

ASSESSMENT AND IMPROVEMENT OF A REQUIRED CONSTRUCTION MANAGEMENT SERVICE-LEARNING COURSE

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There is a trend for universities to embrace high-impact educational practices in their curricula to enrich the student learning experience. During a recent curriculum revision, the faculty at the McWhorter School of Building Science at Auburn University made the decision to add a service-learning course as a requirement for graduation. The service-learning course is centered on a small construction project that serves the community and incorporates the application of various critical facets of construction management: engagement and communication with all stakeholders, planning, estimating, scheduling, and constructing the project. This study is a continuation of previous research concerning the efficacy of the service-learning focused construction management course. Previous research focused on student feedback concerning the execution of the course and project accomplishments. This research continues that work by analysis of data collected from structured interviews of the instructors teaching the course, as well as the evaluating the impact of implemented changes to the course based on data gathered from students. In addition, this study includes an extensive literature review analysis which identifies the current standard of practice for assessment of student learning in service-learning courses in construction management education.

Keywords: engagement, community, high-impact education, service learning

INTRODUCTION

The emergent trend in higher education in the United States is to include high-impact educational practices in their curricula to enrich and improve students' educational experience. It has been recognized that exposing undergraduate students to real-world experiences as part of their education better prepares them to enter the workforce (Farrow and Burt, 2018; Kuh, 2008). Like other land grant institutions in the United States, Auburn University has "impactful service" as one of its strategic goals. This includes innovation and community engagement to enhance the quality of life in the State of Alabama and beyond. (Auburn University, 2019).

In keeping with the trend to include high-impact educational practices in curricula and in order to meet the university's goal of providing "impactful service" to the community, the McWhorter School of Building Science at Auburn University incorporated a service-learning (SL) course as a required part of its curriculum.

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Service-learning is defined as “a form of experiential education in which students engage in activities that address human and community needs together with structured opportunities intentionally designed to promote student learning and development” (Jacoby, 1996). In this case, a SL course includes the planning and execution of a construction project that benefits a non-profit entity that works to improve and/or support the community. Prior to the addition of community engagement to the university’s strategic goals, the McWhorter School of Building Science has long been active in offering opportunities for community engagement to the students. For over 25 years, several faculty members spearheaded the incorporation of service projects as a component in various elective courses in the curriculum. As part of a recent curriculum review in 2016-2017, the faculty made the decision to increase the school’s commitment to community engagement and high-impact educational practices by adding a required standalone SL course as part of the new curriculum. The ‘new’ SL course is offered in the penultimate semester prior to graduation and is designed to integrate all components of the construction process including planning, collaboration with stakeholders, management, safety, quality, and execution while at the same time enhancing community engagement.

Using the experiential learning process to teach construction can be filled with difficulties and is prone to chaotic undertakings that serve as examples of how not to properly manage construction projects. The research focuses on faculty experiences creating and executing the first five semesters of the newly created required SL course in the curriculum and provide recommendations for effectively using SL in construction management curricula. This course differentiates itself from previous courses at Auburn University, and other universities for that matter, because it is a requirement for graduation rather than being an elective. The authors of this paper were not involved in the development and instruction of the course in the first five semesters the course was integrated into the curriculum, which differentiates this research from the majority of previous research on the subject. Most commonly, the authors of SL research in construction management (CM) are also the instructors of record for those courses implementing SL pedagogy. This research is a continuation of work previously conducted concerning this new SL course. The previous research focused on student perceptions and non-profit partner perceptions of the course and have been previously published. The continuation of the research focuses on the experiences of the two faculty members who created and deliver of the new SL course.

LITERATURE REVIEW

The acquisition of knowledge is not a passive process. Cognitive psychologists have studied various experiential learning and educational theories throughout the 20th and 21st century. This foundational research includes Kolb’s work in cognitive learning styles (2015); learning copers and defenders studied by Burner (1986); and Witkin and Goodenough (1977) looked at issues of the field dependence versus field independence. The work of these researchers, as well as others, recognized the cognitive learning process and how deeper learning is achieved when a learner applies concepts from the classroom to real-world experiences.

Engaging the student to experience and apply a set of ideas, processes, or problems notably advances the learning process as compared to other methods of receiving information - such as reading or hearing it through lecture only (Senior, 1998; Smith *et al.*, 2018). The approach of experiential learning is utilized by construction

management educators to reach students at a deeper metacognitive level (Korman, 2015; Park *et al.*, 2016; Slattery *et al.*, 2008; Wu and Luo, 2018). Collins and Redden (2020) evaluated the use of a hands-on, experiential learning experience that goes beyond the typical construction management coursework in a construction estimating course with 102 students over several semesters. The study found that each student's ability to grasp the subject improved, and their preconceived perceptions of construction estimating skills were positively changed. Farrow and Burt (2018) found students that participated in small SL projects, international study, competition teams, or an industry internship connected those experiences to a more profound level of learning.

Cline and Kroth (2008) found the practice of using SL projects in CM curricula challenging for instructors due to logistical concerns, course time constraints, and by the very qualities that set SL apart from other forms of experiential learning. A critical element for success when implementing SL is for the educators to provide assistance and structure for students to ensure they are prepared to learn from experiential opportunities (Cone and Harris, 1996). Under conditions in which frustration, anxiety and other emotional responses are too high, individuals have difficulty forming clear concepts (Eysenck, 1982). Therefore, preparing students and shaping student expectations in order to minimize frustration and debilitating anxiety is a critical element (Cone and Harris, 1996).

The literature illustrates enriching SL elective courses in construction management. In 2010, Auburn University (Bugg, Collins and Kramer, 2017; Farrow, C., Kramer, S., and Meek, D., 2011) initiated a short-term study abroad elective course with a humanitarian aspect incorporated for the students enrolled to assist in the construction of an after school care center in Quito, Ecuador, for underprivileged children in partnership with the non-profit organization Servants in Faith and Appropriate Technology (SIFAT). Colorado State University recently published on the development and success of a SL elective course (CON 464 Construction Leadership) which began in 2011, occurs each spring semester, and is centered on one larger-scale SL project for the total class to work on throughout the semester. The elective course has "an established structured selection of students that wish to enroll in the course and participate in a SL project." (Olbina, S., Mehany, M. and Jesse, K., 2018). While SL elective courses in CM programs are well-documented as valuable and enriching to those students that participate, students who are unable to participate because they were not selected or could not afford additional fees are not able to benefit from the learning experiences afforded by SL elective courses. One primary gap in previous research is the development and implementation of a required course in the CM curriculum that features the execution and management of a large-scale SL construction projects as the focal assessment theme for successful completion of the course. The literature also lacks evidence of a consistent, well-documented implementation of a required course where the program or school has continued refinement and achieved successful balance of the required SL course.

METHODOLOGY

The research was performed by two faculty members not involved in the formulation or execution of the SL in order to maintain 'third party' perspective of the data. The research methodology consists primarily of information obtained during semi-structured interviews executed separately with the Service-Learning Coordinator (SLC) faculty member and the faculty member that has been the instructor for the

course since its creation in Fall 2018. These interviews focused on planning and logistics for the class, institutional enablers, institutional inhibitors, challenges faced by administrators and instructors, lessons learned, improvements and how the class has evolved since its inception in the 2018 Fall Semester. The SLC and instructor were interviewed after the first semester of the course in December of 2018, and then again during the fifth semester in March 2020. This paper incorporates the data obtained from these interviews. The systematic process of organizing and identifying categorically meaning of the interview data was performed by the researchers by thematic coding (Vaughn and Turner, 2015; Rubin and Rubin).

In addition to conducting the interviews with the SLC and course instructor, students completing the course were asked to complete a questionnaire to determine the students' perception of the efficacy of the course, course strengths and course weaknesses. The same was true for the non-profit owners after each semester's project completion to collect their perceptions. The results and analysis of the students and owner perceptions of the required SL course is presented in a conference paper that was scheduled to be published in April 2020 but has been delayed until August 2020 due to the COVID-19 global pandemic. However, it should be noted that students had an overall positive perception concerning the efficacy of the course and owners were positive about their experiences as well. However, both students and owners noted the same challenges noted in the faculty interviews and described below. Complete results are contained in the companion paper.

Course Background

The first time the new SL class was offered was in the Fall Semester of 2018. The current semester (Spring 2020) is the fifth semester the class has been offered. For the Spring and Fall semesters each year, there are two cohorts of 30 students each. For the Summer Semester, there is one cohort of 20 students. In total, as of Spring 2020, 264 students have completed the course. Each cohort is divided into 10-student construction teams; therefore, the maximum number of projects in one semester is six (6). The construction teams are selected randomly by the course instructor. Each construction team selects a leader or "project superintendent". The project superintendent is the single point of contact between the team and the project owner. The project superintendent also is responsible for submitting weekly communication reports which consists of total man-hours logged, look ahead schedules, material and equipment usage, and other field supervision data points. In order to minimize liability concerns, one of the prerequisites for enrolling in the SL course is the Construction Safety Course which includes the requirements for OSHA 30 certification. In addition, students are required to sign a waiver of liability.

In order to select suitable projects, shortlisted non-profit organizations (owners) participated in a request for proposal (RFP) process. The shortlisting process is completed by the McWhorter School of Building Science School Head, the SLC, and the course instructor. Owners submit a written response summarizing the scope of their proposed project(s). After the RFP responses are vetted by the SLC and the course instructor, owners were invited to present their projects to the student construction teams. Each student team then selects the project they will work on for the upcoming semester.

At the start of the semester, each team is assigned to prepare and submit a Site Specific Accident Prevention Plan, a cost estimate with detailed material purchase lists, and construction schedule for their selected project. Each student team then

makes an oral presentation to the owner and course instructor summarizing these documents prior to the start of work. Each team then receives notice to proceed for the project after receiving the owner's written approval of budgets and schedules. The student teams each spend the balance of the semester executing the physical construction of the projects.

The course is designed for the student teams to work approximately four to six hours per week on the planning and the physical execution of their selected project. The students receive two (2) credit hours for completing the course. Table 1 contains the student assessment and evaluation information from the course syllabus:

Table 1: Student evaluation and assessment

Course Objectives	% of Course Assessment
Written Proposal, Estimate, Schedule, Safety Plan and Quality Control Plan	30%
Oral Presentation of the Proposal to the Client	10%
Communication Reports	10%
Mid-Project Inspection (safety procedures, quality, interaction with owner, and involvement of team members)	20%
Completion of Service-Learning Construction	5%
Final Presentation (written and visual documentation, reflection of process)	25%

All members of the student construction teams receive the same grade for the course with one exception. The student assessment has a peer review component where students assess each other's participation and contribution to the project. If a student performs poorly on the peer review, a letter grade is deducted from their final course grade. This assessment component encourages collaboration of all student team members, allows the students to hold each other accountable for the equality and parity of work commitment as well.

RESULTS

Institutional Enablers

As stated above, this required class was instituted, in part, because of Auburn University's stated commitment to community engagement. This, combined with the McWhorter School of Building Science's long history of SL engagements, made the inclusion of a required SL class in the curriculum a natural evolution of the undergraduate education program. Because of the past integration of SL as a course module in Concrete Structures classes or extra-circular activities sponsored by CM student organizations, the McWhorter School of Building Science has established relationships with a network of non-profit entities- locally, regionally, nationally and internationally. These prior relationships facilitated the initial search for eligible SL projects within a 30-mile (50 km) radius of campus. In addition, several of the McWhorter School of Building Science's financial donors earmarked donations to be used to support SL projects, both domestic and abroad. The support of the university administration and generous donors provided a strong foundation for the initiation the course as well as its continued development.

Institutional Inhibitors

According to the SLC and the course instructor, the biggest institutional inhibitor is the credit hour allocation for the course, which is only two semester credit hours for

completing the course. All other courses required by Building Science in the junior and senior level are three or four credit hours. In the view of the SLC and instructor, the credits awarded do not reflect the work required by the students to complete the course work. In addition, the time commitment for the course instructor is far in excess of the time requirement for a normal two credit course. This is due to the instructor having to travel to multiple jobsites all in various locations within a 30-mile (50 km) radius of the campus on a weekly basis to monitor the work, answer questions, and give guidance to the students.

Another institutional inhibitor for this course is the compensation instructors receive for teaching the class. Since this is only two credit hour course offered in the undergraduate curriculum, instructors receive two-thirds of the compensation they receive for a three-credit hour course. However, the compensation factor is minor compared to the considerable time commitment required to plan and successfully execute this SL course. These factors combined do not make this an attractive course to teach.

Efficacy of the Course

The researchers questioned the SLC and the instructor about the educational effectiveness of the course and how they each defined “success” in teaching the course. The following is the consensus of their answers concerning the effectiveness and the most valuable aspects of the course from their perspective:

- The breadth of the educational experience as shown by the course requirements (Table 1) for both planning and execution; the course ties the theoretical into practical application.
- Gaining an appreciation for thorough pre-project planning and the overall efforts it takes to succeed in the preconstruction phase of a project.
- Developing/managing a relationship and communicating with project owners.
- Problem-solving and overcoming obstacles.
- Learning the importance of teamwork/collaboration.
- Gaining actual hands-on construction experience.
- Feeling the gratification of completing an actual project.
- Developing a “heart for helping others.” This particular outcome is based on anecdotal evidence provided by the class instructor. Many students spoke of how completion of the SL project gave them a great deal of satisfaction because it helped the community, and many expressed a desire to continue to participate in community service after graduation.

Challenges

According to the SLC, one of the biggest challenges is selection of SL projects for the students to construct. In the interview, the SLC stated it takes about 95% of their time to solicit, screen, and manage the project selection process. When the class started in the Fall Semester of 2018, it was envisioned there would be many more projects than the students could execute in any semester. In other words, the students would be able to choose from multiple projects when selecting their project. This has not been the case. For the first four semesters that the course has been offered, the number of projects available has been roughly the same as the number of student teams. This was especially problematic in the first semester. Two of the projects were located approximately 65 miles (105 km) from campus. As a result, the student teams assigned to these projects spent three hours each week travelling to and from their

project sites. This resulted in the students either spending less time onsite or increasing their time commitment to the course. Another challenge in the first semester was that the readiness of the projects to be constructed. These challenges included: incomplete designs, project permits had not been obtained, funding shortfalls for materials, and changes in owners' points of contact.

According to the course instructor, the biggest challenge faced by the students is that majority of them have no experience actually building a project. While they have been taught how to plan, schedule, and estimate, the majority of students do not have any practical, hands-on experience at the time they enter this course in their senior year. As a result, many students are apprehensive and anxious about the construction phase of the course. In order to overcome this apprehension, the instructor emphasizes the importance of planning. The instructor is available to offer technical assistance when needed. However, because of the number of project sites and the distance between them the time of the instructor on any one job site is limited. This can lead to construction delays as the students await guidance and/or assistance. The limited availability of the instructor for any one project team has been a major student criticism in course evaluations each semester.

Incorporation of Lessons Learned

The following are the major lessons learned by the SLC and course instructor after offering the course every semester (Spring, Summer and Fall) for the last two years: (1) thoroughly vet and evaluate all owner proposals; (2) keep all project sites within a 30 minute drive of campus; and (3) one instructor for this course is insufficient to handle the workload. It was obvious after the first semester that a more rigorous system to vet projects was required to minimize delays and disruptions caused by design changes, permit issues and other owner caused delays. Just as planning is a major of student work in the class and is required for project success, planning is equally important for owners of SL projects.

To make sure that owners stayed on track with the planning process, the SLC developed a detailed tracking mechanism (Excel spreadsheet) for owners' project progress. Items tracked on the spreadsheet include preliminary contact made, preliminary scope defined, schematic drawings, preliminary estimate/budget, construction drawings, stamped construction drawings, 100% funding available, City of Auburn approvals, final scope/design, project site ready/available, building permit, and approval for presentation to students. The owner progress spreadsheet is used during weekly meetings between the SLC, the course instructor, and the school head to insure there are always sufficient projects to support the execution of the class. The spreadsheet tracking system and weekly meetings have been very effective in improving owner planning which has enhanced the student learning experience. Keeping viable projects in the pipeline takes an intensive effort by the SLC and course instructor to keep owners, who are not always familiar with the project planning and delivery process, on track. While changes, delays and problems can be expected on any construction project, these should be minimized on SL projects of short duration. Otherwise, students are unable to glean the full value of the class and owners can become frustrated with a lack of progress if even they are responsible for the lack of progress.

Incorporating the lesson learned to keep all project sites within a 30-mile radius of campus has become easier now that the course has become established and the school has expanded its pool of eligible project owners. The problems encountered in the

first semester with project sites being so far from campus were due to the limited number of project available for the students to select from. While choices were limited for the first three semesters, the pool of projects had been expanded to the point that students had several choices from which to select.

Now that the course has been offered for five semesters, it has become obvious that one instructor to teach two simultaneous courses with 30 students each (total of six large-scale projects in construction at the same time) in the Spring and Fall semesters is not sufficient as noted by both the instructor teaching the course and the student feedback obtained through previous research. As noted above, in the Spring and Fall there are 6 projects under construction simultaneously. Due to the students' relative lack of construction experience, in an ideal learning environment the instructor would be available to provide guidance and answer questions all times students are working onsite. This is simply not possible given the number of and dispersion of the project sites. In order to address this issue, the faculty met and made the decision to recruit more instructors to teach the class. In recognition of the extraordinary time requirement to teach the class, the decision was made to divide each 30 student course into three, 10 student sections. Instructors would earn 2 semester hours teaching credit for each section. Partly as a result of this policy change, several of the faculty who had previously expressed an interest agreed to teach the class on a trial basis. The additional instructors are scheduled to begin sharing the workload in Fall Semester 2020.

CONCLUSION

The McWhorter School of Building Science continues to recognize the benefits, for both the recipients and providers, of offering a SL course based on multiple large-scale projects each semester. The importance of immersing students into high-impact practices, specifically SL, in CM provides a strong opportunity for student growth and prepares them for their first position in the construction industry. Gaining and formalizing the perceptions, experiences and attempted improvements of the key faculty engaged in the course from its inception to the present is critical to evaluate the course's efficacy and determine how the faculty as a whole can continue to support the extraordinary endeavor to teach every student in the program through a required SL class.

The time commitment and constant, year-round engagement required to assist and guide the non-profit partners through the preconstruction phase of SL projects is a vital element that has revealed itself as a direct factor in the success or failure for the student teams to achieve substantial completion by the end of the semester. The role of the SLC is necessary for the required SL course to achieve maximum educational effectiveness for the students. Having the financial means and institutional support to resource a faculty or staff member to perform the skills of a preconstruction manager for the non-profit owners is imperative.

The instructor of the course must work with the students on day one of the semester to prepare and plan for the successful execution of their projects. This assistance and guidance must continue throughout the semester. The existence of student anxiety surrounding misconceptions and lack of experience in projects of this magnitude requires the instructor to have resources and time to provide all students with direction, and at times a lot of hands-on assistance. As Cone and Harris (1996) and Eysenck (1982) summarized in their research, preparing students and shaping student expectations in the beginning [with an assignment of this magnitude with a lot of

moving parts and responsibility] will minimize frustration and will reduce anxiety so the learner's mind is open to obtain the fullest benefit offered by the SL experience.

Future research includes continuing for the researchers to track the continuing evolution of the course. Because of the COVID -19 global pandemic, the university was required to transition to virtual instruction during the second half of the 2020 Spring semester, as well as the entire 2020 Summer semester. Future research will focus on the examination as to how this transition to virtual classes effected the content of the course, as well as faculty and student perceptions of the effectiveness of the learning experience. Another opportunity for further research is to collect data from alumni of the course to determine if the course has helped them in their professional careers, and if the required commitment to serve the community during their education instilled a desire to continue service work after graduating from the university. Lastly, while service learning (SL) is recognized as a powerful pedagogical tool the authors' see opportunity to initiate studying any ethical issues this course may present. Highlighting possible dilemmas and providing awareness to ensure all involved are prepared to address ethical issues will strengthen all stakeholders' engagement in the course.

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