

Enhancing Construction Management Education Through Collaborative Learning

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Abstract

Collaborative learning has emerged as a vital pedagogical approach in construction management education, reflecting the industry's emphasis on teamwork and interdisciplinary collaboration. This paper examines the application of collaborative learning strategies within construction management programs, focusing on their effectiveness in enhancing student engagement, skill development, and industry readiness. Through a review of the analysis of a specific case study, the paper highlights the benefits and challenges of implementing collaborative learning in this context. The case study includes Collaborative Learning Through Design-Build Projects in a Capstone Course. These examples demonstrate how collaborative learning deepens students' understanding of construction processes and prepares them for the complex, collaborative environments they will encounter in their professional careers. The paper concludes with recommendations for integrating collaborative learning into construction management curricula and suggestions for future research in this area.

Keywords

Interdisciplinary Collaboration, Skill Development, Collaborative Learning, Industry Readiness

1. Introduction

The demand for professionals equipped with technical expertise and strong collaborative and problem-solving skills has become increasingly critical in the rapidly evolving construction industry. Traditionally, construction management education has focused on the technical aspects of the field, such as project planning, cost estimation, and resource management. However, the dynamic nature of modern construction projects, characterized by complex stakeholder involvement and

the need for integrated project delivery, requires a more integrated approach to education.

This shift in industry demands has led educators to explore innovative teaching methods that better prepare students for the realities of the construction industry. Among these methods, collaborative learning has gained prominence as an effective approach to bridging the gap between theoretical knowledge and practical application. By fostering teamwork, communication, and interdisciplinary collaboration, collaborative learning not only enhances the educational experience but also mirrors the collaborative environments that students will encounter in their professional careers (Chan et al., 2002).

1.1. Theoretical Foundations of Collaborative Learning

Collaborative learning is grounded in several educational theories that emphasize the social nature of learning and the importance of interaction in the construction of knowledge. Vygotsky's Social Development Theory (Vygotsky, 1980), for instance, highlights the role of social interaction in cognitive development, suggesting that learning occurs most effectively when individuals engage in shared activities and discussions. Constructivist theories further support the idea that learners actively construct their understanding through interaction with peers and the environment (Vygotsky, 1980).

1.2. Collaborative Learning and Strategies in Higher Education

In recent years, collaborative learning has been increasingly adopted in higher education, particularly in fields that require strong teamwork and problem-solving skills. Studies have shown that collaborative learning leads to higher academic achievement, increased student engagement, and better retention of knowledge. These benefits are particularly relevant in professional disciplines such as engineering, architecture, and construction management, where collaboration is a key component of professional practice (Barkley, Cross, & Major, 2014).

The construction industry is inherently collaborative, requiring professionals to work in teams across various disciplines. As such, construction management education has begun to integrate collaborative learning strategies to better prepare students for the collaborative nature of the industry. Despite its benefits, the implementation of collaborative learning in construction management education is not without challenges. Issues such as group dynamics, unequal participation, and the difficulty of assessing individual contributions can hinder the effectiveness of collaborative learning (Roberts & McInnerney, 2007).

The literature on collaborative learning in construction management education highlights its significant benefits in preparing students for the complexities of the construction industry. Collaborative learning has been shown to enhance critical skills such as teamwork, communication, problem-solving, and interdisciplinary collaboration. These skills are essential for future construction managers, who must navigate diverse teams and complex projects in their professional roles.

Literature provides a solid foundation for understanding the benefits and challenges of collaborative learning in construction management education. However, addressing the identified gaps through targeted research will be crucial for optimizing collaborative learning strategies and ensuring that they effectively prepare students for the demands of the construction industry (Barkley, Cross, & Major, 2014).

1.3. Purpose of the Present Study

The primary purpose of this paper is to explore and analyze the effectiveness of collaborative learning strategies in the education of construction management students. By examining a specific case study and reviewing existing literature, this paper aims to identify best practices, challenges, and opportunities associated with implementing collaborative learning in construction management curricula. Additionally, the paper seeks to provide practical recommendations for educators on integrating interdisciplinary collaboration, leveraging industry partnerships, and employing advanced technologies to enhance students' learning experiences. The goal is to contribute to the ongoing development of construction management education, ensuring that graduates are well-equipped with the skills and knowledge necessary to meet the evolving demands of the construction industry.

2. Methodology

2.1. Group Projects and Case Studies

Effective implementation of collaborative learning in construction management education requires adopting diverse strategies catering to different learning objectives and contexts. Several collaborative learning strategies enhance student engagement, knowledge retention, and skill development within construction management programs (Barkley, Cross, & Major, 2014).

Group projects and case studies are fundamental collaborative learning strategies that immerse students in realistic scenarios, requiring them to apply theoretical knowledge to practical problems. In construction management education, these methods simulate real-world project environments, enabling students to experience the complexities and dynamics of construction projects (Herreid, 2011).

- **Real-World Case Studies:** Instructors present students with detailed case studies based on actual construction projects. These cases include comprehensive information about project scope, timelines, budgets, stakeholder involvement, and challenges faced during execution. Students work in groups to analyze the case, identify problems, and propose solutions (Herreid, 2011).
- **Project-Based Assignments:** Students are assigned to teams and tasked with developing and managing a construction project from inception to completion. This includes tasks that involve site analysis, design planning, cost estimation, scheduling, risk assessment, and resource allocation. Teams must collaborate effectively to integrate various aspects of project management and deliver comprehensive projects (Herreid, 2011).

A notable example includes a project where students in The School of Construction and Design at The University of Southern Mississippi collaborate to design and plan, utilizing various technology platforms, a sustainable residential or commercial building project. Teams conduct feasibility studies, develop eco-friendly designs, estimate costs, and create project schedules, presenting their proposals to a panel of instructors and industry professionals for feedback.

2.2. Evaluation

The outcomes of the case study and survey data were evaluated against the objectives of collaborative learning in construction management education (**Table 1**). The evaluation focused on the following areas:

- Student learning outcomes and skill development.
- The effectiveness of interdisciplinary collaboration.
- The impact of industry partnerships on the learning experience.
- Challenges encountered and strategies to overcome them.

Table 1. Key outcomes of collaborative learning case studies. Adapted from Herreid (2011).

Case Study	Key Outcomes	Challenges
BIM-Based Collaborative Learning	Improved teamwork, technology proficiency	Steep learning curve, communication issues
Industry Partnership for Real-World Projects	Practical experience, professional networking	Coordination with industry timelines
Simulation Games for Decision-Making	Enhanced decision-making skills, critical thinking	Complexity of scenarios, need for additional support
Design-Build Capstone Projects	Comprehensive understanding of the construction process	Managing scope and complexity within the academic timeframe

The course evaluation instrument utilized was a student survey and peer evaluation form developed by the faculty. The peer evaluation form was designed to rate the group participants, excluding themselves on a 25-point scale. Students were required to provide specific feedback on the peer evaluation form for other group members receiving less than 10 points. The student survey allowed students to answer specific questions that aimed to gather feedback on the effectiveness of collaborative learning, the challenges faced, and the perceived impact on skill development and career preparation.

Managing the scope and complexity of the projects within the academic period was a challenge. Clear guidelines and structured milestones helped keep the projects on track. Students appreciated the hands-on nature of the projects and the opportunity to work on real-world challenges, which they found to be a valuable capstone experience that synthesized their learning throughout the program.

2.3. Design

This case study investigates the implementation of design-build capstone projects in the final year of a construction management program at The University of Southern Mississippi in The School of Construction and Design. The aim was to provide students with a comprehensive learning experience encompassing both the design and construction phases.

Students were organized into interdisciplinary teams, each team responsible for designing and planning a small-scale construction project from start to finish. The projects included interaction with real clients and required teams to present their final proposals for evaluation. Design-build projects provide students with a holistic understanding of the construction process and develop their ability to collaborate across disciplines. Students produced tangible outcomes they could showcase in their professional portfolios (**Figure 1**).

A step-by-step diagram of the design-build process, illustrating key stages such as project initiation, client interaction, design development, construction planning, and final presentation.

Figure 1. Design-build capstone project process.

3. Results

3.1. Impact of Collaborative Learning on Student Outcomes

Many students reported significant improvements in key skills such as teamwork, communication, and problem-solving. Collaborative learning activities, particularly those involving real-world projects, were seen as highly effective in developing these competencies. Students participating in collaborative projects demonstrated higher levels of engagement and motivation compared to those in traditional lecture-based courses. The interactive nature of these activities, coupled with the responsibility of working within a team, contributed to sustained interest and effort. Effective implementation of collaborative learning in construction management education requires adopting diverse strategies catering to different learning objectives and contexts. This section explores several collaborative learning strategies that enhance student engagement, knowledge retention, and skill development within construction management programs (**Barkley, Cross, & Major, 2014**).

Students involved in interdisciplinary projects gained a deeper understanding of the various roles and responsibilities within a construction project. For example, collaboration between students of construction management, architecture, and engineering led to a more holistic approach to problem-solving and design. Despite the benefits, some students reported challenges in managing interdisciplinary teams, particularly in aligning different disciplinary perspectives and terminologies. This was more pronounced in teams where members had no prior experience working in interdisciplinary settings.

Industry partnerships were found to be crucial in providing students with practical, real-world experience. Projects that involved collaboration with construction firms or other industry stakeholders allowed students to apply theoretical knowledge to actual industry challenges, bridging the gap between academia and practice.

3.2. Benefits for Students

Collaborative learning in construction management education offers a range of significant benefits for students, enhancing both their academic and professional development.

- **Enhanced Critical Thinking:** Working through complex case studies and projects encourages students to think critically and develop problem-solving skills essential for construction management.
- **Improved Communication Skills:** Group work requires clear and effective communication among team members, mirroring the collaborative communication necessary in construction projects.
- **Understanding team dynamics:** Students learn to navigate and manage different team roles, responsibilities, and dynamics, preparing them for collaborative professional environments.
- **Application of Theoretical Knowledge:** These strategies provide opportunities for students to apply classroom knowledge to practical scenarios, reinforcing learning and demonstrating the relevance of theoretical concepts (Herreid, 2011).

Table 2 presents data on how diverse types of collaborative activities (e.g., group projects, peer learning, industry partnerships) contribute to specific learning outcomes, such as critical thinking, communication skills, and technical proficiency.

Table 2. Student learning outcomes by collaborative activity type. Adapted from Herreid (2011).

Collaborative Activity	Critical Thinking	Communication Skills	Technical Proficiency	Industry Readiness
Group Projects	High	Moderate	High	High
Peer Learning	Moderate	High	Moderate	Moderate
Technology-Enhanced Collaboration	High	Moderate	High	High
Industry Partnerships	High	High	High	Very High

4. Discussion

Based on the findings and case study discussed in this paper, there are recommendations for effectively integrating collaborative learning into construction management education. One of the most reported challenges was unequal participation among team members. In some cases, a few students carried much of the

workload, leading to frustration and reduced learning opportunities for less active members. Some students may contribute less to group work. To mitigate this, instructors can implement peer evaluation systems and clearly define team roles and responsibilities.

Both students and faculty expressed concerns about the fairness and accuracy of assessing collaborative work. The difficulty in evaluating individual contributions within a team was highlighted as a significant barrier to the effective implementation of collaborative learning. Scheduling meetings and coordinating tasks can be challenging. Utilizing collaborative tools and setting clear deadlines can help streamline the process. Evaluating individual contributions in group projects can be complex. Combining group grades with individual assessments and reflections can provide a more balanced evaluation (Oakley, Felder, Brent, & Elhaji, 2004).

The results indicate that collaborative learning is highly effective in enhancing the educational experience of construction management students. It fosters the development of essential skills and provides a platform for interdisciplinary collaboration and real-world application through industry partnerships. However, the successful implementation of collaborative learning requires careful consideration of potential challenges, including the need for equitable participation, effective assessment strategies, and adequate faculty support.

4.1. Enhancing Collaborative Learning

Facilitating an enhanced cross-disciplinary project involves encouraging collaboration between students from different disciplines, such as architecture, engineering, and business, to simulate real-world construction environments where various experts must work together. Additionally, developing a curriculum that includes interdisciplinary courses and projects ensures that students gain exposure to diverse perspectives and roles within the construction industry (Lattuca, Knight, Ro, & Novoselich, 2017). Developing stronger partnerships with construction firms to offer more internship and co-op opportunities allows students to gain hands-on experience in real-world projects. Industry partners seek feedback from students and faculty regarding the expansion of internships and Co-op programs. Regularly inviting industry professionals to deliver guest lectures and conduct workshops provides students with insights into current industry trends and challenges. Providing training and professional development opportunities for instructors to effectively facilitate collaborative learning activities, including the use of advanced technologies like Building Information Modeling (BIM). Ensuring that instructors and faculty have access to necessary resources, such as software, technology, and industry connections, to support collaborative learning initiatives (Baldwin & Chang, 2006).

4.2. Future Research Directions

These recommendations and future research directions aim to guide educators,

researchers, and institutions in further enhancing the integration of collaborative learning into construction management education, preparing students to meet the evolving demands of the construction industry. This paper has explored the benefits and challenges of collaborative learning in construction management education, there are areas where further research is needed. One area of focus includes impact over time. Conducting longitudinal studies to assess the long-term impact of collaborative learning on students' careers, including their ability to work in teams, manage projects, and adapt to industry demands. Comparing the effectiveness of various collaborative learning models across different educational settings (e.g., online vs in-person, large universities vs. smaller institutions) to determine the most effective approaches. Another focus area involves investigating how cultural differences influence the effectiveness of collaborative learning in construction management education, particularly in international programs.

Future research is needed regarding industry feedback. Evaluating the effectiveness of industry collaboration by conducting studies that gather feedback from industry partners on the effectiveness of collaborative learning programs in preparing students for the workforce and identifying areas for improvement. The impact on employability is important to measure through examination of how participants in collaborative learning activities influence graduates' employability, including their ability to secure jobs and advance in their careers.

5. Conclusion

This paper has explored the role of collaborative learning in construction management education, highlighting its potential to enhance critical skills and better prepare students for the complexities of the construction industry. Collaborative learning is highly effective in developing essential skills such as teamwork, communication, problem-solving, and interdisciplinary collaboration. These skills are critical for future construction managers who must navigate diverse teams and tackle complex projects in their professional roles. The integration of industry partnerships into collaborative learning experiences further bridges the gap between academic theory and practical application, providing students with real-world insights and opportunities to engage with industry standards.

However, the successful implementation of collaborative learning requires careful consideration of various challenges, including unequal participation, difficulties in assessing group work, and the need for effective technology integration. Addressing these challenges is crucial to maximizing the benefits of collaborative learning.

The study also identifies several gaps in the literature, including the need for longitudinal studies on student outcomes, research on diversity and inclusion in collaborative learning, and the development of technology-enhanced learning strategies. Additionally, there is a pressing need for more research on faculty development and the impact of industry partnerships on curriculum design.

In conclusion, while collaborative learning offers significant advantages in

preparing construction management students for their future careers, continued research and innovation are essential to address the challenges and fully realize its potential. By refining collaborative learning approaches and addressing the identified gaps, educators can better equip students with the skills and knowledge necessary to succeed in the evolving construction industry.

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Conflicts of Interest

The author declares no conflicts of interest regarding the publication of this paper.

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