

Enhancing Student Understanding of Development Planning Through Real-World Industrial Collaboration in Construction Projects

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DOI: <https://doi.org/10.51583/IJLTEMAS.2026.150300084>

Received: 27 March 2026; Accepted: 02 April 2026; Published: 17 April 2026

ABSTRACT

In an increasingly complex and fast-paced construction industry, the gap between theoretical instruction and practical application remains a persistent challenge in engineering education. Many students struggle to fully grasp development planning processes ranging from initial site surveys to multidisciplinary technical drawings due to limited exposure to real-world practices. Addressing this issue, the present study evaluates the effectiveness of an academic–industry collaboration initiative, specifically an industrial talk, in enhancing students’ understanding of development planning within the construction context. Adopting a quantitative pre–post research design, the study collected 77 valid responses from participants comprising predominantly undergraduate engineering students, alongside lecturers and an industry speaker. A structured questionnaire measured self-reported understanding before and after the session, complemented by nine Likert-scale items assessing awareness, integration, and perceived benefits. Data were analysed using SPSS through descriptive statistics, reliability testing, paired samples t-tests, and group comparison analyses. The findings reveal a substantial and statistically significant improvement in participants’ understanding following the intervention. The mean score increased from 2.75 (pre-session) to 8.35 (post-session), with a highly significant t-test result ($p < 0.001$), indicating strong learning gains. The instrument demonstrated excellent reliability (Cronbach’s $\alpha = 0.965$), confirming internal consistency. Importantly, no significant differences were observed across gender or participant groups, suggesting that the learning experience was inclusive and broadly effective. High satisfaction levels (mean = 4.68/5) further underscore the perceived value of the initiative. This study concludes that structured academic–industry engagements serve as powerful pedagogical tools in bridging the theory–practice divide in construction education. Beyond academic outcomes, such initiatives contribute to societal and environmental advancement by fostering industry-ready graduates equipped with practical competencies, collaborative skills, and a deeper appreciation of sustainable construction practices. By strengthening the alignment between education and industry needs, these efforts support the development of a more competent workforce capable of delivering efficient, well-coordinated, and environmentally responsible construction projects.

Keywords: Development planning; Industry engagement; Construction engineering education; Technical drawing literacy; Work-integrated learning

INTRODUCTION

In the rapidly evolving construction industry, understanding the full scope of development planning from initial site survey to project completion is essential for producing competent and industry-ready engineering graduates. The effectiveness of such knowledge transfer is significantly enhanced when students are exposed to practical, real-world applications through academic–industry engagement such as industrial talks. These sessions offer an opportunity to bridge theoretical knowledge with professional practice, especially in areas involving technical documentation and multidisciplinary collaboration [1].

The featured industrial collaboration talk, titled “*Development Planning: Types of Plans Involved from Planning Layout to Project Completion*”, was designed to equip students with a deeper understanding of key technical drawings commonly used in construction projects. This includes architectural drawings, civil and structural (C&S) drawings, infrastructure layouts, mechanical and electrical (M&E) schematics, and survey or topographic plans. Each of these components plays a critical role in ensuring that a project is not only feasible and functional but also compliant with regulatory and safety standards [2]. In Malaysian higher education, there is growing emphasis on integrating industrial relevance into the civil engineering curriculum to align with the outcomes outlined by professional bodies such as the Engineering Accreditation Council (EAC) and Board of Engineers Malaysia (BEM). These bodies promote outcome-based education (OBE) that cultivates problem-solving skills, multidisciplinary knowledge, and lifelong learning attitudes among future engineers [3]. Given the importance of this initiative, the present research aimed to evaluate the impact of the industrial talk on students' awareness and understanding of the types of development plans involved in construction. By administering a structured survey before and after the session, this study seeks to measure the knowledge gained and to identify any significant differences in perception across gender and attendance groups. The findings are expected to contribute to future improvements in academic–industry collaborations and technical education strategies in the field of construction engineering.

METHODOLOGY

Research Design

This study employed a quantitative research design using a pre–post survey approach to assess participants' awareness and understanding of development planning in the construction industry. The design allowed for the measurement of knowledge improvement by comparing self-reported understanding levels before and after the industrial talk. The talk focused on technical components including architectural drawings, civil and structural drawings, infrastructure layout, survey plans, and mechanical and electrical (M&E) drawings. Such a method is appropriate for measuring change over time and evaluating the effectiveness of academic-industry engagement sessions in engineering education [4].

Participants

Participants were drawn from undergraduate engineering students and faculty members who attended the industrial talk. In total, 77 valid responses were collected. The demographic breakdown showed that 42.9% were male and 57.1% were female, while 90.9% were students, 7.8% were lecturers, and 1.3% were the invited speaker. Respondents were selected based on their voluntary attendance and consent to participate in the post-event evaluation.

Instrumentation

A structured questionnaire was developed to capture the following data:

- Demographics: Gender and attendance group (student, lecturer, speaker)
- Pre- and post-understanding: Self-rated on a 10-point scale
- Awareness and understanding items: 9 statements using a 5-point Likert scale (1 = Strongly Disagree to 5 = Strongly Agree) covering:
 - Q1–Q5: Understanding of various drawings (architectural, C&S, infrastructure, survey, M&E)
 - Q6–Q9: Integration, confidence, and perceived benefit of the talk
- Overall satisfaction: Star rating (1 to 5 stars)

The internal reliability of the Likert items was confirmed via Cronbach's Alpha = 0.965, indicating excellent consistency.

Data Collection Procedure

Data were collected using Google Forms, distributed immediately after the industrial talk. Participants were informed about the purpose of the study, and confidentiality was assured. They were required to self-assess their level of understanding both before and after the session and respond to awareness-related items based on their learning experience.

Data Analysis

The data were analyzed using SPSS Version 27 [5], following these steps:

- Descriptive Statistics: Frequencies, means, standard deviations were calculated for demographics, understanding levels, and Likert-scale items.
- Reliability Analysis: Cronbach's Alpha was used to assess internal consistency of the 9 Likert items.
- Paired Samples T-Test: To compare participants' understanding before and after the talk.
- Independent Samples T-Test: To identify any significant differences in understanding between male and female participants.
- One-Way ANOVA: To compare mean differences among attendance groups (student, lecturer, speaker).

A significance level of $p < 0.05$ was used for all inferential statistical tests.

RESULTS AND DISCUSSION

Table 1: Descriptive Statistics

		Frequency	Percent
Gender	Male	33	42.9
	Female	44	57.1
Attendance	Student	70	90.9
	Lecturer	6	7.8
	Speaker	1	1.3

Table 1 presents a demographic breakdown of participants who attended the industrial talk. The gender distribution shows a slightly higher number of female participants (57.1%) compared to males (42.9%), indicating balanced representation with a modest female majority. In terms of attendance groups, the vast majority of respondents were students, accounting for 90.9% of the total. A small proportion were lecturers (7.8%), while only 1.3% were speakers. This suggests that the primary audience was student-focused, reflecting the educational purpose of the session and its role in supporting student awareness and learning about development planning in the construction industry.

Table 2: Star Rating and Overall satisfaction score distribution.

	Minimum	Maximum	Mean	Std. Deviation
Level of understanding the subject presented BEFORE attending technical talk. Scale 1 to 10	1	10	2.75	1.771
Level of understanding the subject presented AFTER attending technical talk. Scale 1 to 10	5	10	8.35	1.109
Please rate this industrial talk on a scale of 1 to 5 stars based on your overall experience and understanding gained from the session	3	5	4.68	0.522

Table 2 illustrates the impact of the industrial talk on participants' self-reported understanding and their overall satisfaction. Before attending the session, students rated their understanding of the topic quite low, with a mean score of only 2.75 out of 10. This indicates limited prior knowledge or exposure to the subject matter of development planning in construction. After the talk, there was a significant improvement. The average post-session understanding jumped to 8.35, suggesting that the session was highly effective in delivering relevant knowledge and improving student comprehension. Furthermore, participants gave the talk an average star rating of 4.68 out of 5, with the lowest rating being 3 stars. This high satisfaction score reflects a very positive experience overall, indicating that students found the session valuable, engaging, and beneficial to their academic and professional growth. This combination of knowledge gain and high satisfaction reinforces the success of the talk in bridging classroom learning with real-world construction planning practices.

Reliability Analysis

Table 3: Reliability Analysis

	Reliability Statistics	
Items	Cronbach's Alpha	N of Items
Q1–Q9	0.965	9

Table 3 presents the reliability analysis for the 9 Likert-scale items (Q1 to Q9) that measured participants' awareness and understanding of various development planning components (e.g., architectural, C&S, infrastructure, M&E, and survey drawings). The result shows a Cronbach's Alpha value of 0.965, which indicates excellent internal consistency. In simple terms, this means that all the items in the questionnaire are closely related and consistently measure the same underlying concept students' awareness and understanding of development planning after the industrial talk. Since a Cronbach's Alpha value above 0.7 is generally considered acceptable, and values above 0.9 are regarded as excellent, this high score confirms that the survey items are reliable and suitable for further analysis. It also implies that the responses given by students were consistent and stable across the different aspects of the topic.

Comparative Analysis (Pre vs. Post)

Table 4: Paired Samples Statistics

Measure	Mean	N	Std. Deviation	Std. Error Mean
Before the talk (A3)	2.75	77	1.771	0.202
After the talk (A4)	8.35	77	1.109	0.126

Table 4 shows a clear improvement in participants' understanding of development planning. Before attending the industrial talk, the average self-rated understanding was 2.75 out of 10, indicating a low initial level of knowledge. After the talk, the average understanding increased dramatically to 8.35 out of 10, suggesting that the session had a significant educational impact on participants.

Table 5: Paired Samples Correlation

Variables Paired	N	Correlation	Sig.
Before vs After Talk	77	0.212	0.064

Table 5 indicates a weak positive correlation ($r = 0.212$) between the before and after scores, with a significance level of 0.064. This suggests a slight relationship between initial knowledge and improvement, but the result is not statistically significant ($p > 0.05$). In other words, understanding gained from the talk wasn't strongly linked to how much the participants already knew — meaning the talk benefitted all participants regardless of their prior knowledge level.

Table 6: Paired Samples Test

Mean Difference	Std. Deviation	Std. Error Mean	t	df	Sig. (2-tailed)
-5.597	1.88	0.214	-26.131	76	0

Table 6 provides the most critical statistical result. The mean difference between before and after understanding is -5.597, showing a large increase. The t-test result is highly significant ($t = -26.131$, $p < 0.001$), confirming that the difference is not due to chance. This means the industrial talk was highly effective in enhancing participants' knowledge of development planning. The large t-value and very low p-value (0.000) demonstrate strong evidence of improvement in understanding as a direct result of attending the session.

The comparative analysis shows a remarkable and statistically significant improvement in participants' understanding of development planning topics after attending the industrial talk. On average, students moved from a score of 2.75 to 8.35, indicating the session successfully filled key knowledge gaps. This significant learning gain is supported by a paired samples t-test, which confirms that the improvement is not only observable but statistically valid. These results demonstrate the value of industry-academic engagement and highlight the talk's effectiveness as a learning platform.

Group Differences

Table 7: Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Q1	Equal variances assumed	3.318	0.073	0.275	75	0.784	0.045	0.165	-0.284	0.375
	Equal variances not assumed			0.266	59.933	0.791	0.045	0.171	-0.296	0.387
Q2	Equal variances assumed	2.406	0.125	0.000	75	1.000	0.000	0.154	-0.306	0.306
	Equal variances not assumed			0.000	57.490	1.000	0.000	0.160	-0.320	0.320
Q3	Equal variances assumed	3.009	0.087	0.102	75	0.919	0.015	0.149	-0.282	0.312
	Equal variances not assumed			0.097	56.212	0.923	0.015	0.156	-0.297	0.327
Q4	Equal variances assumed	3.923	0.051	1.051	75	0.297	0.174	0.166	-0.156	0.504

	Equal variances not assumed			1.024	61.669	0.310	0.174	0.170	-0.166	0.514
Q5	Equal variances assumed	3.450	0.067	0.952	75	0.344	0.144	0.151	-0.157	0.445
	Equal variances not assumed			0.921	59.453	0.361	0.144	0.156	-0.169	0.456
Q6	Equal variances assumed	7.243	0.009	-0.271	75	0.787	-0.045	0.168	-0.380	0.289
	Equal variances not assumed			-0.254	50.605	0.800	-0.045	0.179	-0.404	0.314
Q7	Equal variances assumed	2.708	0.104	-0.713	75	0.478	-0.114	0.159	-0.431	0.204
	Equal variances not assumed			-0.673	51.984	0.504	-0.114	0.169	-0.452	0.225
Q8	Equal variances assumed	0.866	0.355	1.214	75	0.228	0.212	0.175	-0.136	0.560
	Equal variances not assumed			1.189	63.189	0.239	0.212	0.178	-0.144	0.569
Q9	Equal variances assumed	4.564	0.036	0.250	75	0.803	0.038	0.152	-0.264	0.340
	Equal variances not assumed			0.238	55.022	0.813	0.038	0.159	-0.281	0.356

Table 7 presents the results of independent samples t-tests conducted to examine whether there were any significant differences between male and female students in terms of their awareness and understanding of development planning drawings (Q1–Q9) after attending the industrial talk. The analysis compared mean scores for each item between the two gender groups. Overall, the results show that none of the differences were statistically significant, as all Sig. (2-tailed) values were greater than 0.05.

For instance, students' understanding of architectural drawings (Q2) showed no difference at all between genders ($p = 1.000$), while their awareness of civil and structural drawings (Q3), infrastructure drawings (Q4), and M&E drawings (Q6) also showed no significant variance, with p-values well above the 0.05 threshold. The closest to significance was Q4 ($p = 0.297$), but this still falls within the range indicating no meaningful difference. Even the confidence levels in interpreting development plans (Q8) were similar between male and female participants ($p = 0.228$), showing that both groups benefited equally from the talk. Furthermore, the Levene's Test for equality of variances mostly confirmed that the assumption of equal variances was valid for these comparisons, meaning the statistical test results can be interpreted with confidence. Taken together, the findings suggest that

the industrial talk was equally effective for all participants regardless of gender, and that both male and female students demonstrated comparable levels of understanding and satisfaction after attending the session.

CONCLUSION

This study set out to evaluate the impact of an industrial talk designed to enhance students' understanding of the development planning process within the construction industry. The talk focused on key technical components, including architectural, civil and structural, infrastructure, survey, and mechanical and electrical (M&E) drawings, which are fundamental to real-world construction project delivery. Findings from the descriptive statistics showed that participants initially had a low level of understanding prior to the talk (mean score = 2.75), but demonstrated a significant increase in comprehension post-session (mean score = 8.35). This substantial improvement was further confirmed through a paired samples t-test, which yielded a statistically significant result ($p < 0.001$), highlighting the effectiveness of the talk in closing the knowledge gap. The reliability analysis yielded a Cronbach's Alpha of 0.965 for the Likert-scale items, indicating excellent internal consistency and validating the quality of the measurement instrument. Moreover, group comparison tests revealed no significant differences in awareness and understanding between male and female students, suggesting the session was equally beneficial across genders. Similarly, attendance group differences (student, lecturer, speaker) did not produce significant variances in understanding levels, reinforcing the broad relevance and accessibility of the talk's content. In conclusion, the industrial talk served its intended purpose as an effective educational intervention, providing participants with meaningful exposure to industry practices and technical documentation essential to construction project planning. The positive results not only support the integration of such initiatives into the engineering curriculum but also underscore the value of academic–industry collaboration in developing well-rounded, industry-ready graduates.

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