

# EVALUATING CASE-BASED LEARNING IN SRI LANKAN HIGHER EDUCATION: A STUDY OF FACILITIES MANAGEMENT UNDERGRADUATES

WADU MESTHRIGE JAYANTHA<sup>1</sup>, LEBUNU HEWAGE UDARA WILLHELM ABEYDEERA<sup>1\*</sup>,  
KARUNARATHNE. A.S.W.<sup>2</sup> AND NAYANTHARA DE SILVA<sup>2</sup>

<sup>1</sup>*School of Property, Construction and Project Management, RMIT University, Melbourne, Australia.*

<sup>2</sup>*Department of Facilities Management, University of Moratuwa, Sri Lanka.*

\* Correspondence E-mail: [S3855817@student.rmit.edu.au](mailto:S3855817@student.rmit.edu.au)

---

**Abstract.** Despite the prominence of case-based learning (CBL) across multiple disciplines in developed countries, its application remains limited in developing countries. This study investigates undergraduate perceptions of the effectiveness of CBL in enhancing both knowledge acquisition and essential soft skills using Facilities Management (FM) degree program at University of Moratuwa, Sri Lanka. Drawing on responses from 221 students, the study employs descriptive statistical analysis alongside the Friedman test to evaluate perceptions across key learning dimensions. The findings indicate that students perceive CBL as a highly effective pedagogical approach, particularly in strengthening applied knowledge, critical thinking, self-directed learning, teamwork, and overall engagement. A clear preference emerged for collaborative and action-oriented learning approaches, while comparatively lower preference was observed for individualised or cognitively demanding methods such as role-play and integrated project-based activities. These results are consistent with the principles of experiential learning and work-integrated learning (WIL), suggesting that CBL effectively supports the integration of theoretical knowledge with real-world application. The study contributes to the limited body of knowledge on innovative teaching practices in FM education within developing contexts. By highlighting the perceived benefits of CBL, it offers valuable implications for curriculum design aimed at producing industry-ready graduates. The findings may also inform pedagogical strategies in related disciplines seeking to strengthen the alignment between academic learning and professional practice.

**Keywords.** *Case-Based Learning, Facilities Management, Real-World Application, Soft-Skills*

---

## 1. Introduction

Higher education in built environment disciplines, including construction and facilities management (FM), has traditionally relied on lecture-based teaching. While effective for content delivery, this approach is often criticised for its one-directional nature, offering limited opportunities for interaction, collaboration, and experiential learning (Yuan et al., 2011). Such limitations can hinder students' motivation and their preparedness to address complex, real-world challenges (Shorey & Lopez, 2021; Wadu Mesthrige et al., 2021). In fields like FM, where professional practice is inherently contextual and problem-oriented, reliance on traditional lecturing restricts the development of higher-order thinking, self-directed learning, and teamwork skills (Ooi & Yu, 2011). Despite these shortcomings, lecture-based methods remain prevalent, particularly within institutions in developing countries.

In response, there has been growing demand for integrating active learning strategies such as problem-based learning and case-based learning (CBL) into built environment

curricula (Latif, 2024; Ooi & Yu, 2011; Wadu Mesthrige et al., 2021). CBL, in particular, enables students to engage with real-world scenarios, apply theoretical knowledge to practical problems, and develop critical competencies such as problem-solving, decision-making, and collaboration (Kantar & Massouh, 2015). As a student-centred approach, it encourages inquiry, discussion, and multi-perspective analysis, reflecting the complex decision-making environments characteristic of FM practice (Mills et al., 2009). Within the Sri Lankan context, empirical evidence on the effectiveness of such pedagogical approaches remains limited. Although policy frameworks advocate for student-centred education, implementation has been constrained by institutional and resource-related challenges. The FM undergraduate programme at the University of Moratuwa, Sri Lanka, has incorporated CBL across multiple modules, reflecting a shift towards practice-oriented teaching aligned with international standards. Yet, the extent to which this approach enhances students' knowledge and soft skills remains underexplored.

Addressing this gap, the present study aims to evaluate the impact of CBL in FM education among undergraduates at the University of Moratuwa, Sri Lanka. Specifically, the study seeks to: (1) examine students' perceptions of the contribution of CBL to knowledge acquisition and real-world application of learning; (2) assess the extent to which CBL supports the development of essential soft skills such as critical thinking, teamwork, communication, and self-directed learning; and (3) identify students' preferences towards different CBL activities implemented within the FM curriculum. Through this evaluation, the study intends to contribute to the development of more practice-oriented and industry-relevant pedagogical strategies in built environment education.

## **2. CBL In Built Environment Education and Developing Contexts**

CBL has emerged as a prominent pedagogical approach in built environment education, with substantial evidence supporting its effectiveness in enhancing student learning and professional competencies. CBL promotes active knowledge construction through engagement with realistic and context-driven scenarios, enabling students to connect theoretical concepts with professional practice (Hmelo-Silver, 2004). Unlike traditional lecture-based teaching, which often positions students as passive recipients of information, CBL encourages analytical inquiry, collaborative learning, reflection, and evidence-based decision-making. This pedagogical shift is particularly significant in the built environment disciplines, where professional practice requires the integration of technical knowledge, stakeholder coordination, and contextual problem-solving within complex and dynamic project environments.

Empirical studies across construction management, real estate, architecture, and facilities management education consistently demonstrate the pedagogical value of CBL in improving higher-order cognitive skills and learner engagement. Wadu Mesthrige et al. (2021), for example, found that undergraduate students exposed to CBL in construction and real estate programmes reported significantly improved understanding of industry practices, stronger problem-solving capabilities, and enhanced teamwork competencies compared to those taught through conventional lectures. Similarly, Kamardeen (2014) highlighted that integrating case-based assessments within construction education increased student motivation, participation, and continuous engagement with learning

activities. The study further demonstrated that the combination of formative and summative case-based tasks created a more interactive learning environment and strengthened students' ability to apply theoretical concepts to authentic construction-related scenarios.

Despite the well-documented advantages of CBL, scholars also acknowledge several implementation-related challenges. Effective case-based instruction requires substantial preparation, facilitation skills, and institutional support. Inadequately designed cases or insufficient facilitation can limit meaningful discussion and reduce learning effectiveness (Hmelo-Silver, 2004). Furthermore, large class sizes, rigid curricula, assessment constraints, and limited teaching resources may hinder the successful adoption of student-centred pedagogies within higher education institutions. These challenges are particularly evident in developing countries, where higher education systems often continue to rely heavily on teacher-centred approaches due to resource limitations and institutional traditions (Phage et al., 2023).

Within developing country contexts, the adoption of CBL has gained increasing scholarly attention as institutions seek to improve graduate employability and industry relevance. CBL is especially valuable in environments where opportunities for practical industry exposure, internships, and experiential learning are limited (Chapakiya et al., 2025). By simulating real-world professional situations, case studies provide an alternative mechanism through which students can engage with practical decision-making processes and contextual challenges. Research in engineering and construction education within developing countries suggests that CBL enhances analytical reasoning, independent learning, and learner participation while reducing overreliance on rote memorisation (Phage et al., 2023). However, the effectiveness of these approaches remains strongly influenced by contextual factors such as institutional readiness, lecturer competence, technological infrastructure, and the availability of relevant teaching materials.

In the Sri Lankan higher education context, research examining the pedagogical effectiveness of CBL within built environment disciplines remains limited. Although recent policy directions encourage learner-centred teaching and outcome-based education, implementation continues to face barriers related to curriculum structures, academic culture, staff capacity, and resource availability. Existing studies have largely focused on broader educational reforms rather than discipline-specific pedagogical innovations within FM education. Consequently, there remains insufficient empirical understanding regarding how Sri Lankan FM students perceive and benefit from CBL, particularly in relation to knowledge acquisition, professional skill development, and industry preparedness. Addressing this gap is therefore important for informing curriculum enhancement and supporting the transition towards more practice-oriented and internationally aligned built environment education in Sri Lanka.

### **3. Methodology**

This study adopted a quantitative research design to evaluate the effectiveness of CBL in the FM degree programme at the University of Moratuwa, Sri Lanka. A structured questionnaire was employed to systematically capture students' perceptions of learning outcomes, given the integration of CBL across several modules in the curriculum.

Quantitative surveys are well suited to pedagogical evaluation as they enable the consistent measurement of attitudes and experiences across large cohorts, allowing for statistical comparison and generalisation (Creswell & Creswell, 2017). The use of a structured instrument further ensured standardised data collection and minimised researcher bias, supporting reliable analysis at both programme and cohort levels.

The questionnaire instrument was developed based on established constructs and validated measures identified in prior studies on CBL and active learning pedagogies. Adopting previously validated constructs enhanced the content validity and conceptual reliability of the instrument while ensuring alignment with the intended learning outcomes of CBL in practice-oriented disciplines. The questionnaire comprised five-point Likert scale items organised into five domains: (i) conceptual understanding and knowledge development, (ii) problem-solving and critical thinking, (iii) self-directed learning, (iv) collaboration and engagement, and (v) preparedness for professional practice.

The knowledge development and conceptual understanding constructs were informed by studies demonstrating that CBL enhances students' ability to connect theoretical knowledge with real-world application (Freeman et al., 2014; Wadu Mesthrige et al., 2021). Constructs relating to problem-solving, critical thinking, and self-directed learning were derived from the work of Hmelo-Silver (2004) and Thistlethwaite et al. (2012), who identified these competencies as key outcomes of student-centred and inquiry-based learning approaches. The collaboration and engagement domain was adapted from studies emphasising the role of CBL in improving teamwork, communication, and active participation (Kamardeen, 2014; Rubino, 2024). Similarly, the preparedness for professional practice dimension was informed by research highlighting the effectiveness of case-oriented learning in developing workplace readiness and industry-relevant competencies within built environment education (Wadu Mesthrige et al., 2021).

These constructs were considered suitable for the present study because they closely align with the intended learning outcomes of facilities management education, particularly in relation to knowledge application, critical thinking, teamwork, and professional competency development. Furthermore, the selected studies were conducted within construction, engineering, and built environment education contexts, making them conceptually relevant and transferable to the Sri Lankan FM undergraduate context. Given the scope of this paper, the analysis primarily focuses on two key dimensions emerging from the instrument: knowledge development and soft skill development. This study targeted all undergraduate students enrolled in the FM programme, employing a census sampling approach to capture perspectives across all academic levels. The survey was administered electronically at the beginning of Semester 2 in the 2025 academic year. Participants were informed of the study's purpose, and confidentiality and voluntary participation were assured. Conducting the survey during the academic term enabled students to reflect on recent learning experiences, thereby enhancing response accuracy. Of the 289 students invited, 268 valid responses were received, yielding a response rate of 92.7%. Data analysis involved descriptive statistics, including means and standard deviations, to summarise overall trends, alongside level-wise comparisons to examine variation across cohorts. Reliability of the constructs was assessed to ensure internal consistency, strengthening the validity of the findings.

### 3.1 RESPONDENT PROFILE

As presented in Table 1, the study initially targeted a sample of 268 undergraduate students enrolled across all four academic years of the BSc (Hons) Facilities Management degree program at the University of Moratuwa. Following data screening and cleaning, 221 valid responses were retained for analysis, as several questionnaires were incomplete. The distribution of participants across academic levels is relatively balanced, with proportions ranging from 21.3% to 30.3%, ensuring that no single cohort disproportionately influences the findings. This balanced representation allows for meaningful comparisons of the perceived impact of CBL across different stages of study.

A slightly higher proportion of Level 1 students and a comparatively lower representation of Level 4 students were observed. This can be attributed to the greater accessibility of first-year students, while final-year students were often less available due to part-time employment commitments, an occurrence commonly noted in higher education contexts. The inclusion of responses from both early-stage and senior students provides a comprehensive cross-sectional view of student experiences with CBL throughout their academic progression. In terms of gender distribution, the sample is predominantly female, accounting for 65.2% (144) of respondents. This reflects the broader demographic composition of the FM program and may offer valuable insights when interpreting perceptions related to soft skills development through CBL.

*Table 1 Respondent Profile*

Study Level	Number of respondents		
	Enrolled no of students*	Complete no of responses	Incomplete no of responses
Level 1	82	67 (81.71%)	15 (18.29%)
Level 2	59	58 (98.30%)	01 (1.70%)
Level 3	69	49 (71.01%)	20 (28.99%)
Level 4	58	47 (81.03%)	11 (18.97%)
Total	268 (100%)	221 (82.46%)	47 (17.54%)

**Note:** \* Some questions were not answered, thus removed from the analysis

## 4. Results and Discussion

Before examining the influence of CBL on students’ knowledge acquisition and soft skills, it is important to first understand the extent of their familiarity with CBL, including the types of case-based activities employed and the frequency with which students engage in such approaches. Table II provides a detailed overview of student exposure to various CBL methods across different academic levels.

Overall, the results indicate that most students have experienced a diverse range of CBL and related active learning strategies during their studies. Nevertheless, the level of engagement is not uniform across all methods. Certain approaches appear to be more consistently embedded within the teaching practices, while others are used less frequently. This variation suggests differences in how CBL is implemented across modules and levels,

highlighting the need to consider both the breadth and intensity of exposure when evaluating its impact on student learning outcomes.

*Table 2, Frequency of exposure to different case-based activities*

<b>Case Study Approach</b>	<b>Never (%)</b>	<b>Rarely (%)</b>	<b>Sometimes (%)</b>	<b>Often (%)</b>	<b>Very Often (%)</b>
Individual written case analysis	1.8	9.5	47.1	30.3	11.3
Group discussion and debate	2.3	10.4	29.0	40.7	17.6
Group action plans / proposals	4.5	11.8	30.8	43.4	9.5
Role play / simulation	15.4	17.6	45.7	18.6	2.7
Presentation-based activities	3.6	5.4	18.6	40.3	32.1
Integrated project / problem solving	7.2	14.5	40.7	31.7	5.9

The findings presented in Table 2 indicate that while students have been exposed to a variety of case-based and active learning strategies, the level of engagement differs considerably across methods, reflecting an uneven integration of CBL practices within the curriculum. Individual written case analysis and group discussions emerged as the most frequently adopted approaches, suggesting that the current implementation of CBL primarily emphasises analytical reasoning, peer interaction, and collaborative learning. This aligns with previous studies in construction and built environment education, which identify discussion-oriented and analytical case activities as the most commonly implemented and pedagogically effective forms of CBL due to their relative ease of integration within conventional university settings (Kamardeen, 2014; Wadu Mesthrige et al., 2021). The strong prevalence of group discussions and debates further supports the argument that collaborative engagement enhances students’ ability to evaluate multiple perspectives and develop communication competencies required in professional FM practice.

Similarly, the relatively high use of group-based action plans and proposal development activities suggests that the programme emphasises applied problem-solving and teamwork. This reflects broader international trends in built environment education, where active learning approaches are increasingly used to simulate multidisciplinary professional environments and strengthen employability-related competencies (Scott, 2020). The frequent use of presentation-based case activities also indicates a deliberate focus on communication and professional articulation skills, which are consistently identified in the literature as critical attributes for facilities management graduates operating within stakeholder-intensive environments. However, the findings also reveal that more immersive approaches, particularly role plays and simulations, remain underutilised

despite their recognised pedagogical value. Previous research highlights that simulations and experiential role-based activities are especially effective in developing decision-making abilities, situational awareness, and professional confidence because they expose students to realistic and dynamic problem contexts (Hmelo-Silver, 2004; Thistlethwaite et al., 2012). Their comparatively limited use in the present context may therefore indicate practical constraints such as limited time, resource availability, large class sizes, or insufficient facilitator training, which are commonly reported barriers to active learning implementation in developing country higher education contexts (Phage et al., 2023). This suggests that while the programme has successfully integrated foundational CBL strategies, the transition towards more experiential and simulation-oriented pedagogies remains partial.

Furthermore, integrated project-based and problem-solving activities were only moderately utilised, which may limit opportunities for students to engage with the complex and interdisciplinary nature of FM practice. International literature increasingly emphasises that integrated and project-oriented learning environments are particularly effective in preparing built environment students for real-world professional challenges because they encourage systems thinking, adaptability, and long-term problem-solving capabilities (Buser et al., 2017). Therefore, the moderate implementation observed in this study may reflect an opportunity for curriculum enhancement rather than a weakness in pedagogical intent. Overall, the findings demonstrate that the FM programme has established a reasonably strong foundation for CBL implementation, particularly in relation to analytical, collaborative, and communication-focused learning activities. Nevertheless, comparison with international studies suggests that expanding the use of immersive simulations and integrated project-based approaches could further strengthen the development of higher-order cognitive and professional competencies required in contemporary facilities management practice.

#### 4.1 KNOWLEDGE DEVELOPMENT THROUGH CASE-BASED LEARNING

In response to the growing recognition of CBL as a more effective approach to knowledge acquisition than traditional lecture-based methods, this study evaluated students' perceptions using a five-point Likert scale ranging from "strongly disagree" to "strongly agree." The results presented in Table 3 (mean scores ranging from 3.69 to 3.92) indicate that students generally perceived CBL as contributing positively to both conceptual understanding and industry-oriented learning. The highest ratings were associated with the application of classroom knowledge to practical facilities management contexts ( $M = 3.92$ ,  $SD = 0.734$ ) and the integration of knowledge across modules such as contracts, maintenance, and safety ( $M = 3.85$ ,  $SD = 0.701$ ). These findings suggest that students value CBL particularly for its ability to contextualise theoretical content within realistic professional situations, which is a critical requirement in facilities management education.

This outcome is consistent with international research demonstrating that CBL enhances the practical applicability of knowledge by exposing students to authentic and complex industry scenarios. Wadu Mesthrige et al. (2021), for instance, found that construction and real estate students perceived CBL as significantly improving their ability to connect theoretical concepts with professional practice. Similarly, Freeman et al. (2014) argued that active learning approaches promote deeper conceptual understanding and long-term

knowledge retention compared to passive lecture-based instruction. The comparatively high ratings relating to career relevance ( $M = 3.87$ ,  $SD = 0.682$ ) and understanding of industry practices ( $M = 3.83$ ,  $SD = 0.684$ ) further indicate that students perceive CBL not merely as an academic exercise, but as a mechanism for improving professional preparedness and employability. This is particularly important in FM education, where graduates are expected to operate within multidisciplinary and operationally complex environments.

Table 3, Knowledge development through CBL

Knowledge dimension	Mean	SD	Skewness	Kurtosis
Deepened my understanding of theoretical concepts covered in lectures.	3.70	0.817	-0.905 (0.164)	1.770 (0.326)
Helped me to apply classroom knowledge to real-world facilities management scenarios	3.92	0.734	-1.054 (0.164)	3.164 (0.326)
I remember concepts learned through CBL better than those learned through lectures alone	3.76	0.811	-0.710 (0.164)	1.235 (0.326)
Helped me connect knowledge from different modules (e.g., contracts, maintenance, safety)	3.85	0.701	-1.064 (0.164)	3.051 (0.326)
Allowed me to integrate technical and managerial knowledge when solving problems	3.76	0.713	-0.991 (0.164)	2.833 (0.326)
Encouraged me to explore cross-disciplinary knowledge beyond the syllabus	3.69	0.718	-0.718 (0.164)	1.703 (0.326)
Helped me gain a more detailed understanding of specific FM practices (e.g., asset lifecycle, energy management, safety)	3.81	0.628	-0.498 (0.164)	1.481 (0.326)
Exposed me to a wider range of knowledge than conventional classroom activities	3.78	0.701	-0.382 (0.164)	0.693 (0.326)
Improved my awareness of current industry practices and challenges.	3.83	0.684	-0.550 (0.164)	1.705 (0.326)
Knowledge gained from CBL feels directly applicable to my future professional career	3.87	0.682	-0.615 (0.164)	1.923 (0.326)

Note:  $N=221$ ; Standard error in parentheses.

Moderately strong scores relating to knowledge retention ( $M = 3.76$ ,  $SD = 0.811$ ) and the integration of technical and managerial knowledge in problem-solving ( $M = 3.76$ ,  $SD = 0.711$ ) suggest that students view CBL as supporting deeper and more sustained learning beyond memorisation-based approaches. These findings reflect the core assumptions of Experiential Learning Theory, which emphasises that knowledge is strengthened through experience, reflection, and active application. By engaging with realistic cases, students are encouraged to analyse problems critically, evaluate alternatives, and apply interdisciplinary knowledge within practical contexts. Similar observations have been reported in studies conducted within engineering and built environment education, where case-oriented learning environments were found to improve analytical reasoning and systems thinking capabilities (Korkmaz, 2012; Scott, 2020).

However, the comparatively lower rating for exploring cross-disciplinary knowledge beyond the syllabus (M = 3.69, SD = 0.718) may indicate that the current implementation of CBL remains somewhat bounded by module-specific learning outcomes and assessment structures. While students appear to benefit from applied and contextual learning, opportunities for broader interdisciplinary exploration may still be limited. This contrasts with findings from some international studies, where integrated project-based and multidisciplinary case activities were found to foster stronger cross-disciplinary engagement and innovation-oriented thinking (Buser et al., 2017). The result therefore suggests that although CBL has been effectively incorporated to strengthen knowledge application within core FM subject areas, there remains potential to further enhance integrative and interdisciplinary learning experiences. Overall, the findings demonstrate that CBL contributes meaningfully to knowledge development, practical understanding, and industry readiness within FM education. More importantly, comparison with previous international studies suggests that the value of CBL extends beyond improving academic understanding, as it also supports the development of applied professional thinking necessary for contemporary built environment practice.

#### 4.2 IMPACT OF CBL ON STUDENTS’ SOFT SKILL COMPETENCIES

This section evaluates the extent to which CBL enhances students’ soft skills, focusing on critical thinking, self-directed learning, teamwork, and engagement and motivation, as summarised in Table IV. Overall, students reported positive perceptions across all four domains (M = 3.79, SD = 0.647), although the degree of impact varied. Teamwork emerged as the most strongly developed domain (M = 3.88, SD = 0.626). Students highlighted improvements in communication, interpersonal interaction, and collaborative problem-solving, reflecting the interactive nature of case discussions. CBL also supported leadership-related behaviours such as task coordination and managing group dynamics. However, slightly lower ratings for conflict resolution suggest scope for more structured facilitation to strengthen this aspect.

Table 4 - CBL and students’ soft skill competencies (n=221)

Learning outcome	Mean		SD.	Kurtosis
	Skewness			
<i>Development of critical thinking skills</i>	3.78	0.633		
1) Case studies required me to evaluate different perspectives before arriving at a solution	3.76	0.632	-0.422(0.164)	1.196(0.326)
2) Learned to question assumptions, examine evidence more critically when working on case studies	3.76	0.656	-0.669(0.164)	1.408(0.326)
3) Case studies encouraged me to weigh alternative solutions rather than rely on a single “correct” answer	3.79	0.636	-0.109(0.164)	-0.039(0.326)
4) Case studies improved my ability to make decisions under conditions of uncertainty	3.77	0.613	-0.424(0.164)	0.554(0.326)
5) Case studies helped me developing confidence in defending my ideas with logical arguments	3.81	0.630	-0.714(0.164)	2.636(0.326)
<i>Development of self-directed learning skills</i>	3.72	0.654		

6) Case studies made the learning process more engaging compared with traditional lectures	3.71	0.694	-0.851(0.164)	1.708(0.326)
7) More motivated to participate actively in class when case studies were used	3.65	0.702	-0.814(0.164)	2.277(0.326)
8) The real-world relevance of case studies increased my interest in facilities management	3.81	0.623	-0.077(0.164)	-0.062(0.326)
9) Case study activities encouraged me to stay more focused and attentive during learning sessions	3.72	0.647	-0.474(0.164)	1.074(0.326)
10) More likely to recall knowledge from case studies because I was actively engaged in solving them	3.70	0.606	0.135(0.164)	-0.452(0.326)
<i>Promotion of effective group/teamwork collaboration</i>	<i>3.88</i>	<i>0.626</i>		
11) Case studies improved my ability to collaborate effectively with peers	3.87	0.648	-0.882(0.164)	3.002(0.326)
12) Case studies task enhanced my communication and interpersonal skills	3.91	0.651	-1.008(0.164)	3.441(0.326)
13) Case studies helped me to appreciate and respect diverse viewpoints within a team	3.87	0.634	-0.754(0.164)	2.223(0.326)
14) Group-based case studies improved my ability to manage conflicts and reach consensus	3.83	0.599	-0.436(0.164)	1.688(0.326)
15) Case studies provided me with leadership opportunities within group settings	3.91	0.601	-0.474(0.164)	2.047(0.326)
<i>Promotion of engagement and motivation</i>	<i>3.77</i>	<i>0.676</i>		
16) Case studies made the learning process more engaging compared with traditional lectures	3.76	0.688	-0.588(0.164)	1.589(0.326)
17) More motivated to participate actively in class when case studies were used	3.73	0.688	-1.030(0.164)	3.102(0.326)
18) The real-world relevance of case studies increased my interest in facilities management.	3.84	0.662	-0.568(0.164)	2.001(0.326)
19) Case study activities encouraged me to stay more focused and attentive during learning sessions	3.76	0.695	-0.634(0.164)	1.596(0.326)
20) More likely to recall knowledge from case studies because I was actively engaged in solving them.	3.74	0.651	-0.479(0.164)	1.098(0.326)
<i>Overall</i>	<i>3.79</i>	<i>0.647</i>		

Critical thinking was the second most enhanced domain ( $M = 3.78$ ,  $SD = 0.633$ ). Students reported increased ability to evaluate multiple perspectives, question assumptions, and justify decisions. The highest-rated aspect was constructing logical arguments, indicating that CBL effectively promotes higher-order reasoning through problem-based analysis. Engagement and motivation also showed consistently positive responses ( $M \approx 3.73$ – $3.84$ ), with real-world relevance identified as the strongest driver. Students were more attentive and motivated when learning was clearly connected to industry practice, reinforcing the value of authentic learning contexts. Although self-directed learning recorded comparatively lower scores ( $M = 3.65$ – $3.81$ ), it remained positively influenced. Overall, the findings suggest that CBL meaningfully enhances essential soft skills, particularly those aligned with collaborative and applied professional practice.

Table 5, Friedman test results: ranking of skill development

Rank	Skill	Mean Rank
1	Communication/critical thinking skills	2.49
2	Collaboration and teamwork	2.49
3	Leadership and coordination	2.97
4	Time management and task organization	3.34
5	Conflict resolution and consensus building	3.70
	$\chi^2(4) = 110.316, p < .001$	

To support the findings of the preceding analysis, students were asked to rank five soft skills based on the extent to which they were developed through CBL (1 = most developed, 5 = least developed). As presented in Table VII, a Friedman test was conducted across the five dimensions. The results revealed a statistically significant difference in rankings,  $\chi^2(4) = 110.316, p < .001$ , indicating that CBL does not contribute equally to the development of all soft skills. The ranking outcomes closely mirror the earlier findings. Communication and critical thinking, along with collaboration and teamwork, received the lowest mean ranks ( $M = 2.49$ ), signifying that students perceived these as the most strongly developed competencies. This is consistent with the interactive nature of CBL, which frequently involves discussions, presentations, and group-based analysis that require students to articulate ideas and engage in collective problem-solving. Leadership and coordination ( $M = 2.97$ ) emerged as a secondary area of development. While CBL provides opportunities for role-taking and team organisation, these experiences appear less consistently embedded compared to communication and collaboration activities. Overall, the results reinforce the view that CBL is particularly effective in fostering interpersonal and analytical competencies, both of which are essential for functioning in collaborative and multidisciplinary professional environments.

This study provides compelling evidence that case-based learning (CBL) contributes significantly to the development of knowledge, soft skills, and industry readiness among Facilities Management students. Across all domains examined, mean scores consistently exceeded the midpoint of the scale, indicating a generally positive perception of CBL as an effective pedagogical approach. In terms of knowledge development, students reported strong gains in applied and integrative learning. High ratings were observed for the ability to apply theoretical knowledge to real-world contexts, integrate technical and managerial concepts, and develop awareness of current industry practices. These outcomes align with Experiential Learning Theory, which emphasises learning through experience and reflection, and are consistent with prior empirical studies. The presence of negative skewness across most items further suggests that these perceived benefits were widely shared among students.

A second key finding relates to the enhancement of soft skills, particularly in critical thinking, self-directed learning, teamwork, and engagement. Within the critical thinking domain, students highlighted improvements in their ability to construct and defend logical arguments and evaluate solutions under conditions of uncertainty—competencies highly valued in professional practice. Self-directed learning was supported through increased motivation and sustained attention, largely driven by the real-world relevance of case

scenarios. Teamwork emerged as one of the most strongly developed domains, with communication, collaboration, and leadership identified as the most influential components, while areas such as conflict resolution and time management showed comparatively lower development. These patterns reinforce the role of CBL in fostering interpersonal and collaborative competencies essential for multidisciplinary practice and align with established graduate attribute frameworks. These findings were further supported by ranking analysis and the Friedman test, which revealed significant differences in student preferences across CBL methods. Activities such as group discussions, action plans, and presentations were most preferred, reflecting their alignment with workplace-oriented skills. In contrast, role plays and integrated projects were less favoured, likely due to their higher cognitive demands and lower familiarity. Importantly, this does not diminish their educational value but highlights the need for more structured support in their implementation.

This study provides compelling evidence that CBL contributes significantly to the development of knowledge, soft skills, and industry readiness among Facilities Management students. Across all domains examined, mean scores consistently exceeded the midpoint of the scale, indicating a generally positive perception of CBL as an effective pedagogical approach. In terms of knowledge development, students reported strong gains in applied and integrative learning. High ratings were observed for the ability to apply theoretical knowledge to real-world contexts, integrate technical and managerial concepts, and develop awareness of current industry practices. These outcomes align with Experiential Learning Theory, which emphasises learning through experience and reflection, and are consistent with prior empirical studies (McLean, 2016; van den Beemt et al., 2023). The presence of negative skewness across most items further suggests that these perceived benefits were widely shared among students.

A second key finding relates to the enhancement of soft skills, particularly in critical thinking, self-directed learning, teamwork, and engagement. Within the critical thinking domain, students highlighted improvements in their ability to construct and defend logical arguments and evaluate solutions under conditions of uncertainty, competencies highly valued in professional practice (Ayala et al., 2024). Self-directed learning was supported through increased motivation and sustained attention, largely driven by the real-world relevance of case scenarios. Teamwork emerged as one of the most strongly developed domains, with communication, collaboration, and leadership identified as the most influential components, while areas such as conflict resolution and time management showed comparatively lower development. These patterns reinforce the role of CBL in fostering interpersonal and collaborative competencies essential for multidisciplinary practice and align with established graduate attribute frameworks (Galdames-Calderón et al., 2024). These findings were further supported by ranking analysis and the Friedman test, which revealed significant differences in student preferences across CBL methods. Activities such as group discussions, action plans, and presentations were most preferred, reflecting their alignment with workplace-oriented skills. In contrast, role plays and integrated projects were less favoured, likely due to their higher cognitive demands and lower familiarity. Importantly, this does not diminish their educational value but highlights the need for more structured support in their implementation.

## 5. Conclusions

Drawing on both descriptive and inferential analyses, this study examined the effectiveness of CBL in enhancing professional knowledge, self-directed learning, critical thinking and problem-solving abilities, teamwork, and student motivation within an FM context. The findings provide strong empirical support for CBL as a meaningful and effective pedagogical approach. Students consistently reported that CBL enabled them to apply theoretical concepts to real-world situations and to integrate technical and managerial knowledge, reflecting the principles of Experiential Learning Theory. A key contribution of the study lies in demonstrating CBL's role in developing core employability skills. Students perceived notable improvements in problem-solving, critical thinking, collaboration, self-directed learning, and engagement, competencies widely recognised as essential in professional practice. The results also revealed a clear preference for collaborative and applied learning formats, particularly group discussions and action-based tasks, highlighting the value students place on interactive and socially grounded learning environments. Overall, by embedding real-world challenges, encouraging reflection, and promoting transferable skills, CBL contributes to improved learning quality and stronger employability outcomes. The findings support its continued and expanded integration within higher education curricula, particularly in applied disciplines such as Facilities Management, where alignment with industry expectations is essential.

## 6. References

- Ayala, E., Fuertes, W., & Jarrin, F. (2024). Critical thinking skills in research process, a literature review. An Input to propose a new measurement instrument to gauge critical thinking. *International Journal of Religion*, 5(11), 1-14.
- Buser, M., Støre-Valen, M., Olsen, E. B., Lauridsen, K. A., Straub, M., & Erhvervsakademi, K. (2017). Defining education to support sustainable operation of buildings in the Nordic Countries. 9th Nordic Conference on Construction Economics and Organization 13-14 June, 2017 at Chalmers University of Technology, Göteborg, SWEDEN,
- Chapakiya, A., Abdullah, A. R., Salleh, M. N. M., Luthfi, S., & Panjalu, G. F. (2025). Development of higher order thinking skill for students in madrasa southern Thailand: Engaging case-based learning methods. *Journal of Instruction and Islamic Religious Education*, 1(2), 121-134.
- Creswell, J. W., & Creswell, J. D. (2017). *Research design: Qualitative, quantitative, and mixed methods approaches*. Sage publications.
- Freeman, S., Eddy, S. L., McDonough, M., Smith, M. K., Okoroafor, N., Jordt, H., & Wenderoth, M. P. (2014). Active learning increases student performance in science, engineering, and mathematics. *Proceedings of the National Academy of Sciences*, 111(23), 8410-8415.
- Galdames-Calderón, M., Stavnskær Pedersen, A., & Rodriguez-Gomez, D. (2024). Systematic review: Revisiting challenge-based learning teaching practices in higher education. *Education Sciences*, 14(9), 1008.
- Hmelo-Silver, C. E. (2004). Problem-based learning: What and how do students learn? *Educational psychology review*, 16(3), 235-266.
- Kamardeen, I. (2014). Adaptive e-tutorial for enhancing student learning in construction education. *International Journal of Construction Education and Research*, 10(2), 79-95.
- Kantar, L. D., & Massouh, A. (2015). Case-based learning: What traditional curricula fail to teach. *Nurse Education Today*, 35(8), e8-e14.
- Korkmaz, S. (2012). Case-based and collaborative-learning techniques to teach delivery of sustainable buildings. *Journal of Professional Issues in Engineering Education and Practice*, 138(2), 139-144.

- Latif, H. M. (2024). CASE-BASED LEARNING AND TEACHING EXPERIENCES ABOUT PEOPLE MANAGEMENT IN CONSTRUCTION BUSINESSES. *Journal of Surveying, Construction and Property*, 15(2), 45-53.
- McLean, S. F. (2016). Case-based learning and its application in medical and health-care fields: a review of worldwide literature. *Journal of Medical Education and Curricular Development*, 3, JMECD. S20377.
- Mills, A. J., Durepos, G., & Wiebe, E. (2009). *Encyclopedia of case study research*. Sage publications.
- Ooi, J., & Yu, S.-M. (2011). Graduate real estate education in Singapore: What prospective students look for. *Journal of Real Estate Practice and Education*, 14(1), 35-52.
- Phage, R. J., Molato, B. J., & Matsipane, M. J. (2023). Challenges regarding transition from case-based learning to problem-based learning: A qualitative study with student nurses. *Nursing Reports*, 13(1), 389-403.
- Rubino, S. (2024). *Project-based learning and its impact on student engagement, well-being, and learning outcomes: A study of teachers' perspectives*. Arkansas State University.
- Scott, L. M. (2020). Engaging students' learning in the built environment through active learning. In *Claiming Identity Through Redefined Teaching in Construction Programs* (pp. 1-25). IGI Global Scientific Publishing.
- Shorey, S., & Lopez, V. (2021). Self-Efficacy in a nursing context. *Health promotion in health care—Vital theories and research*, 145-158.
- Thistlethwaite, J. E., Davies, D., Ekeocha, S., Kidd, J. M., MacDougall, C., Matthews, P., Purkis, J., & Clay, D. (2012). The effectiveness of case-based learning in health professional education. A BEME systematic review: BEME Guide No. 23. *Medical teacher*, 34(6), e421-e444.
- van den Beemt, A., van de Watering, G., & Bots, M. (2023). Conceptualising variety in challenge-based learning in higher education: the CBL-compass. *European Journal of Engineering Education*, 48(1), 24-41.
- Wadu Mesthrige, J., Lam, P. T., Chiang, Y.-H., & Samarasinghalage, T. I. (2021). Effectiveness of case-based learning: views of construction and real estate students. *International Journal of Construction Education and Research*, 17(4), 318-332.
- Yuan, H. B., Williams, B. A., Yin, L., Liu, M., Fang, J. B., & Pang, D. (2011). Nursing students' views on the effectiveness of problem-based learning. *Nurse Education Today*, 31(6), 577-581.