Evaluation of the Impact of a Summer Construction Camp on Participants' Perceptions

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Dr. Mohammadsoroush (Tommy) Tafazzoli is an assistant professor in the School of Design and Construction at Washington State University. Tommy has his bachelor degree in Civil Engineering, his master's in Transportation Engineering and his PhD in Construction Management. Prior to joining the CM faculty, Tommy served as an instructor in the Soil Mechanic's Lab at the University of Nevada, Las Vegas where he was doing his PhD. Besides teaching the Soil Mechanic lab, he has been an instructor for "Introduction to Civil Engineering", and a teacher assistant for "Civil Engineering Materials". In Addition to his academic experience, Tommy has been involved in different teaching activities since 2003. Tommy's construction industry background comes from his international experience serving as a part-time field engineer when he was doing his bachelor's degree between 2005 and 2008. Additionally, he has served as an estimator and a construction management assistant between 2008 and 2011. Tommy was an interne at Nevada Department of Transportation (NDOT) in 2016 where he got the chance to be exposed to heavy construction projects at Reno, Nevada. Tommy has both of the most distinguished sustainable construction credentials in the United States which are LEED AP (Leadership in Energy and Environmental Design Accredited Professional) as well as the ENV SP (Envision^{TM} Sustainability Professional). He is committed to contribute to the essential paradigm-shift in the construction education, which considers the impacts of all decisions and actions for the whole life-cycle of the projects. Tommy's major research background is studying the causes of delays in the construction industry of the United States. In his PhD dissertation, he developed a dynamic model based on fuzzy logic which can predict the percentage of delay based on a questionnaire that assesses the project for different delay-causing factors. He also works on construction materials efficiency and has developed an index that measures the efficiency of the material use throughout the construction process. Tommy attempts to provide his students with the practical knowledge that helps them to serve successfully in the construction industry. As an active ASCE (American Society of Civil Engineers) member, he also aims at contributing to the research needs of the industrial firms at local and national level. Dr. Tafazzoli Research Interests Measuring the risk of delay in construction projects Sustainable construction Integrating 'green' and 'lean' construction practices Infrastructure assess management Construction Productivity

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Abstract

This paper concisely reports on the design and organization of a summer camp in the construction area and explores the impacts of such activities on getting high school students' awareness of the benefits of a construction career. Summer camps provide a pathway for examining youth development in specific areas. Camps represent environments where participants can develop their technical knowledge, social skills, and emotional intelligence through a series of theoretical and practical activities that are fun, engaging, interesting, challenging, and result in tangible outcomes in the short term. Building Construction Science program at Mississippi State University offers a summer program to increase students' interest in construction careers. This summer program attracted high school students from different areas of the state of Mississippi who had limited, if any, exposure to construction related career fields. The main goal of this program was to introduce construction science and trades to students through a small-sized construction project. This gave students a first-hand encounter with construction trades, increased their construction knowledge, and provided information from construction instructors and professionals to think about construction as a future college major and career. This study aimed to explore how participating in a construction summer camp affected middle and high school students' attitudes towards construction trades and careers and their perceptions of construction careers. A group of professional instructors from the Mississippi Construction Education Foundation (MCEF) led participants for one week. Students were divided into groups of five or six and were instructed in performing construction activities such as framing, roofing, mechanical rough-in, and electrical rough-in so that all building was done by students. A retrospective quantitative survey was administered at the end of the program. Results indicate that participation in the program had a positive effect on the students' understanding of what construction is and the work different construction trades perform. The results show a positive impact on participants' attitudes toward different aspects of the construction program at Mississippi State University. Also, participants reported a significant difference between their Pre- and Post-camp perceptions in construction-related subjects.

Keywords: Construction, Summer Camp, Education, Project-based Learning

INTRODUCTION

The Building Construction Science (BCS) program at Mississippi State University is a comprehensive studio-based four-year curriculum. Through a sequence of eight studios, students are introduced to a variety of subjects such as materials and methods, estimating, scheduling, safety, building codes, contract negotiation, and construction law. Project management serves as the core concept of the curriculum and unifies these subjects throughout the program. For the first time, the BCS program through a collaboration with Mississippi Construction Education Foundation (MCEF) hosted a group of high school students for a week-long camp in which students participated in a variety of construction and non-construction activities. Construction activities included major activities to construct four hunting cabins including framing, sheathing, plumbing rough-in and electrical rough-in.

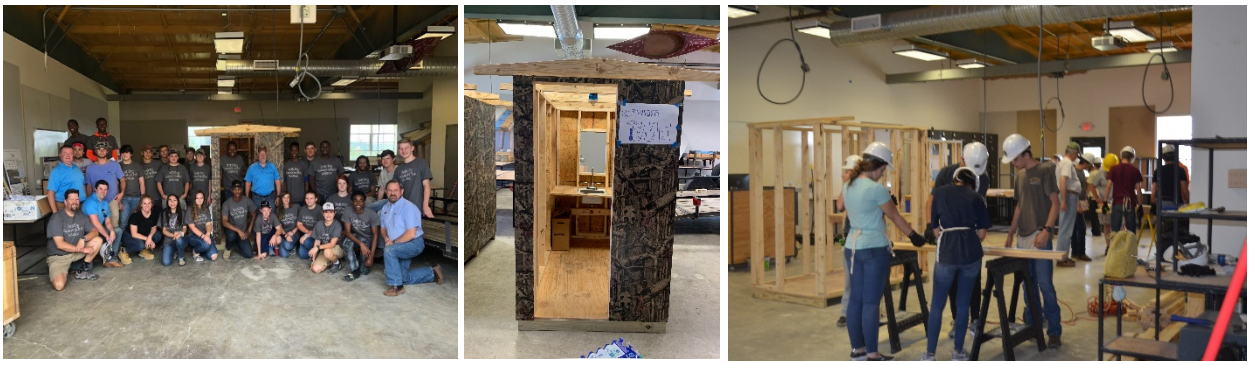

Figure 1: Construction Summer Camp Participants

LITERATUER REVIEW

Summer camps are considered a typical summer event for many college-level programs. Summer camps are an effective tool that universities use to promote STEM careers for middle school and high school students. Attending these camps can generate or increase interest in a particular STEM discipline which may potentially result in an increase of enrollment for the university or college hosting the camp. On average, one-third of households nationwide reported that at least one child participated in a summer program (National Summer Learning Association, 2016). In addition, surveys conducted by American Camp Association indicated that approximately 50% of camps have a 48% rate of return for counselors each summer (Nichols, 2013). Research has shown that camps have been effective at building lasting, meaningful traditions alongside strong personal relationships (Mourouzis, 2018). Carruthers (2013) examined the change of social capital and emotional intelligence experienced by campers by using a

longitudinal dataset and stated that social capital positively correlates with emotional intelligence. Also, it was found that residential camps generate a stronger effect on the relationship between social capital and emotional intelligence than day camps. The effectiveness of summer camps and evaluation of students' success or failure have been investigated in a study conducted by Wilson and Sibthorp (2017) in which they stated that failure experiences are important to realize as such failures can result in unproductive and disrupt youths' engagement in positive youth development frameworks during summer camps.

However, the main outcome of summer camp is sought to be an increased interest in the camp subject. Students' attitudes towards a major or field are factors which maintain the potential to influence students' willingness to pursue that major in college. Several potential motivators, including interest, relevance, fun and enjoyment, and hands-on learning can interact and may explain why a person pursues a particular action. Drey (2016) explored students' affect towards mathematics and science and their perceptions of hands-on activities pertaining to their motivation in STEM during summer camp, and concluded students participation increased their motivation.

Winn, Kweder, and Curtis (2012) developed a program, entitled Engineers of Tomorrow (EoT), in which they aimed to increase high school students' knowledge of and motivation toward science, technology, engineering, and mathematics (STEM) educational and career paths. After implementing an innovative survey strategy, they concluded that the number of students who enrolled in STEM programs after attending their summer camp was higher than originally estimated. They also stated that using social media, particularly Facebook, is an effective way to reaching out and contact summer campers. In another similar study, Hammack, Ivey, Utley, & High (2015) conducted a study to measure how participating in a week-long engineering summer camp impacted a group of 19 middle school students' perceptions towards engineering and technology. They reported that students' attitudes towards engineering were significantly impacted. Álvarez (2017) discussed the importance of summer camps as a recruiting tool for future university students and concluded that attendance to their institution camp in the building and programing of robots had a significant effect on the enrollment of participating students. Through a pre-test and post-test, the results showed that the camp increased interest among the students specifically in the sciences, (biology, chemistry, physics) and in pursuing university level studies at their institution.

While construction programs are among the college majors suitable for construction camps, and many construction schools host summer camps, there is little research performed to measure the impact of construction summer camp on students' perception and their enrolment. Mitchell, Washington, and Kuh1 (20001) reported on an engineering and construction camp in which 45 students from communities throughout the United States in a camp sponsored and manned by the United States Air Force Academy's Department of Civil and Environmental Engineering. The camp consisted of different activities including

design, construction, and destructive field testing of a concrete beam; construction of a wood frame building; design, construction, and testing of a sprinkler system; soil testing and compaction; and a few site visits. The researchers noted that as a result of the assessment performed by the staff at the Academy the program was an overwhelming success. In another construction summer camp study, Redden and Simons (2018) reported on a service-learning project which involved partial construction of a tiny house on wheels (THOW) in which eleven high school students attended a series of construction lecture classes including blueprint reading, estimating, modeling, safety, quality control, and scheduling for one week. They stated that their results showed that applying knowledge gained in the lecture sessions to a service-based project increased the camp participants' interest in construction as a professional career.

METHODOLOGY

The main purpose of this study was to explore the perceptions of participants in the camp toward the different aspects of it and what factors and to what extent can potentially impact their decisions to choose their majors and schools. A quantitative research methodology was used to obtain, categorize, analyze, and exhibit students' insights. A survey was designed to include questions on factors impacting students' perceptions, such as motivating factors in choosing the program and school, influential individuals in choosing major, construction major characteristics, and the camp agenda. A 5-level Likert scale was used to quantify the intensity/frequency of items. The main research questions were:

- To what extent does the camp impact students' perception toward construction majors?
- To what extent do different factors impact high school students to choose construction as their major?
- How does the summer camp change student's perceptions on the major, program, and school?

Due to the limited knowledge and familiarity of summer camp students, only general aspects of construction majors were included in the survey. A paper version of survey was distributed at the end of program to increase interactions with the researchers and to remove possible ambiguities while answering the questions. The data were then gathered, compiled, coded, and analyzed using statistical software.

RESULTS

Twenty-one high school students participated in the summer camp in which 38% were freshman, 14% were sophomore, 19% were junior, and 29% were in senior year. The Participant group consisted of 19%

of female students and 81% of male students. Participants stated that social media such as Website/Email Blasts/Facebook/Twitter (29%) and School Newsletter/Newspaper (24%) were the two main ways that they heard about the camp.

After the demographic questions, participants were asked to specify how much they expect to earn with a construction degree right after their graduation, and their anticipation on the number of hours per week they will work in their future jobs. Figures 2 and 3 show the percentage of each level for these two questions.

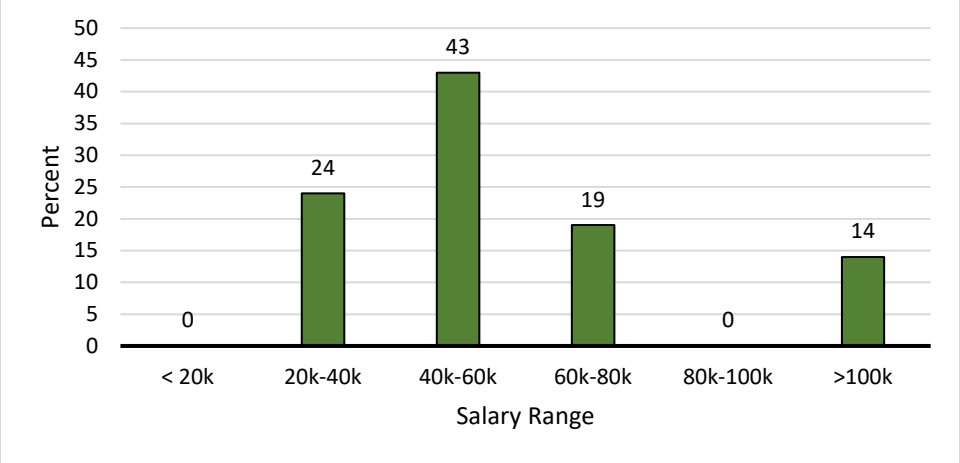

Figure 2: Percentage of Expected Salary Ranges

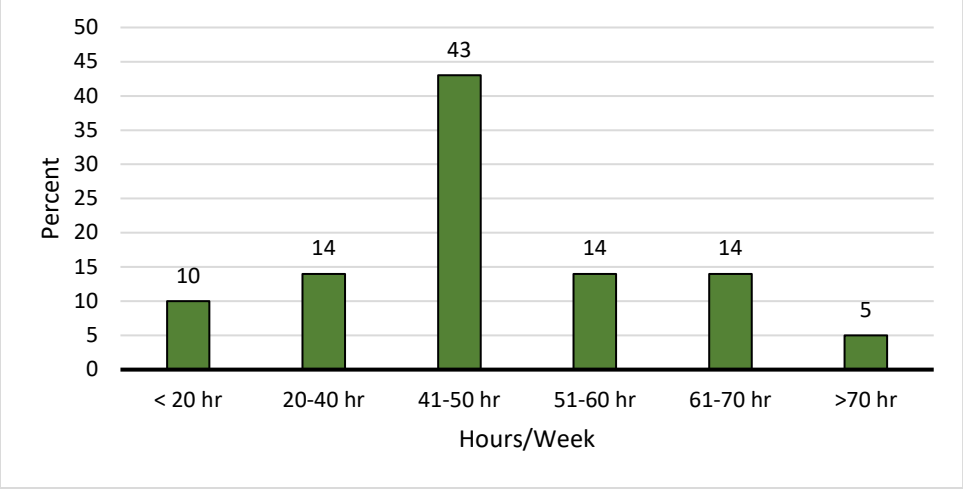

Figure 3: Percentage of Expected Required Hours

In the next section, participants rated their interests in construction, Mississippi State University and the BCS program before and after attending the camp. The first question asked to rate the interest of participants in general construction. Figure 4 shows the percentage of each level for Before and After situations.

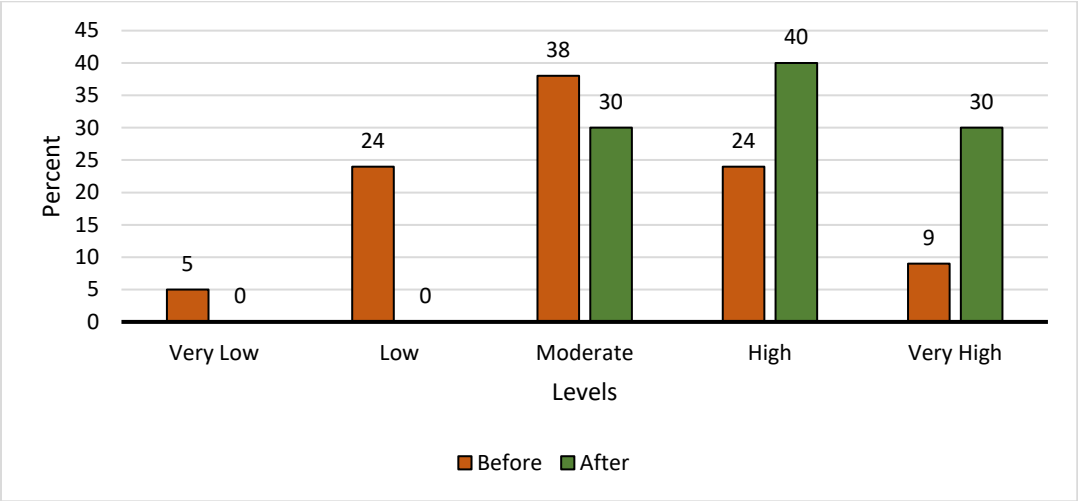

Figure 4: Percentage of Before and After Interest Levels in Construction

The second question asked participants to rate the possibility of choosing Mississippi State University as their college before and after attending the camp. Figure 5 shows the percentage of each level.

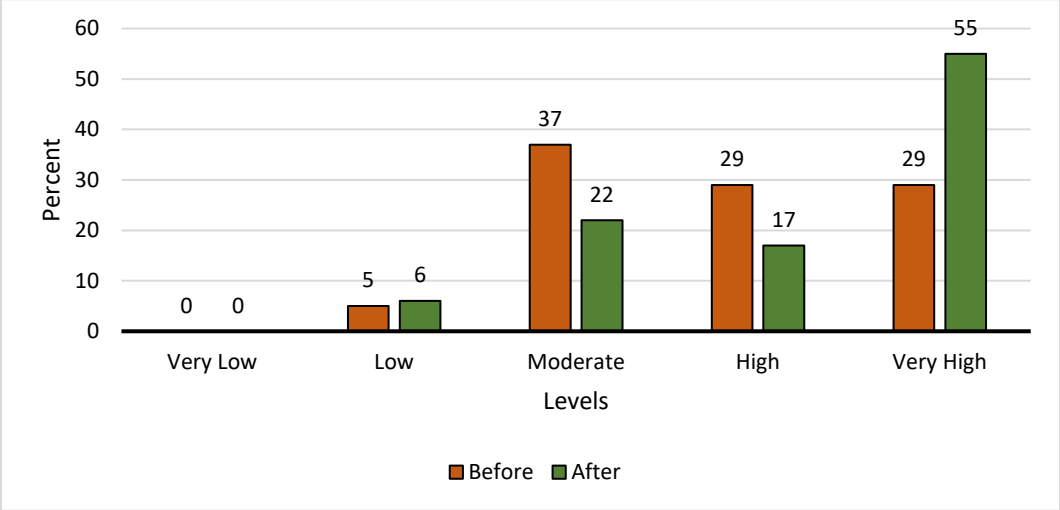

Figure 5: Percentage of Before and After Interest Levels in the BCS program

And finally, participants rated the possibility of choosing BCS program as their major. The percentage of each level for Before and After situations is shown in Figure 6.

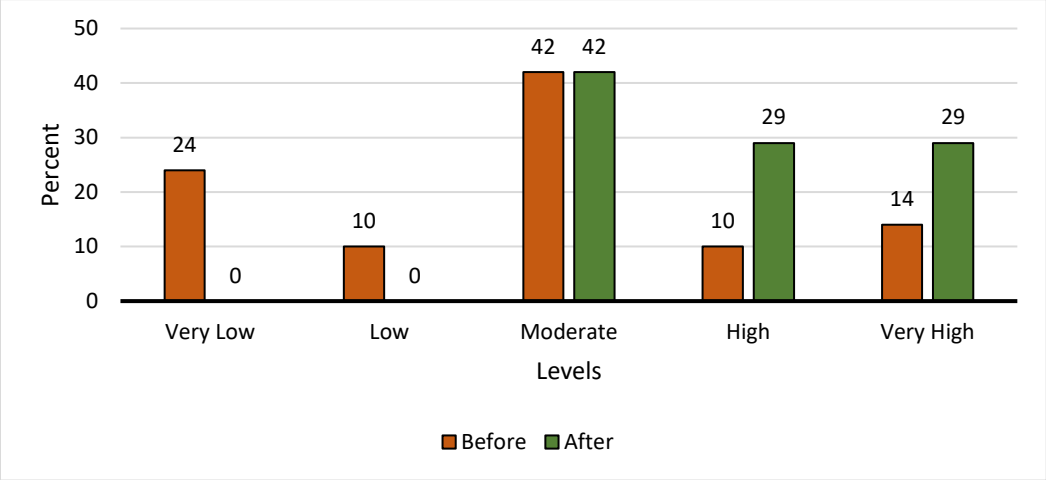

Figure 6: Percentage of Before and After Interest Levels in Mississippi State University

In the next section, participants were asked to rate the quality of each item during their camp using a 5-level Likert scale (1: Very Low, 5: Very High). The responses were quantified and input in the data model. Table 1 shows the average of scores for each factor.

Table 1: Average Score of Camp Agenda Items

Factor	Diversity of Subjects	Construction activities	Location (Miss. State Uni.)	Length of summer camp	Length of activities per day	Instructors	Training	Entertainments	Food	Accommodation	Non- Construction activities
Average (out of 5)	4	4.19	4.38	3.85	3.67	4.43	4.38	4.43	4.52	3.85	4

In the next section, participants were asked to what extent possible different factors can impact them to choose construction as their major. A 5-level Likert scale (1: Very Low, 5: Very High) was used to rate the items (Figure 7). Possible factors included the following items:

A. Salary
B. Nature of construction activities
C. To join a family company
D. Someone among my parents/friends/relatives is in the construction industry
E. Someone among my parents/friends/relatives has motivated me to pursue this major
F. I like hands-on experiences
G. I do not like difficult math problems

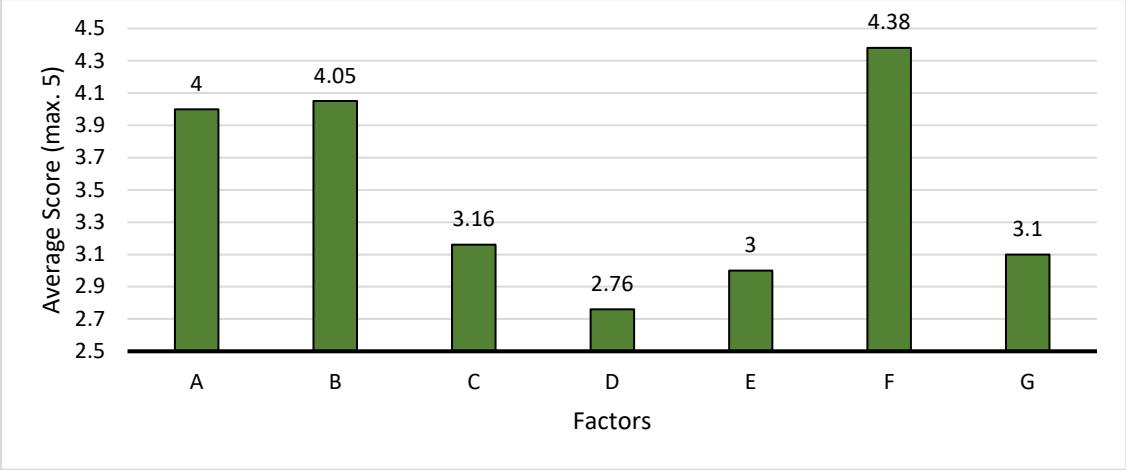

Figure 7: Average Score Factors Impacting Students' Perception

In addition, participants rated the Influence of following individuals on their decision to choose their majors using a 5-level Likert scale (1: Very Low, 5: Very High). Figure 8 shows the average score of each individual (out of 5).

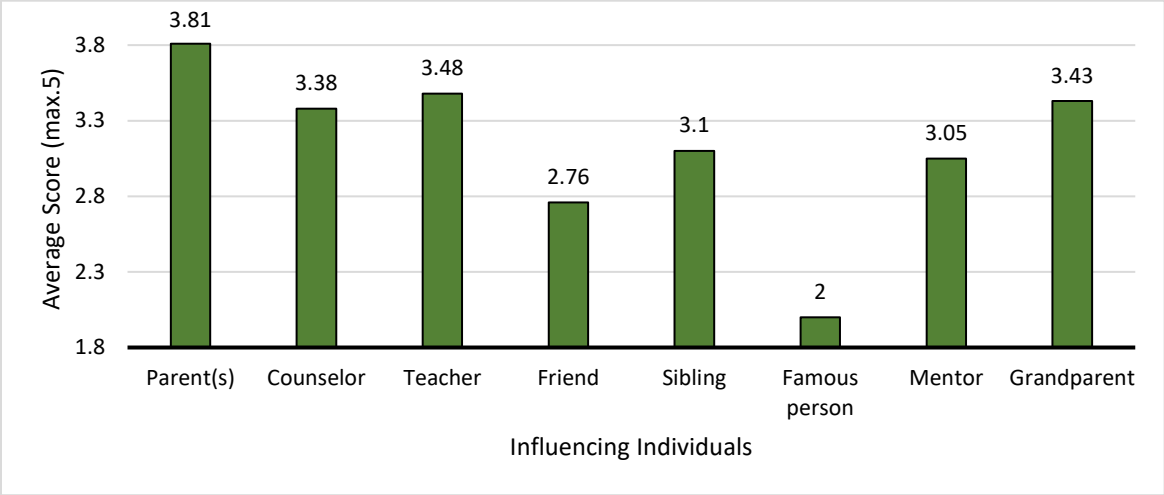

Figure 8: Average Score of Individual Impacting Students' Perception

In the last section, participants were asked to rate likelihood of attending the camp again. Table 2 shows the percentage of each level.

Table 2: Percentage of Each Likelihood Level

Level	Percent
Very Low	5
Low	24
Moderate	38
High	24
Very High	9
SUM	*100*

In addition, participants' level of satisfaction about the camp was rated at the end. Figure 9 shows the percentage of each satisfaction level. As shown in the figure, there was a high level of satisfaction on the camp in general.

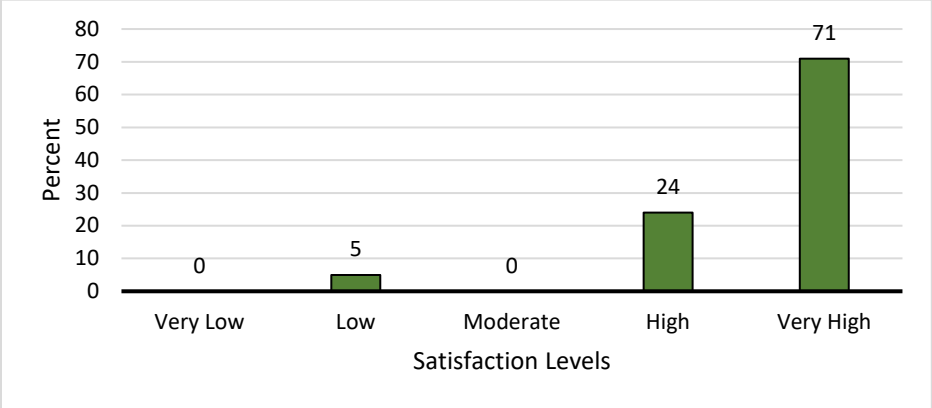

Figure 9: Percentage of Each Satisfaction Level

DISCUSSION

Summer camps are an informative, yet attractive tool that college programs use to enhance the general understanding of their prospective students and increase enrollment as well as increase incoming students' academic preparation. Summer camps also help parents and students to obtain first-hand information about their targeted programs and schools. Encounters with faculty, educational

environments, and facilities can assure students to what extent their potential program interests are similar to what they expect. The summer camp in BCS program was the first experience for the Mississippi State University administration to interact with potential students and demonstrate a number of hands-on construction activities. The main goal of this camp was to place high school students in a mock construction environment and expose them to a space resembling the BCS construction classes. The exposure to such activities created a sense of affiliation with the subject matter. The results of this study indicate different noticeable points that will be discussed later in the paper. Female students comprised 19% of participants which is twice of the number of female students' percentage in typical construction programs. Summer camps can help construction programs to recruit more female high school students and therefore entice them to choose construction as their major by showing their success in short summer camps programs. Having a clear and accurate perception of the construction field and its requirements is another factor that impacts student attraction and retention. Students' perception of future income as well as time commitment after their graduation is not off based from the current actual situation. Hence, if anyone decides to pursue a construction degree in college, they will not be discouraged, or even surprised, by reality in the construction industry. This helps construction programs to grow determined bodies of students along with increasing the retention rate.

The impact of summer camps on students' perceptions and their opinion toward different major-related topics is noticeable. As shown in Figures 3-5, the summer camp impacted students' perceptions toward the construction, BCS program, and Mississippi State University. To further explore the difference between the Pre and Post-camps situations, a Wilcoxon Signed Ranked Test was performed. The results, shown in Figure 10, indicate that there is a statistically significant difference between the Pre and Post situations on all three subjects (Construction, Attending Mississippi State University, Choosing BCS Program).This means the camp has been effective in providing information about the construction, program, and university, and possibly changing the view of students toward these options.

Organized construction summer camps encompass many activities and thus should carefully be planned and executed. For example, the length of summer camps (e.g. one week) or length of construction activities per day (e.g. eight hours) can impact students' perceptions. One method to decrease the intensity of construction activities for summer camp high school students is to combine digital training and interaction with physical activities so that students do not feel exhausted after a long day of construction activities.

Another section of results is the comparison between different factors that influence high students to choose construction as their major. Among a series of pre-determined factors, hands-on experiences, nature of construction activities, and salary gained highest scores. However, it should be noted that the

average of other factors such as joining a family company or disliking difficult math problems is above the average. These factors can be the subject of initiatives to attract prospective construction students.

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.	Decision
1	The median of differences between Contruction (BEFORE) and Contruction (AFTER) equals 0.	Related-Samples Wilcoxon Signed Rank Test	.001	Reject the null hypothesis.

Asymptotic significances are displayed. The significance level is .05.

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.	Decision
1	The median of differences between YYY (BEFORE) and YYY (AFTER) equals 0.	Related-Samples Wilcoxon Signed Rank Test	.034	Reject the null hypothesis.

Asymptotic significances are displayed. The significance level is .05.

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.	Decision
1	The median of differences between XXX (BEFORE) and XXX (AFTER) equals 0.	Related-Samples Wilcoxon Signed Rank Test	.003	Reject the null hypothesis.

Asymptotic significances are displayed. The significance level is .05.

Figure 10: Wilcoxon Signed Ranked Test Results

Finally, as indicated by students, the role of parents, teachers, and grandparents in leading students to choose a construction major is indisputable. One gap that is being typically mentioned by high school students is the unfamiliarity of their teachers and counselors with construction programs. While teachers and counselors can have a such considerable impact on students' perceptions, it is essential for construction educators and planners to ensure they have provided ample information and facilitated the path to acknowledge construction as a college major with bright horizon for their students.

CONCLUSION

Summer camps are a typical short time period experience that enable high school students to explore their targeted majors and colleges and familiarize themselves with the subjects, faculty, and facilities of their aimed majors. The BCS construction summer camp at Mississippi State University was the first

experience with high school students who participated in the event for one week. The camp's agenda included various construction and non-construction activities. Construction activities consisted framing, sheathing, and rough plumbing and electrical of shooting cabins. Each group consisted of five or six students who received instructions, worked with each other, interacted with other groups and instructors, and ultimately built four hunting cabins. The results of this paper were produced from the data gathered at the end of this camp. The main objective of this study was to explore students' perceptions toward the camp and use their feedback and preferences in subsequence camps. The students' perceptions are an important input for the construction educator to plan accordingly and increase the quality of academic preparation and the quantity of student enrollments. The survey aimed to consider factors that impact students' perceptions before entering construction programs. Students expressed their expectation of salary and time on the job requirements. The reported numbers were close to the reality which eliminates the blind intertest in construction and increases students' success probability. Another noticeable result is the change of students' interest in construction, the program, and the college. The statistical tests show that there is significant difference between the pre- and post- situations, which indicates the effectiveness of the camp. It is worth noting that parents (and grandparents) still have the major role in steering students to choose their college majors. Also, affirmative factors such as the nature of construction programs, hands-on activities, and salary are among factors that have the highest influence on students' perceptions. The students' feedback discussed above can be incorporated to target more students in summer camps and potentially increase the enrollment numbers. Further study can include the exploration of gender-based perceptions, construction subject interest, and the distinction between construction and similar programs (e.g. civil engineering and architecture).While this paper reported the perceptions of summer camp students in a studio-based construction program, generalization of outcomes is not warranted and would necessitate further investigation. More qualitative and quantitative studies with larger samples are required. Incorporating the insight of high school students in other construction schools will enhance the results of this study and the application of its findings.

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