

Improving Student Learning Outcomes in the Construction Surveying Course

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Improving student learning outcomes (SLOs) can be challenging especially when faced with efforts to achieve accreditation of construction educational program by the American Council for Construction Education (ACCE). The challenge may prompt academic programs to diversify ways to address the SLOs to meet ACCE standards, e.g., incorporating collaborative efforts of construction industry and academia. This research assessed the collaboration between academia and industry professionals to improve SLO and mastery in the construction-surveying course using surveying camp. Specific objectives were to determine the impact of the camp to students and meeting the ACCE-SLO 11, and determine the relationship between score variables (self-assessed score vs camp score). The hypothesis was that students would benefit highly from the camp activities and that their performance would meet the ACCE standard. Excel software facilitated the analysis of data obtained from survey questionnaires and camp examination scores. The result showed negative correlation and predictive indices for the score variables, implying that students' confidence negatively correlated with the average camp scores although they were above the ACCE threshold. Additionally, the students were very satisfied with the collaborative effort. Thus, the hypothesis of students benefitting highly and their performance meeting the ACCE threshold were supported. It was recommended that the camp program be replicated in future while considering students' ideas, and that the outcome be a part of the ACCE periodic reporting.

Key Words: ACCE, Construction Management, Layout, Student Learning Outcomes, Surveying

Introduction

The mission of most Construction Science and Management (CSM) educational programs in the United States of America (USA) is to produce "Project Ready'' professionals who can manage people, time, cost, and physical resources in construction projects. In preparing for professionalism, students may take courses such as Construction Layout and Surveying that prepare them to be field engineers, which to some can be the first step in the professional growth ladder. The programs ensure that students meet certain learning goals or outcomes to be able to demonstrate some level of knowledge, understanding and mastery that is akin to the needs of the construction industry.

Most learning ventures ensure that there is continuous improvement in the accumulation of knowledge and application. That is, knowledge gained is for the positive development of an individual. In academic settings and specifically in the realm of construction management education, learning outcomes are encouraged and monitored by the American Council for Construction Education (ACCE). ACCE is an accrediting body for construction science and management degree programs in the USA. The organization accredits degree programs (associate degree programs, undergraduate and master's degrees) using student learning outcome (SLO) based standards. Two (2)-year or four (4)-year degree issuing construction programs need to adhere to these outcome based standards in order to become accredited. The accreditation status implies that the program has met the needed minimum rigor required of students to be competent enough and are ready for the needs of the construction industry. Achieving this status has put pressure on many construction programs to lift up their standards to ensure better students' learning outcomes as well as achieving recognition as one of the 'good' programs belonging in the league of programs offering better construction education to its students. Such programs will only achieve accreditation status after they meet the twenty (20) ACCE student learning outcomes especially for the four-year degree programs. The pressure to meet the SLOs was evidently experienced by a CSM program in the southeastern part of the USA that was climbing the ladder of accreditation from being in the candidate status (two years before) to obtaining a full accreditation status. Among other SLOs, the CSM program specifically focused on improving its ACCE SLO 11 to the best possible. This SLO 11 alluded to applying basic surveying techniques for construction layout and control whereby the construction surveying and layout course was the grounding course for achieving this specific SLO.

Recently, the course was delivered by lectures with some out of class activities involving site layouts. Some equipment mishaps were realized in the process that resulted in insufficient time to execute the course activities and therefore limiting the ability to achieve ACCE SLO 11. A possible solution to this problem was to bring construction-surveying professionals to the university over a given time (e.g., weekend boot camp) to train students on conducting successful surveying and layout operations. Thus, the main objective of this boot camp was to create a learning forum for students through close association with the construction industry professionals. The benefit was to enhance student mastery of the construction survey concepts through hands-on activities. Students would be prepared to pursue the construction field engineering profession after graduation. Additionally, the camp contributed to the CSM department's continuous course assessment and improvement as stated by the ACCE SLO 11 that related to application of basic surveying techniques for construction layout and control, where attaining 80% in the course implied sufficient mastery. This exercise would glean some lessons and useful tips that would be shared with the construction academic community and to improve the future delivery of the construction surveying course for the benefit of students and achieving a better score in the SLO assessed. Ultimately, the goal is to improve students' level of thinking, analytical reasoning, communication (both verbal and written), as well as problem solving skills.

Literature Review

A review of literature was conducted to document the current topics about students' learning outcomes. It was also conducted on the art and science of collaboration between academia and the construction industry with the goal of ensuring sufficient mastery of students in subjects that require application of principles and concepts in construction.

Understanding Student Learning Outcomes

Learning outcomes are statements that describe the knowledge and ability of students after the completion of a course. The outcomes could be knowledge, skills or specific attitudes students show or are able to demonstrate at the end of a course. Ideally, they are statements about what a student has learned after course completion (Chaplot & Stute, 2008). Collecting these SLO data could be useful in formative and summative assessments of programs.

Many programs have been established to ensure better use of learning outcome assessment data. For example, the National Institute for Learning Outcomes Assessment (NILOA) was established in 2008 to find and disseminate ways that universities and colleges can use assessment data to inform and strengthen educational programs and to communicate with stakeholders and policy makers (Mehany & Gebken, 2016; NILOA, 2017). NILOA (2017) provided a report that stated that universities must show reports of good learning outcome assessment and that the data from assessment must be used for improving teaching and learning. This viewpoint is also held high by the ACCE whereby students' SLO data may be collected on a semester basis and it is encouraged that the assessment data be used to improve the course for the subsequent semesters where possible. In essence, the advice is to use SLO data for curriculum improvement as part of keeping or maintaining construction program's accreditation status.

Research has shown many routes to improving learning outcomes among students. Hands-on learning can be instrumental in reinforcing mastery. Collins and Redden (2017) assessed the efforts to improve SLOs in an undergraduate estimating course. The study focused on utilizing hands-on learning to produce better accuracy in the estimates done by students. To receive this hands-on experience, students were equipped with necessary building materials to create cast-in-place wall reinforcing and formwork. Overall, hands-on experience proved to be better. Learning incorporating a blend of traditional class teaching methods with more technology based teaching methods has also been effective in producing better student learning outcomes. Rogers and Tingerthall (2013) assessed the effectiveness of using the blended learning method known as "flipping the classroom" in a construction management scheduling class. Flipping the classroom creates a more flexible environment for students, allowing lectures to be given electronically while class time is used for problem solving and discussion (Rogers & Tingerthall, 2013).

Comparing these studies raises some key viewpoints. The study by Collins and Redden (2017) researched the success of hands-on learning among students while carrying out the case study. They found hands-on learning to be very instrumental within construction education. Hands-on learning labs along with lectures proved to be very effective at higher education institutions such as the University of Nebraska and Purdue University (Collins & Redden, 2017). In comparison, flipping the classroom had proven to be slightly trickier. Because of this, researchers had to find the most effective approaches to flipping the classroom. This approach required more planning in the course (Rogers & Tingerthall, 2013). To accurately determine and ensure success in improving SLOs, certain methods were put in place for each study. Researchers used pre-exercise and post exercise surveys along with a statistical analysis of the surveys given. The surveys aided in measuring the attitudes and knowledge of the students before and after the hands-on exercise (Collins & Redden, 2017). In the study by Rogers and Tingerthall (2013), 16 modules were developed that were centered on supporting the success of the SLOs. Students were given a list of skills that they were expected to demonstrate by the end of the semester. Overall, the methods for improving SLOs were effective. Students who took part in the hands-on learning lab were able to identify their strengths and weaknesses in estimating which helped in achieving objectives. Flipping the classroom proved to create a more intimate environment within the classroom where students could better understand the materials taught.

Bottom-line, when SLOs are well organized and practiced, they can provide the benchmarks upon which students, faculty and university can measure their levels of achievement. Students will know what is expected of them and will strive to meet or exceed the requirements or goals. Faculty can use SLOs to gauge students' performance to a level of mastery or to the national norm especially for standardized examinations such as the American Institute of Constructors (AIC) examination. With such steps in the achievement gap or improvement ladder, the faculty can find ways to improve the curriculum so that students can have a grip of the course content towards meeting the SLOs. Such efforts may require incorporating industry personnel to expose the students to the industry needs. Thus, there is need for collaboration with industry professionals to enhance mastery of students.

Collaboration between Academia and Industry for Student Learning

Meeting or exceeding SLOs may require a collaborative atmosphere. Collaboration is a relationship that has benefits for the parties involved; usually obtaining results that are greater than the results obtained alone (Slusarek et al., 2010). The idea is to collaborate with schools to train those who will be needed in the construction industry. This collaboration can also form a symbiotic relationship where faculty, students and industry benefit altogether.

Collaboration can also be with students to achieve mastery. Benhart et al. (2017) conducted a study that emphasized capstone courses and how they connect a multitude of construction management undergraduate educational subjects or courses into real life problem solving and learning. This type of learning usually takes place in the senior year of the curriculum. Students may struggle to integrate the appropriate skills and understanding to implement the vital construction elements, especially if the capstone project is not properly structured. This may hinder graduates from proper transition from college to the real world of the construction industry. Benhart et al. (2017) found out that group-work on real life problems can be more beneficial to the learning process of students. Students seemed to be more engaged and felt that working with unknown individuals was an advantage, taking them out of their comfort zones. This is a benefit from project-based learning. A disadvantage of project-based learning is the requirement of more time for preparation and less lecturing, which may cause stress for the instructor (Benhart et al., 2017).

From these, the need for collaboration is evident by the merits and/or benefits. In the case of the capstone study, the industry heavily affects the quality in which students learn and in preparing them for the future workforce. Each collaborative effort works together to create a better future, learning process, and relationship(s) between students and industry. So aspiring university programs and industries can join hands in making a better future for students.

Overall, the literature review showed benefits and issues that may be experienced in achieving SLOs and mastery. A research method was formulated to assess the collaboration between industry and students to achieve mastery.

Research Methods

A surveying camp incorporated a collaborative effort between academia and construction industry surveying professionals. The camp involved bringing the professionals to conduct surveying operations in the school setting. The exercises started with in-class lecture that included: 1.) surveyors sharing their vast experiences from the construction industry, best practices such as good note taking skills and available opportunities for students once they graduate, 2.) reading survey drawings and required mathematical principles, and 3.) overview of construction surveying and layout. It then proceeded to fieldwork where students learned using equipment such as GPS, level, and total station for distance and angle measurements, traversing and leveling. Students applied the surveying principles in the field and were assessed with a grading rubric, before taking end of day exam. They evaluated the camp using survey questionnaire in three levels: beginning, middle, and end of camp. Also, they were assessed on the various aspects of the fieldwork, e.g., ability to handle survey equipment and record correct field measurements using field notebook, engaging during the camp, wearing proper personal protective equipment (PPE), etc. Student field assessment and end of day test/exam provided the score for the camp (this was 20% of the course grade).

Data were gathered from the survey questionnaire feedback and camp exam score. Descriptive statistics comprising of mean, mode, median, standard deviation, skewness and kurtosis showed the variations and distribution of the scores or ratings. Correlation and regression analyses determined the relationship and predictive indices of the score variables. Qualitative data were used to explain the impact of the camp to the students and the CSM program.

Aim, Objectives and Hypothesis of the Research

The surveying camp exercises created a learning environment where students could learn alongside industry professionals thereby enhancing their understanding of the construction-surveying concepts through hands-on exercises. A research process was instituted with the specific aim of investigating the collaboration between academia and industry to improve SLO and mastery in the construction survey course. The first objective was to determine the correlation between the score variables in relation to their mastery during the exercises. The second objective was to determine the level of impact of the exercise to the students and in meeting the ACCE SLO 11. These were assessed with survey questionnaire (initial, middle and end of the camp surveys) and the camp scores. The hypothesis was that the students were expected to benefit significantly from the exercise and that their performances were expected to meet ACCE SLO threshold of 80% minimum for the CSM program.

Sample Size and Demographics

After data screening to remove those who did not come to complete the full camp exercises, the number reduced from 15 to 9 (N = 9). Sophomore, junior and senior level students enrolled for the spring 2017 surveying course. The data reflected the performance in the CSM program towards accreditation and so the outcome of this research could be generalized or applicable to the population of accredited CSM undergraduate programs in the USA.

Survey Questionnaire Administration, Interview and Data Analysis

Approval to conduct research with human subjects was sought and granted by Institution Review Board (IRB) before administering the questionnaire. Paper and pencil survey questionnaire was then administered to students at the beginning, middle and end of the camp. This survey method was chosen because of its ease in getting instant feedback from students. The initial survey asked students questions such as their levels of excitement for the exercise on a five-point Likert scale (least excited =1, somewhat excited = 2, neutral = 3, excited = 4 and very excited = 5), preparation for the exercise (not prepared =1, somewhat prepared = 2, prepared = 3, very prepared = 4) and what they expected to learn from the exercises. The mid-point survey asked students about their assessment of the surveying exercises thus far on a five-point Likert scale (1 = not good, 2 = somewhat good, 3 = neutral, 4 = good, 5 = very good), whether they were learning anything new (1=never, 2 = somewhat, 3=neutral, 4 = much, 5=very much), whether the materials they learned over the semester related to the content of the in-class portion of the camp (1 = never, 2 = somewhat, 3 = neutral, 4 = relate much, 5 = relate very much), their liking of the schedule of the exercises (1= not at all, 2=somewhat like it, 3=like it, 4 = very much like it), what they liked most from the in-class lectures, their self-assessment in regard to retaining the materials learned and providing ideas to aid in improving the exercise at the midpoint of the program. The end survey asked them their overall assessment of the exercises, whether they learned anything new, the scheduling of the whole camp program, their percent grade placement in regard to understanding and retention of the materials, overall satisfaction with the exercises (1= never, 2=somewhat satisfied, 3=neutral, 4 = much satisfied, 5=very satisfied), what they would change about the program, some things they liked, and recommendations for future development of the camp program. The survey feedback was followed by interview after two days for those who volunteered to provide more information. This was to validate the survey feedback. The interview asked them about aspects of the camp that caught their attention most, overall structure of the camp, bringing the surveyors at the end of the semester was good idea or not as well as overall view of the surveyors. They were also asked about the score weight of the camp exercises (20% of course grade), level of satisfaction with the exercises and the final recommendations to aid in improving the camp and future course delivery.

Data were analyzed using excel for the quantitative data. This statistical analysis tool was selected because the dataset was not large enough to warrant the use of sophisticated statistical analysis systems or tools such as SAS or SPSS. Specific themes were developed and discussed for the qualitative aspect of the survey data and interviews.

Results

Descriptive and inferential statistical results were presented and discussed in relation to predicting the camp scores.

Descriptive Statistics

The details of the questionnaire items are summarized below for statistical analysis results shown in Table 1.

- Initial survey questionnaire
  - Q5 = Level of excitement with the exercise that day (4-point Likert scale).
  - Q6 = Preparedness for the exercises (5-point Likert scale).
- Mid survey questionnaire
  - Q4 = Assessment of the program/exercise thus far (5-point Likert scale).
  - Q5 = Assessing the learning of new information (5-point Likert scale).
  - Q6 = Assessing course content and relating to the in-class part of exercise (5-point Likert scale).
  - Q7 = Level of liking the exercises (4-point Likert scale).
- End of survey questionnaire
  - Q4 = Overall assessment of the program/exercises (5-point Likert scale).
  - Q6 = Overall assessment of learning new information (5-point Likert scale).
  - Q8 = Overall assessment of the schedule or timing of the program (5-point Likert scale).
  - Q9 = Overall assessment of course and relating to the overall exercise (5-point Likert scale).
  - Q10 = Overall individual assessment of mastery and retention of the camp exercise (1-100)
  - Q11 = Overall level of satisfaction with the exercise/program (5-point Likert scale).

Table 1 shows the results of the descriptive statistics comprising of mean, median, standard deviation, skewness, kurtosis, minimum and maximum values for the initial survey, mid survey, end survey and camp score variables.

Table 1. Descriptive statistics of the survey questionnaire items and the camp scores

	Item	N	Mean	Median	Mode	Std	Skew	Kurt	Min	Max
Initial Survey	Q5	8	3.11	3.00	3.00	1.54	-0.24	-1.31	1.00	5.00
	Q6	8	2.60	3.00	3.00	0.89	-0.21	0.14	1.00	4.00
Mid Survey	Q4	8	3.60	3.50	3.00	1.06	0.04	-0.94	2.00	5.00
	Q5	8	3.75	4.00	4.00	0.89	-1.03	1.85	2.00	5.00
	Q6	8	4.25	4.00	4.00	0.71	-0.40	-0.28	3.00	5.00
	Q7	8	2.50	2.00	2.00	0.76	1.32	0.88	2.00	4.00
End Survey	Q4	9	4.10	4.00	4.00	0.78	-0.22	-1.04	3.00	5.00
	Q6	9	4.10	4.00	5.00	1.05	-1.09	0.61	2.00	5.00
	Q8	9	2.22	2.00	1.00	1.20	0.57	-1.10	1.00	4.00
	Q9	9	4.22	4.00	5.00	0.83	-0.50	-1.28	3.00	5.00
	Q10	9	88.3	95.0	95.0	10.0	-1.82	3.64	65.0	95.0
	Q11	9	3.56	4.00	4.00	1.33	-0.97	0.30	1.00	5.00
Camp Grade	Score	9	87.1	84.5	-	8.00	0.30	-0.91	75.5	100

From Table 1, the initial survey feedback showed that students were relatively excited (*M = 3.11, SD =1.54*) and prepared (*M = 2.60, SD = 0.89*) to begin the program. After going through the in-class lecture session, they took the mid-point survey that was to inform the progress of the surveying camp program. The students felt good and energetic about the session (*M = 3.60, SD =1.06*) and expressed their learning of new things (*M = 3.75, SD =0.89*). Respondents stated that a lot of information in the lecture highly resembled the semester course content (*M = 4.25, SD = 0.71*). They admired the in-depth explanation that included construction drawings/plans that the speakers were ready to explain in detail. However, they were not very pleased with the schedule of the in-class exercise (*M = 2.50, SD = 0.76*), students citing long lecture time. The end survey questionnaire feedback showed students were very pleased with the program in overall and that they learned a lot of important information (*M = 4.10, SD =0.78*). They admired the fieldwork piece that most of them cited the critical use and maneuvering of sophisticated survey equipment such as GPS, level and total station as enlightening as well as keeping them engaged throughout the exercise thereby making them learn more. However, they were not pleased with the overall schedule of the survey camp (*M = 2.22, SD =1.20*). Noteworthy, students believed that the exercises provided in the camp highly related with the content of their semester coursework in construction surveying and layouts course (*M = 4.22, SD = 0.83*). Thus, they assessed themselves and believed that they would achieve a high grade B on average (*M = 87.1, SD =8.00*). Overall, they were much satisfied with the exercises from the surveying camp (*M = 3.56, SD =1.33*). Students enjoyed being engaged in hands-on activities and the rigor provided by the surveyors especially in answering their concerns or questions and in executing the fieldwork activities with uttermost precision and accuracy. Recommendations for the future included having the course in a reduced time slot rather than a long day of work. Others stated having the sessions divided three times during the semester; all after the mid part of the semester after students have had a grip of the course content. Most of these viewpoints from the survey questionnaire feedback were validated with a follow-up interview of five (5) students who volunteered to take part. Interviewed students commented favorably about the expertise and experience level of the surveyors; citing giving students the necessary tips to execute proper and reliable surveying operations using state of the art tools and techniques. However, it was not good to hear that some students managed to come because the camp part of the course was weighted heavily, implying they would skip it if it were not given 20% of the course grade.

Correlation between the Scores in End Survey Self-Assessment and Surveying Camp Scores

Correlation analysis investigated the strength of relationship between the self-assessment scores and the camp scores of students. Modified Pearson Correlations Coefficients guide was used in the interpretation of correlation indices (Wao et al., 2016). Using the guideline, (+/-0.01 to 0.09 = negligible relationship, +/-0.1 to 0.19 = very weak relationship, +/-0.2 to 0.29 = weak positive/negative relationship, +/-0.3 to 0.39 = moderate positive/negative relationship, +/- 0.4 to 0.69 = strong positive/negative relationship, +/- 0.7 and higher = very strong positive/negative relationship), the correlation or relationship between the scores was negligible (r = -0.034).

Linear Regression of the Scores in End Survey Self-Assessment and Surveying Camp Scores

Linear regression analysis assessing the predictive ability of the self-assessed score on the camp score is in Table 2.

Table 2. Regression analysis of score variables

	N	RMSE	R^2	Standardized Coefficients
Camp score vs self-assessed score	9	0.587	0.001146	0.302

In Table 2, R^2 estimated the amount of variance in the camp score that was accounted for by the independent variables self-assessed scores. Specifically, self-assessed score accounted for 0.12% of the variance in the camp score variable. The Root Mean Square Error (RMSE) indicated the magnitude by which the prediction of camp scores tended to be off from the prediction line. The prediction equation was as follows:

- Surveying camp score = 89.45 - 0.027*(Self-assessed score).

The regression model shows a negative slope which is also supported by the negative correlation index. This is also supported by the non-statistical significant result (at $p = .05$) of the regression coefficients for the variables. Usually, the interpretation is to reject the null hypothesis if $p < .05$ and conclude statistical significance, or fail to reject the null hypothesis if $p > .05$. The regression coefficient for self-assessed score variable [$t\ (8) = -0.0896$, $p = .9311$] was not statistically significant making it not a better positive predictor of surveying camp scores of students.

Discussion and Conclusion

The review of literature has shown that SLOs can be improved in many ways. Such may include blending the course delivery with in-class lecture activities as well as hands-on project related activities, with the latter showing better outcomes as characterized by greater level of engagement, retention and mastery. The ACCE and NILOA organizations have provided platforms to streamline and guide academic programs for better SLOs by implementing accreditation policies. However, they do not prescribe the specific methods for meeting the goals, leaving respective programs to have the liberty to diversify their own ways to achieve measurable SLOs. Thus, this dilemma or challenge motivated the effort to conduct research that focused on SLO 11 as per the ACCE accreditation nomenclature. The research employed both in-class lecture and project based hands-on activities; an approach that is similar to the research by Rogers and Tingerthal (2013) which documented successful learning methods. In addition, collaboration between academia and industry showed potential benefits to students whereby students worked alongside surveying professions. Survey questionnaire, interviews, and examinations provided data to aid in examining the SLO and effects of collaboration. Reporting the analysis results utilized descriptive and inferential statistics for quantitative research. Qualitative aspect entailed discussing specific themes raised during the camp.

The survey questionnaire results showed students expressing a relatively high level of eagerness and keenness to learn from the industry professionals. This desire to learn is important because learning is usually effective when students are motivated and energized. This is greatly reinforced when the instructors also reciprocate with similar characteristics that students can identify with, thus adding more positivity to the greater learning atmosphere. The latter was evident in this research when the surveying professionals were very enthusiastic to go in detail when explaining and answering the questions posed by students. In fact, the students interviewed expressed becoming more detail oriented when they realized that they were part of the rigor provided by the surveyors, and the course instructor who had introduced to the class similar items as those discussed in the camp. The easiness of the surveyors to allow students to handle the equipment added to the confidence building that translated in a positive learning atmosphere. In all, learning was effective when anchored and supported well with collaboration.

Industry-academia collaboration is a key approach to prepare students to be project ready when they graduate. Students citing greater level of satisfaction with the camp activities showed that they had learned enough from this collaborative effort toward their professional readiness. High level of satisfaction could lead to confidence which was reflected by students reporting high ratings in their self-assessed scores that also implied high retention and mastery ($M = 88.3$, $SD = 10$). This average score for the level of mastery was not significantly different from the actual surveying camp score ($M = 87.1$, $SD = 8.00$). Noteworthy, these high scores showed their steadfast attention and greater mastery of ideas, which was over the threshold of 80% according to ACCE standard.

Performing at 80% level of mastery was the minimum goal of the CSM program for SLO 11 and so predicting the final score would be important in assessing the degree of meeting this goal. Attempt to predict the camp score from self-assessed score driven by confidence and satisfaction yielded a negative correlation between the self-assessed score and the surveying camp score. The negative correlation was further exemplified in the regression model that yielded a negative coefficient and non-statistically significant slope for the self-assessed score variable, implying students mastery dwelled more on what they learned through hands-on experience and not memorizing for exam. The negative indices could also imply that students did not perform well in the final test because of fatigue from the whole day's work. This explains their recommendations to space out the camp exercises over the semester schedule.

In conclusion, this research showed the importance of collaborative effort between academia and industry to improve SLOs towards meeting ACCE standards. It showed the importance of engaging professionals rooted in construction coming to offer experiential ideas to students in a project based setting. It was evident from the observation by the instructor, the feedback from the survey questionnaires and interviews that the surveying camp accomplished the goals beyond the expectations of students. Students hailed the surveyors for their great work ethic and the desire to educate them to achieve higher mastery of the concepts and procedures through class lectures and hands-on exercises. In-class portion aided in orienting them to the expectations in the field. It resonated mostly with items already discussed during the semester, and thus, fieldwork not only continued to boost their confidence with the in-class lecture portion as applied in the field, but also reinforced and improved their prior knowledge of the subject thereby improving the SLO. This was the greatest accomplishment as students learned monolithically well with demonstration of proper surveying and layout techniques at higher mastery level. Most importantly, learning was improved, students benefitted significantly and the ACCE SLO 11 threshold was exceeded. Thus, the outcome supported the hypothesis developed for this research. Noteworthy, it was recommended that this research outcome be included in the ACCE report for the CSM program as part of maintaining their accreditation status. Further, the collaboration to be replicated in future taking into the consideration the students' recommendations.

Future Research

This research may need to be continued with different students and large sample sizes. This would ensure robust statistical outcomes that are more representative of the general population of interest. Smaller sample sizes can be limiting in the ability to generalize to a wider population, and this could be a limitation in this research.

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