# Using Social Media to Improve Minority Students' Skills When Connecting Courses with Different Educational Modalities

**Dr. MOHAMED ELZOMOR, Florida International University**

Dr. Mohamed ElZomor is an Assistant Professor at Florida International University (FIU), College of Engineering and Computing and teaches at the Moss School of Construction, Infrastructure and Sustainability. Dr. ElZomor completed his doctorate at Arizona State University (ASU), Ira A. Fulton Schools of Engineering. Prior to attending ASU, Dr. ElZomor received a master's of science degree in Architecture from University of Arizona, a master's degree in Engineering and a bachelor of science in Construction Engineering from American University in Cairo. Dr. ElZomor moved to FIU from State University of New York, where he was an Assistant Professor at the college of Environmental Science and Forestry. Mohamed's work focuses on Sustainability of the Built Environment, Engineering Education, Construction Engineering, Energy Efficiency Measures and Modeling, Project Management, and Infrastructure Resilience. Dr. ElZomor has extensive professional project management experience as well as a diverse cross-disciplinary academic knowledge. Mohamed, distinct expertise supports fostering interdisciplinary research in addition to embracing innovative pedagogical approaches in STEM education. Dr. ElZomor has been integrating innovative and novel educational paradigms in STEM education to support student engagement, retention, and diversity.

**Mr. Piyush Pradhananga,**

Piyush Pradhananga is a Ph.D. student in Civil and Environmental Engineering at Florida International University (FIU). Piyush holds a B.S. in Civil Engineering from Tribhuwan University (TU). Following his graduation in 2016, he joined a leading real estate corporation in Nepal as the site engineer working on a multi-million project. He later joined a research firm based in London where he worked as an Engineering Graduate Researcher. Piyush is currently a Graduate Research Assistant at the Moss School of Construction, Sustainability, and Infrastructure at FIU where he focuses on multidisciplinary research that harmonizes sustainability in construction. His other research interests include Sustainable Construction, Construction Safety, Engineering Education, Green Building, and Energy Efficiency Measures.

**Dr. Arif Mohaimin Sadri, Florida International University**

Dr. Arif Mohaimin Sadri is an Assistant Professor in the Moss School of Construction, Infrastructure and Sustainability (MSCIS) at the Florida International University (FIU). Previously he was a Visiting Assistant Professor in the Department of Civil and Environmental Engineering at the Rose-Hulman Institute of Technology and an Adjunct Professor in the Civil Engineering Dept. at the Valparaiso University. Dr. Sadri received his doctoral training from the Lyles School of Civil Engineering at Purdue University with a solid background in Civil Engineering (Transportation), Network Science, and Social Science. Dr. Sadri specializes in resilience engineering, evacuation modeling, shared mobility, social influence modeling, machine learning, agent-based modeling, and network modeling. Dr. Sadri's research focuses on the critical interdependence between social and infrastructure networks and integrates human proactive decision-making components into the civil infrastructure management challenges. Dr. Sadri develops human-centered and network-driven techniques that complement to the science of infrastructure resilience and sustainability.

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## Abstract

This study evaluates the integration of Social Media (S.M.) platforms as an informal pedagogical tool to support STEM learning by fostering engagement and increasing interactional competence and collaborative skills. Construction engineering education has been plagued with low engagement levels partially due to its timeworn pedagogical means and ineffective use of technology. S.M. platforms are convenient and effective informal educational means that encourage engagement and interactions between peers. Nowadays, construction programs are shifting to online education, and this research is geared to understand the interactions between student bodies within different instructional modalities. This study focuses on the successes of the second-year implementation of integrating S.M. in a Construction Management (CM) program in a minority serving institution. The implementation consisted of periodically collecting student feedback to (1) evaluate students' interactional competency skills and confidence in collaborative skills and; (2) describe how S.M. can be utilized to submit course deliverables, which in turn increases minority students' skills, engagement, and interactions. The novel contribution of this research is to study the effectiveness and student engagement level when integrating S.M. in different CM courses (Sustainability, Construction methods/materials, Automation in Construction) with various instructional modalities (fully online, Face-to-Face, and hybrid). This research initiative presents paired t-test and box plots paired with line plots from pre and post-course surveys of 75 students. Finally, this paper highlights the challenges and lessons learned along with recommendations for transferring this pedagogy to other institutions.



**Key Words: Social Media, Minority Students, Interactional Competence, Collaborative Skills, Construction Management, Educational Modalities**


## 1. Background and Motivations

The President's Council of Advisors on Science and Technology projected a required increase of one million STEM graduate students in the next decade and advocated to develop innovative teaching practices, which improves student engagement as well as performance and meets this goal. Also, there is an urgent need to bolster the competitiveness of STEM fields in the United States, which necessitates improving the available pedagogies that support teaching and training [1]. STEM courses are primarily lecture-based that lack interactive learning environments and place students in a more passive role without providing enough opportunities to be creative and engage with peers [2]. As such, technical issues related to ensuring innovative pedagogies that train and support STEM students have escalated, such as the integration of STEM courses positioned in upper and lower divisions to benefit student learning and training [3]. However, student engagement suffers from the challenges associated with such logistics, which is also evident from the lower number of STEM graduates in recent years [4]. Therefore, it has become

critical to address student engagement by integrating real-world contexts to develop more challenging examples that relate their coursework to real-life experiences [5]. Another means to a couple of classrooms with real-world exposure is the use of available technological tools (i.e., Social Media), thus connecting students with their classroom peers as well as the entire world [6]. Social Media is a free platform that is easily accessible where students could immerse themselves in actual problems while sharing, interacting, and discussing solutions with each other as well as professionals. However, the integration of Social Media in STEM education is yet to be fully implemented in course syllabi.

Social Media, a technological tool that includes different social networking platforms (Facebook, Twitter, LinkedIn, Instagram, etc.), is used by more than 40 million students [7]. Recent studies have shown how to leverage social media data to quantify social influences using network science principles and data-driven methods [8]. The accessibility of Social Media tools through a laptop, cell phone, or tablet makes it convenient and universal; thus, the number of students using Social Media is on the rise significantly [9]. Social Media is an effective platform for students as it provides connections to current and former peers, facilitates emotional support, and recommends creative activities [10]. This is critical because developing connections for minority students is one of the essential aspects of wholesome academic experience. In general, minority students are less likely to be comfortable in expressing their ideas and experiences due to communication barrier or others, thus integrating social media tools encourage the sharing of perspectives more effectively without discomfort [11]. Despite such benefits, the integration of Social Media in education faces several technical obstacles, availability of interest, and privacy issues due to which effective strategies need to be developed to integrate Social Media in STEM disciplines efficiently, thus enhancing students' learning and engagement [12].

Research studies in recent years explored an effective method of integrating Social Media platforms as an informal learning environment in non-STEM fields such as learning new languages, facilitating social support, and developing innovative literacies [13]. These studies demonstrated that integrating Social Media in informal learning environments improves communication between students and/or teachers, engagement in creative activities, and a better understanding of the course materials [14]. Similarly, the application of social media such as hashtags in twitter has also been experimented to examine the social media activism campaign for enhancing gender diversity within the engineering discipline [15]. Other advantages of integrating Social Media are the flexibility of following course lessons in any place and during any time and ideally engaging in course materials by sharing opinions and discussing problems with peers [16]. The use of Social Media has also been introduced in the medical field, where the integration of Social Media tools increased opportunities for cooperative and active learning [17]. Recent studies on infrastructure resilience and sustainability in the engineering domain have shown how to quantify social influence through Social Media interactions systematically [18]. There is a growing literature on network science and social influence modeling, which may shed more light on this topic ([19], [20]). As a next step, this study is gathering data to explore the application of Social Media platforms in STEM education and to evaluate whether their integration enhances student professional skills and retention. Analyzing the retention of students has been postponed to future studies, as the authors need to gather additional data.

## 2. Methodology

A pre- and post-course questionnaire survey was conducted at the beginning and end of the fall 2018 semester in three STEM classes with three different instructional modalities (e.g., fully online, face-to-face, and hybrid). The data collection is considered a pilot study to evaluate the impacts of S.M. in a CM program. The three initial experimental courses are Sustainability, Construction Materials/Methods, and Automation in Construction representing a lower, middle, and higher-level students in a minority-serving institution where about 60% of the students are Hispanic, making the university one of the top granters of bachelor's degree to Hispanic undergraduates. The study seeks to enhance underrepresented student's soft skill development who usually face professional challenges in today's competitive professional fields. The diversity of students in this university provides an excellent opportunity to understand the effectiveness of integrating S.M. platforms to support STEM course deliverables from different perspectives, including minorities.

The STEM courses Sustainability, Construction materials/methods, and Automation in Construction each had 25, 35, and 15 pre-course responses, respectively. In total, 75 students responded to the post-course survey, while all 75 students in three courses responding to the pre-course survey had a matching post-course response. Students were asked to create a unique unanimous personal identification code (first four letters of the name of the city where you were born + last four digits of students' phone numbers) to match students' pre- and post-responses. Also, the survey collected personal, demographic and background information through six categories: Military status (i.e., Veteran, Non-Veteran), Gender (Male, Female), Race (African American, Asian, White, Hispanic, other), Employment status (i.e., Employed, Unemployed), and finally whether the student uses Social Media or not.

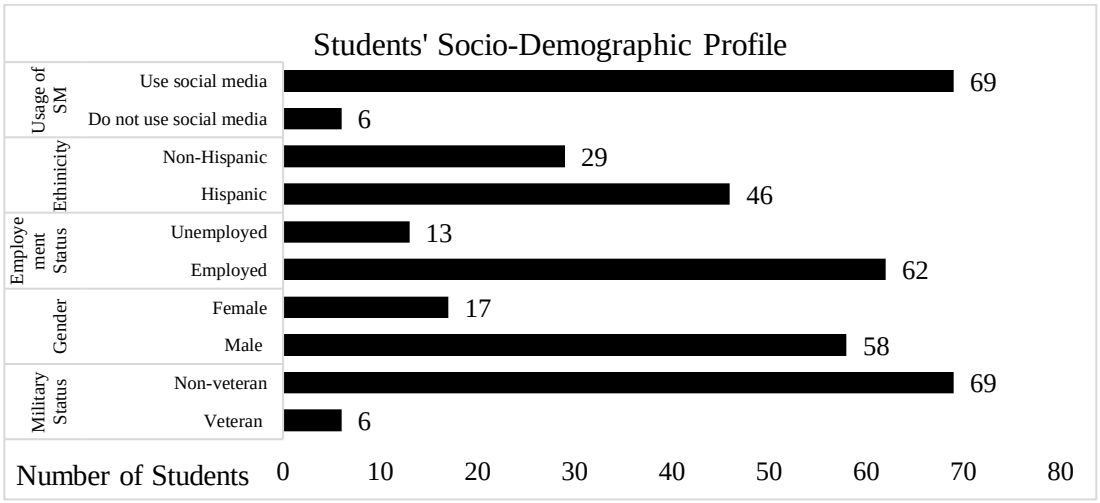


Figure 1: Student responses based on personal, demographic and background information (N=75)

The questionnaire in the survey is related to the students' different skill levels, academic goals, and their anticipation to integrate Social Media platforms in courses. The research was based on surveying students twice a semester to understand/evaluate the impact of Social Media

activities/assignments that were introduced during the semester. At the beginning of the term, a pre-course survey gathers information related to student's study habits, self-evaluation of current professional skills, as well as information about average *Grade in High School, Effectiveness of Social Media for learning STEM and Effectiveness of Social Media* in supporting overall class deliverables. Instructors included course learning outcome statements in their syllabi, which can be evaluated through Social Media, especially that some of those outcomes do not need calculations but rather require an overall understanding of concepts that can be represented by a tweet/post or a one-minute video. During the semester, students were required to use twitter to submit their homework as well as to post comments about their understandings of class materials, which were graded towards their course participation. For example, in the substantiality course, the instructor provoked general questions that relate to class materials, and students were asked to tweet about them; some of these questions were: (1) what is not sustainable about their homes; (2) how our infrastructure can be more sustainable; and (3) what the correlations between sustainability from social, economic and environmental perspectives are. Another example from a previous implementation was in an Ethics course, where students posted an image on Instagram that responds to what is ethics from an engineering perspective and how would a project manager's office include unethical/biased resources. By the end of the semester, the students complete a post-course survey that addresses the same questions.

The pre- and post-course surveys in this study are also used to evaluate the effectiveness of integrating Social Media platforms in STEM courses. The responses from pre- and post-course surveys were matched and compared using paired t-tests in SPSS. A paired t-test is a parametric test in which assumptions are made about the parameters of the distributed population from which a sample has been drawn. The basic statistical procedure for conducting a paired t-test includes determining whether the mean difference between two sets of observations, for example, individual scores in each of the survey sets, is equal to zero or not. As such, for paired t-test in SPSS, a confidence interval of 95% is set for the analysis.

## 3. Results and Discussion

This section presents the results of the pilot study conducted in three construction management (CM) courses offered at a leading Minority-serving institution. At the beginning of the semester, minority students were surveyed to identify their preferred means of communication within each course. Their responses indicated the preference to utilize Social media platforms, followed by face-to-face. Therefore, pre and post-course surveys recorded the improvement in students' grades, professional skills, and engagement throughout the semester, and students rated the effectiveness of social media in achieving these deliverables.

Students were asked about how they collaborated with their team members and what was the best means of communication. Many students indicated that they used a social media platform, such as WhatsApp, to stay connected with other students. While other students highlighted that they used email, google hangout, and other social media platforms. One of the students reported, "We coordinated through emails and WhatsApp. This was a good way to collaborate considering everyone was involved in different classes and work. WhatsApp kept us updated with all the activities of the group." Similarly, another student indicated, "I communicated with other

students through social media platform called WhatsApp. I think this is a good method of quick communication, in my opinion, and the one method I prefer out of all I have encountered so far."

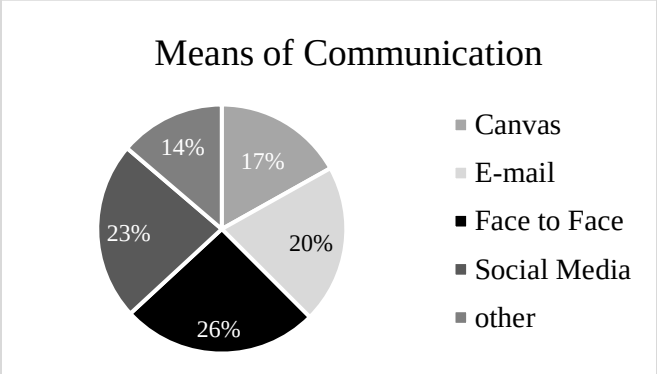


Figure 2: Students' preference for the various means of communication (N=75)

To identify the effectiveness of Social Media platforms in learning and supporting overall class deliverables, a paired t-test was conducted using pre- and post-course survey data. From the assessment of differences between the pre- and post-course surveys for the courses, it could be observed that students, in general, have found the Social Media platforms to be effective for learning as well as in supporting overall class-deliverables. It can be concluded that the P-value is greater than 0.05 for all variables indicating there is no significant difference in means of pre- and post-course results.

Table 1: Paired t-test analysis of the Effectiveness of Social Media

| S.N. | Variable | Course | Absolute Mean Difference | t | Degree of Freedom | P-Value |
|---|---|---|---|---|---|---|
| **1.** | Effectiveness of Social Media Platforms for Learning STEM course | Sustainability | .04 | .106 | 24 | .916 |
| | | Construction Methods | .1333 | .695 | 14 | .499 |
| | | Automation in Construction | .2857 | -1.58 | 34 | .124 |
| **2.** | Effectiveness of Social Media Platforms in supporting overall class deliverable | Sustainability | .250 | -.743 | 23 | .465 |
| | | Construction Methods | .0667 | .202 | 14 | .843 |
| | | Automation in Construction | .0286 | .106 | 34 | .916 |

Additionally, the effectiveness of social media platforms (e.g., Twitter) were also represented with box plots for understanding the overall changes in the perception of social media use based on students' self-ratings. The authors integrated a social media platform (twitter) in three different construction management courses and were provided an activity using social media. For instance, they were asked to post an image or a video that provoked construction-related sustainable questions along with the use of hashtags such as #Coursenumber, #sustainability and, #construction. The authors assessed the effectiveness of social media based on a five-point Likert scale from 1 (Not at all) to 5 (very effective). The median students' self-evaluation (shown as a thicker line in figure 3) indicates that at the start of the course, the median student rated social media moderately effective in both learning and supporting overall deliverables. Fig. 3 demonstrates that at the end of the course, the median student rated the **effectiveness of social Media** as effective with one level increase in rating for supporting overall deliverables, probably because of its increased peer discussions and sharing of ideas and understandings. While for the

**effectiveness of social media in learning**, the same rating of students was observed in the post-course survey, probably because these more advanced students were more productive in a face to face class and an online class.

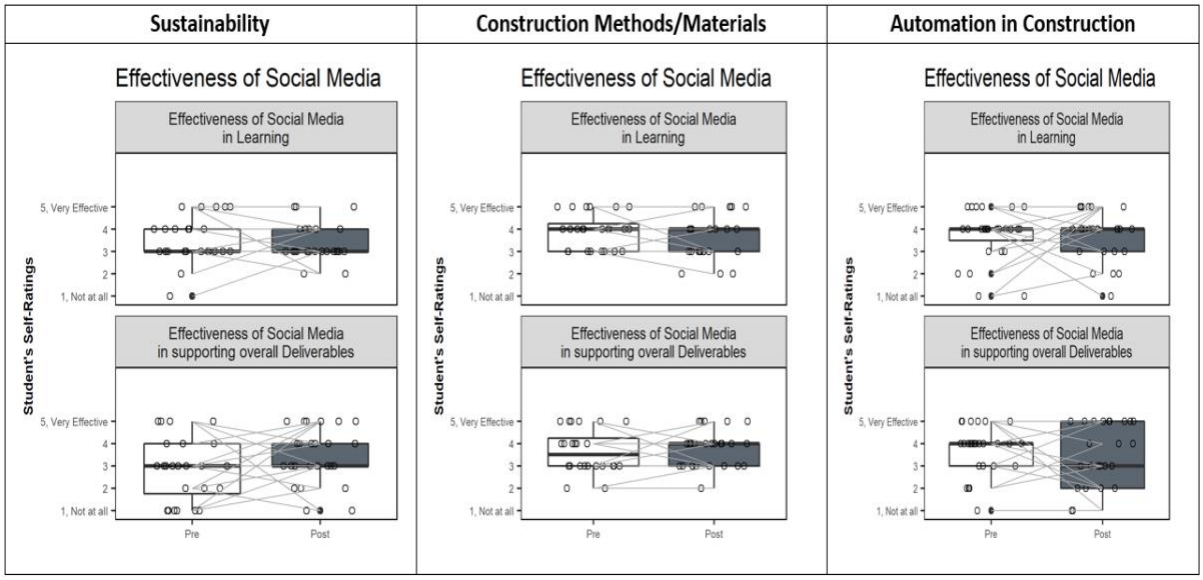


Figure 3: Students' pre and post-course ratings on the effectiveness of social Media

### 3.1.Students' Professional skills

For better comprehension of students' professional skills, box plots with line plots were made using R-studio, which provided an understanding of how the comparable results are spread out. The rectangular box between two whiskers consists of the dark horizontal line representing median value and the edges of the box represent the 1st quartile and 3rd quartile. The line plots between pre and post-course results of the box plot show the correlation and progress of the students throughout the study period. This paper evaluated different professional development skills which can be categorized into two categories: (1) Interactional Competency Skills and; (2) Collaboration Skills. The study only focused on the elements of professional development skills that are affected by the integration of social media platforms in construction management courses. In particular, the study encourages underrepresented and minority students ' professional skill development who seek to pursue graduate and professional degrees. For instance, interactional competency skills such as technical communication is a type of professional development skills which is likely developed by students throughout the course. On the other hand, interdisciplinary skills are not likely to develop during students' course activities and are instead developed during in-course communication. The authors focus on three interactional competence (I.C.) skills which include: (1) technical communication skills (i.e., talking with someone from within your field of expertise); (2) Interdisciplinary communication (i.e., talking about technical details with someone from outside your field of expertise) and; (3) Understanding the perspectives of different fields pertaining to the same problem. Students were assessed for their skills in I.C. on the five-point scale: 1 (no knowledge), 2 (beginner: some experience or basic knowledge), 3 (proficient: can utilize at a satisfactory level), 4 (advanced: can utilize better than most), and 5 (expert: can utilize with a superior level of skill and teach to

others). Collaborative skills developed by students through integration of social media platforms include: (1) providing feedback to team members, (2) receiving criticism from team members, (3) communicating technical information to people within their field of expertise and, (4) communicating technical information to people outside their field of expertise (technical interdisciplinary communication). This was also assessed based on a five-point Likert scale from 1 (Not at all confident they could do this) to 5 (extremely confident they could be highly successful and could teach others to be successful). Students' self-reported confidence in collaborative skills at the start and end of the course for all the students are represented in box plots with line plots.

### 3.1.1. Sustainability

The survey results indicated that students assessed more growth for themselves and reported a gain in confidence in interdisciplinary communication skills. Although the median value of confidence in collaborative skills was consistent, students in the Sustainability course showed some improvement, especially in technical interdisciplinary communication skills, as shown by the box plots with line plots. On the other hand, the students' responses (shown as a thicker line in figure 4) for self-reported skill levels indicate that most of the students showed improvement in technical communication, interdisciplinary communication, and understanding the perspectives of different fields as shown by the line plots.

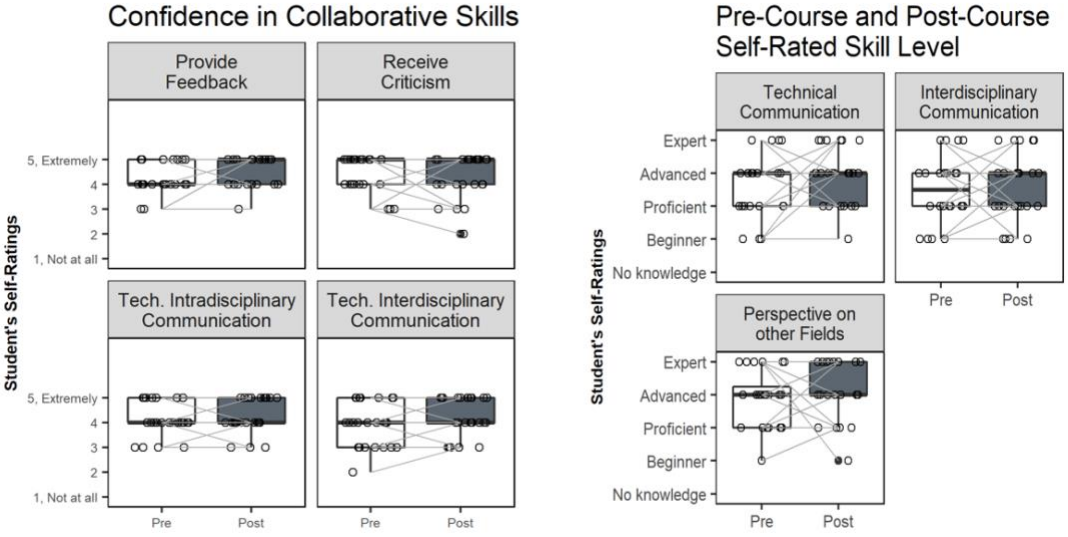


Figure 4: Students' pre and post-course self-ratings for Sustainability (N=25)

Fig. 4 demonstrates that the median value for students' self-rated skill improved to advance in interdisciplinary communication skills, indicating a one-level increase over the semester, possibly due to ease of communication through social media platforms. However, students, median value remained the same for technical communication and understanding the perspectives of different fields on a problem at the start and end of the course. Perhaps this was because these more advanced students were already capable of technical skills.

### 3.1.2. Construction Materials and Methods

The obtained results show that students' self-ratings have consistent median value in both pre and post-course surveys for all collaborative skills and self-rated soft skills, as shown in Figure 5. On the other hand, it can also be observed that the line plots show an improvement in students' confidence in collaborative skills and self-rated skill levels, with most of the lines having an upward slope from pre to post-course box plots. However, some students have a downward slope in skill level from start to end of the course, perhaps because these more advanced students did not find social media platforms to be effective for developing these skills.

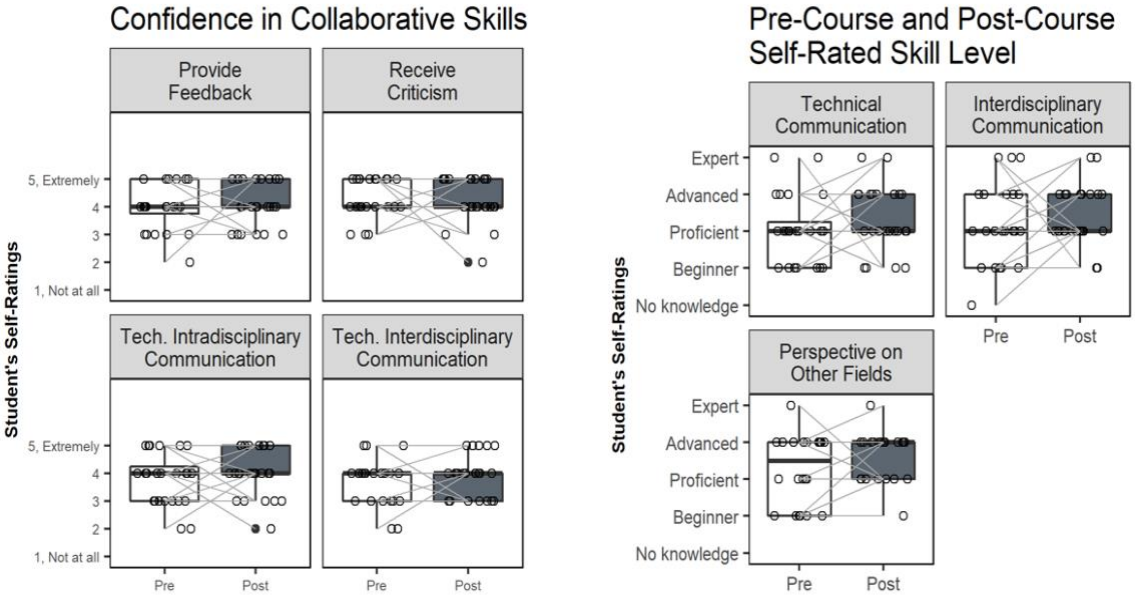


Figure 5: Students' pre and post-course self-ratings for Construction Methods/Materials (N=35)

### 3.1.3. Automation in Construction

In comparison to Sustainability and Construction methods/materials, the survey results of automation in Construction indicated that students assessed more growth in receiving criticism and interdisciplinary technical communication. While their growth was similar to that of Construction methods for another skill level. Fig. 6 demonstrates that the median value for student's confidence in technical interdisciplinary communication skills and receiving criticism increased to 4 and 5, respectively. This indicates a one-level increase over the semester, possibly due to ease of communication through social media platforms. However, some students line plots have a downward slope in skill level from start to end of the course, perhaps because these more advanced students did not find social media platforms to be effective for developing these skills.

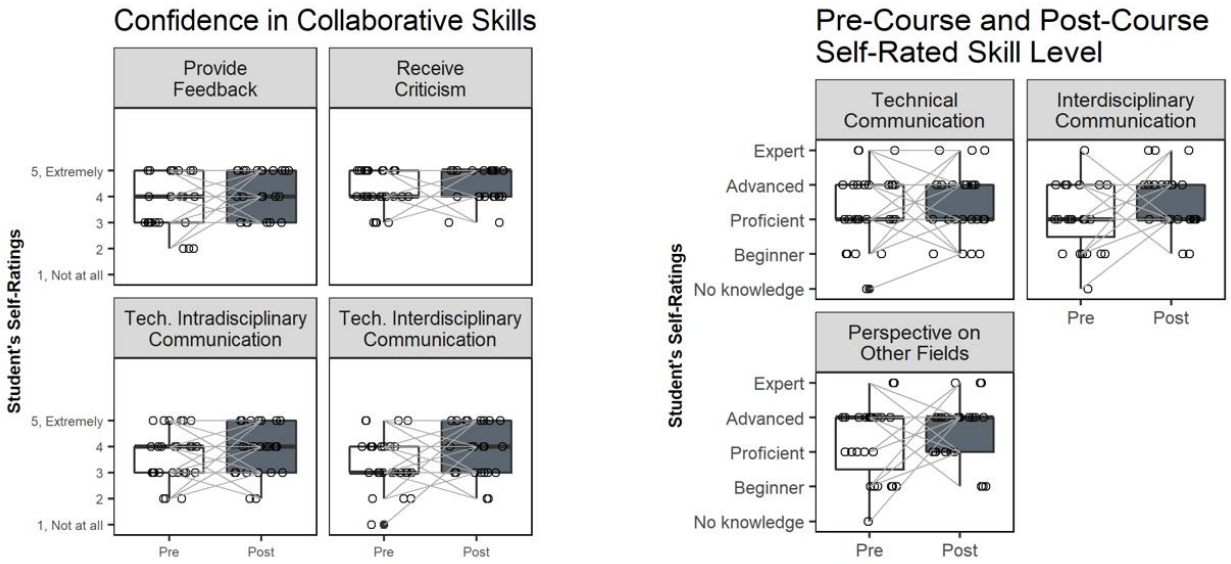


Figure 6: Students' pre and post-course self-ratings for Automation in Construction course (N=15)

## 4. Challenges, Lessons Learned, and Recommendations

This implementation requires courses to be offered during the same semester and their assignments to be connected so that students relate to each course's learning outcomes. The instructors must dedicate time to planning the logistics, aligning the syllabi, and homework projects. Any overlap between courses reflects real life, so faculty must embrace how those overlaps can be utilized to correlate Social Media homework for the benefit of the students. A major concern was that one student was registered for two of the courses at the same time, yet the faculty decided to ask the student to conduct each course's deliverable separately.

Integrating such innovative technological tools that are engaging to learners not only creates a sense of appreciation and belonging but also provide real connections to the world. Minority students who are less aware of issues in the U.S. construction industry were able to connect to current issues outside academia through their engagement in Social Media. Social Media activities that were infused by hashtags of real-world engineering and Construction (1) increased the engagement of students through online discussions, (2) connected construction course work with real-life issues, and (3) motivated leaners to stay in their majors. Further, this study shows that engaging in Social Media activities helped students develop their research skills as they initially needed to gain additional insights on particular topics pre engaging in a Social Media activity. The flexibility that Social Media platforms provided in terms of connection with peers improved their teamwork skills and diversified their selections for team presentations while motivated them to engage in extracurricular construction issues. Additionally, students mentioned that Social Media supported their critical thinking skills, made the course more interesting, and helped them retain the course materials more effectively.

It is challenging and critical for instructors to train students effectively in a course that has an outside component, especially that learners should differentiate between accurate and inaccurate information in the real-world. Hence, there should be a balance between face-to-face meetings and online activities to effectively utilize the benefits of integrating Social Media platforms in Construction. Future research should include more institutional paradigms that address collaborative/shared deliverables that open up more discussions between various disciplines. This approach has some limitations, including privacy and finding a mutual platform for the whole class (Twitter, Facebook, Instagram, etc.). Therefore, although this framework creates a replicable pedagogy to develop professional skills in CM students, the scope of the data collection may be a little narrow as there remain challenges to track students beyond the semester especially due to conforming with Family Education Rights and Privacy Acts (FERPA). Furthermore, validating the efficient performance of CM students in the industry would require further study with an assessment plan designed to track these student's post-graduation.

## 5. Conclusion

This study evaluated the effectiveness of Social Media platforms in Construction Management courses with different instructional modalities and divisions in the program by using pre-and post-course surveys. A paired t-test and box plot showed the effectiveness of Social Media platforms in enhancing the skills and increasing engagement and continued interest in Construction Management courses. Indeed, the integration of Social Media platforms positively impacted students which became possible through real-world exposure to issues in Construction education. Additionally, a student from all three courses (including Sustainability, Methods, Materials, and Equipment and Automation in Construction) improved their grades, which could be associated with exposure to more engaging and practical examples available in professional construction sites through Social Media platforms. This study focuses on the development of underrepresented and minority student's professional skills in construction management. This study also validates the positive impact of Social Media platforms on student performance at the end of the semester in comparison to the beginning. Future research should collect more comprehensive data and capture the actual Social Media online interactions to quantify the level of influence in construction learning in a versatile environment.

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