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E-B Environment - Behaviour Proceedings Journal

ISSTM-TEd 2024

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e-IPH e-International Publishing House Ltd., United Kingdom

International Symposium on Strategy & Transformation Management For Tertiary Education

Virtual Symposium

14 – 16 Oct 2024

Main Organiser: Universiti Teknologi MARA (UiTM)
Co-Organiser: East Kazakhstan Technical University (EKTU)

Current State, Benefits and Challenges of Collaborative Teaching in Civil Engineering

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Abstract
This study explores the current state, benefits, and challenges of collaborative teaching in a civil engineering undergraduate program at a Malaysian Higher Learning Institution. Collaborative teaching involves national/international industry and academic professionals as guest lecturers, offering students practical insights and real-world relevance. A case study approach, combining document analysis and questionnaire survey, revealed increased student engagement, better understanding of industry practices, and curriculum enrichment. However, implementation is hindered by scheduling conflicts, resource constraints, and limited qualified speakers. The findings offer practical implications for educators seeking to integrate industry expertise and enhance the alignment of civil engineering education with professional demands.
Keywords: Collaborative teaching; Civil engineering education; Industry integration; Student engagement

DOI: https://doi.org/10.21834/e-bpj.v10iSI34.7463

1.0 Introduction

The civil engineering industry is rapidly evolving due to technological advancements and the demand for sustainable infrastructure (Ahern, 2007). In response, educational institutions are adopting innovative pedagogies to improve students' professional readiness. Collaborative teaching has emerged as a promising approach, involving industry professionals and academic staff to blend real-world insights with theoretical instruction (Asiri, 2025; Okeke, 2025; Ramachandra & Shripathi, 2024). Delivered through both face-to-face and online modes, this method enhances curriculum flexibility and provides diverse engagement opportunities (Indraprastha, 2023).

This approach addresses the persistent gap between academic learning and industry needs, where traditional lectures often fail to prepare students for real-world, multidisciplinary challenges. Collaborative teaching fosters interactive learning environments and aligns with the shift toward experiential education, allowing students to apply classroom knowledge in practical contexts (Williams, 2002). Previous studies have reported benefits, including increased student engagement (Okeke, 2025; Liang & Tse, 2025), improved conceptual understanding (Ramasamy et al., 2022), and enhanced career preparedness (Howell et al., 2024; Chen et al., 2024).

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DOI: https://doi.org/10.21834/e-bpj.v10iSI34.7463

However, despite its promise, collaborative teaching presents several challenges, particularly in logistics, curriculum integration, and aligning academic and industry objectives. Coordinating schedules between academic staff and industry professionals (Khan et al., 2025), ensuring the relevance of industry-led content (Liu et al., 2025), and maintaining consistent student participation (Checa-Morales et al., 2021) are among the key obstacles institutions face when implementing this face-to-face or online approach.

The significance of addressing these challenges cannot be overstated. To remain relevant in a constantly evolving sector, civil engineering programs are facing an increasing need to adopt instructional approaches that align with real-world practices. Collaborative teaching can enrich the student learning experience and better prepare future civil engineers for the demands of the profession. Despite the growth of previous studies on collaborative teaching, few studies have focused on capturing the current state of its implementation, particularly within civil engineering programs.

Thus, this study aims to investigate the current state, benefits, and challenges of implementing collaborative teaching in the civil engineering program at the largest Institution of Higher Learning (IHL) in Malaysia. Specifically, the objectives of this study are to: (1) examine the current implementation and structure of collaborative teaching in the program; (2) identify the key benefits of collaborative teaching for students, such as enhanced engagement and better understanding of industry practices; (3) explore the challenges faced by educators and institutions in implementing this approach, including logistical issues and resource constraints; and (4) offer practical recommendations for overcoming these challenges to improve the integration of industry expertise into civil engineering curricula. To achieve these objectives, a mixed-methods approach was utilized, including document analysis of collaborative teaching reports and a questionnaire survey. The findings will provide valuable insights into how collaborative teaching, both in face-to-face and online environments, can be more effectively utilized in civil engineering education and offer practical recommendations to enhance its impact on student learning outcomes.

2.0 Collaborative Teaching

Collaborative teaching, either face-to-face or online, has gained prominence in response to the growing need to integrate industry expertise into engineering education (Sandhya et al., 2024; McKenna et al., 2009; Matthews et al., 1995). Traditional lecture-based instruction emphasises theoretical knowledge but overlooks essential practical skills (Dietrich & Evans, 2022; Williams, 2002). This disconnect has led educators to adopt collaborative teaching to better align academic outcomes with industry expectations.

Industry-university partnerships are increasingly recognised as essential to engineering pedagogy (Chandrasekaran et al., 2014; Chandrasekaran et al., 2015). By involving industry professionals as co-lecturers, students engage directly with real-world challenges, enhancing the relevance of academic content (Williams, 2002; Khan et al., 2020). Grounded in experiential learning theory, this method improves student engagement and bridges the gap between theory and application in civil engineering education (Ellis & Hafner, 2007).

Despite its benefits, collaborative teaching faces challenges, including scheduling conflicts, content misalignment, and inconsistent delivery (Liew et al., 2012; Khan et al., 2025). Online formats may further reduce engagement, while divergent teaching styles can confuse students if not well-coordinated (Nussbaumer, 2001; Romanelli et al., 2009). To optimise this approach, institutions must address logistical and pedagogical barriers and develop frameworks that balance academic rigour and industry relevance (Gable et al., 2004; Oulamine, 2025).

2.1 Benefits and Challenges of Collaborative Teaching

Collaborative teaching significantly benefits civil engineering students by enriching academic and practical learning experiences. As outlined in Table 1, this approach enhances student engagement, reinforces the connection between theoretical knowledge and industry application, and increases opportunities for experiential learning, which are essential for preparing students to meet professional expectations. Nevertheless, several challenges may affect its successful implementation, including logistical constraints, reduced student engagement in online settings, and difficulty in maintaining a balance between academic content and practical relevance. These challenges underscore the necessity for structured coordination between academic staff and industry professionals to ensure a coherent delivery and alignment with learning outcomes.

Table 1. Benefits and challenges of collaborative teaching in higher education

Aspect	Authors	Benefits	Authors	Challenges
Student engagement	McKenna et al. (2009); Khan et al. (2020); Okeke, 2025; Liang & Tse, 2025	- Enhances student engagement by exposing them to real-world problems and fostering active learning environments. - Encourages active participation and interaction with industry professionals.	Romanelli et al. (2009)	- Maintaining student engagement, particularly in online settings, is challenging due to reduced physical interaction. - Students may struggle to stay focused and motivated in virtual environments, leading to disengagement and less active participation.
Theory-practice connection	Ramachandra & Shripathi (2024); Williams (2002); Chandrasekaran et al. (2014)	- Strengthens the link between theoretical content and professional practice, preparing students for the real world. - Ensures that students understand how academic knowledge is applied in industry settings.	Nussbaumer (2001)	- Balancing the emphasis on practical experience with maintaining a strong theoretical foundation. - The risk of overemphasising practical content may overshadow necessary theoretical learning, creating a disjointed learning experience.
Experiential learning	Ellis & Hafner (2007); Kolb (1984)	- Provides hands-on projects replicating industry challenges, giving them real-world experience.	Liew et al. (2012); Romanelli et al. (2009)	- Integrating industry-based projects into the academic schedule, especially with limited time and educational constraints.

		- Develops critical problem-solving skills by applying knowledge in real-world scenarios aligned with experiential learning theory.		- Ensuring experiential learning activities align with academic objectives requires careful planning and coordination.
Industry-university collaboration	Ramachandra & Shripathi (2024); Chandrasekaran et al. (2014); Chandrasekaran et al. (2015)	- Helping students stay updated with the latest industry practices, bridging the gap between academia and industry. - Provides networking opportunities for students, fostering job placements or internships, thus helping with career development.	Liew et al. (2012)	- Coordinating the schedules of academic staff and industry professionals can be logistically challenging, creating inconsistencies in content delivery. - Ensuring that the collaboration is balanced and meets both academic and industry expectations, particularly when aligning the curriculum with industry trends.
Teaching style differences	Mutalib et al. (2017); Bashir et al., 2021	- Exposes students to various teaching methods and industry perspectives, enriching their learning experience by offering diverse viewpoints. - Combining theoretical academic instruction with practical industry insights provides students with a holistic understanding of the subject.	Nussbaumer (2001); Mutalib et al. (2017); Romanelli et al. (2009)	- Different teaching approaches between academic instructors and industry professionals may confuse students, particularly when teaching styles diverge. - A lack of continuity in teaching styles or content delivery could disrupt the flow of the course, leading to a fragmented or disjointed learning experience for students.

3.0 Methods

This study employed a case study approach to investigate the current state, benefits, and challenges of collaborative teaching in the program. The methods consisted of two components: document analysis and a questionnaire survey. Each method was selected to provide comprehensive insights into how industry professionals contribute to civil engineering education as guest lecturers and how this teaching model impacts students and lecturers.

This study focuses on collaborative teaching sessions conducted over four consecutive semesters: March-July 2022 (20222), October 2022-February 2023 (20224), March-July 2023 (20232), and October 2023-February 2024 (20234). Only completed sessions with full reports submitted and evaluated were included in this study, resulting in the examination of 57 collaborative teaching reports. Throughout the four semesters, 50 distinct courses were offered, resulting in a cumulative total of 172 course offerings.

3.1 Document Analysis

The document analysis aimed to evaluate the structure of collaborative teaching sessions and how they support the program outcomes and learning outcomes. Document analysis was conducted on two types of documents, which are (i) Lesson Plan and (ii) Collaborative Teaching Reports. Data from this phase provided a foundation for understanding the operational aspects of collaborative teaching. Lesson plan detailed course lesson plans from courses that have incorporated industry guest lecturers were reviewed to assess how collaborative teaching is integrated into the curriculum. This analysis focused on aligning industry guest lectures with course learning outcomes, the extent of industry participation, and the topics covered by guest lecturers. The collaborative teaching reports prepared by the lecturer-in-charge that document the planning and implementation of collaborative teaching sessions were analyzed.

3.2 Questionnaire Survey

A structured questionnaire survey was designed and distributed to lecturers who have conducted collaborative teaching sessions involving industry professionals as guest lecturers in civil engineering courses. This survey aimed to gather insights from the lecturers on the current state, benefits, and challenges of this teaching approach. The questionnaire included a combination of closed-ended and open-ended questions, allowing for both quantitative analysis and qualitative insights.

The questionnaire was distributed electronically to all lecturers in the civil engineering program who had participated in collaborative teaching sessions. Participants were given a week to complete the survey, with a reminder sent midway through the response period. Anonymity was assured to encourage honest and open responses. The quantitative data from the closed-ended questions were analysed using descriptive statistics, while the qualitative data from the responses to the open-ended questions were analysed using content analysis.

4.0 Results and Discussion

4.1 Current State

Collaborative teaching was officially introduced to the Faculty in the March-July 2022 semester and has since been incorporated as a key component of the university's annual academic performance appraisal. This method, which other universities have successfully adopted, has received positive feedback for effectively bridging the gap between theoretical learning and real-world application (Ramachandra & Shripathi, 2024). Building on this success, the analysis presented here focuses on collaborative teaching sessions conducted over four consecutive semesters. Only completed sessions with full reports submitted and evaluated were included in this analysis, examining 57 collaborative teaching reports. Throughout the four semesters, 50 distinct courses were offered, resulting in a cumulative total of 172 course offerings. The courses are categorised into four divisions: (1) Structural and Materials (STRUCM), (2)

Geotechnical and Transportation Engineering (GEOTREN), (3) Water Resources and Environmental Engineering (WRES), and (4) Construction Business and Project Management (CBPM).

The analysis of collaborative teaching sessions reveals a generally positive trend, characterised by an increasing number of sessions conducted over time, irrespective of the semester in which the courses were offered. The most notable growth occurred between semesters 20222 and 20232, reflecting a heightened focus on integrating industry collaboration into the curriculum. This trend suggests a progressive movement toward embedding collaborative teaching as a core part of the educational strategy. Fig. 1 summarises the conducted collaborative teaching compared to the number of courses offered for each particular semester across divisions during the assessed period.

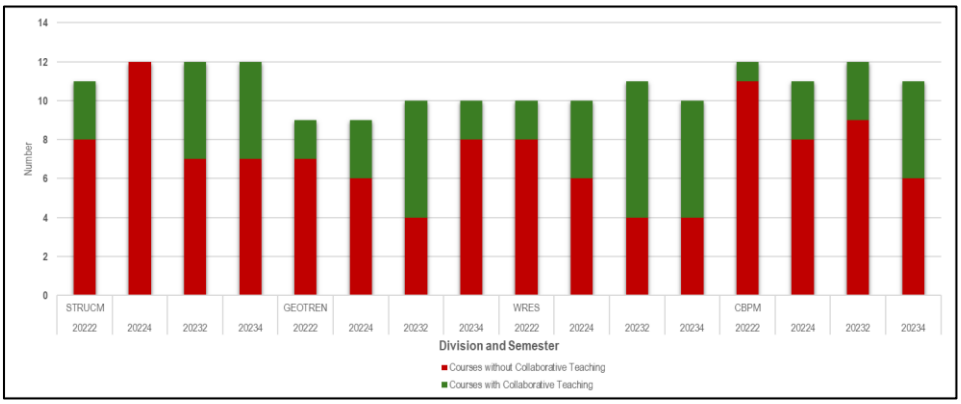

Fig. 1. Collaborative teaching across semesters

Several courses (e.g., Dynamics) consistently integrate collaborative teaching into their teaching and learning activities nearly every semester. However, it is noteworthy that 20 courses (approximately 40%) did not conduct collaborative sessions at all. This lack of engagement may be attributed to various factors, including scheduling conflicts (Robert John & Shannon, 2023; Liew et al., 2012), insufficient resources, different goals and expectations (Hillerbrand & Werker, 2019), and the inherent nature of specific courses, which may not easily lend themselves to collaborative teaching methods (e.g., Laboratory courses).

There are seven distinct models of collaborative teaching, each offering different levels of involvement across course development, delivery, and assessment (i) Model 1: Course Content Development Collaboration, (ii) Model 2: Delivery Collaboration, (iii) Model 3: Assessment Evaluation Collaboration, (iv) Model 4: Course Content Development and Delivery Collaboration, (v) Model 5: Course Content Development and Assessment Evaluation Collaboration, (vi) Model 6: Delivery and Assessment Evaluation Collaborations, and (vii) Model 7: Course Content Development, Delivery and Assessment Evaluation Collaboration.

Among these, Model 2, focused solely on delivery collaboration, was applied in a striking 86% of the courses across the four semesters. This preference for delivery collaboration suggests a strategic reliance on this model, likely due to its efficiency in facilitating guest lecturers and industry professionals to deliver specific content without requiring them to participate in course design or evaluation. In addition, delivery-focused collaboration is less time-consuming for external collaborators while enriching the students' learning experience with industry knowledge and real-world practices. Other models, such as Model 3 (7%), Model 6 (3.5%), and Model 7 (1.8%), were used sparingly, while Models 1 and 5 were not used at all.

Fig. 2 illustrates the collaborative teaching mode of delivery, with online teaching being the most frequently used approach, accounting for approximately 61% of the total. This reflects the increasing shift toward virtual learning, likely influenced by the need for remote education post-pandemic or other logistical factors. Face-to-face teaching comprised approximately 33 % of the total, gradually increasing over the semesters, suggesting a return to in-person teaching and learning. However, the use of hybrid modes (approximately 2%) remains minimal. This suggests an opportunity to expand hybrid approaches, which could provide students with more flexibility and diverse learning experiences, particularly when collaborating with guest speakers from different states or countries.

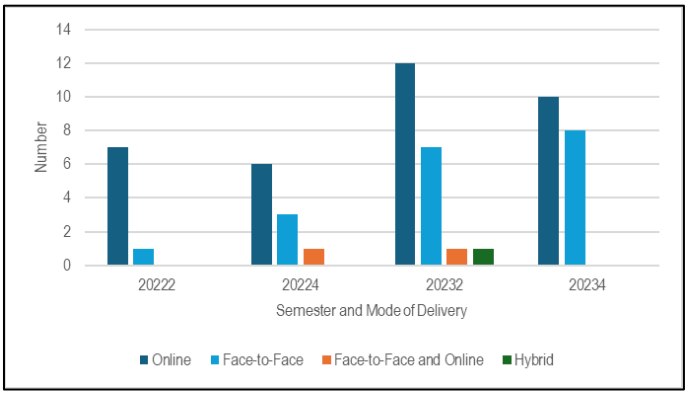

Fig. 2. Mode of delivery

Fig. 3 illustrates the distribution of guest speakers involved in collaborative teaching. During the study period, 119 guest speakers were invited to participate in collaborative teaching. Most were from industry, with local industry representatives contributing nearly 59% of the total guest speakers. Their participation increased consistently across the semesters, reflecting the strong relationship between the civil engineering program and local industry partners. In contrast, international industry speakers were only present in one semester (20224), indicating a limited global dimension within the collaborative teaching framework. This aligns with Orta and Bøhn (2009), who emphasize that organizational differences and cross-cultural communication challenges contribute to such limitations in international collaboration. Additionally, local university speakers accounted for approximately 13% of the total, while international university speakers contributed around 11%, indicating some diversity; however, the overall engagement from external academic sources remained limited.

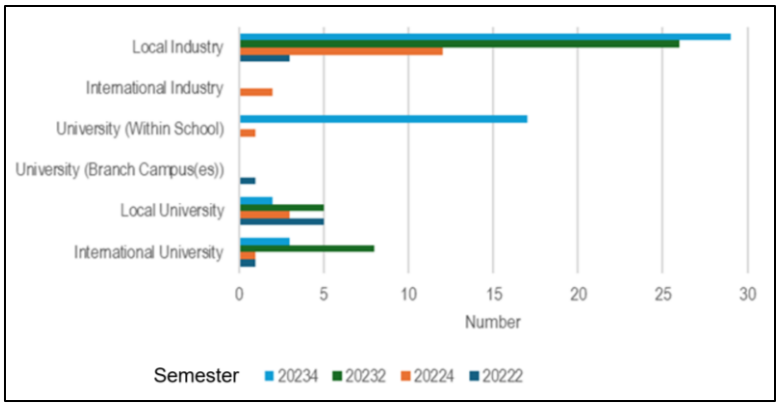

Fig. 3. Guest speakers for collaborative teaching

4.2 Questionnaire Survey

4.2.1 Overview of Collaborative Teaching as part of the Teaching and Learning Activities

A survey of 60 project leaders (97% response rate), representing a diverse mix of professional qualifications and academic experience (nine respondents held qualifications as both Professional Engineers and Technologists (Ir. Ts.), 15 were Professional Engineers (Ir.), 18 were Technologists (Ts.), and the remaining had no professional qualifications), confirmed significant institutional engagement with collaborative teaching. The data indicate that half of the respondents had organised over three sessions, which were typically conducted once per semester (74%) and were predominantly lecture-based. Guest speakers were primarily selected for their field expertise (60%) or through professional networks (32%).

Respondents generally agreed that guest lectures aligned with course learning outcomes. Further, 94% believed the current level of industry involvement was sufficient to enhance student knowledge, a finding consistent with Ellis and Hafner (2007). An equally high percentage reported moderate to very high student engagement, a noteworthy result given the challenges in maintaining participation, particularly in online formats, as highlighted by Romanelli et al. (2009) due to reduced physical interaction.

The content delivered by guest speakers was highly practical, focusing on real-world case studies, current industry trends and technologies, and specific technical concepts. Conversely, foundational theoretical knowledge and the explicit development of professional or soft skills were less emphasised during these collaborative sessions.

4.2.2 Benefits of Collaborative Teaching

Fig. 4 illustrates the key benefits of collaborative teaching, with the most significant advantages relating to integrating industry practice into the curriculum. Providing real-world examples and practical knowledge was the most cited benefit (26%), followed closely by helping students better understand industry expectations (24%). These findings affirm that industry experts effectively bridge the gap between academic theory and professional application (Ramachandra & Shripathi, 2024), which is critical for preparing students for their careers (McKenna et al., 2009; Ellis & Hafner, 2007). Real-world examples help contextualize theoretical concepts, making learning more relevant and tangible for students. By clarifying workforce demands, these sessions directly improve career preparedness (Williams, 2002; Chandrasekaran et al., 2014). Industry insights provide students with a deeper understanding of the skills in demand and how their education aligns with the evolving needs of the workforce. This practical exposure enhances employability and ensures students are job-ready upon graduation.

Beyond these primary benefits, respondents identified other valuable outcomes. Collaborative teaching was recognised for keeping the curriculum updated with industry trends (19%), increasing student engagement and interest (17%), and providing important networking opportunities (14%). These results highlight the multifaceted impact of such partnerships, which ensure programmatic relevance, stimulate student motivation, and foster crucial professional connections for students before they enter the real industry. Industry involvement not only enriches the academic content but also helps institutions stay competitive by adapting to the latest trends and technologies. Additionally, the opportunity for students to network with industry professionals provides valuable contacts for internships and future employment.

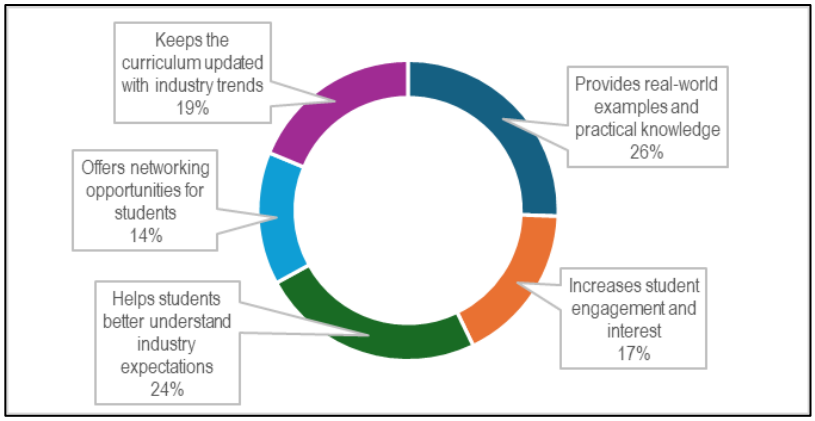

Fig. 4. Benefits of collaborative teaching

The overall sentiment towards these collaborations was overwhelmingly positive, underscoring their perceived value. Most respondents (75%) rated the guest lectures as 'very' or 'extremely effective.' In contrast, only a small fraction found them 'moderately' (23%) or 'slightly' (2%) effective, confirming that collaborative teaching is widely regarded as a highly impactful educational strategy in civil engineering. The effectiveness of these collaborations is reflected in the overwhelmingly positive feedback, indicating that they make a significant contribution to students' academic experiences and career outcomes.

4.2.3 Challenges of collaborative teaching

The primary challenges identified reflect logistical complexities inherent in coordinating academic-industry collaboration. The most significant obstacles were time constraints within the course schedule (33 respondents) and scheduling conflicts with industry experts (32 respondents). These issues often stem from the differing priorities and commitments of academic and industry schedules, making it difficult to find mutually available times. This difficulty in aligning disparate schedules is consistent with findings by previous studies (Liew et al., 2012; Robert John & Shannon, 2023) and underscores the necessity of meticulous planning for successful implementation (McKenna et al., 2009; Mutalib et al., 2017). Successful collaboration relies on early engagement and frequent communication between stakeholders to minimize these scheduling issues.

Further challenges include pedagogical issues such as low student engagement (17 respondents), which may stem from misaligned teaching styles between academics and practitioners that can cause student confusion (Nussbaumer, 2001; Romanelli et al., 2009). The shift between theoretical and practical approaches can also create a disconnect in learning styles. Conversely, other research suggests that co-teaching can enhance student engagement (McKenna et al., 2009), underscoring the importance of interactive delivery (Ellis & Hafner, 2007). Co-teaching methods that incorporate real-world examples and interactive sessions could mitigate engagement issues. Additional barriers included the limited availability of suitable industry experts (11 respondents) and difficulties integrating practical content with theoretical requirements (4 respondents). These barriers emphasize the need for strong industry-academic partnerships to ensure that useful content is effectively delivered within the academic framework.

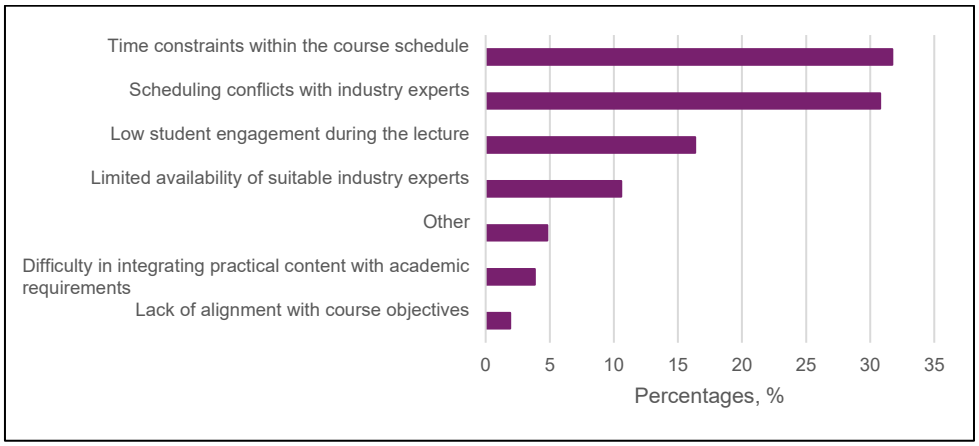

Fig. 5. Challenges of collaborative teaching

5.0 Conclusion and Recommendations

This study confirms that collaborative teaching is a vital pedagogical tool in civil engineering education, effectively bridging the gap between theory and industry practice. While the benefits, such as providing real-world context and clarifying professional expectations, are significant, the findings reveal that current implementation predominantly relies on a convenient "delivery-only" model, often

conducted online with local partners. This approach, while valuable, suggests that the full potential for deeper integration into curriculum design and assessment remains untapped, mainly due to significant logistical challenges like scheduling conflicts. Therefore, a strategic shift is required for institutions to move beyond opportunistic engagement towards systemic integration. This involves creating flexible academic frameworks and incentivizing more comprehensive collaboration models that foster true pedagogical partnerships.

However, several limitations must be acknowledged. First, this study focuses exclusively on civil engineering courses, which may limit the generalizability of the findings to other disciplines. Second, this study is conducted within a single institution, which may limit its applicability to broader contexts. Lastly, this study does not examine the specific nature of teaching delivery, such as design, calculation, or theoretical aspects, which could impact collaborative teaching outcomes. Future research should focus on comparing different collaboration models to improve student competencies and explore institutional strategies that address logistical barriers, ultimately strengthening academic-industry partnerships.

Future studies should broaden the scope by including multiple institutions and a wider range of engineering disciplines to assess the transferability of the results. Additionally, investigating the specific methods of delivery and their impact on learning outcomes would provide deeper insights into how different teaching approaches contribute to student success. By addressing these factors, research could provide more actionable recommendations for fostering sustainable academic-industry collaborations.

Acknowledgements

The authors thank the Faculty of Civil Engineering, Universiti Teknologi MARA (UiTM), for supporting this study. We sincerely appreciate Prof. Ir. Ts. Dr. Che Khairil Izam Che Ibrahim for his mentorship and critical insights. Thanks to the anonymous reviewer(s) who gave valuable comments. The authors would also like to thank everyone who was directly or indirectly involved in the success of the study.

Paper Contribution to Related Field of Study

This study contributes to civil engineering education by examining collaborative teaching in a Malaysian higher learning institution. It highlights the benefits of integrating industry professionals with academic staff to bridge the gap between theoretical learning and real-world industry practices. The findings offer valuable insights into the challenges of implementing collaborative teaching and provide practical recommendations for overcoming these barriers. This study advances the understanding of experiential learning in engineering education, offering a model for other institutions seeking to better align curricula with industry needs. Ultimately, the study enriches the literature on innovative teaching methods in engineering education.

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