows the means and standard deviations of the responses to all the factors that were identified in existing literature as influential, positively or negatively. Out of the 15 factors identified in the literature, construction lab classes (mean= 1.28, standard deviation= 0.96) (Figure 13) were identified as the most effective in retaining female CM students followed by scholarships and fellowships (mean= 1.36, standard deviation= 1.01) (Figure 14), and internships (mean= 1.39, standard deviation= 1.21) (Figure 15).

It is interesting to note that internships and hands-on learning, such as construction lab classes, have been repeatedly reported by students to be highly positively influential in the decision to enter and remain in the program. This indicates that all practical experiences related to work in the industry attracts and retains female students and must also be emphasized in marketing initiatives. Academia must also try to increase the scope of hands-on learning in the degree curricula.

Table 4. **Factors and Programs that Retain Females in Construction Management Programs (Ranked Order)**

RANK	FACTORS AND PROGRAMS	n	MEAN	STANDARD DEVIATION
1	Construction lab classes	25	1.28	0.96
2	Scholarships and fellowships	25	1.36	1.01
3	Internship	23	1.39	1.21
4	In- classroom innovation	32	1.5	0.8
5	Community of students	29	1.59	1.03
6	Community of students	29	1.59	1.03
7	Faculty members of your	29	1.62	1.12
8	Involvement in student	29	1.66	1.08
9	Workshops and seminars	27	1.67	1.06
10	Student members of your	31	1.77	0.92
11	Mentoring	26	1.81	1.37
12	Involvement in research	24	1.83	1.46
13	Academic advising	30	1.83	1.22
14	Non- internship work	22	2.00	1.52
15	Mathematical analysis	28	2.04	1.31
16	Tutoring	25	2.12	1.53

Note: Mean values closer to 1 indicate *Highly Positive* influence, 3 indicate *No Influence and* 5 indicate *Highly Negative* influence.

Community of students, In-classroom innovation, workshops and seminars, female faculty members, involvement in student organizations were some of the other factors which had a positive influence on the students' decision to remain in the CM program.

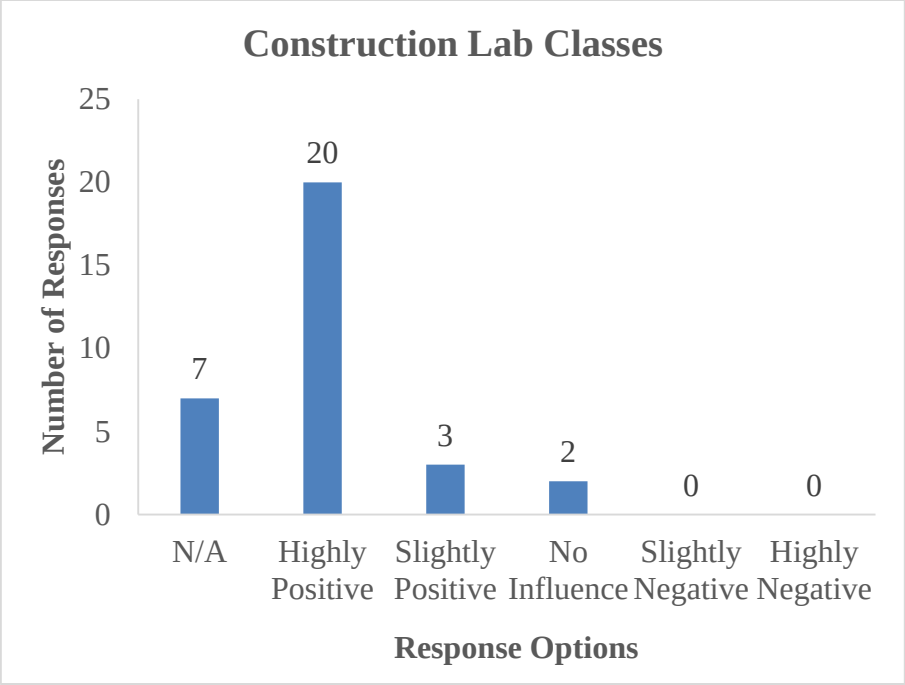

Figure 13. Construction Lab Classes: Response Options vs. Number of Responses

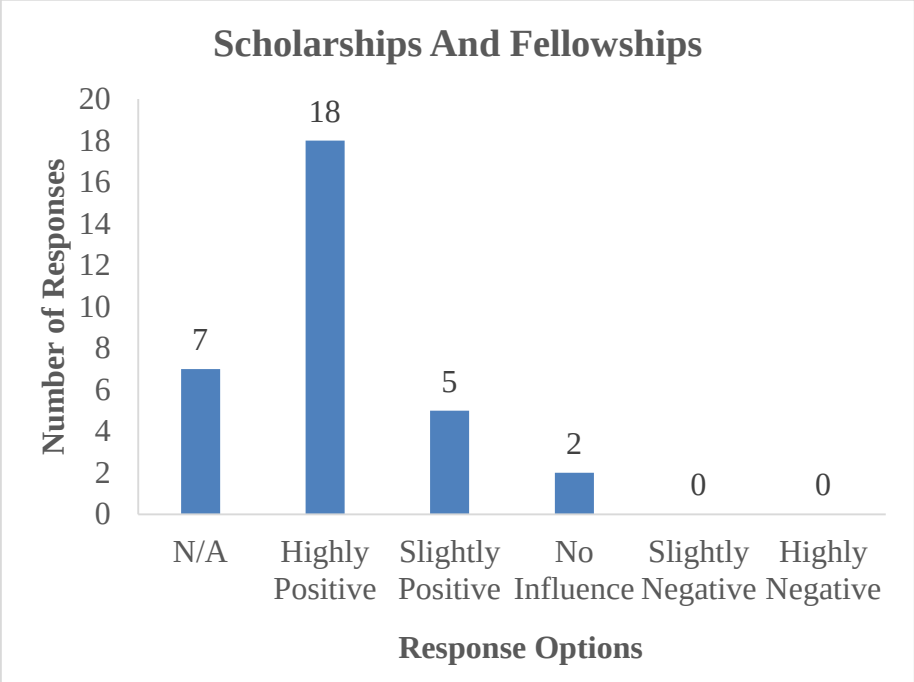

Figure 14. Scholarships and Fellowships: Response Options vs. Number of Responses

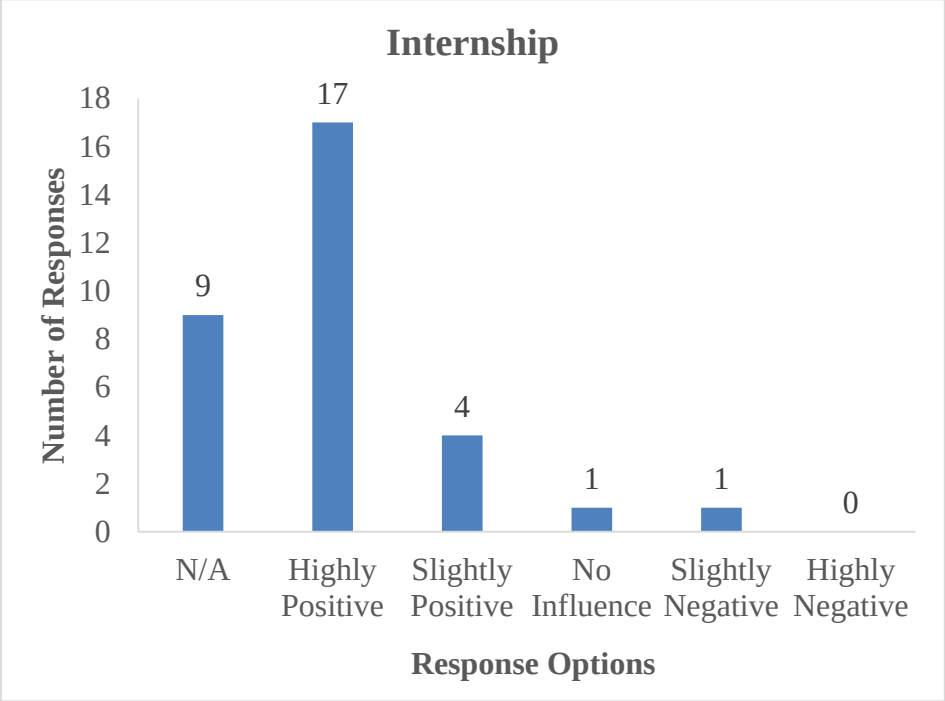

Figure 15. Internship: Response Options vs. Number of Responses

As for the lowest means, tutoring (mean= 2.12, standard deviation=1.53) (Figure 16), non- internship work experience (mean= 2.04, standard deviation=1.31) (Figure 17) and mathematical analysis (mean= 2.00, standard deviation=1.52) (Figure 18) were the least positively influential factors among female CM undergraduates. Courses based on mathematical analysis such as estimation and scheduling, though not highly positive, were reported as positive overall. This supports existing literature which states that "for women especially, contextualizing math skills via a practical problem effectually sparks and can sustain a long-term interest in STEM subjects (Halpern et al. 2007)". (Knight et al., 2011, p. 6)

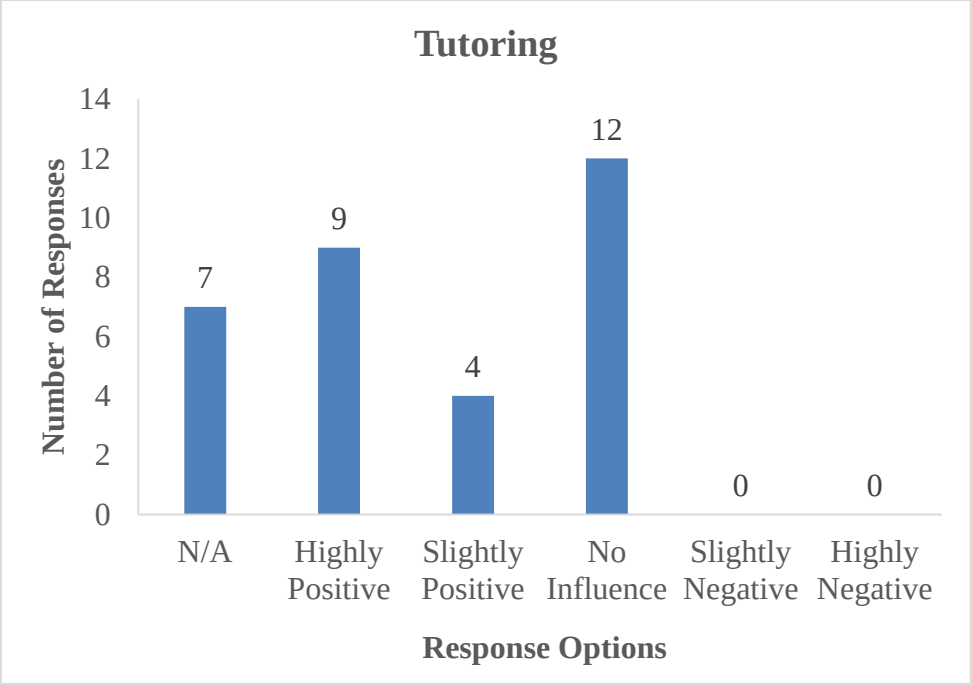

Figure 16. Tutoring: Response Options vs. Number of Responses

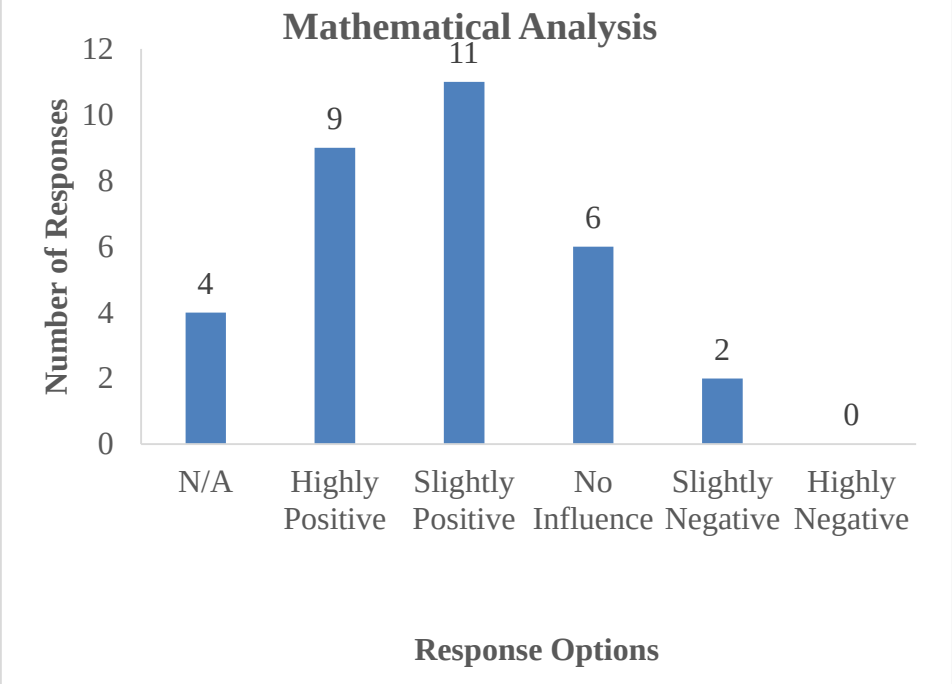

Figure 17. Mathematical Analysis: Response Options vs. Number of Responses

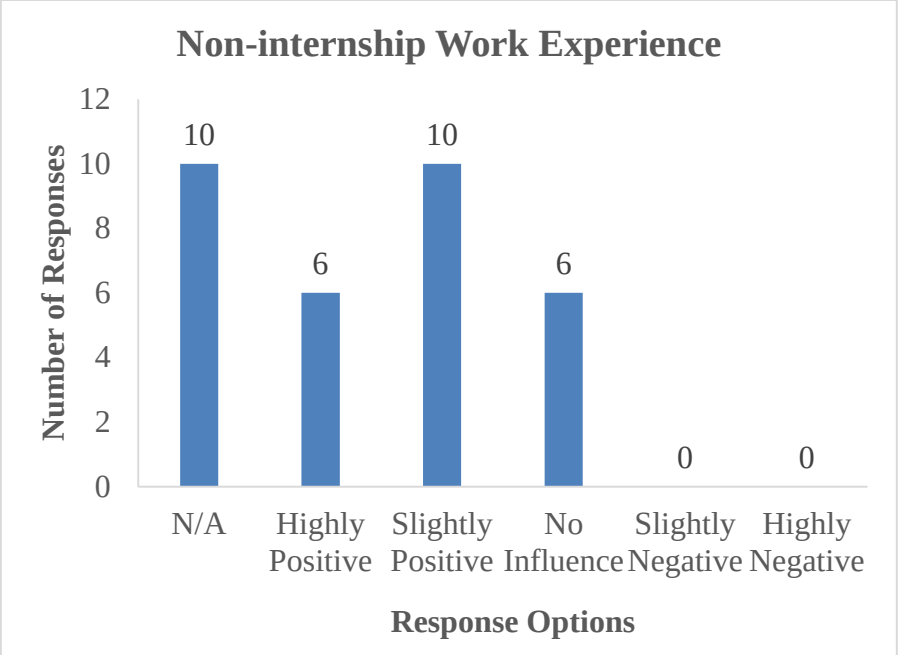

Figure 18 Non- Internship Work Experience: Response Options vs. Number of Responses

The Table 5 identifies the factors that most of the students had not experienced or were not exposed to as non-internship work experience (31%), internship (28%) and involvement in research (25%).

One factor that needs further attention is internships. Internships were reported by most students who have participated in one or more internships as highly positively influential in their decision to remain in the CM program. However, internships were also one of the factors which were not experienced by most of these freshmen and sophomore students. Evidently, this is because internships are generally offered to juniors and seniors or in other words, as per the CM curricula, students are required to go on an internship only when they are juniors. As shown in the data, introducing internships to

the curricula at the freshmen and sophomore levels would help in retention of female students. Also, as shown in Table 5, academic advising and in classroom innovation were experienced by most students. Since these factors are already being recognized by most students, it would be wise to make efforts to develop these further in the direction of retaining more female students.

Table 5 Ranked Order of Factors the Participants Had Least Exposure to (Retention Factors)

RANK	FACTORS AND PROGRAMS	NO. OF *N/A* RESPONSES	NO. OF RESPONSES	PERCENTAGE
1	Non- Internship Work Experience	10	32	31%
2	Internship	9	32	28%
3	Involvement In Research	8	32	25%
4	Tutoring	7	32	22%
5	Scholarships And Fellowships	7	32	22%
6	Construction Lab Classes	7	32	22%
7	Mentoring	6	32	19%
8	Workshops And Seminars	5	32	16%
9	Mathematical Analysis	4	32	13%
10	Faculty Members Of Your Gender	3	32	9%
11	Involvement In Student Organizations	3	32	9%
12	Community Of Students	3	32	9%
13	Academic Advising	2	32	6%
14	Student Members Of Your Gender	1	32	3%
15	In- Classroom Innovation	0	32	0%

Other Factors that Retain Females in CM Programs- Participants' Suggestions

"Interest in the coursework" (7), "job opportunities" (6), and "people in academia" (5) were the three most prominent themes that arose from the nineteen participant responses (Figure 19).

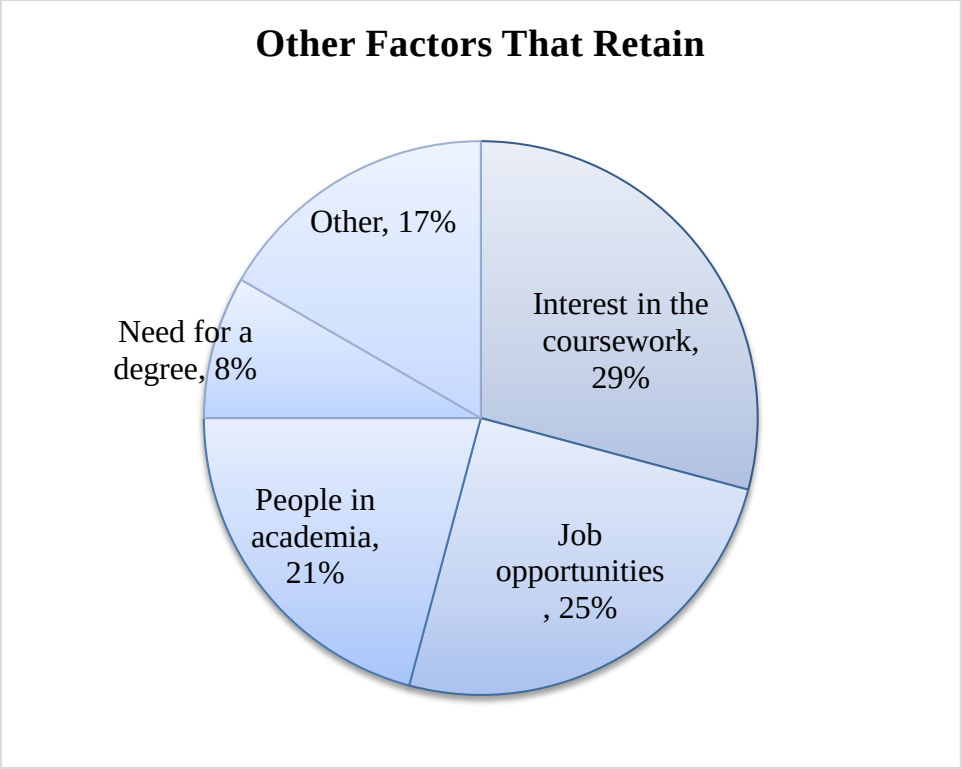

Figure 19. **Other Factors that Retain- Participants' Suggestions**

Students made statements which denoted their interest in coursework such as "Was in Architecture, but didn't like it; but did like buildings" and "I enjoy and am good at math related courses and also thoroughly am fascinated by the materials used in construction."

Other accounts provided by students “positive faculty, good environment” and “I love that we are such a family” attests the positive influence the people in academia had on the students’ decision to remain in the CM program.

Additionally, two students mentioned “helpful and knowledgeable advisors” and “easy coursework” to be two other positive factors. One student also interestingly noted the need she feels to prove herself in a male-dominated industry, “I want to prove myself and to everyone who doubts that a woman can be successful and love what they do in this field.”

Other Programs That Retain Females in CM Programs

Participants were also asked what other programs could positively influence students’ decision to remain in the CM degree program. Twelve respondents answered this question and the four themes were created (Figure 20) based on these responses are “hands- on learning” (5), “some form of work experience in the industry” (4), and “good college advisors” (2)

Here again, hands-on learning has been repeatedly stated by participants to be highly positively influential in their decision to remain in the program. This is worthy of note and must be given importance by CM departments who are concerned about retaining more women in their CM degree programs.

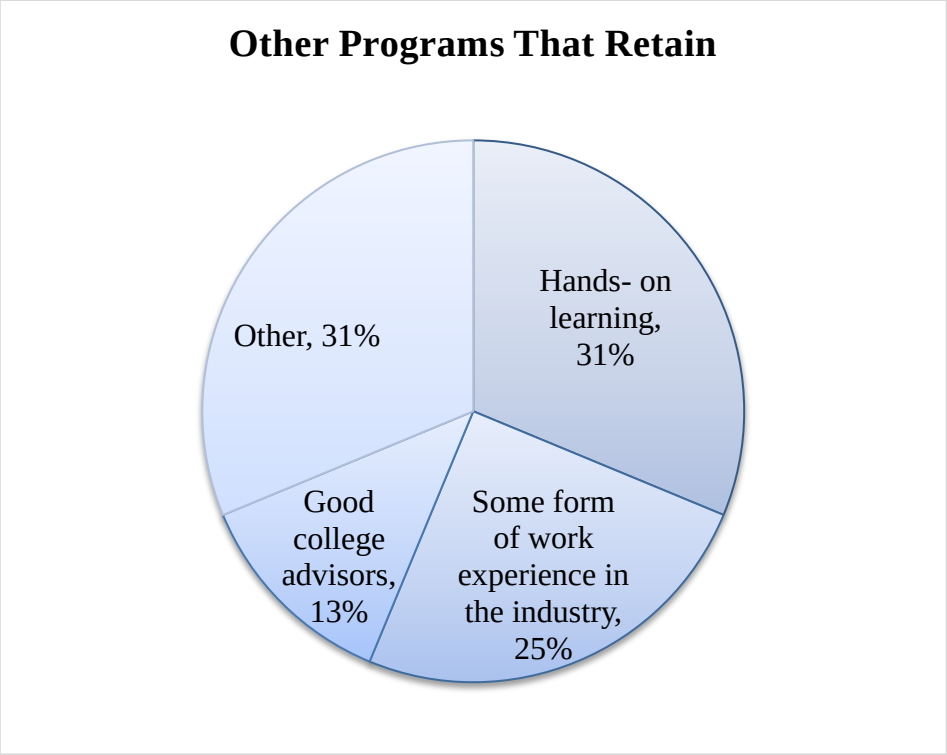

Figure 20. **Other Programs that Retain- Participants' Suggestions**

Factors Which Influence Decision to Transfer into CM Degree Program

Only 10 of the 17 transfer students responded to this question (Figure 21). Their responses were classified into three codes, i.e., "ease to transfer in" (2), "liked Construction compared to the previous degree" (6) and "other" (2).

Figure 21 suggests that majority of the participants, especially those who transferred from another program at the same university, were unaware of the program when they entered college and then found out about this program through others and shifted their major. This attests what is stated in existing literature that most of the female high

school student population is unaware of the existence of CM degree programs and calls for reform of marketing initiatives geared towards recruitment of women into CM degree programs.

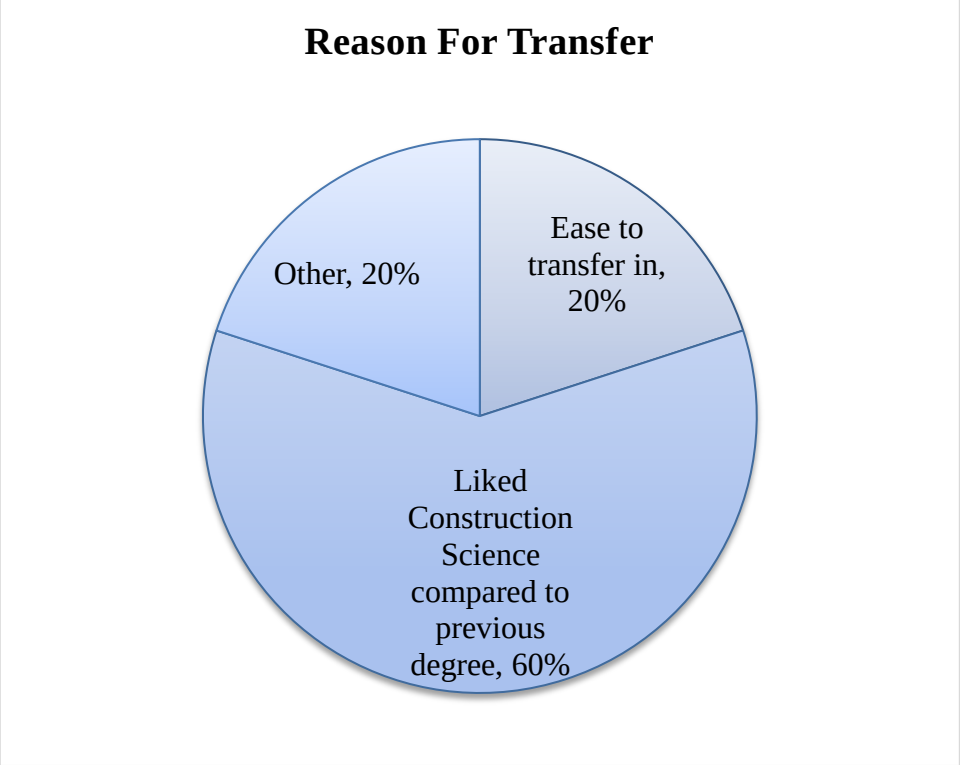

Figure 21. **Reasons for Transferring into CM Degree Program**

CHAPTER V

CONCLUSION

The survey was taken by 40 female CM freshmen and sophomores from the five chosen universities. Almost the entire sample of female students (96%) who participated in the study was from lower- middle class, middle class and upper- middle class families. Sixty seven percent of the participants reported a positive change in their perception of the construction industry after entering the program and all of them stated their intent to continue in the major. In addition, all but one plans on working in the industry after obtaining their undergraduate degree. However, this participant indicated that she was not leaving the industry but was only planning on furthering her education. It is also interesting to note that most of the participants (60%) displayed interest in working in the Commercial sector followed by the Residential sector (27%) although the type of job preferred by these participants was equally split between field and office job positions.

Most of the factors utilized in the survey were reported to have influences on the students' decision making in a similar way as that was mentioned in existing literature. However, the main purpose of this study was to identify the most effective factors in attracting and retaining freshmen and sophomore CM students as directly reported by female CM students. So, in this section, we discuss the three most effective factors under both the categories, i.e., recruitment and retention.

Students reported awareness about career opportunities, internship opportunities and field trips to job sites as the three factors that were most positively influential in their decision to enter the construction management programs. On the other hand, construction lab classes, scholarships and fellowships, and internships were identified as the most effective in retaining female CM students.

Some of the students noted that they were not aware of the program. In addition, 60% of the transfer students stated that they liked CM compared to their previous degree. This attests that most of the female high school student population is unaware of the existence of these CM degree programs. This could be due to a couple of reasons. As stated in existing literature, this could be due to the general lack of knowledge about the industry among the parents, school counselors and advisors. Or it could be that the existing marketing initiatives are not reaching out to their target population. This beckons remodeling of these initiatives.

Based on the results obtained in the study, advertisements must emphasize career opportunities in the Commercial and Residential sectors of the industry in terms of job profiles (both field and office) and job security. Similarly, the target population should be made aware of the coursework of CM degree programs so that they become more knowledgeable of what educational qualifications are required for a career in the industry. Scholarships and fellowships offered should also be emphasized. The students also provided relevant suggestions on how to improve the current scenario. Several students advocated the need for high school initiatives such as shadowing programs to

Construction Science classes and schools, mentoring programs and workshops for high school students; and better advertisement.

Additionally, classes based on hands-on learning, and practical experience, in terms of internships, community service, and field trips to job sites, can be said to have a highly positive influence on the students' decision to remain in the program. Therefore, CM Departments are encouraged to provide as many as such opportunities to freshmen and sophomore CM students if retention of female CM students is of significance to them.

Limitations of the Study

The population size was computed using institutional enrollment data whereas the sample size was estimated based on the student classification as self- reported by the participants of the study. Lastly, all participants did not respond to all questions nor did they all complete the surveys. Therefore, in order to deal with the missing data, pair wise deletion was employed. So, sample sizes, means and standard deviations were calculated separately for each question and sub-question. Therefore, generalization to the female CM student population of the five universities should be done *with caution.*

The study also has a few other limitations, which are common to survey research, such as the following (Leedy and Ormrod, 2005):

- Respondents may not have felt comfortable providing answers that represent themselves in an unfavorable manor.

- Respondents may not have been fully aware of their reasons for any given answer because of lack of memory on the subject, or even boredom.
- Certain answer options may have been interpreted differently by respondents. For example, in this study, the answer option *N/A* and *No Influence* may have been confused by some participants though an explanation was provided in the survey questionnaire.
- Since survey research is a methodology relying on standardization, the researcher was forced to develop questions general enough to be minimally appropriate for all respondents, possibly missing what is most appropriate to many respondents. For example, sexual stereotyping- which was identified as a negative influence in the literature review, was not incorporated in the survey questionnaire in order to avoid offending the participants and also because this question may appear to be 'leading'.

Recommendations for Future Research

Although the focus group sessions were used to test the effectiveness of the survey questionnaire and to mitigate threats to internal validity, the questionnaire used in the study cannot be said to be a valid instrument. A starting point of future research should be validating the instrument. Secondly, this study used a convenience sample. It is recommended that future studies employ random sampling to ameliorate external validity. It is also advised to address a bigger population which covers the smaller CM programs as well. It will be interesting to draw comparisons between the factors that

influenced the CM degree choice making process of students in smaller CM programs and bigger CM programs like the ones included in this study.

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APPENDIX A

FIGURES

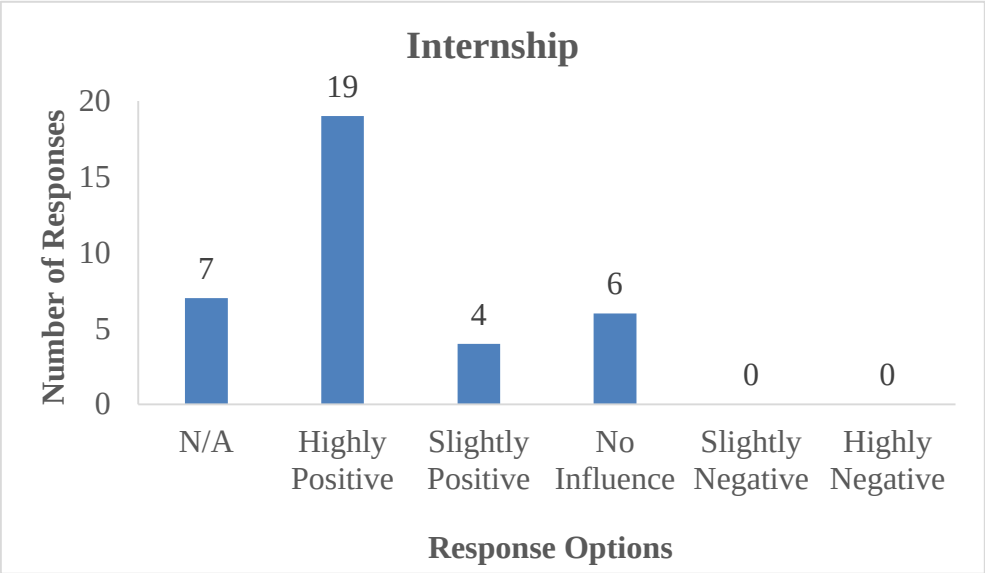

Figure 1. Internship: Response Options vs. Number of Responses (Recruitment Factor)

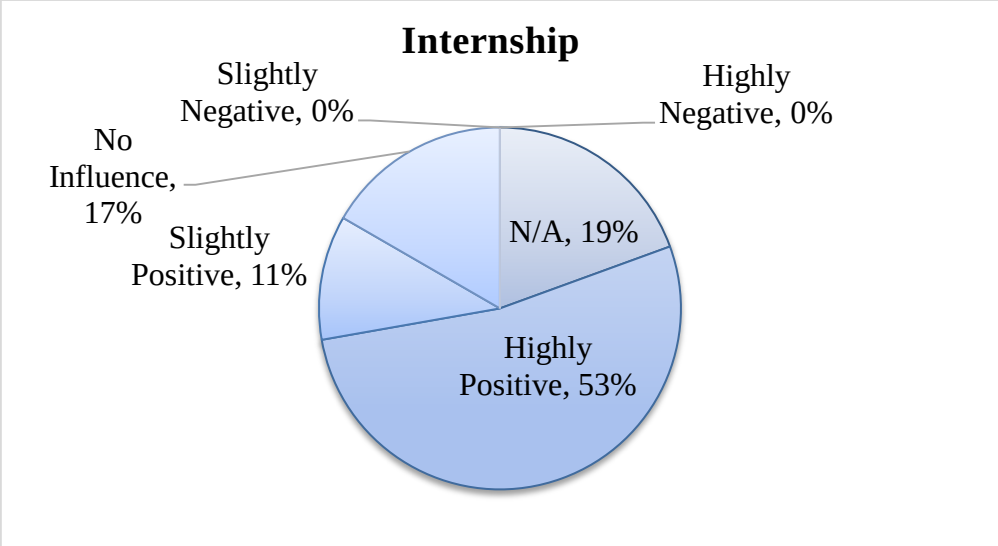

Figure 2. Internship: Percentages of Responses under each Response Option (Recruitment Factor)

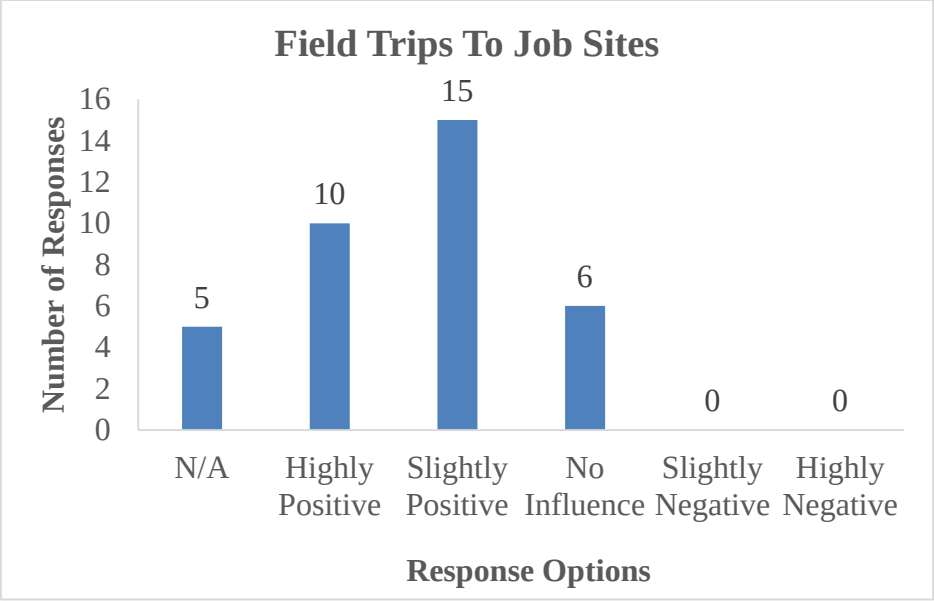

Figure 3. Field Trips to Job Sites: Response Options vs. Number of Responses (Recruitment Factor)

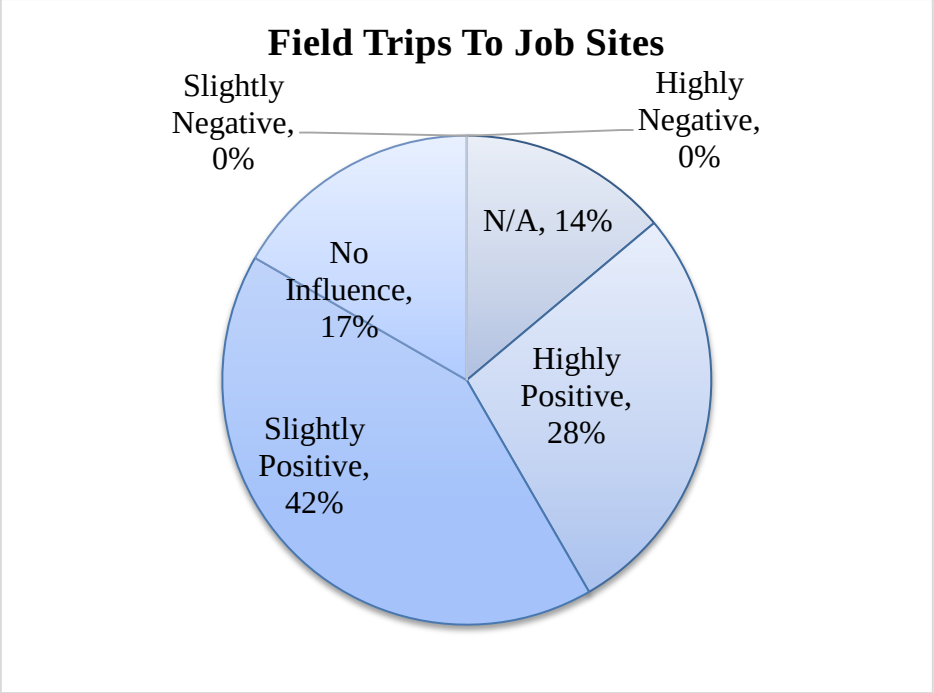

Figure 4. Field Trips to Job Sites: Percentages of Responses under each Response Option (Recruitment Factor)

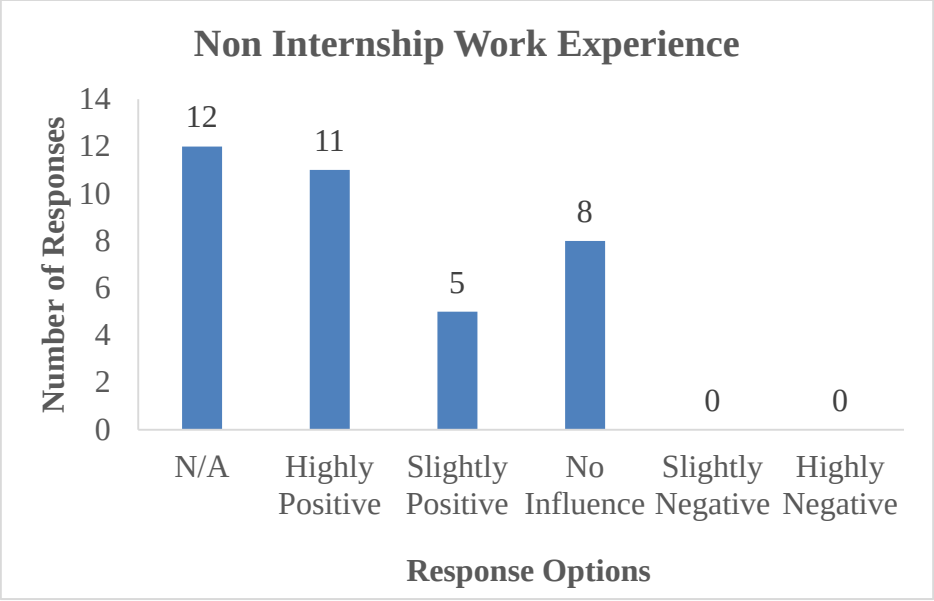

Figure 5. Non- internship Work Experience: Response Options vs. Number of Responses (Recruitment Factor)

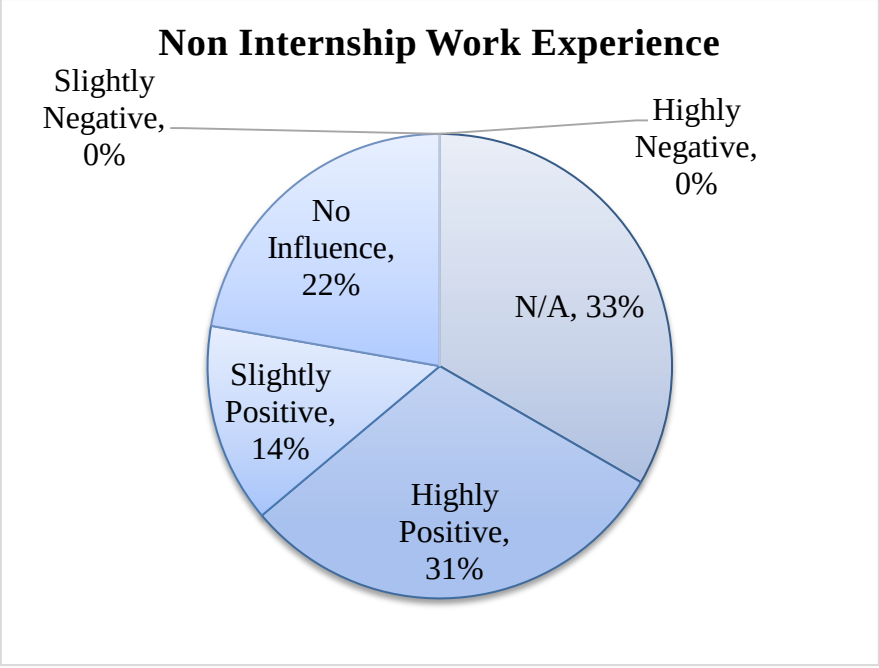

Figure 6. Non- internship work experience: Percentages of Responses under each Response Option (Recruitment Factor)

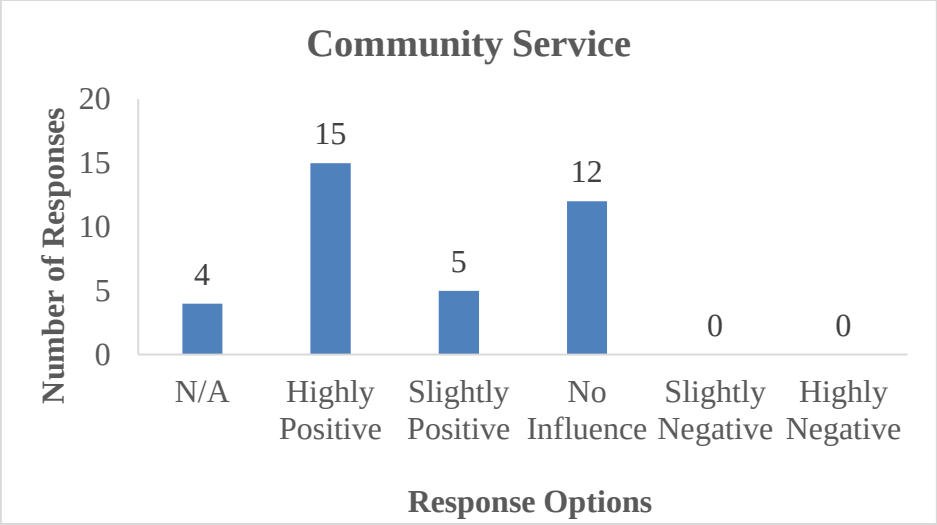

Figure 7. Community Service: Response Options vs. Number of Responses (Recruitment Factor)

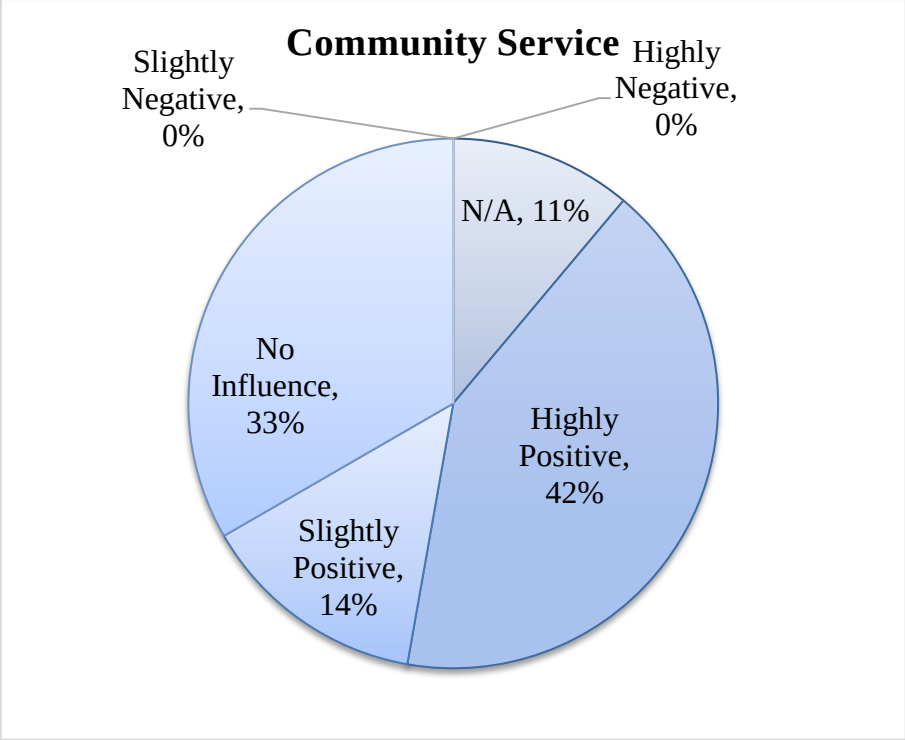

Figure 8. Community Service: Percentages of Responses under each Response Option (Recruitment Factor)

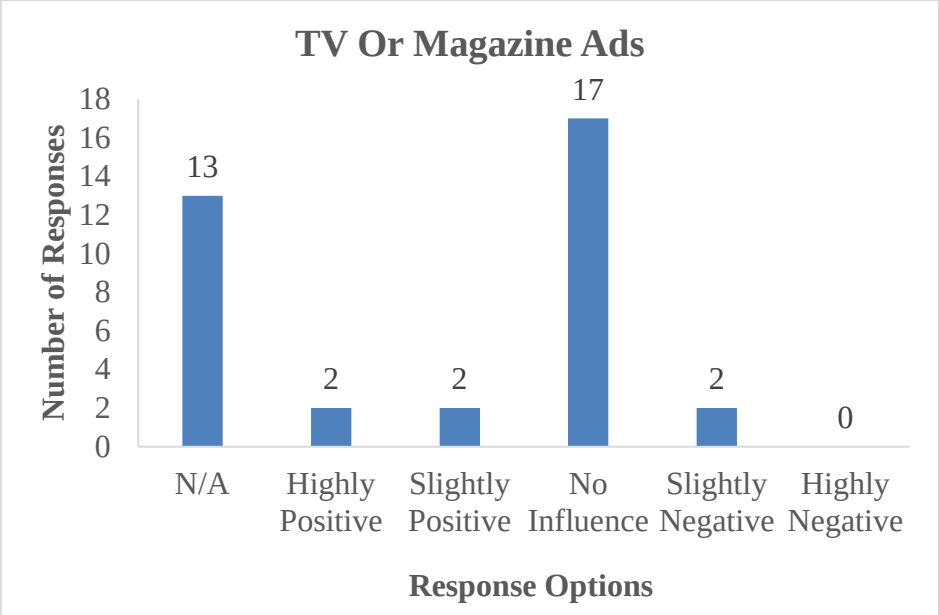

Figure 9. TV or Magazine Ads: Response Options vs. Number of Responses (Recruitment Factor)

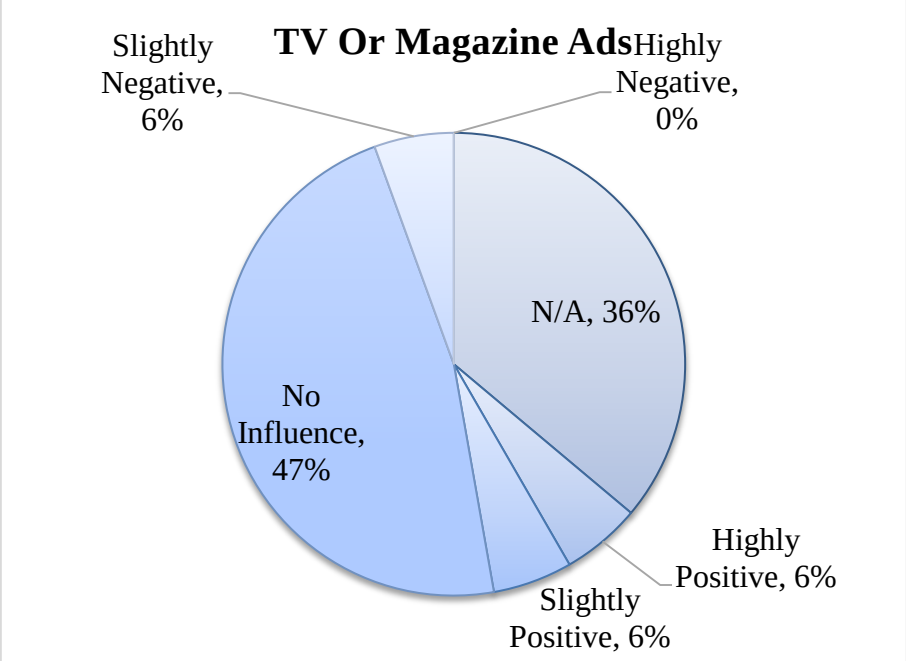

Figure 10. TV or Magazine Ads: Percentages of Responses under each Response Option (Recruitment Factor)

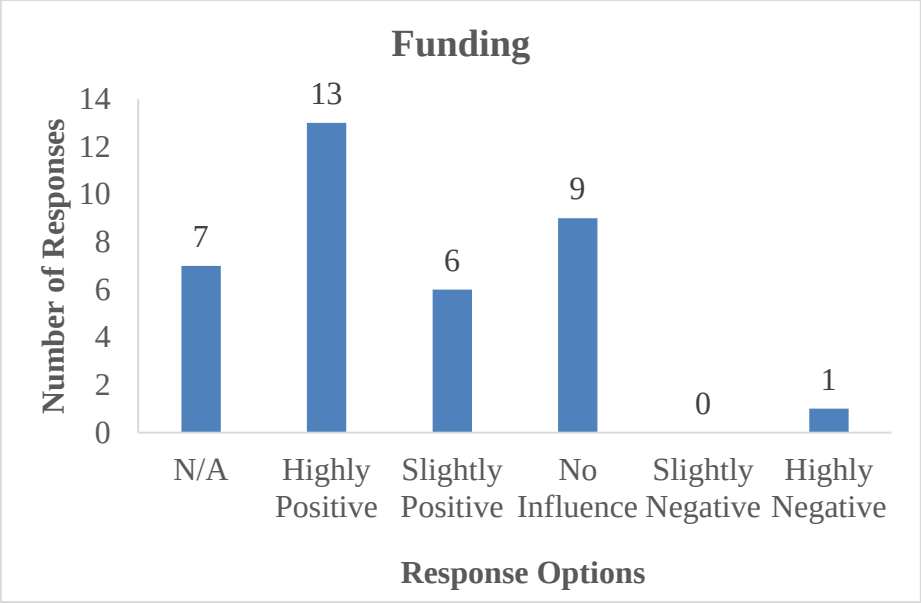

Figure 11. Funding: Response Options vs. Number of Responses (Recruitment Factor)

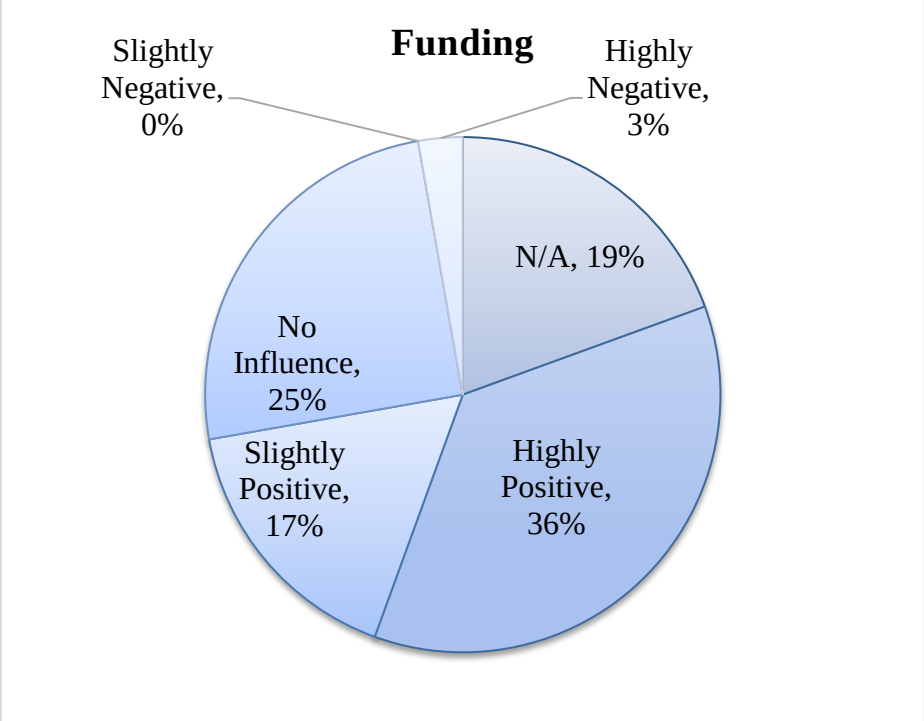

Figure 12. Funding: Percentages of Responses under each Response Option (Recruitment Factor)

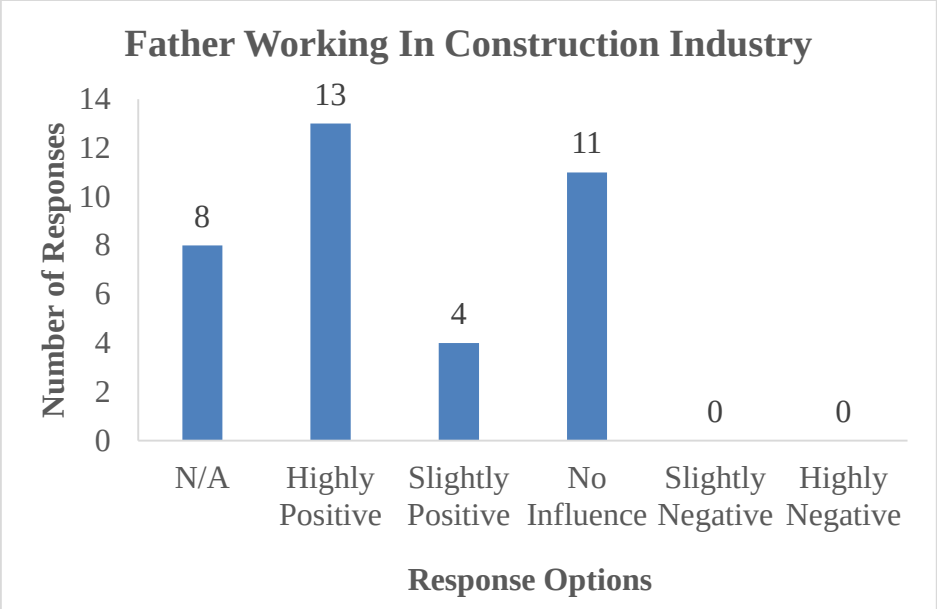

Figure 13. Father Working in Construction Industry: Response Options vs. Number of Responses (Recruitment Factor)

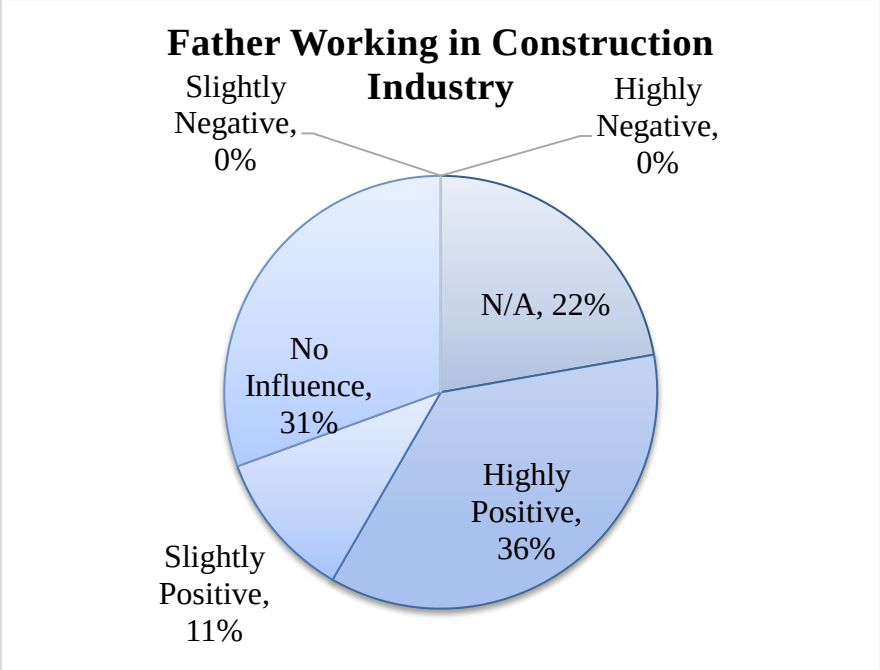

Figure 14. Father Working in Construction Industry: Percentages of Responses under each Response Option (Recruitment Factor)

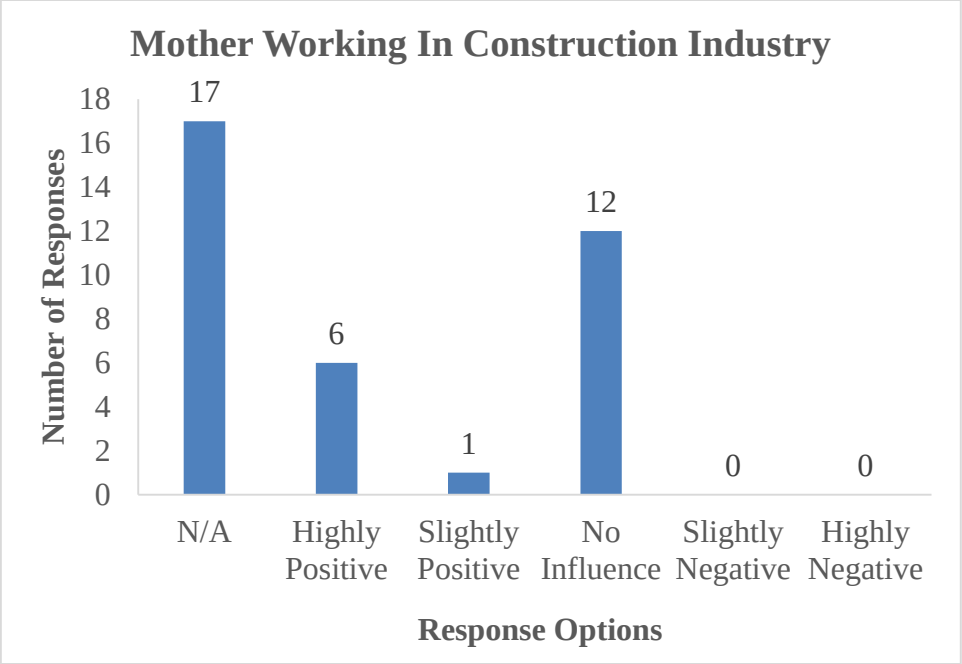

Figure 15. Mother Working in Construction Industry: Response Options vs. Number of Responses (Recruitment Factor)

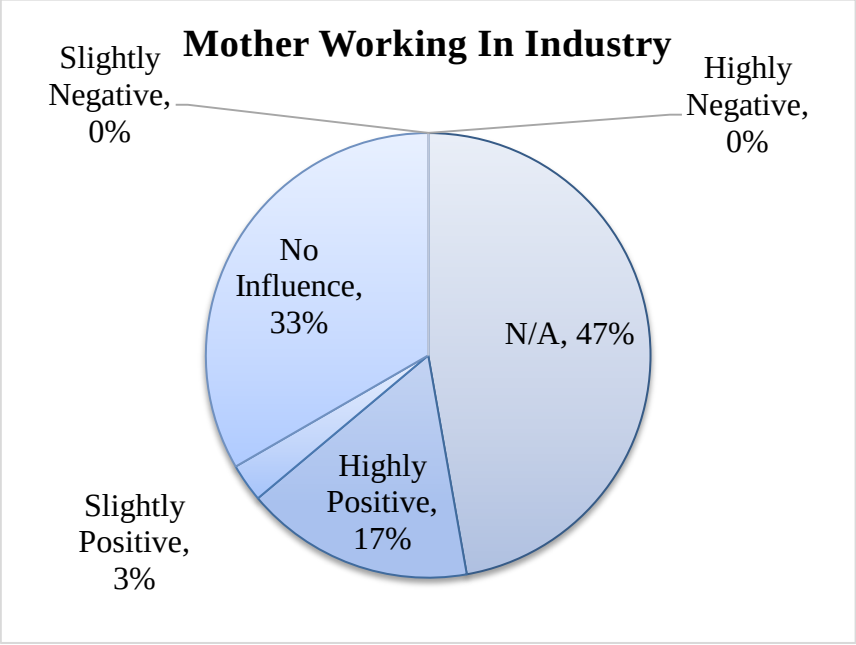

Figure 16. Mother Working in Construction Industry: Percentages of Responses under each Response Option (Recruitment Factor)

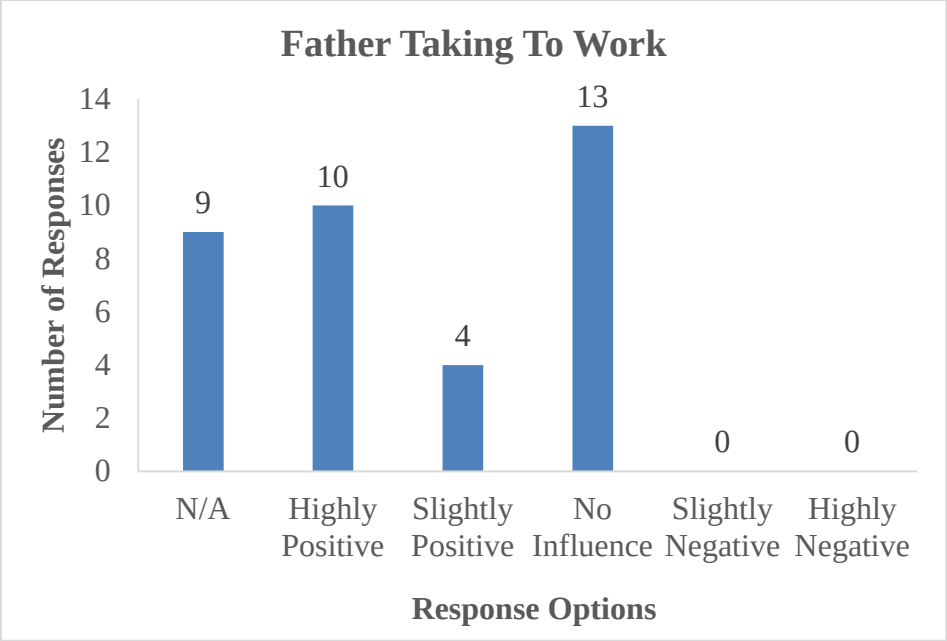

Figure 17. Father Taking To Work: Response Options vs. Number of Responses (Recruitment Factor)

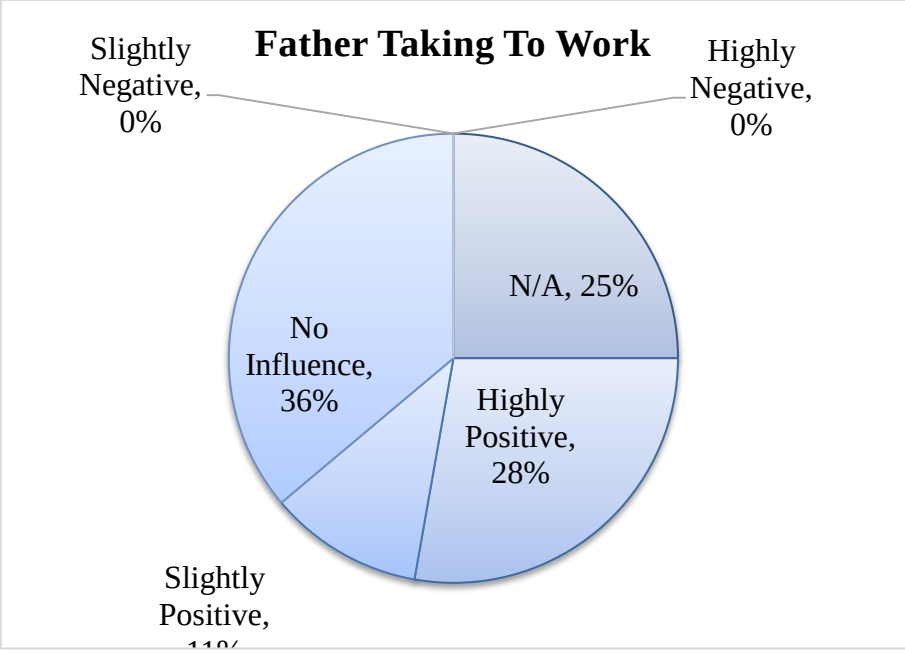

Figure 18. Father Taking To Work: Percentages of Responses under each Response Option (Recruitment Factor)

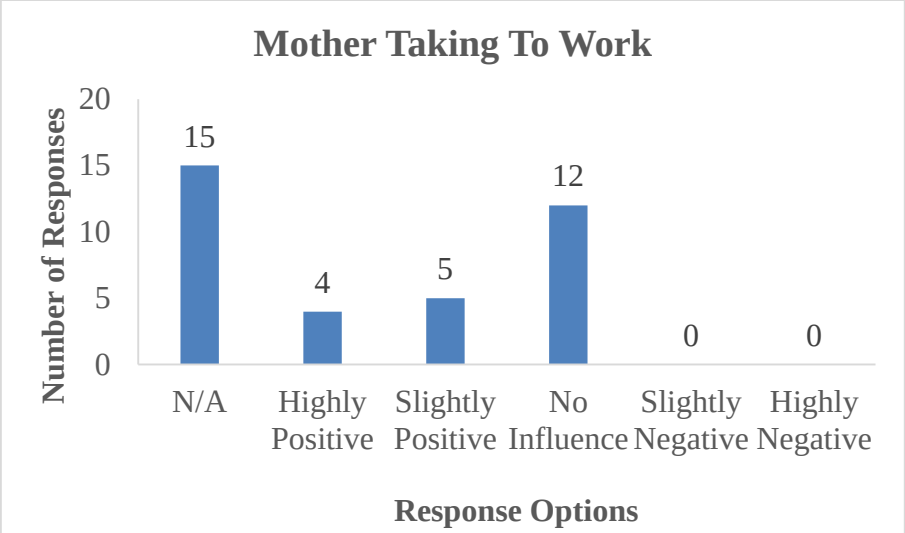

Figure 19. Mother Taking To Work: Response Options vs. Number of Responses (Recruitment Factor)

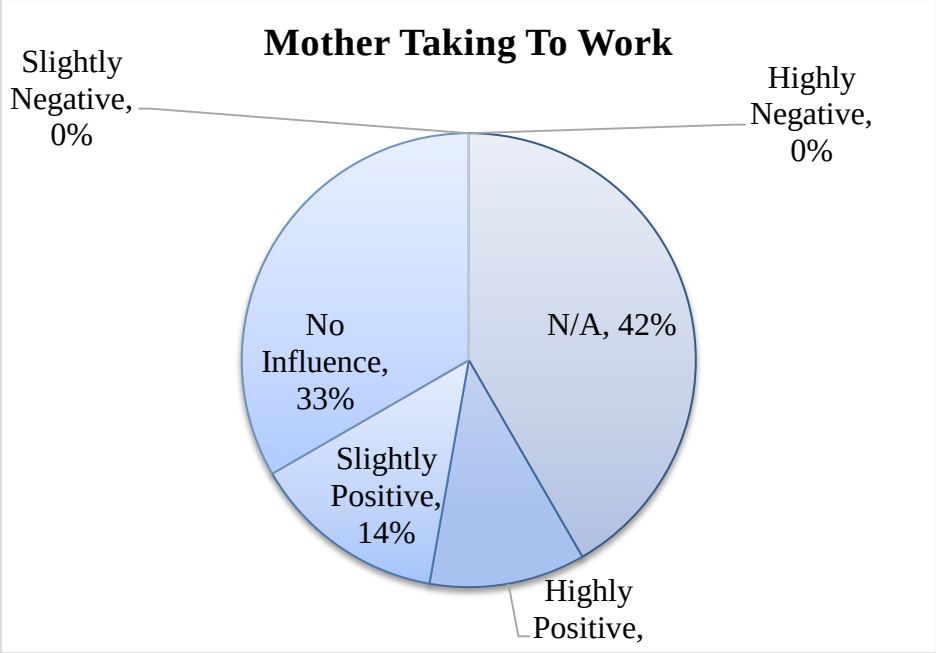

Figure 20. Mother Taking To Work: Percentages of Responses under each Response Option (Recruitment Factor)

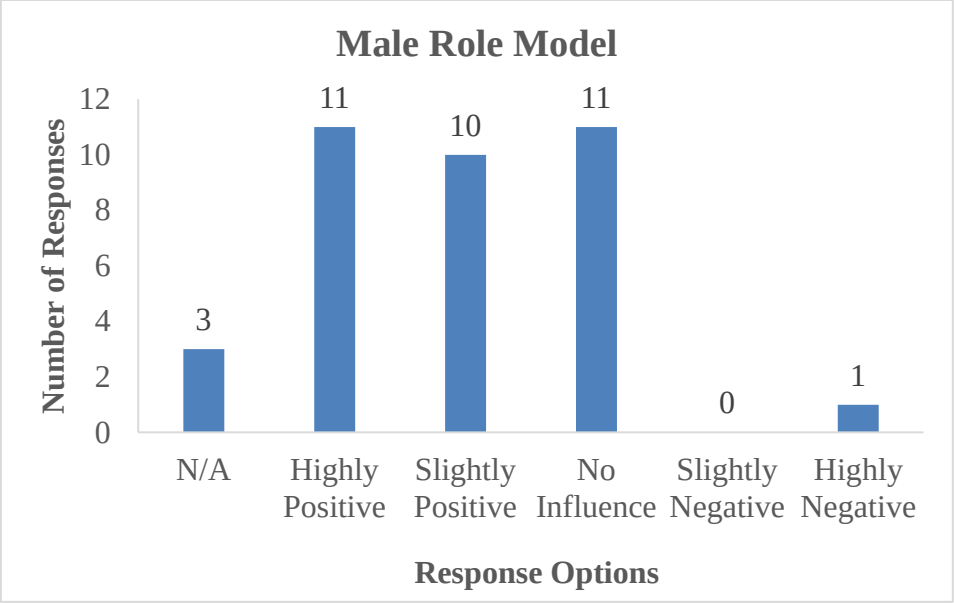

Figure 21. Male Role Model: Response Options vs. Number of Responses (Recruitment Factor)

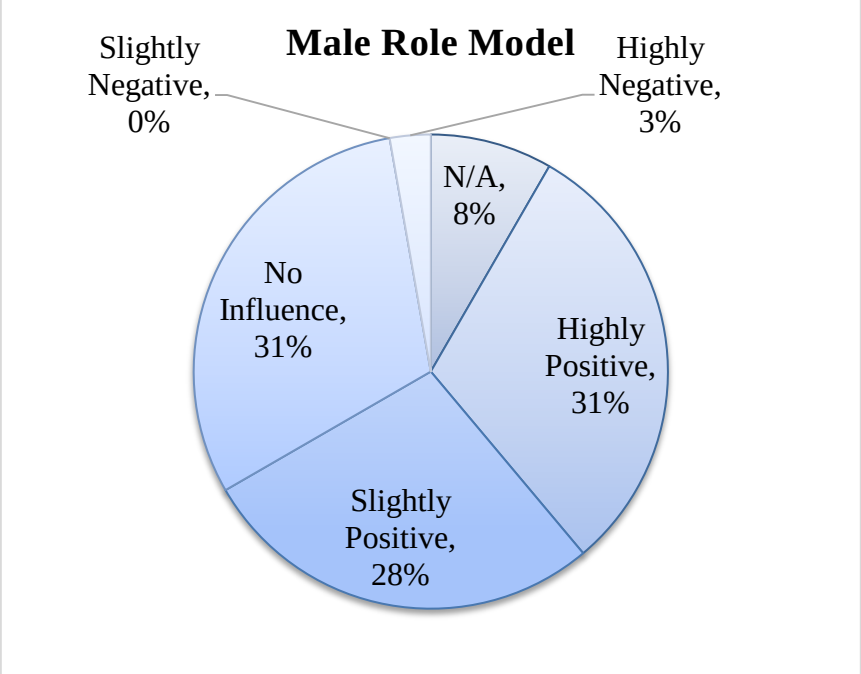

Figure 22. Male Role Model: Percentages of Responses under each Response Option (Recruitment Factor)

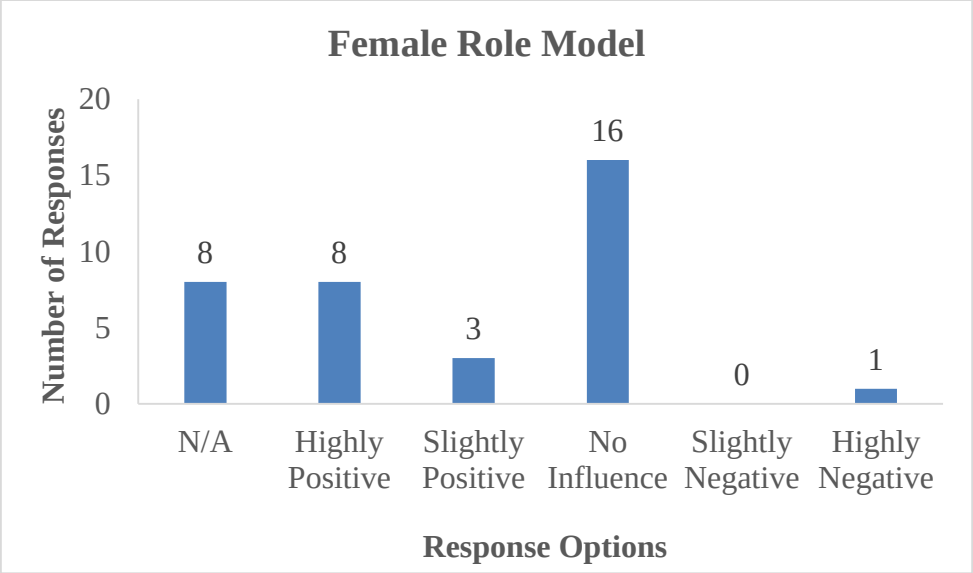

Figure 23. Female Role Model: Response Options vs. Number of Responses (Recruitment Factor)

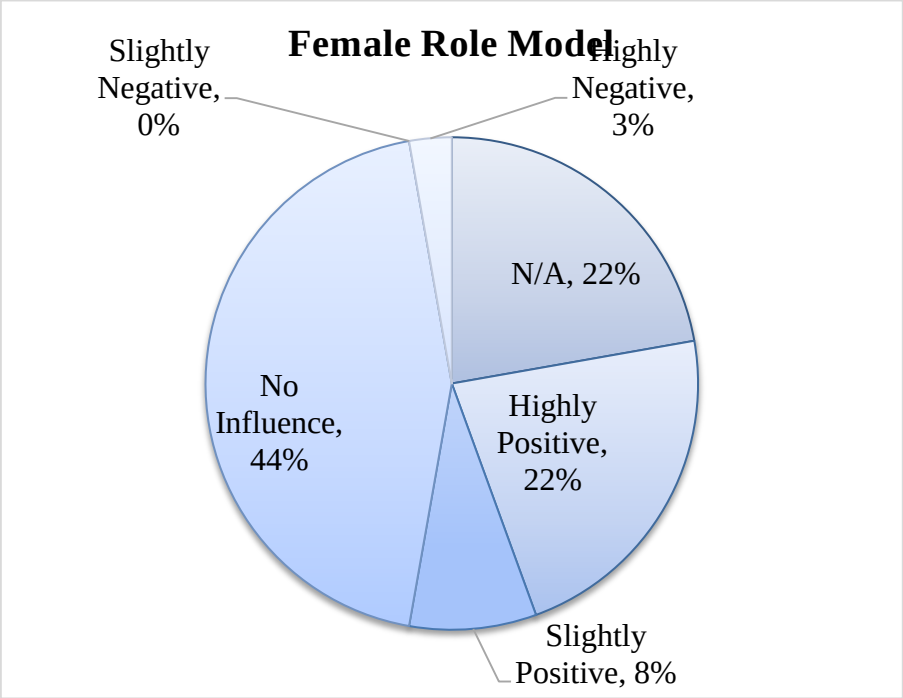

Figure 24. Female Role Model: Percentages of Responses under each Response Option (Recruitment Factor)

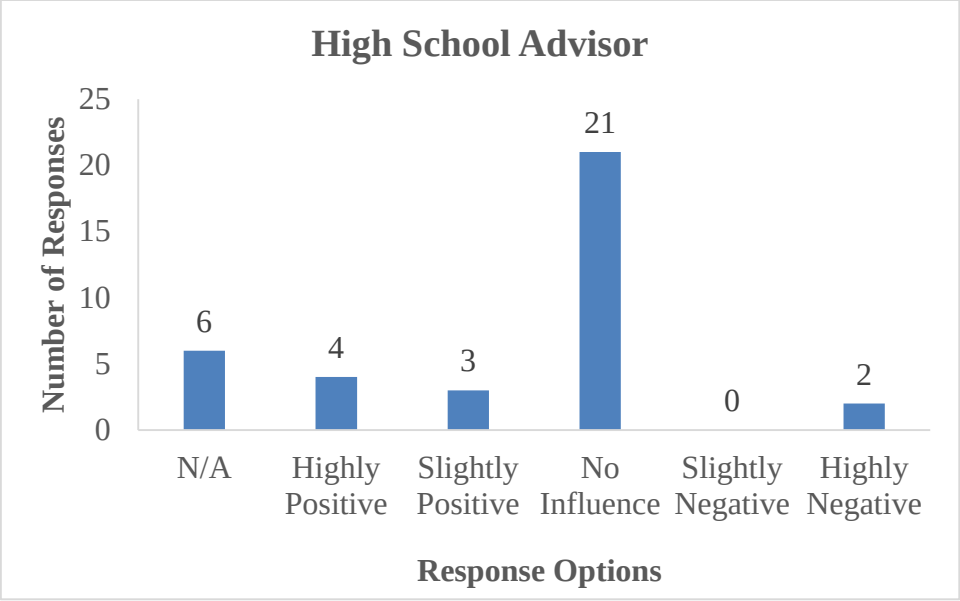

Figure 25. High School Advisor: Response Options vs. Number of Responses (Recruitment Factor)

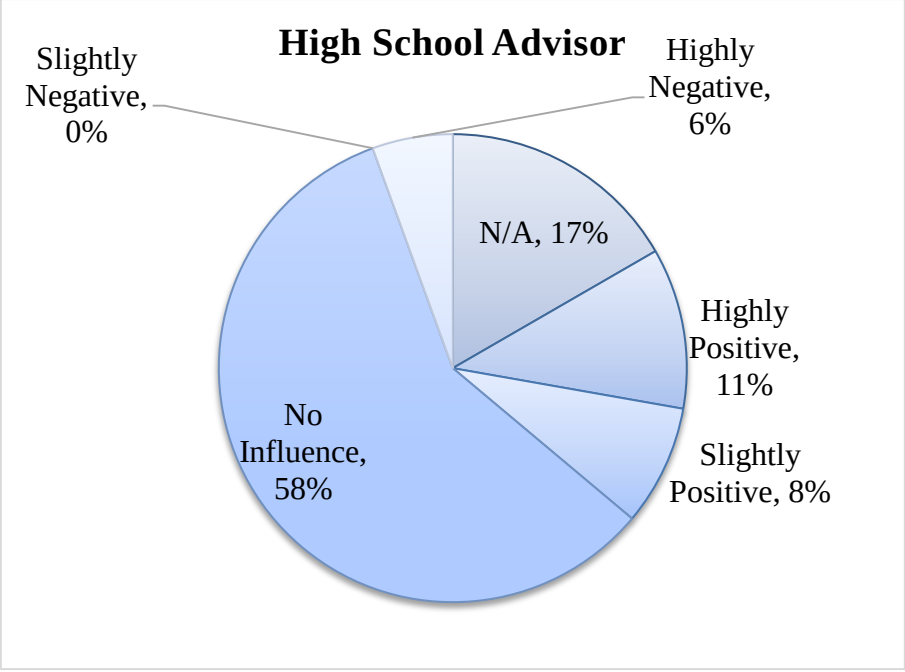

Figure 26. High School Advisor: Percentages of Responses under each Response Option (Recruitment Factor)

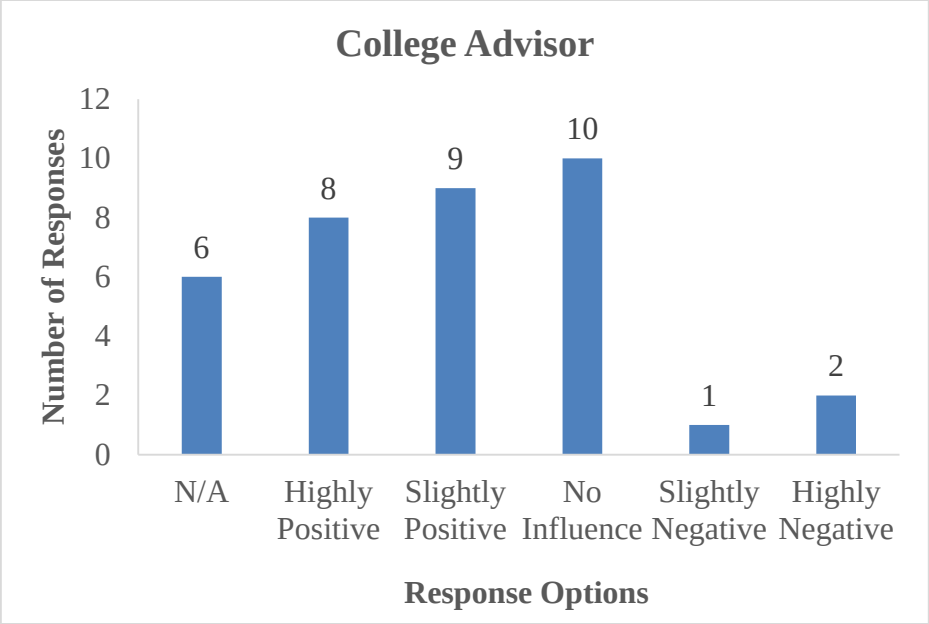

Figure 27. College Advisor: Response Options vs. Number of Responses (Recruitment Factor)

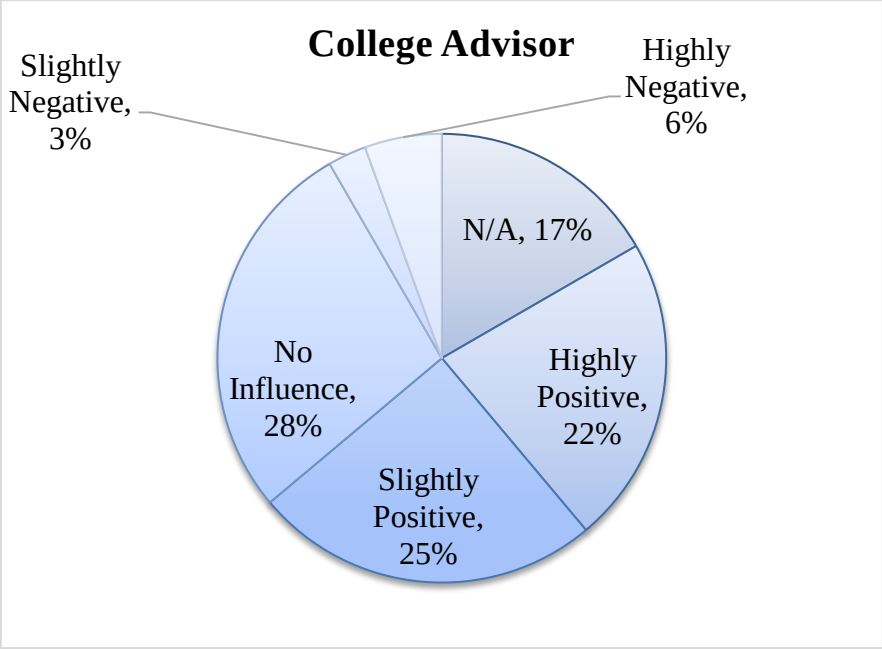

Figure 28. College Advisor: Percentages of Responses under each Response Option (Recruitment Factor)

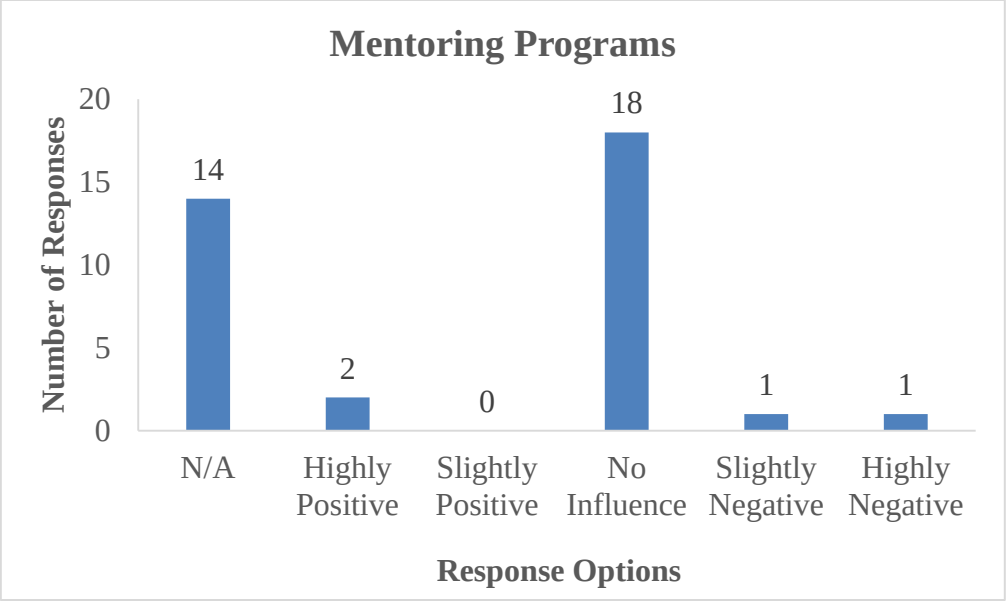

Figure 29. Mentoring Program: Response Options vs. Number of Responses(Recruitment Factor)

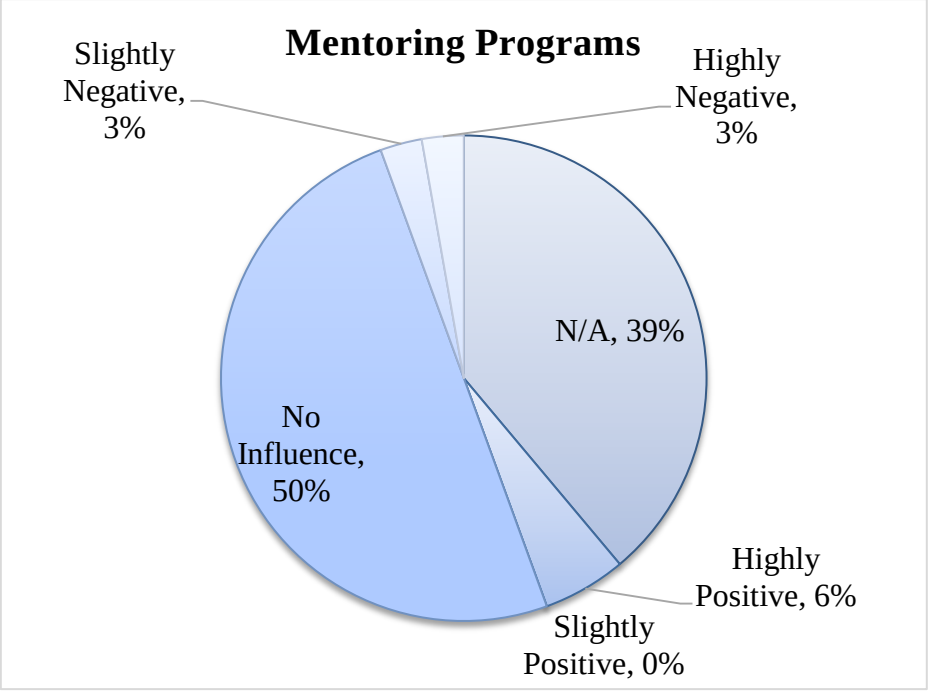

Figure 30. Mentoring Program: Percentages of Responses under each Response Option(Recruitment Factor)

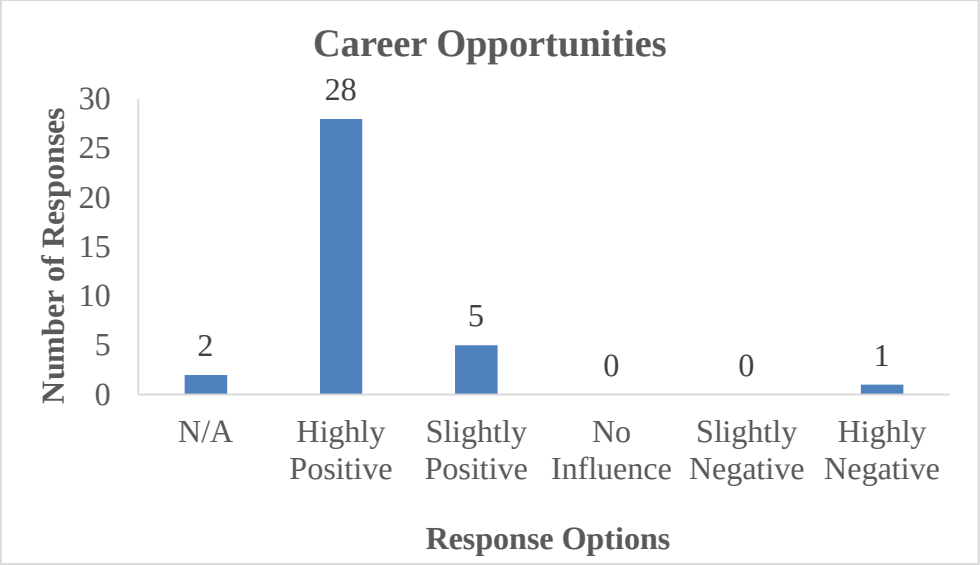

Figure 31. Career Opportunities: Response Options vs. Number of Responses (Recruitment Factor)

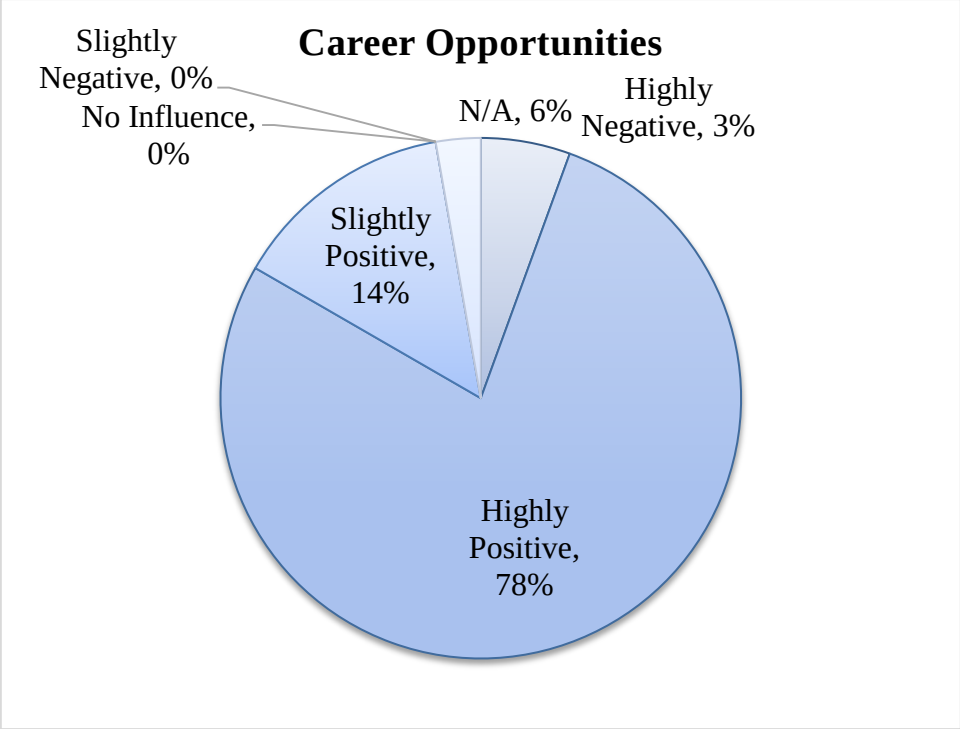

Figure 32. Career Opportunities: Percentages of Responses under each Response Option (Recruitment Factor)

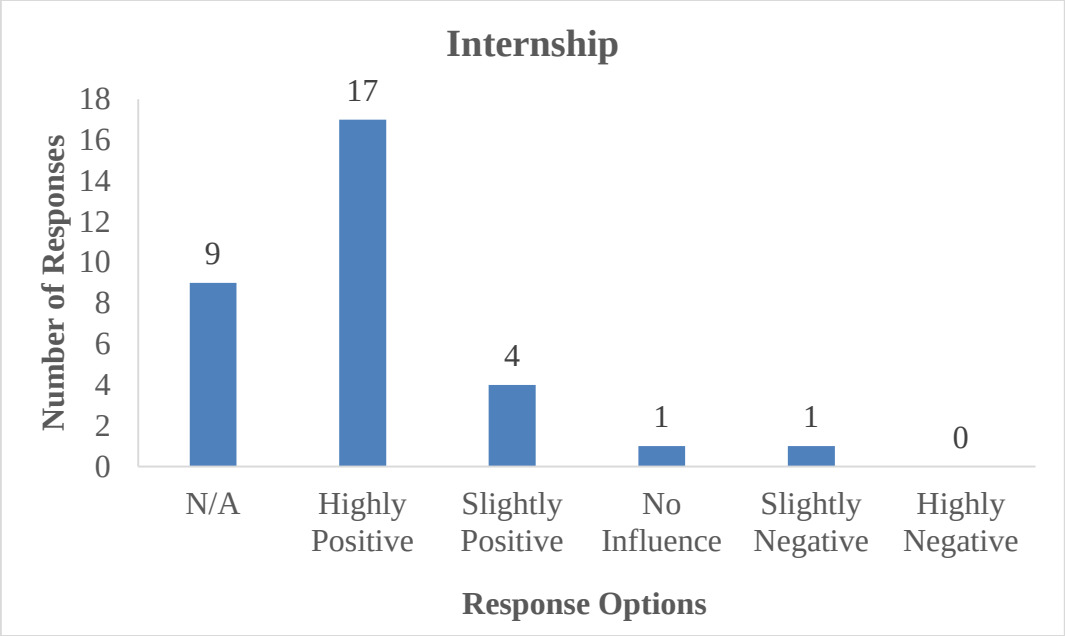

Figure 33. Internship: Response Options vs. Number of Responses (Retention factor)

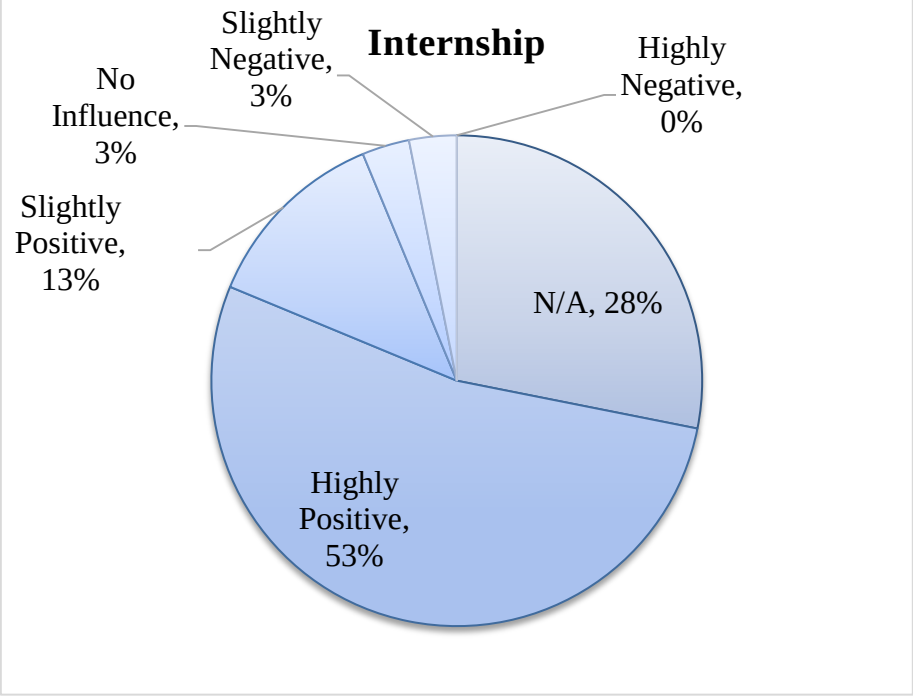

Figure 33. Internship: Percentages of Responses under each Response Option (Retention Factor)

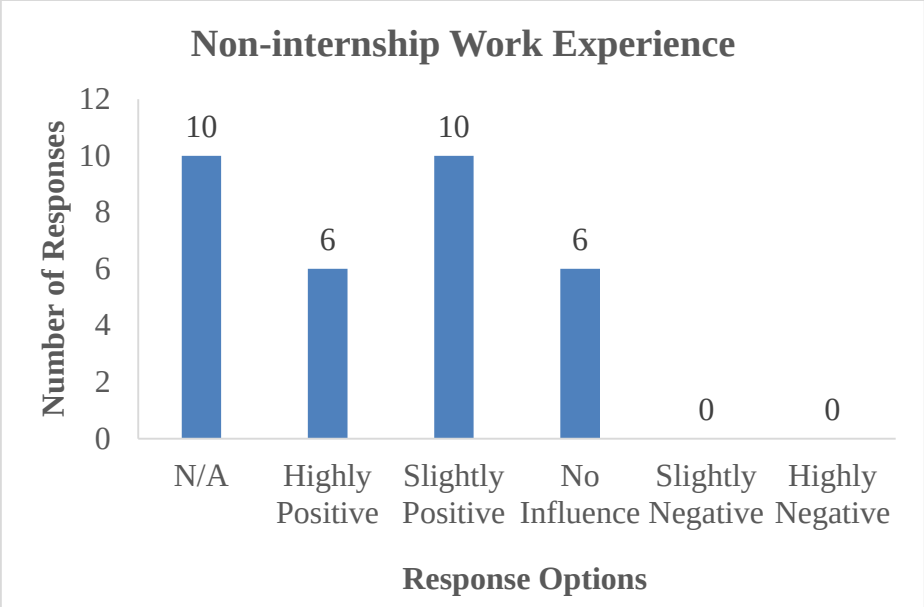

Figure 35. Non- internship Work Experience: Response Options vs. Number of Responses (Retention factor)

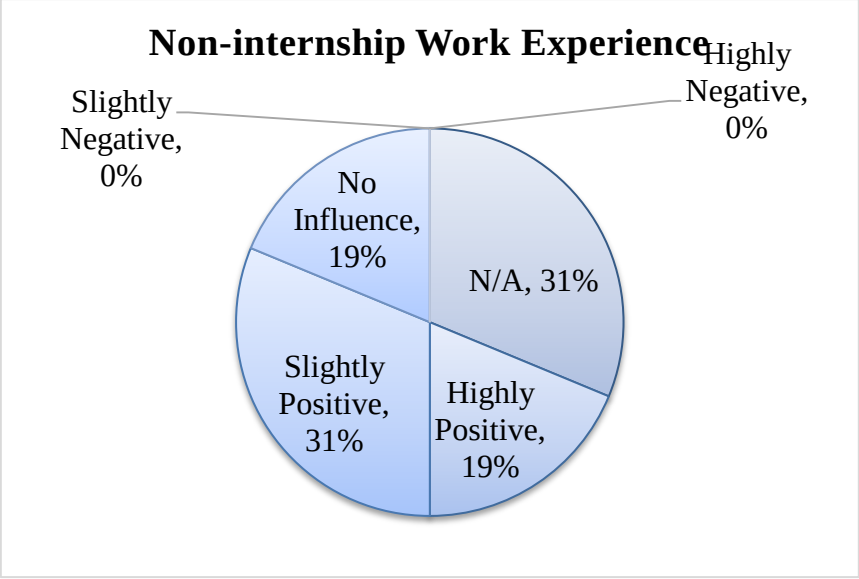

Figure 36. Non- internship Work Experience: Percentages of Responses under each Response Option (Retention Factor)

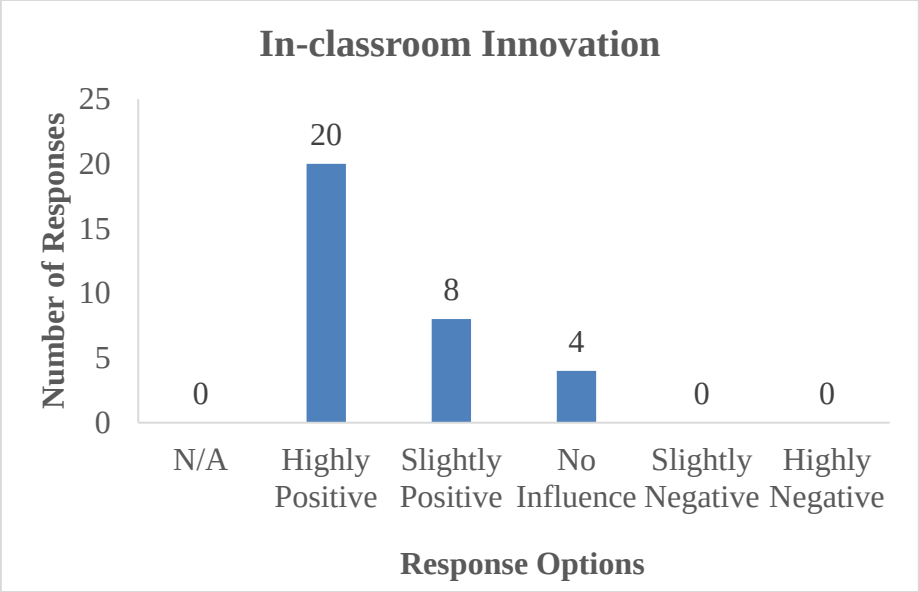

Figure 37. In- classroom Innovation: Response Options vs. Number of Responses (Retention Factor)

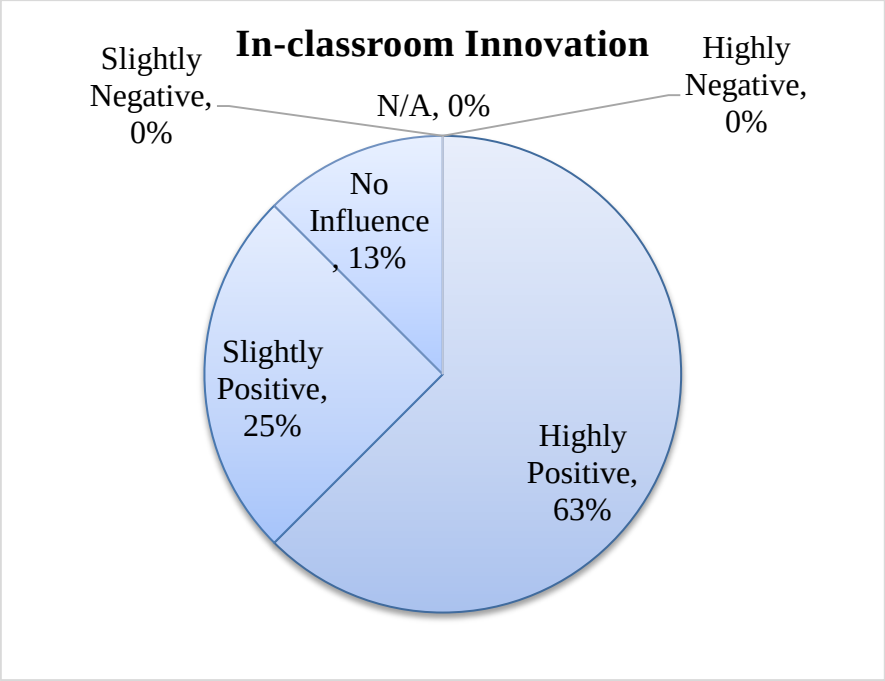

Figure 38. In- classroom Innovation: Percentages of Responses under each Response Option (Retention Factor)

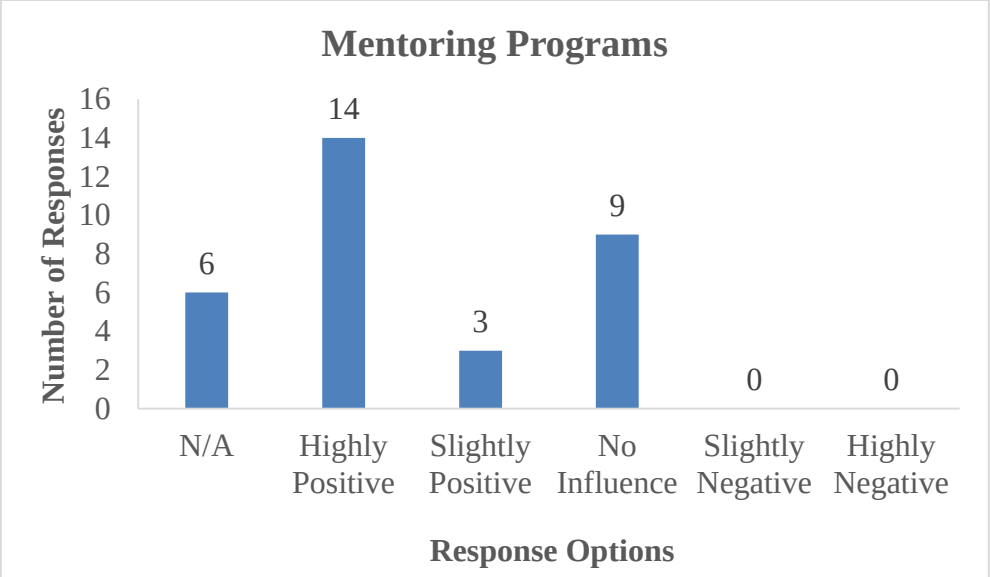

Figure 39. Mentoring Program: Response Options vs. Number of Responses (Retention Factor)

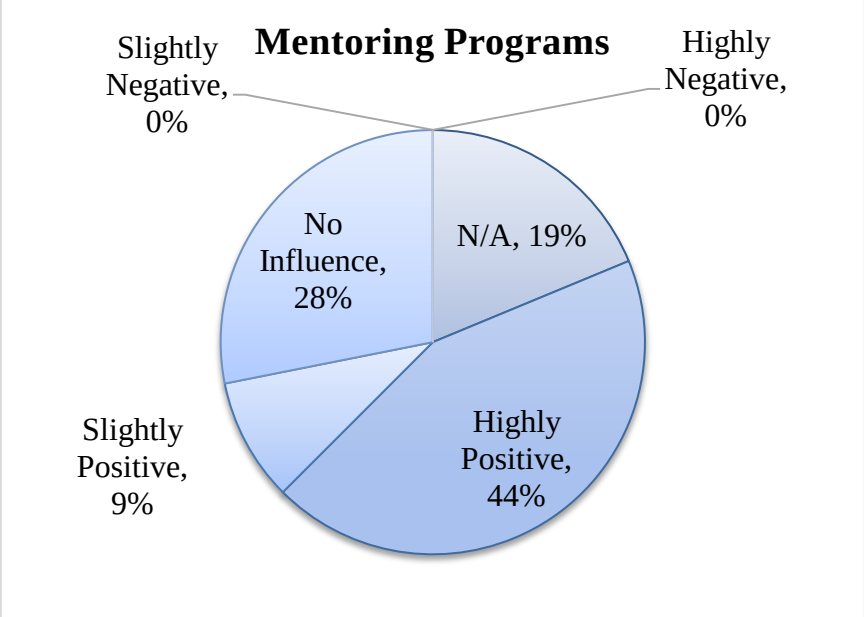

Figure 40. Mentoring Program: Percentages of Responses under each Response Option (Retention Factor)

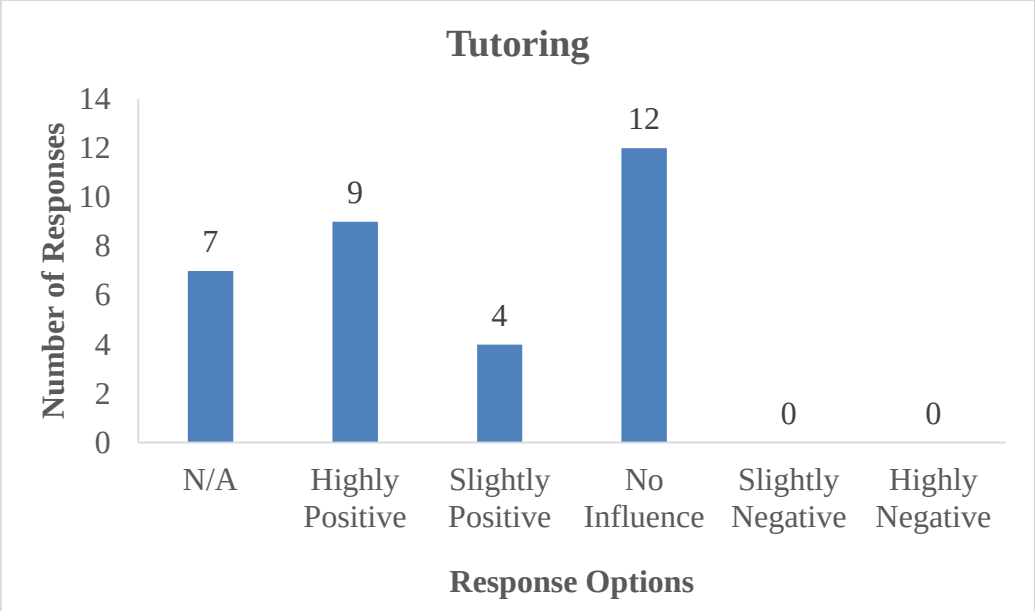

Figure 41. Tutoring: Response Options vs. Number of Responses (Retention factor)

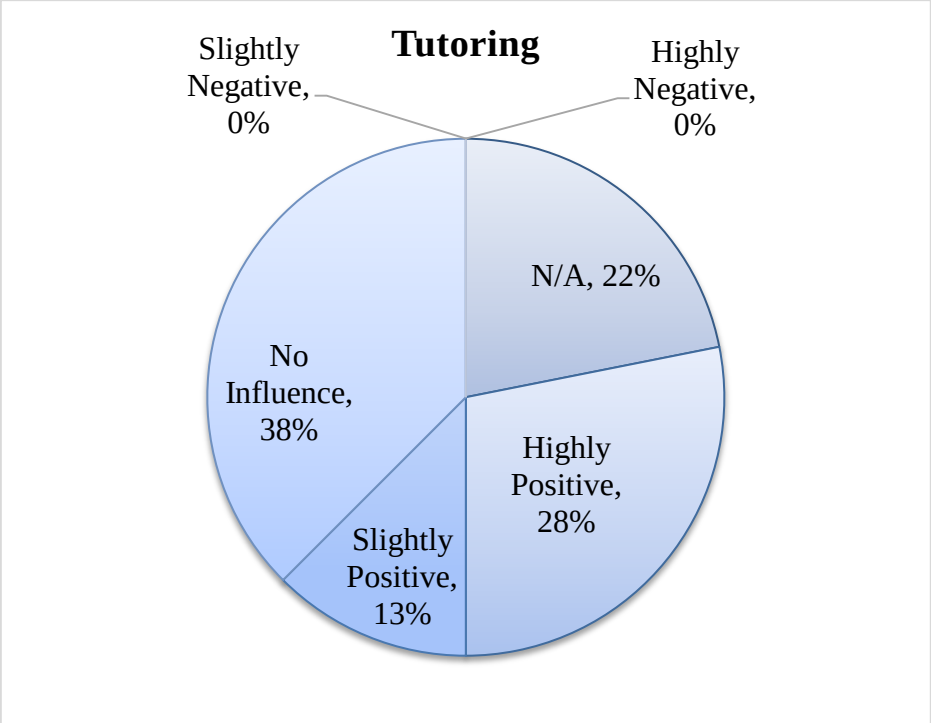

Figure 42. Tutoring: Percentages of Responses under each Response Option (Retention Factor)

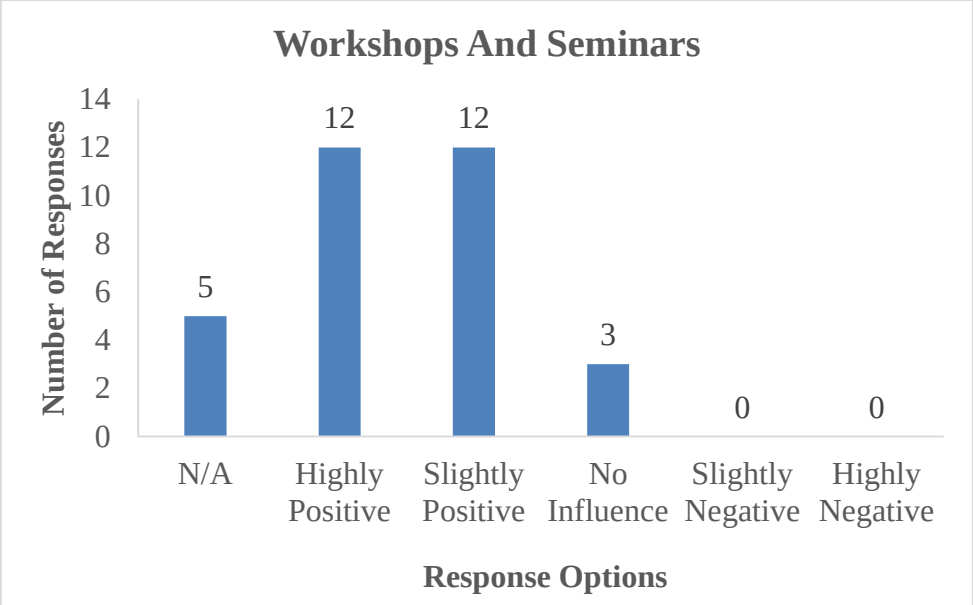

Figure 43. Workshops and Seminar: Response Options vs. Number of Responses (Retention Factor)

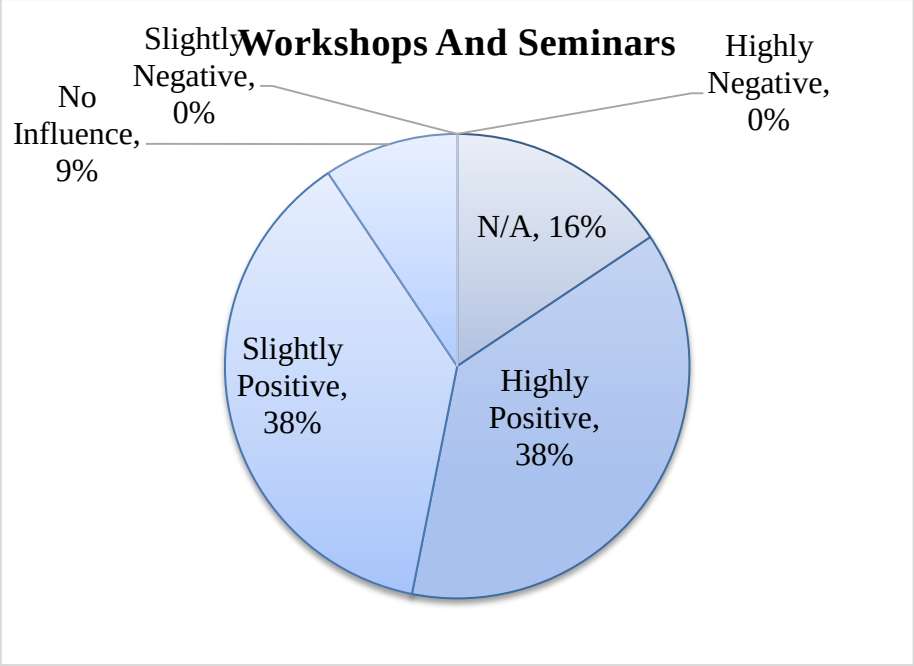

Figure 44. Workshops and Seminars: Percentages of Responses under each Response Option (Retention Factor)

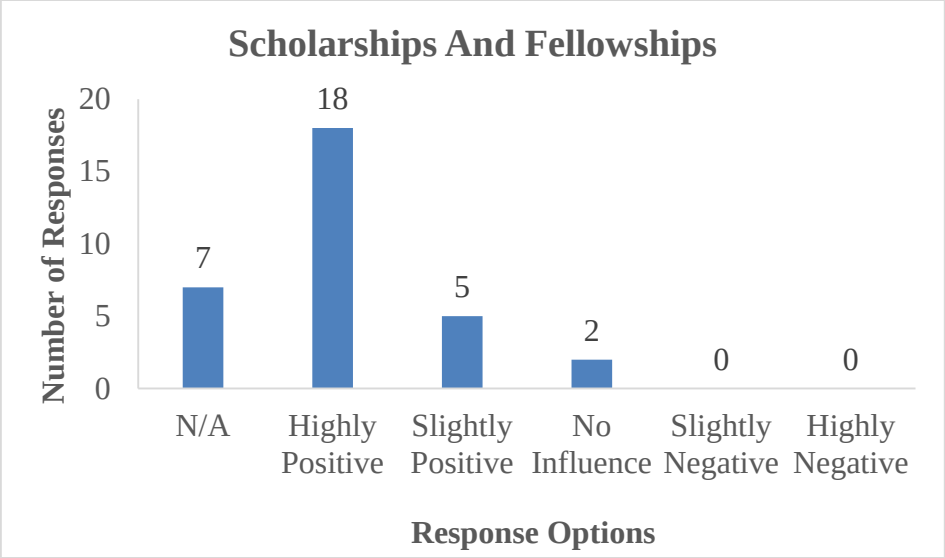

Figure 45. Scholarships and Fellowships: Response Options vs. Number of Responses (Retention Factor)

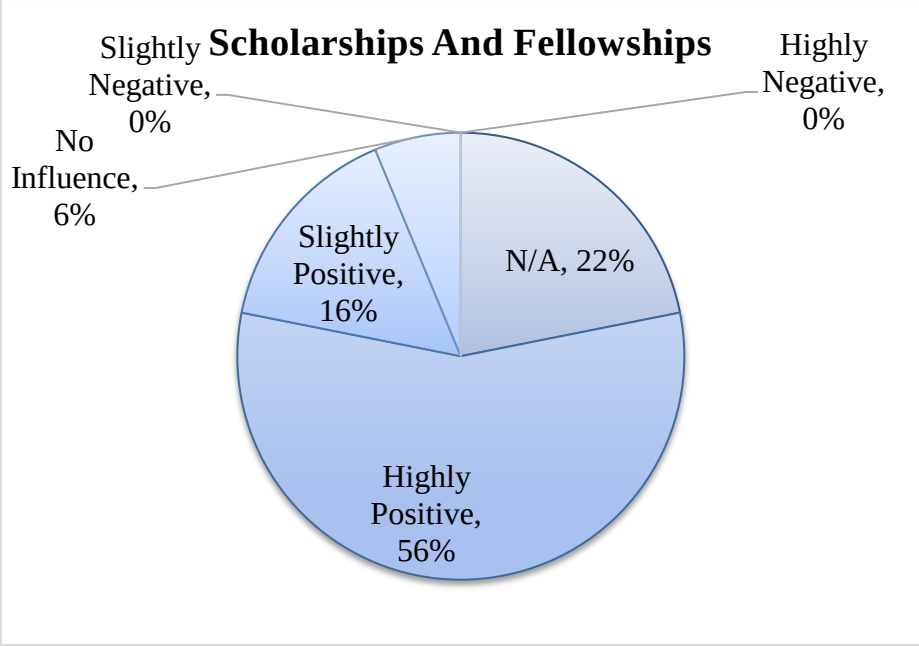

Figure 46. Scholarships and Fellowships: Percentages of Responses under each Response Option (Retention Factor)

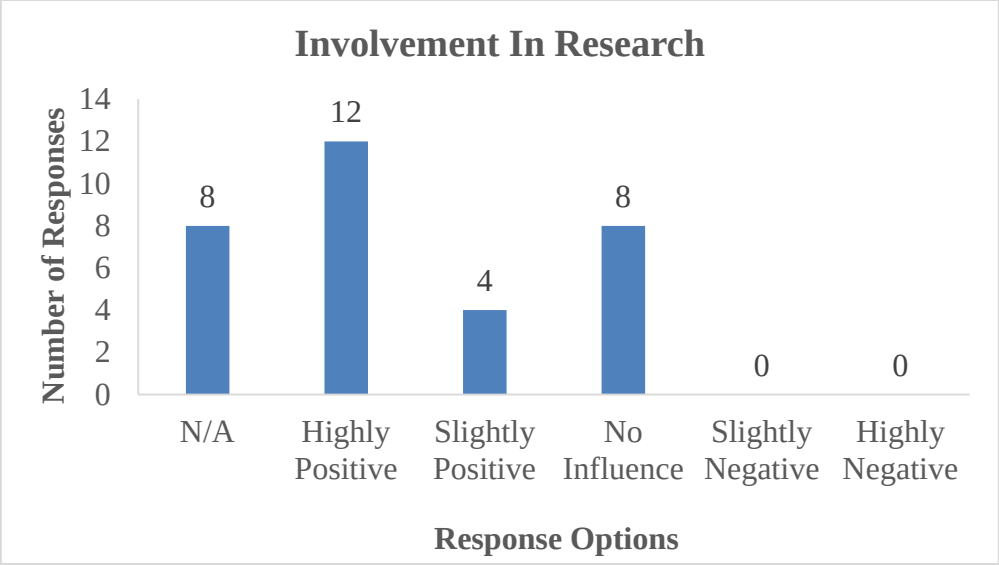

Figure 47. Involvement in Research: Response Options vs. Number of Responses (Retention Factor)

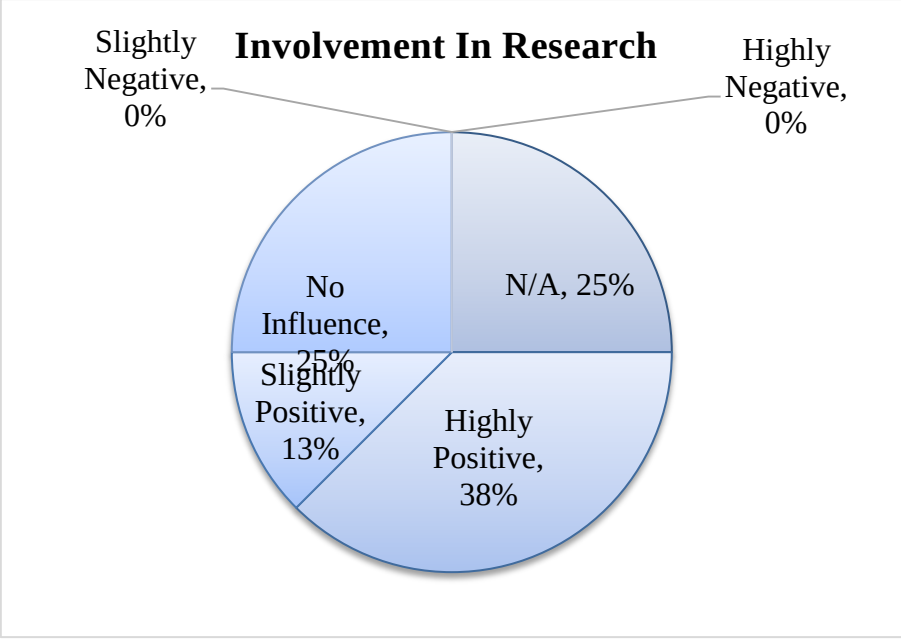

Figure 48. Involvement in Research: Percentages of Responses under each Response Option (Retention Factor)

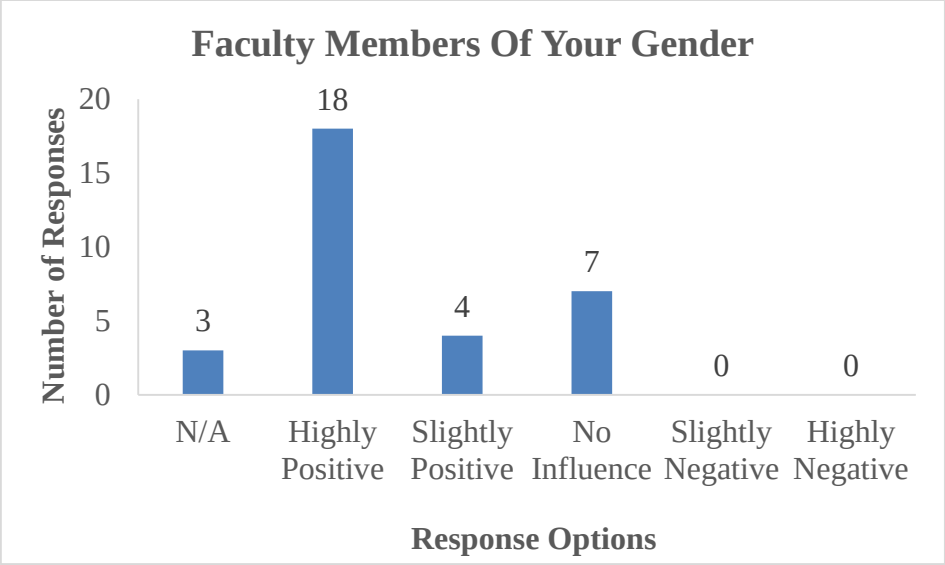

Figure 49. Faculty Members of Your Gender: Response Options vs. Number of Responses (Retention Factor)

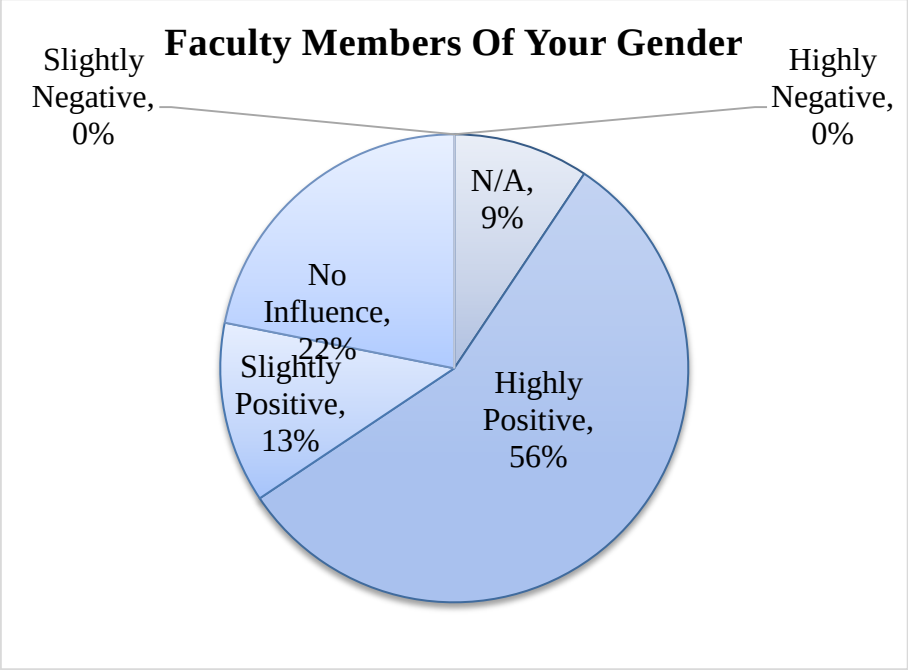

Figure 50. Faculty Members of your Gender: Percentages of Responses under each Response Option (Retention Factor)

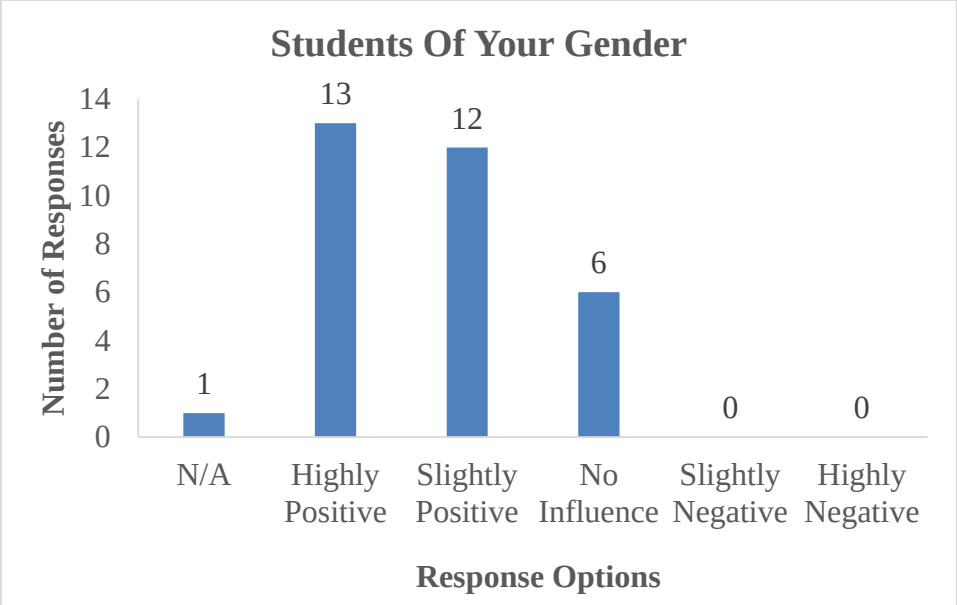

Figure 51. : Students of Your Gender: Response Options vs. Number of Responses (Retention Factor)

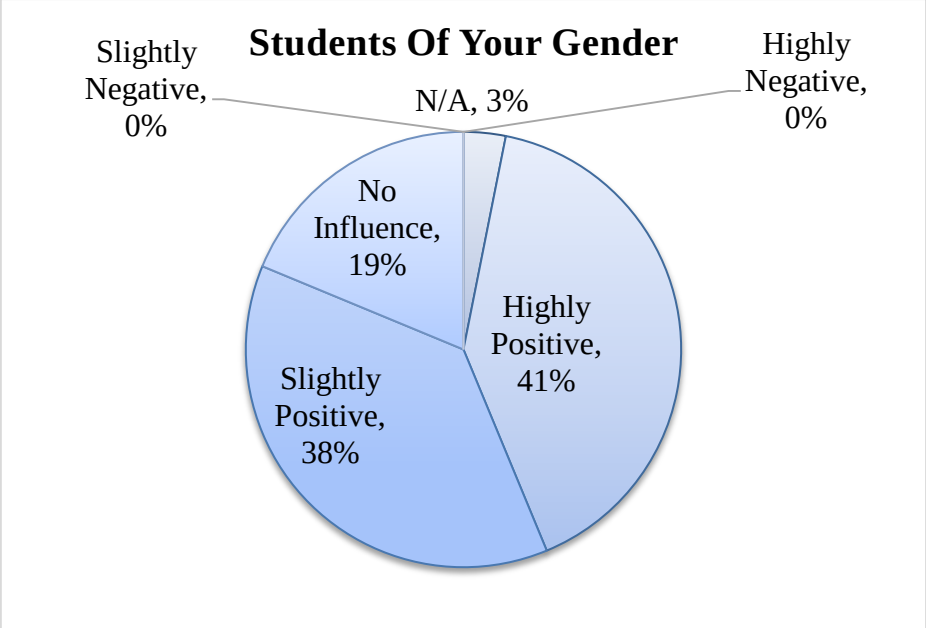

Figure 52. Students of Your Gender: Percentages of Responses under each Response Option (Retention Factor)

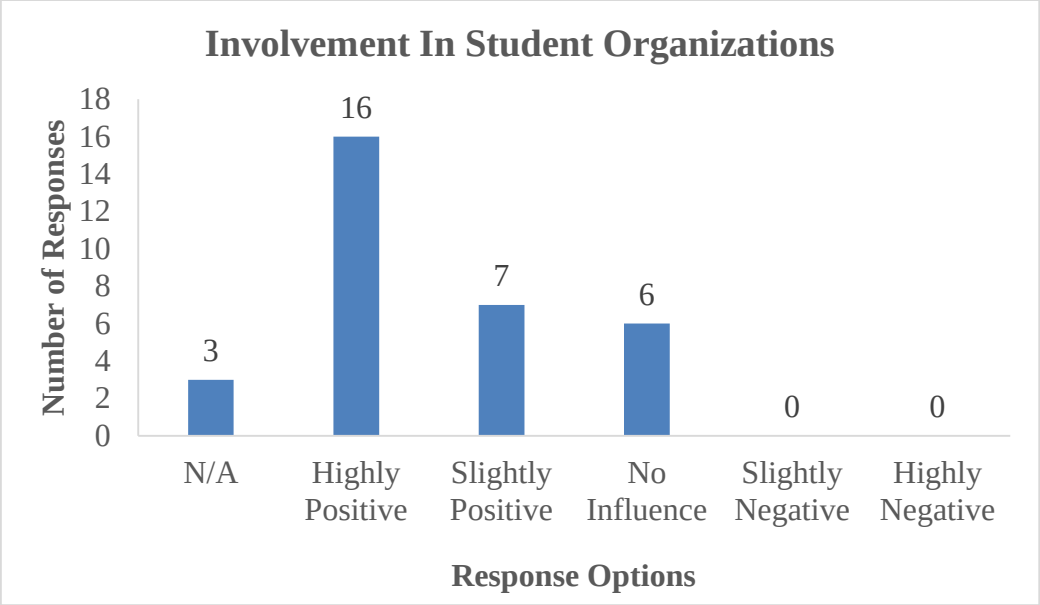

Figure 53. Involvement in Student Organizations: Response Options vs. Number of Responses (Retention Factor)

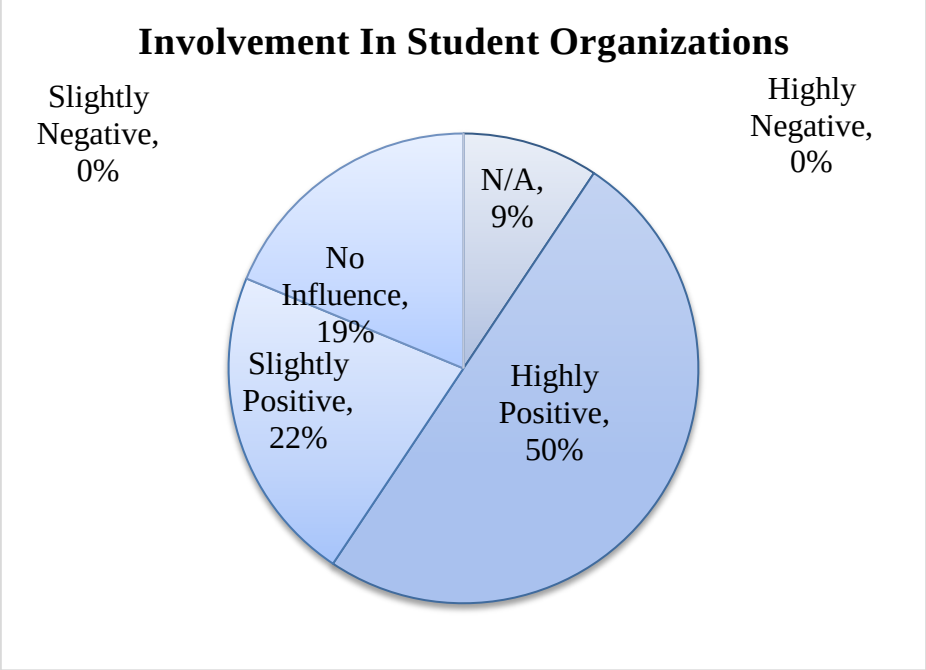

Figure 54. Involvement in Student Organizations: Percentages of Responses under each Response Option (Retention Factor)

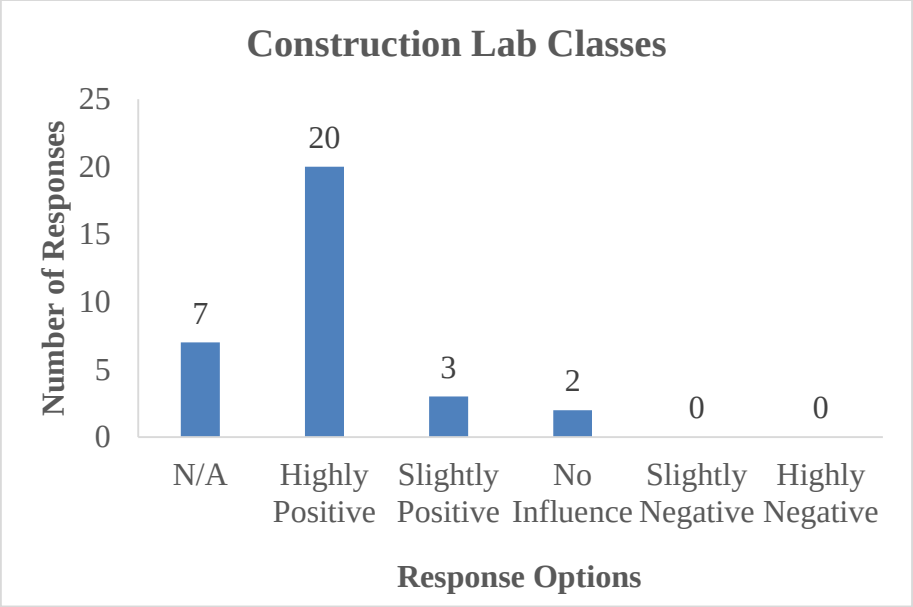

Figure 55. Construction Lab Classes: Response Options vs. Number of Responses (Retention Factor)

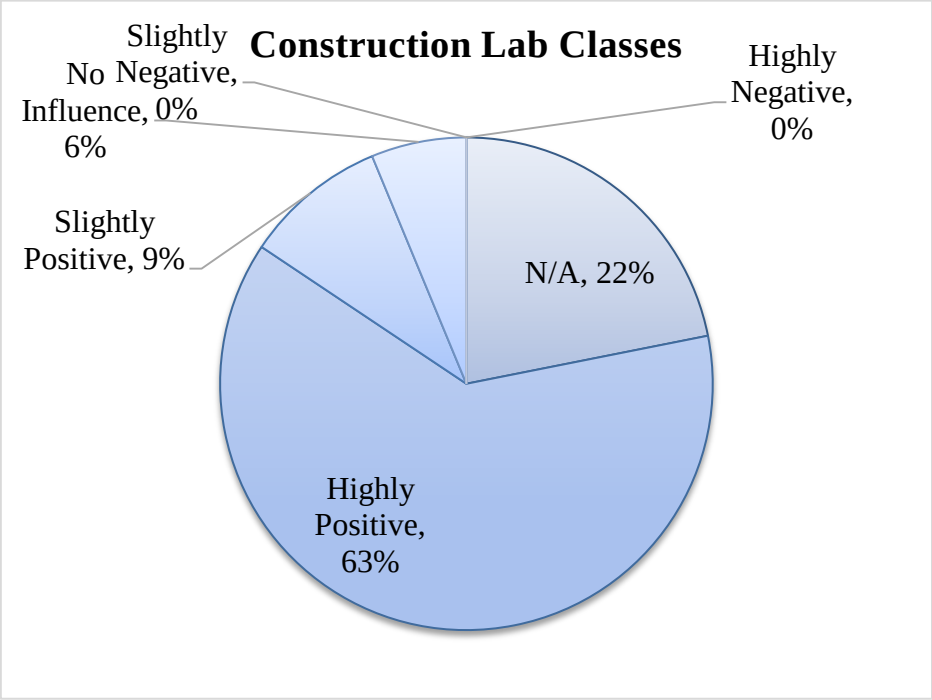

Figure 56. Construction Lab Classes: Percentages of Responses under each Response Option (Retention Factor)

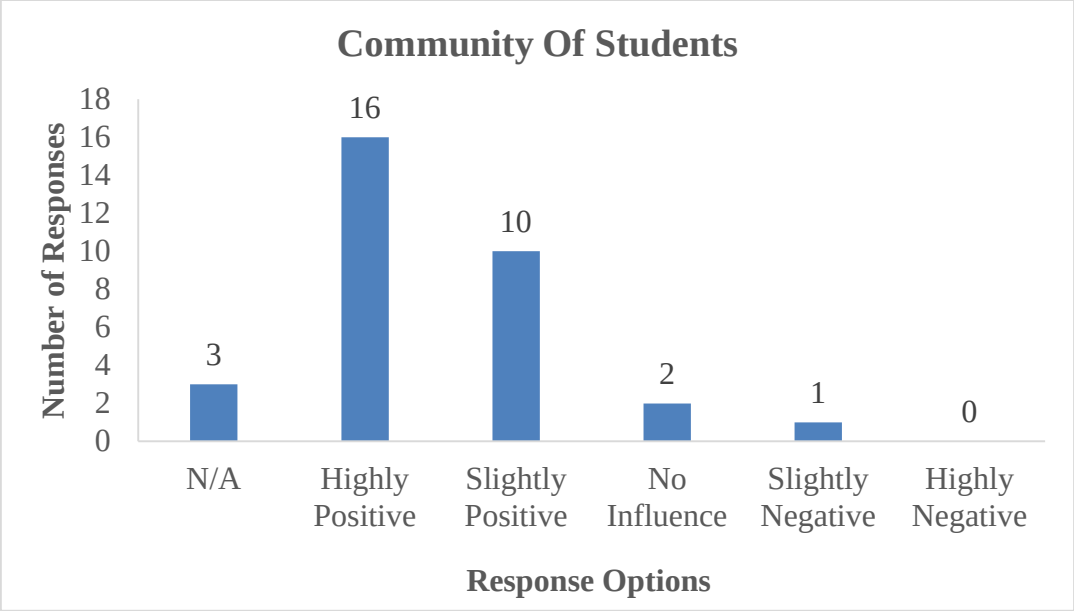

Figure 57. Community of Students: Response Options vs. Number of Responses (Retention Factor)

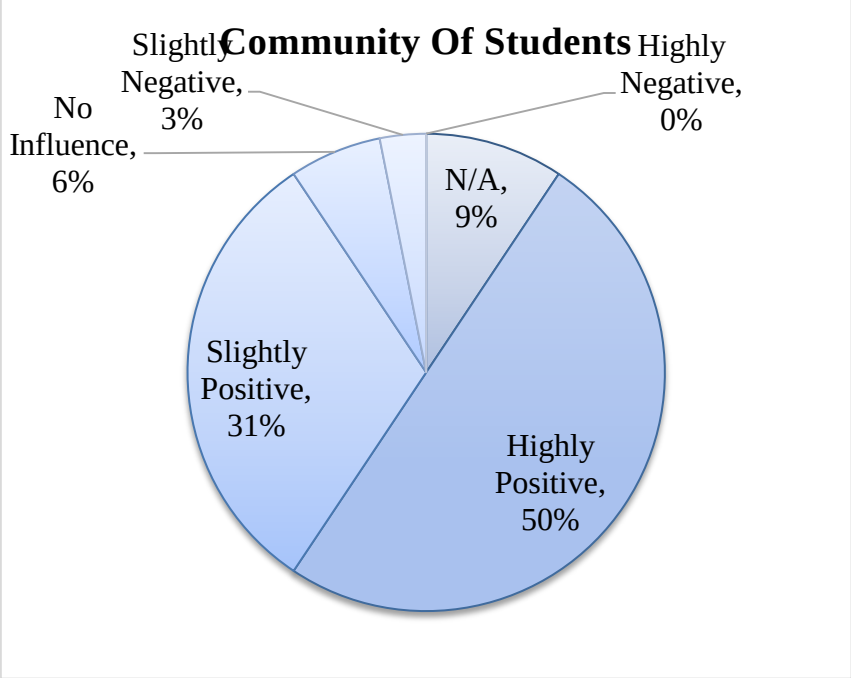

Figure 58. Community of Students: Percentages of Responses under each Response Option (Retention Factor)

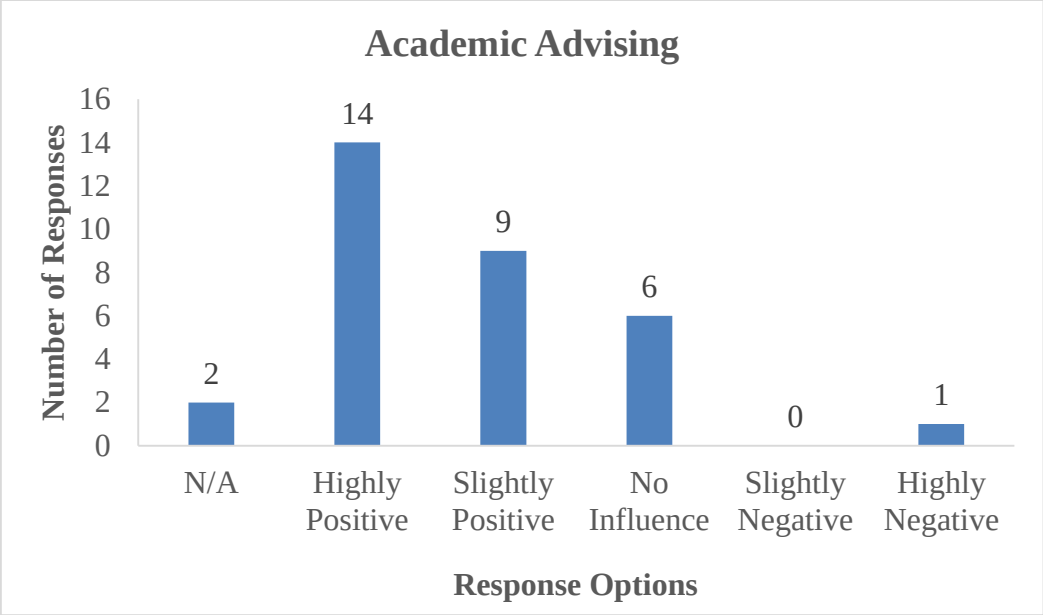

Figure 59. Academic Advising: Response Options vs. Number of Responses (Retention Factor)

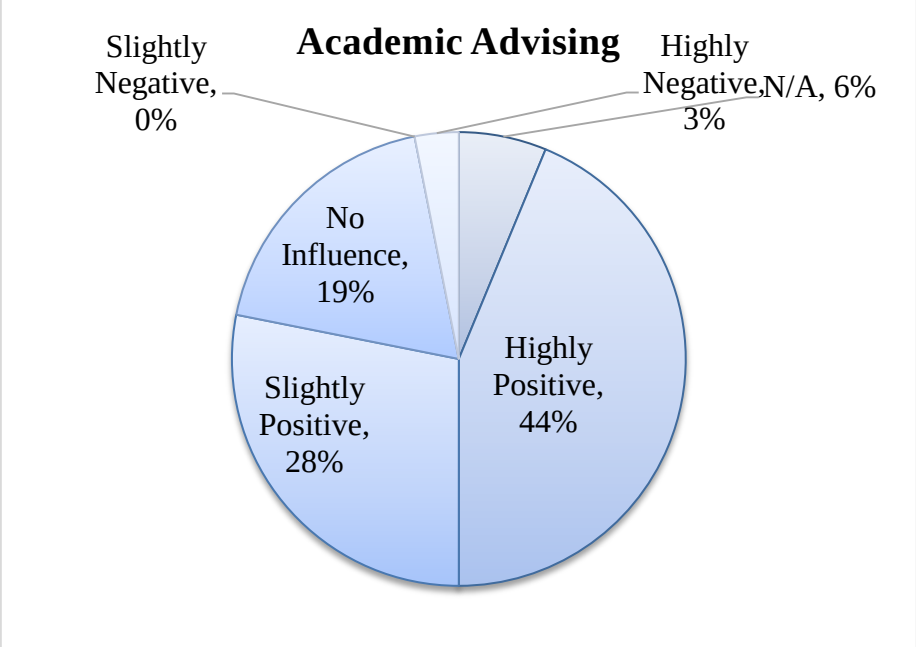

Figure 60. Academic Advising: Percentages of Responses under each Response Option (Retention Factor)

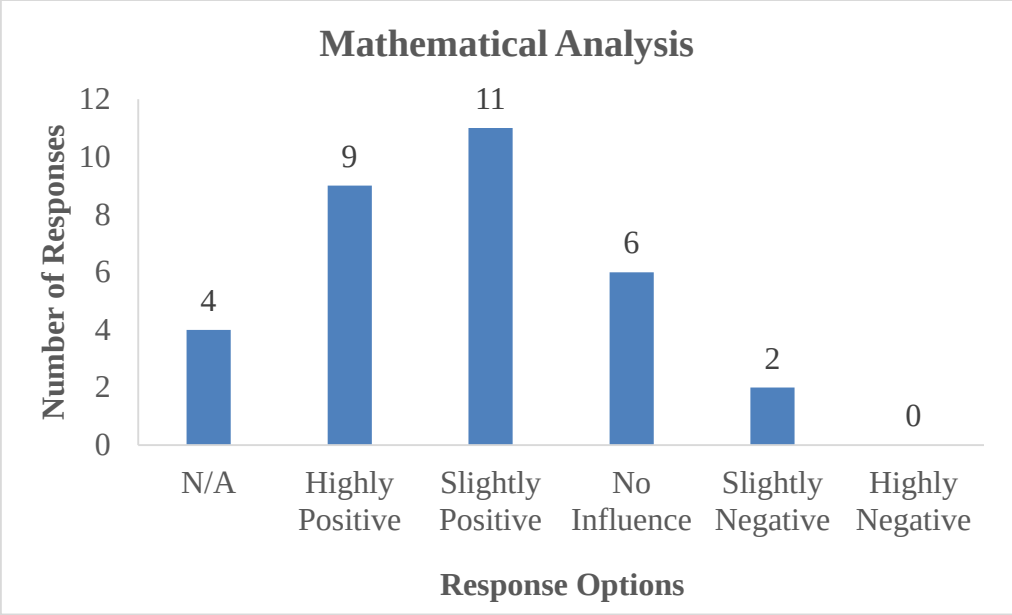

Figure 61. Mathematical Analysis: Response Options vs. Number of Responses (Retention Factor)

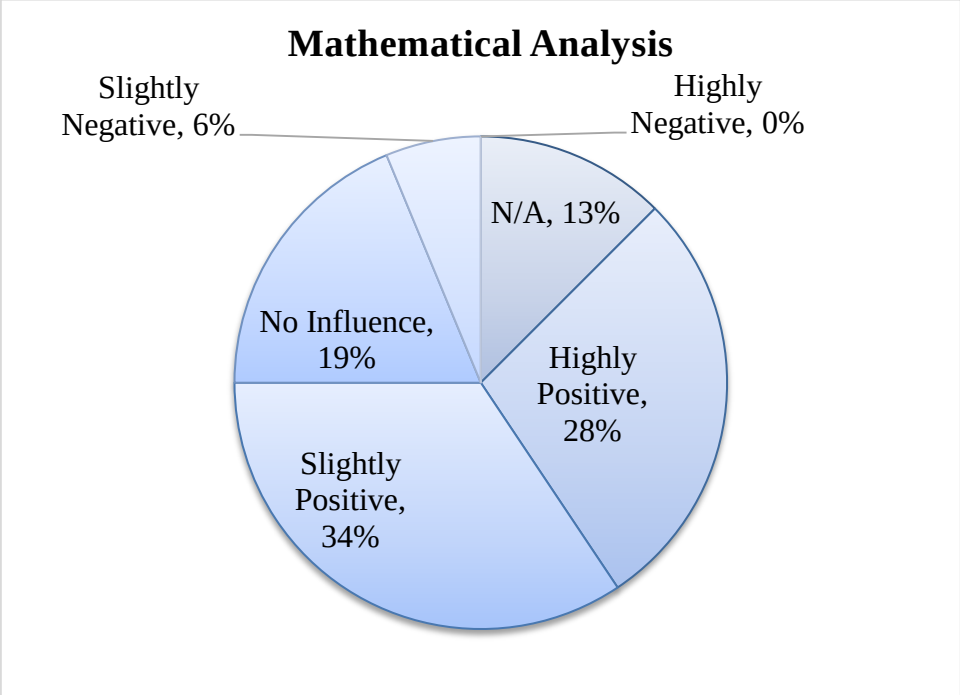

Figure 62. Mathematical Analysis: Percentages of Responses under each Response Option (Retention Factor)

APPENDIX B

SURVEY QUESTIONNAIRE

Factors for Selecting Construction Related Degree Survey

Please fill in the circle which corresponds to your desired response.

1 Gender ○ Male ○ Female

2 What is your student classification? Freshman ○ Sophomore ○ Junior ○ Senior ○

3 Which University do you attend? _____

4 How would you classify your family's socioeconomic status while growing up? Upper Class ○ Upper-Middle ○ Middle Class ○ Lower-Middle ○ Lower Class ○

5 What is your major? _____

6 Do you plan to change your major? ○ Yes ○ No

If yes, please specify to what: _____

7 For each of the following items please indicate how they impacted **SELECTION OF YOUR MAJOR:**
Check N/A if you were not aware of or have not participated in the items.

		N/A	Highly Positive	Slightly Positive	No Influence	Slightly Negative	Highly Negative
a	Internship(s)	○	○	○	○	○	○
b	Field trips to job sites	○	○	○	○	○	○
c	Previous non-internship work experience in the industry	○	○	○	○	○	○
d	Community service	○	○	○	○	○	○
e	TV or Magazine ads	○	○	○	○	○	○
f	Scholarship or other funding opportunities in the degree	○	○	○	○	○	○
g	Your father working in the industry Your mother working in the industry	○ ○	○ ○	○ ○	○ ○	○ ○	○ ○
h	Your father taking you to work Your mother taking you to work	○ ○	○ ○	○ ○	○ ○	○ ○	○ ○
i	A male role model not your parent	○	○	○	○	○	○
j	A female role model, not your parent	○	○	○	○	○	○
k	A high school advisor/counselor	○	○	○	○	○	○
l	A college advisor/counselor	○	○	○	○	○	○
m	Mentoring program at school Please specify the name of the mentoring program: _____	○	○	○	○	○	○
n	Career opportunities after graduation	○	○	○	○	○	○

8 What other factors influenced you to select your degree?

_____

_____

9 What other programs could positively influence students to select your degree program? Any ideas or suggestions?

_____

_____

Answer the following only if you are enrolled in a construction related degree program. Other majors can turn in survey.

10 Please indicate how the following items have affected your decision to **REMAIN IN THE CONSTRUCTION RELATED PROGRAM:**
Check N/A if you are not aware of or have not participated in what is being mentioned in the subquestion.

		N/A	Highly positive	Slightly Positive	No Influence	Slightly Negative	Highly Negative
a	Internship after enrolling in the construction related degree	○	○	○	○	○	○
b	Non-internship construction work experience after enrolling in college	○	○	○	○	○	○
c	In-classroom innovation in construction classes(use of videos, gadgets etc)	○	○	○	○	○	○
d	Mentoring	○	○	○	○	○	○
e	Tutoring	○	○	○	○	○	○
f	Workshops and Seminars	○	○	○	○	○	○
g	Scholarships and Fellowships	○	○	○	○	○	○
h	Individual involvement in construction-related research	○	○	○	○	○	○
i	Faculty members of your gender	○	○	○	○	○	○
j	Students of your gender in the program	○	○	○	○	○	○
k	Involvement in construction related student organizations	○	○	○	○	○	○
l	Hands on experience in construction lab classes	○	○	○	○	○	○
m	Community of construction students/ classmates	○	○	○	○	○	○
n	Academic advising	○	○	○	○	○	○
o	Courses based on mathematical analysis (e.g. structures, estimating)	○	○	○	○	○	○

11 What other factors influenced your decision to remain in the construction related degree program?

12 What other programs could positively influence students' decision to remain in your degree program? Any ideas or suggestions?

13 Has your perception of the construction industry changed after entering the program? If yes, how and why?

14 Do you anticipate working in the construction industry after obtaining your undergraduate degree?

- ○ Yes
- ○ No

15 If you answered 'Yes' to Question 14, please answer the following subquestions?

a What type of position do you hope to have upon graduation?

- ○ Field
- ○ Office

b Which sector do you plan to work in?

- ○ Residential
- ○ Industrial
- ○ Commercial
- ○ Infrastructure

16 If you answered 'No' to Question 14, please explain why?

17 Did you **transfer** into the Construction related degree program?

- ○ Yes, from another four-year university
- ○ Yes, from a two-year university
- ○ Yes, from another program at my current university
- ○ No

18 If a transfer student, are there other factors which influenced your decision to transfer into your degree program?