

Summer Camp's Impact on High School Students' Perceptions of Construction Management: A Case Study

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Hands-on projects are effective in teaching and reinforcing Science Technology Engineering and Mathematics (STEM) principles. For this reason, STEM based summer camps often include a hands-on project as part of the camp. Additionally, service-learning based projects often provide value and a rewarding experience to those participating. This case study involves a hands-on service-learning project as part of a week-long building construction summer camp for high school students. The service-learning project involved partial construction of a tiny house on wheels (THOW). Campers attended lecture classes on blueprint reading, estimating, modeling, safety, quality control, and scheduling, all of which related back to the service-learning project. A survey was administered to the campers before the first class and after completion of the camp. Survey results indicate that applying knowledge gained in the lecture sessions to a service-based project was effective in elevating the camp participants' interest in construction management as a career. Additionally, the majority of responses concerning professionalism of construction managers went from "moderately professional" on the pre-camp survey to "extremely professional" on the post-camp survey. Information gathered from this study will be used to evaluate future summer camps.

Key Words: summer camp, service-learning, recruitment, education, outreach

Introduction

Summer camps across the country take on many forms and fulfill a multitude of purposes. Often summer camps organized by universities set out with the goal of recruiting the attendees into a certain field. There has been an increase in Science, Technology, Engineering, and Mathematics (STEM) based summer camps to help attract and recruit young students with a recent trend of job growth in the STEM professions. Projections show a continued trend of job growth in STEM professions out-pacing other areas by a ratio of three to one (Langdon, et al., 2011). One particular subset of STEM careers, Construction Management (CM), has struggled recently with negative perceptions among the public. Research has shown the current construction industry does not have a good reputation in the overall job market (Barthorpe et al., 2000; Kashiwagi & Massner, 2002; Clarke & Boyd, 2011; Ling & Ho, 2013; Escamilla & Ostadalimakhmalbaf, 2017). It is important to educate the public on what CM careers entail to overcome the negative perceptions. According to Clarke and Boyd (2011), "Too many youths are not aware of the different paths that a career in construction could take them." It is especially important to educate this younger generation on CM as a viable career path before they are required to choose a college major.

Many STEM and construction camps have reported hands-on activities or student competitions as part of the camp curriculum (Slattery & Slattery, 2008; Gaedicke et al., 2016; Hammack et al., 2015). Reports of these camps rarely include projects that are rooted in service-learning. Service-based projects provide a sense of accomplishment to those participating along with an increased understanding of the subject matter. Service-learning makes significant contributions to students' understanding of academic material, including a greater depth of understanding, increased analytical skills, and a greater ability to apply what's learned (Hurd 2006). It is important to consider the value a service-based construction camp could add to the student experience.

Literature Review

Research has shown the current construction industry does not have a good reputation in the overall job market (Barthorpe et al., 2000; Kashiwagi & Massner, 2002; Clarke & Boyd, 2011; Ling & Ho, 2013; Escamilla & Ostadalimakhmalbaf, 2017). The construction image problem can be attributed to a lack of knowledge and

information about the industry, career opportunities it can offer, and required qualifications (Agaipou, 2002; Fielden et al., 2000; Bilbo et al., 2009; Escamilla et al., 2016). With the well-documented lack of information available to today's youth, the challenge of overcoming the negative perceptions of construction careers involves reaching students at the high school or middle school level.

One tool universities use to promote STEM careers is summer camps held for middle school and high school students. These camps seek to generate or increase interest in a particular STEM discipline with the potential benefit of recruitment for the university or college hosting the camp. Some studies documenting these camps report on their effectiveness at promoting understanding or perception of STEM careers among campers. Other studies focus on the camps' goal of attracting more youth into a particular field of study.

At a Midwestern middle school, participation in an engineering summer camp had a positive impact on middle school students' understandings of what technology is and what engineers do (Hammack et al., 2015). The researchers also noted the partnership between practicing teachers and engineering faculty was important to the success of the camp (Hammack et al., 2015). A camp at California State University East Bay included lectures from industry leaders, field trips, and a competition. Based on student surveys, the researchers concluded the program was valuable and emphasizing high-tech aspects of the construction industry such as Building Information Modeling (BIM) may be a pathway to attract more high school students into the construction field (Gaedicke et al., 2016). The literature overwhelmingly points to positive attitudes and perceptions among attendees of STEM based summer camps.

One strategy employed at these STEM and construction camps includes incorporation of hands-on activities. Studies confirm hands-on activities and inside/outside work experiences are influencing factors in promoting construction as a career option and the STEM field as a whole (Kisi et al., 2011). A unique aspect of construction which many people enjoy is seeing a physical representation of the accomplished tasks at the end of each work day. Students are attracted to the idea of leaving something permanent behind to be remembered by (Bringham Jr. et al., 2012). Incorporating hands-on activities into these camps, whether on a large- or small- scale, could resonate with the students and instill a true appreciation of the construction field.

One gap in the literature was documentation of service-learning based activities at these summer camps. Although many universities and colleges provide service-learning opportunities for university students in various majors, the idea of incorporating service-learning into high school camps seems relatively unexplored. The National Society for Experiential Education has defined service-learning as "any carefully monitored service experience in which a student has intentional learning goals and reflects actively on what he or she is learning throughout the experience" (Furco, 1994). Based on this definition, service-based projects could prove a useful conduit for many aspects of STEM, particularly construction education.

Service-learning activities have proven effective in college level construction programs. Farrow et al. (2011) reported on student perceptions of a week-long service-learning trip in Quito, Ecuador. Six of the seven attendees said they would go on the same trip again if it was offered during their remaining time in school, and all seven students indicated they would recommend the experience to a friend. Research also shows service-learning can help improve student understanding of a particular subject. Arumala (2002) noted a gradual increase in number students who passed statics, strength of materials, and structural design courses after service-learning exercises were introduced into these courses. With the many noted benefits of service-learning, particularly in construction education, it seems likely that service-learning could also prove beneficial for summer construction camps.

Objectives and Methodology

The objectives of this project were to:

- Educate high school students on careers available in Construction Management
- Provide the opportunity to contribute to a service-learning project
- Facilitate and apply practical construction knowledge taught at the camp through hands-on exercises
- Attract high school students to consider Construction Management as a career path

Summer Camp Structure and Organization

Auburn University (AU) hosts a multitude of camps each summer through various colleges and schools on campus. These camps are offered through AU Youth Programs with the University Outreach Office. The 2017 Building Construction Summer Camp was the first high school summer camp of its kind to be hosted by the McWhorter School of Building Science (BSCI). Marketing for all AU camps was primarily done through the AU Youth Programs website. Information for the Building Construction Camp was also available on the BSCI website. The opportunity to apply for scholarships was offered to ensure any interested applicant could attend and not be excluded from the camp based on financial limitations. A total of eleven students attended the camp, all of which were housed in one of the residence halls on AU's campus. One camper did apply and receive a scholarship to attend.

The 2017 Building Construction Summer Camp began with the arrival of the campers on Sunday afternoon and concluded after lunch on Friday. Figure 1 shows the detailed camp itinerary.

Building Construction Camp, June 11-16, 2017

SUN	MON	TUES	WED.	THURS	FRI
AUBURN UNIVERSITY	**7:30-8:30 am** Breakfast	**7:30-8:30 am** Breakfast	**7:30-8:30 am** Breakfast	**7:30-8:30 am** Breakfast	****be packed before 7:30am** **7:30-8:30 am** Breakfast **8:30-10 am** Project Evaluation
	9-11:30 am What is BSCI? Intro of Project for the week. Blueprint Reading Class	**9-11:30 am** Safety & Quality Control Class	**9-11:30 am** Work on Construction Project	**9-11:30 am** Work on Construction Project	**10-11:30 am** Camper's Presentation of project: explain estimate, 3D model, and present the final product
	11:30 am-12:30 pm Lunch **1-3:30 pm** Estimating Class	**11:30 am-12:30 pm** Lunch **1-2 pm** Scheduling Class	**11:30 am-12:30 pm** Lunch **1-5pm** Work on Construction Project	**11:30 am-12:30 pm** Lunch **1-4pm** Finish Construction Project	**11:30 am-12:30 pm** Checkout **Camp Manager:**
3-5 pm Check in	**3:30-5 pm** Construction Information Technology Class	**2-5:15 pm** Start Construction Project		**4pm** AU Student Recruitment Talk	**Camp Counselors:**
5-6 pm Pizza Party	**5:15-6:30 pm** Dinner	**5:45-6:45 pm** Dinner	**5:30-6:30 pm** Dinner	**5:30-6:30 pm** Dinner	**Building Construction POC:**
6-7 pm Get to Know You **7:15-8 pm** Camp Rules and Orientation	Evening Activities	Evening Activities	Evening Activities	Evening Activities	
9:30-10:30 pm Snacks & Relax	**9:30-10:30 pm** Snacks & Relax	**9:30-10:30 pm** Snacks & Relax	**9:30-10:30 pm** Snacks & Relax	**9:15-10:15 pm** Pack & Relax	
10:45 pm Lights Out	**10:45 pm** Lights Out	**10:45 pm** Lights Out	**10:45 pm** Lights Out	**10:45 pm** Lights Out	

Figure 1: Building Construction Camp Itinerary

During the camp, the eleven camp participants were provided meal cards which they used to purchase their meals at various on-campus dining venues. The housing and meal plan was intentionally modeled to provide the campers with an experience akin to living on campus as a college student. Two AU college students (not majoring in Building Construction) served as camp counselors and led the campers to all of their scheduled activities throughout the week. On Monday and Tuesday, the campers attended lecture classes on blueprint reading, estimating, construction specific information technologies, safety, quality control, and scheduling. The classes were taught by BSCI faculty and all content taught related directly to the hands-on service project. The campers began physical construction on the project on Tuesday afternoon. Campers were broken up into teams to work on various tasks associated with the project. BSCI faculty and students in the professional program assisted the campers throughout the build.

The scope goal of the camp was for the campers to complete the trailer preparation, exterior framing, and sheathing for a tiny house on wheels (THOW). The project consisted of insulating and installing plywood subflooring on an 18-foot long trailer. The trailer also included a 3-foot porch extension which was decked with 1"x4" pressure treated deck boards. The campers completed framing of the four exterior walls and the roof during the week. Time only allowed for one of the walls to be sheathed before the campers had to leave for their presentations on Friday. The BSCI faculty along with one BSCI student and other volunteers set the walls and roof in place before the campers returned with their parents to see the finished product on Friday. Figures 2 through 5 show the hands-on project at various stages of the summer camp.

Figure 2: Trailer Insulation Complete

Figure 3: Camper Making Framing Cuts

Figure 4: Framing for one Side (Long) Wall

Figure 5: Project at the end of the camp

The campers were provided a full set of plans, including interior build-out, which helped the understand the layout and appreciate the space. The campers also understood the service-learning aspect of the project. As explained to them by the faculty, the finalized THOW will be donated to a non-profit organization that provides housing to veterans in need. The completion of the THOW after the summer campers leave will be the task of various BSCI students and faculty members.

Research Methodology

This study utilized a repeated measures design by giving a survey before and after participation in the building construction camp. The first survey was administered before the first lecture class on Monday morning, and the second survey was administered after the campers' presentations on the final day of the camp. The primary purpose of both surveys was to gauge their knowledge, attitudes and perceptions of the construction management profession both before and after completing the activities of the camp. The qualitative data obtained was used to bring better awareness to understanding the success or failure of the camp and to the primary objectives of the camp, since this was the first ever of its kind offered at AU. The surveys investigated campers' interests, understanding and perceptions in the following areas: technology, problem-solving and design, managing finances (i.e. estimating), time management (i.e. scheduling), construction quality and field operations, learning styles and motivation, construction industry and career paths, and community engagement/outreach.

The researchers distributed both surveys to all legal guardians of the campers prior to the campers' arrival at the camp, and received signature approval letters at check-in from all legal guardians of the campers. The campers completed both surveys in computer labs on Auburn University's campus. The surveys were completely anonymous

and voluntary for the campers to complete. Due to the space limitation of this paper, a complete copy of each survey is not provided herein. A summary of the survey questions may be found in the results of this paper.

Results

A total of eleven survey responses were collected in the first survey. This represented 100% of the campers that participated in the camp. Seven out of eleven identified themselves as being 17-18 years old. Three out of eleven responded stating they were between 15-16 years old, and one camper responded as being older than eighteen years old. The campers primarily reside within the state of Alabama, though a few noted they traveled to Auburn from other states. The farthest camper traveled from Texas to attend the camp. The race demographic responses included over 72% identifying themselves as white, while the other camper responses included identifying themselves as African American, Pacific Islander and/or Other. The gender spread was ten males and one female. A total of ten survey responses were collected in the second survey. This represented 91% of the campers that attended the camp, meaning one camper decided not to participate in the second survey. The researchers did not pursue receiving a reason for the one camper's choice not to participate in the second survey. The survey was completely voluntary to complete and per the Consent Form instructions the camper elected to not participate and had the right to make this choice.

Camp Day 1 Survey

Do you plan to further your education after high school graduation? (Yes, Maybe, No) All campers responded yes.

Select the type of educational institution you will most likely attend to obtain further education and/or professional training after high school. Nine out of eleven campers selected university (4 year college), while one was unsure, and the last respondent selected vocational school.

I am at this summer camp because: (open-ended question) Seven out of eleven campers responded by stating the camp was providing them an opportunity to figure out if Building Construction was the right major for them when they went to university. Three other respondents stated they were interested in learning more about construction, but did not mention their future major specifically in these responses. A follow-up question identified these three campers all having interest in majoring in some area of engineering.

How much experience do you have currently in construction? (An extensive amount, a moderate amount, a little, none at all) 45% of the campers (five) answered to having a moderate amount, while four answered a little and two with none at all.

How does the construction industry impact our communities? (extremely positive, moderately positive, slightly positive, neither positive or negative, slightly negative, etc.) 63% of the campers (seven) answered extremely positive, while four answered moderately positive.

Table 1 illustrates the remaining survey responses for the survey given to the campers before the first class lecture.

Table 1. *Survey response answers to Day 1 Survey*

	A great deal	A moderate amount	A little	Neither like nor dislike	Dislike a little	Dislike a moderate amount	Dislike a great deal
Rate how much you like learning about:							
Technology	3	3	4	1	-	-	-
Managing money	4	1	3	1	2	-	-
Time management	1	3	4	1	2	-	-
Construction quality	3	6	2	-	-	-	-
Building design	5	4	2	-	-	-	-
Rate how much you like learning through:							
Hands-on activities	6	5	-	-	-	-	-
Rate how much you like:							
Problem-solving	3	6	1	1	-	-	-

Camp Day 5 Survey

How much experience do you have gained from attending the 2017 Building Construction Summer Camp? (An extensive amount, a moderate amount, a little, none at all) 70% of the respondents answered to having an extensive amount, while two answered to having a moderate amount, and one camper responded to have a little.

Did you experience trying to put something together without instructions at the 2017 Building Construction Summer Camp? (Yes, Maybe, No) 70% of the respondents answered yes, while two answered maybe, and one camper responded no.

How does the construction industry impact our communities? (extremely positive, moderately positive, slightly positive, neither positive or negative, slightly negative, etc.) 70% of the campers (seven) answered extremely positive, while three answered moderately positive.

Table 2 illustrates the remaining survey responses for the survey given to the campers after they completed their presentations on Friday.

Table 2. *Survey response answers to Last Day Survey*

	A great deal	A moderate amount	A little	Neither like nor dislike	Dislike a little	Dislike a moderate amount	Dislike a great deal
Rate how much you like learning about:							
Technology	6	3	1	-	-	-	-
Estimating(i.e. managing money)	4	3	-	1	2	-	-
Scheduling(i.e. time management)	3	2	3	2	-	-	-
Construction quality	6	1	3	-	-	-	-
Building design	4	5	1	-	-	-	-
Rate how much you like learning through:							
Hands-on activities	8	2	-	-	-	-	-

Authors' Analysis and Discussion

Campers' participation in applying knowledge gained in the lecture sessions to a service-based project was effective in elevating the camp participants' interest in construction management as a career. Survey participants' responses in the pre-camp survey illustrated relatively high interest in the learning style of hands-on activities. Interestingly the same question theme in the post-camp survey received higher responses, 15% increase, in the interest (or liking) of learning through working on the THOW in the lab hours. This result strengthens the researchers' original hypothesis of better result for campers' learning outcomes from the combination of hands-on opportunities while working on a service project.

The campers appeared to regard motivation in work efforts when the end product is intended to help someone equally important from the first day survey to the last day survey. The researchers acknowledge the campers all were aware of the plan to construct a THOW before they attended the camp. This may or may not have been an influencer on how the participants responded to this question. Regardless of such, the campers vocalized throughout the week their excitement and the meaningful impact their work was going to provide to a community member. A few select responses to open-ended questions regarding service-learning are provided to also support the valuable insight the campers gained from putting their time and energy into creating a home for someone in need. In the open-ended question *Describe how you felt when building the tiny house*, it was stated:

Participant 1 "excited and motivated"
Participant 2 "motivated"
Participant 5 "excited and inspired"
Participant 10 "stressed because of the amount of work but overall happy"

In the open-ended question *List one impact you think occurred on our community from the work completed during the 2017 Building Construction Summer Camp*, it was stated: Participant 8 "someone who didn't have a home before has one now!"

One motivating result in the opinion of the researchers was on the topic of professionalism in the role of construction managers. Before the high school students started the camp, the majority of them generally recognized people that manage construction projects as "moderately professional," whereas on the last day of the camp they answered the same question with an overwhelming eight of ten respondents selecting the highest option which was "extremely professional." A few select responses to an open-ended question following the rating of professionalism question are provided to also support the perception expansion which occurred in the campers regarding the process of construction management and those that work in the industry. In the open-ended question on the last day survey *List two things you learned about the construction industry from attending the summer camp*, it was stated:

Participant 1 "the amount and depth of preparation and the amount of time needed to complete a project"
Participant 2 "takes a lot of planning, and I really enjoyed building"
Participant 3 "…. And the value of teamwork"
Participant 4 "lots of planning goes into a construction project"

From the first day survey to the last day survey, the campers appeared to regard the construction industry as to having a relatively high positive impact on our communities and the completion of the camp did not change this result significantly.

The camp duration posed a challenge for the amount of scope that could be reasonably accomplished in one week's time. This is recognized as an area of improvement for future modifications to the camp structure. One limitation of this study is the number of participants. Though the results of the study are demonstrative of the group that participated in the camp, they may not be statistically sound due to the relatively small survey size. The authors intend to administer the same survey to future camp participants in order to strengthen the data set.

Recommendations and Future Research

The growth of the program is an area the researchers would like to track and include in future research. One survey question asked the campers if they had any immediate family members working in the Architecture, Engineering, Construction (AEC) industry. Seven out of eleven in the first day survey responded yes. The authors believe engaging more high school students in future camps that may not have immediate family member in the AEC industry could create wider reach in educating younger generations about the career opportunities in construction management. Also, a qualification for applying to attend the camp was the high school student had to be a rising junior or senior. The researchers intend to study this enrollment limitation and determine whether it is appropriate to open the qualification to rising freshman and sophomores as well.

Overall, the researchers discovered the perceptions and lessons learned from executing this service-learning based summer camp opportunity proved to positively impact the camper's understanding of the construction industry and potential career paths available to each of them. The McWhorter School of Building Science, in partnership with the AU Youth Programs Office, plans to pursue the organization and execution of the same summer camp model in the coming summer. Future camps will take into consideration all input from the surveys as the team formulates the itinerary and service project scope. Future research will seek to gather perceptions and opinions of additional groups involved in the camp, such as camp counselors and any involved community partners.

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