



IPad-Supported Active Learning and Student Engagement in Higher Education

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Abstract

Digital technology has become an important component of present education, changing traditional teaching practices and reforming learning environments. Among these technologies, mobile devices, specifically tablets, have significant importance in teaching. Since its introduction in 2010, Apple's iPad has obtained considerable attention as a cost-effective, portable, and versatile educational tool capable of supporting diverse instructional approaches across all levels of education. It included a wide range of educational applications, and software capabilities enable interactive, student learning experiences. As a result, the iPad has been increasingly adopted to enhance engagement and support personalised learning. This growing integration of tablet technology raises important questions regarding its teaching effectiveness, implementation challenges, and overall impact on teaching and learning outcomes. This paper examines the implementation of technology in the teaching process (TEL) to enhance and facilitate students' learning, understanding development and inspire students to participate in module content. iPads were used in lectures and tutorials for two modules, Advanced Engineering Mathematics and Modelling (Level 5) and Thermofluids and Dynamics (Level 4), to deliver content, demonstrate problem-solving, and support explanations using animations, images, and short video clips. Data were collected through a purpose-designed questionnaire completed by 135 Level 4 and 5 engineering students at London South Bank University (LSBU). The findings show that iPad integration significantly improved student engagement, understanding of complex topics, and interaction with instructors. Students reported clearer explanations, easier interpretation of graphs and tables, and improved concentration throughout longer lectures. Overall, the results demonstrate that iPads effectively support learning and create a more interactive and engaging engineering teaching environment.

Keywords: Active learning, Digital technology in education, Engineering education, Interactive teaching, Technology-enhanced learning

1. Introduction

A significant issue confronting higher education institutions worldwide is the ongoing reduction in student retention and completion rates. This challenge not only affects learners who withdraw or must repeat assessments, but also undermines institutional reputation, enrolment levels, and long-term financial stability. In response, universities are required to adopt effective and innovative strategies to deliver high-quality education that aligns with increasing expectations for engaging and meaningful learning experiences. While traditional approaches—such as lectures, presentation slides, printed materials, and tutorials—remain widely used, emerging technologies like iPads present new opportunities to enrich teaching and learning. Student motivation is a critical factor in academic success, influencing behaviour, engagement, and overall well-being. Learners who are motivated are more likely to achieve their academic goals, making it essential for educators to capture and sustain student interest. Consequently, integrating modern technological tools into teaching practices is vital for ensuring the continued relevance of higher education in a digitally driven world (Pai & Borba, 2012).

In parallel, the importance of digital technology in education has increased considerably in recent years, with growing evidence highlighting its ability to enhance learning outcomes (Hillmayr et al. 2020). Earlier studies have demonstrated the diverse applications and benefits of digital tools in educational contexts (Chiu and Reynolds, 2012 & Ma et al., 2014). However, the key concern is not simply the presence of technology, but the effectiveness of its implementation within pedagogical practices (Afifa and Astuti, 2024).

Since its launch in 2010, the iPad has gained considerable attention as a resource for supporting education. In my own teaching experience, I began incorporating the iPad in 2017 and have found it to be a highly effective tool for connecting face-to-face and virtual learning environments. The availability of numerous educational applications through the App Store further enhances its practicality. Importantly, it has enabled me to meet curriculum requirements while offering more interactive and engaging learning experiences. Empirical studies suggest that the use of iPads in teaching can foster environments that promote student engagement and improve understanding (Aydinli & Elaziz, 2010; Banister, 2010). Several higher education institutions have explored this approach. For instance, Abilene Christian University incorporated iPads into multiple courses, while Oklahoma State University implemented a pilot programme to evaluate their impact on learning. The results indicated that iPads can enhance student engagement and contribute positively to the academic environment (Nilsson et al., 2010).

Further evidence is provided by a qualitative case study conducted by Rob Miles (2019), which reported improvements in collaborative learning and classroom management through the use of iPads. As education continues to adapt to rapid technological developments, there is a growing need for innovative pedagogical approaches that equip students with the skills required in an increasingly interconnected and technology-oriented world (Poling, 2013). Digital tools not only support collaboration but also enable learners to develop a deeper understanding of complex concepts that may be difficult to grasp independently. At London South Bank University (LSBU, 2023), discussions with Alessio Corso revealed how iPads have been effectively integrated into the Engineering Design and Practice module. Students are able to present and refine their work without changing location, using digital pens to make real-time edits. This enables immediate incorporation of feedback, saving of revisions, and uploading of work to virtual learning platforms. Additionally, the ability to view peers' work supports comparison, reflection, and peer-assisted learning (Corso, 2023).

Digital technologies fulfil a wide range of roles within educational environments (Ma et al. 2014), and several theoretical frameworks have been developed to explain these functions, including the SAMR model (Hamilton et al. 2016) and the instrumental orchestration framework (Trouche, 2004). These approaches provide valuable perspectives on how technology shapes teaching and learning processes.

A key emphasis in technology integration is the adoption of student-centred practices that encourage active engagement with learning materials. Researchers such as (Drijvers et al. 2013) have examined and categorised these approaches, while (Blömeke et al. 2006) describe them as “innovative learning-supportive,” characterised by interactive, content-driven, and activity-based use of technology. The integration of digital tools to support active learning is widely associated with improved educational outcomes, particularly when technology is used in transformative ways rather than simply replicating traditional methods in digital formats (Hamilton et al. 2016).

In addition to supporting learning processes, digital technology can significantly influence student motivation. When used effectively, it can stimulate curiosity, increase interest, and enhance emotional engagement. Stoilescu (2015) highlights the motivational benefits of digital tools, while Bray and Tangney (2017) emphasise their role in shaping attitudes such as self-efficacy. Evidence suggests that digital technology can have a meaningful impact on student motivation (Afifa and Astuti 2024), which in turn affects learning behaviours and academic performance (Pekrun et al. 2017). However, although motivation is an important consideration, it should not be the sole focus of technology integration. Much of the existing research continues to prioritise measures that are not in-depth, such as the types of devices used, access to technology (Lin et al. 2012), frequency of use, and patterns of student interaction (Lei and Zhao 2007). Consequently, the deeper effects of technology integration on teaching practices and learning outcomes remain insufficiently understood.

This study seeks to address the above limitation by examining how the integration of digital technology in teaching can improve the instructional process, encourage active engagement with course content, enhance student learning, and strengthen conceptual understanding.

2. Research Method and Assessment

The project was planned in advance across Semesters 1 and 2 of the 2023–2024 academic year. It involved collaboration with 135 undergraduate students to examine their experiences of incorporating iPads into teaching. In this context, the iPad was used by the relevant teaching team to deliver lectures and tutorials for Advanced Engineering Mathematics and Modelling (Level 5, Year 2) as well as Thermofluids and Dynamics (Level 4, Year 1). The teaching team has relevant teaching experience that matches the background of the two modules contained in this research. The method also incorporated animations, brief video segments, and images on the iPad to improve the delivery of course content. Particular focus was placed on topics involving figures and tables, for which short videos were prepared in advance to demonstrate how these visual elements could be used to support and enhance students’ understanding.

Throughout a 20-week teaching period, lectures and tutorials were supported through dedicated iPad applications. All necessary teaching resources were preloaded onto the device, which was connected to a lecture theatre projector for display. Additionally, selected applications were utilised to further facilitate and enrich the delivery of both lectures and tutorial sessions.

3. Data Collection Process, Instrumentation and Analysis

A tailored questionnaire was developed for this study to gather data from students within the School of Engineering at LSBU. The evaluation aimed to assess the impact of incorporating

iPad-based technology into the teaching process, particularly in relation to students' learning, their understanding beyond the classroom, and their level of engagement during lectures. Additionally, the questionnaire included items designed to examine how the proposed teaching approach influenced instructional practices and how it could assist the teaching team in developing more effective teaching strategies. Three weeks prior to the end of the second semester, the customised questionnaires were distributed to the participating students. Responses were collected anonymously, with no requirement for students to include their names. Participants were also informed about the main objective of the study and how the findings would contribute to improving both teaching practices and the overall learning experience.

The data were collected in a structured manner, and participants' responses were carefully grouped into five categories: poor, fair, no opinion, good, and excellent. The results were then presented as percentages of the total responses. Expressing the findings in percentage form makes them easier to understand and interpret, while also enabling comparisons across different groups or survey questions, regardless of variations in sample size. In addition, converting raw data into percentages standardises the results on a common scale (0–100), enhancing the consistency and professionalism of the analysis and reporting. This method provided a clearer evaluation of overall satisfaction and effectiveness based on participants' feedback. To address the research aims, all collected data were subsequently entered into Microsoft Excel, which served as the main analytical tool for the study. Using Excel, the data were organised, processed, and analysed to identify trends, calculate percentages, and generate meaningful insights. The software also supported the clear and structured presentation of the final results, ensuring accurate interpretation and reporting of the study's findings.

Table 1 summarises the percentage responses gathered from the participants. The percentage figure was obtained by dividing the total number of responses of each category for a specific question by the total number of participants

$$\text{Response (\%)} = \frac{\text{total responses for a specific question}}{\text{total number of the participants}}$$

Table 1: Students' Responses about Using an iPad in the Teaching Process

No	Questions	Poor	Fair	No Opinion	Good	Excellent
		(%)	(%)	(%)	(%)	(%)
Group 1	1 <i>I appreciate integrating the iPad into the teaching process, interactive teaching</i>	0	2	10	29	59
	2 <i>Using the iPad in the teaching process is a fun and engaging environment</i>	0	2	10	34	54
	3 <i>Using the iPad in the teaching process encourages you to develop your ideas and think outside the box</i>	1	3	25	34	37
	4 <i>Integrating the iPad into the teaching process makes hard topics easy to learn and saves reading time</i>	1	3	12	34	50

	5	<i>Applying this tool to other modules will help you to maximise the learning outcomes</i>	1	1	13	35	50
	6	<i>Integrating the iPad into the teaching process motivates you to do more reading and work through the tutorial</i>	1	2	24	33	40
	7	<i>Using the iPad in the teaching process benefits your learning and provides more structured explanations</i>	0	2	13	33	52
Group 2	8	<i>Integrating the iPad into the teaching process helps you to stand for a longer lecture</i>	1	2	19	36	42
	9	<i>You are more confident in applying the knowledge you learned, including figures and tables, to solve a related question.</i>	0	2	15	39	44
	10	<i>You are exposed to a better way of reading figures and tables, and you are more confident in applying the learned knowledge that includes using tables and figures to solve a related question.</i>	1	2	24	27	46
	11	<i>Encourage you to attend the class, learn, and get more information, as well as enjoy the lecture</i>	1	2	19	39	39
	12	<i>You feel proud when you tell your friends from other universities that your lecturers are integrating technology into their teaching.</i>	1	1	37	30	31
	13	<i>Capturing and recording the interactive lecture (including iPad) and uploading it to Moodle site will benefit your learning and understanding.</i>	0	1	15	30	54

4. Results and Discussions

The questionnaire items were organised into two groups, with each group designed to address a specific research aim. Group one, with 7 questions focused on students' learning and strengthening conceptual understanding, and group two, with 6 questions, examined the teaching process and encouraged students' active engagement, see Table 1. Moreover, for a better understanding of the results, Table 1 has been converted to Positive vs Neutral vs Negative, as follows: Positive = Good + Excellent; Neutral = No Opinion; and Negative = Poor + Fair; see Table 2.

To address the research objective, the data collected for Group 1 are presented in Figure 1 to illustrate the impact of integrating technology into the teaching process on students' learning and their conceptual understanding. Figure 1 displays a 100% stacked bar chart representing the distribution of negative, neutral, and positive responses across all Group 1 questions. The results clearly show that most responses fall within the positive category, particularly for

Questions 1, 2, 4, 5, and 7, where positive responses exceed 85%. In contrast, Question 3 exhibits a relatively higher proportion of neutral responses compared to the other questions in the group, suggesting more diverse student perceptions.

Responses for Group 2, which examine the teaching process and its role in encouraging students' active engagement, are presented in Figure 2. The results indicate that the majority of responses fall within the positive category, particularly for Questions 9 and 13, where positive responses exceed 80%. In contrast, Questions 8, 10, 11, and 12 show slightly lower levels of positivity, with values below 80%. Furthermore, Questions 10 and 12 exhibit relatively higher neutral response percentages compared to the other questions in the group, suggesting a greater variation in student perceptions.

Table 2: Students' Responses via Positive vs Neutral vs Negative.

	No	Questions	Negative (%)	Neutral (%)	Positive (%)
Group 1	1	<i>I appreciate integrating the iPad into the teaching process-interactive teaching</i>	2	10	88
	2	<i>Using the iPad in the teaching process is a fun and engaging environment</i>	2	10	88
	3	<i>Using the iPad in the teaching process encourages you to develop your ideas and think outside the box</i>	4	25	71
	4	<i>Integrating the iPad into the teaching process makes hard topics easy to learn and saves reading time</i>	4	12	84
	5	<i>Apply this tool to other modules will help you to maximise the learning outcomes</i>	2	13	85
	6	<i>Integrating the iPad into the teaching process motivates you to do more reading and workout the tutorial</i>	3	24	73
	7	<i>Using the iPad in the teaching process benefits your learning and provides more structured explanations</i>	2	13	85
Group 2	8	<i>Integrating the iPad into the teaching process, help you to stand for a longer lecture</i>	3	19	78
	9	<i>You are more confident in applying the learned knowledge, including figures and tables, to solve a related question.</i>	2	15	83
	10	<i>You are exposed to a better way of how to read figures and tables, and you are more confident in applying the learned knowledge</i>	3	24	73

		<i>that includes using tables and figures to solve a related question.</i>			
11		<i>Encourage you to attend the class and learn and get more information as well as enjoy the lecture</i>	3	19	78
12		<i>You feel proud when you tell your friends from other universities that your lecturers are integrating technology into their teaching.</i>	2	37	61
13		<i>Capturing and recording the interactive lecture (including iPad) and uploading it to Moodle site will benefit your learning and understanding.</i>	1	15	84

Fig. 1. The participant responses for Group 1 focused on students' learning and strengthening conceptual understanding.

Note. The horizontal axis represents the (%) responses, while the vertical axis represents the questions submitted to the participants

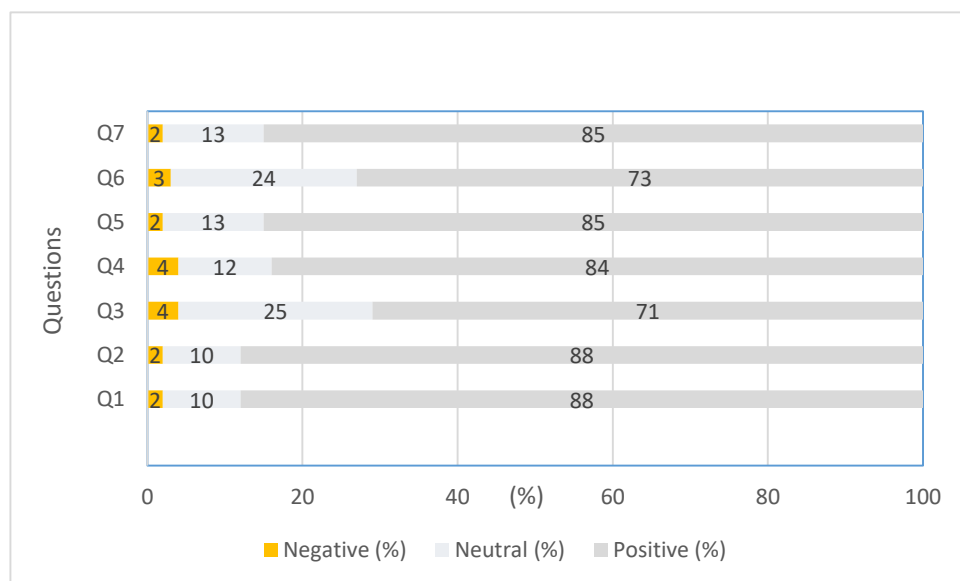
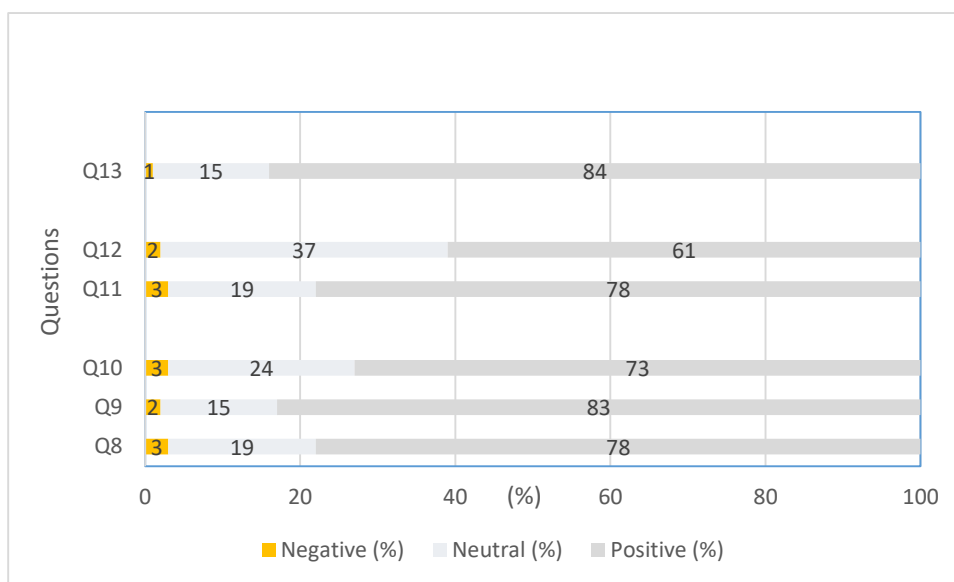


Fig. 2. The participant responses for Group 2 examined the teaching process and encouraged students' active engagement.

Note. The horizontal axis represents the (%) responses, while the vertical axis represents the questions submitted to the participants



The findings of this study demonstrate that the integration of iPads into the teaching process has a predominantly positive impact on students' learning experience, engagement, and conceptual understanding. Across both Group 1 and Group 2, the majority of responses were concentrated in the positive category, indicating a high level of student acceptance and perceived usefulness of the technology-enhanced learning environment. For Group 1, which focused on learning and conceptual understanding, the results revealed consistently high levels of positive responses, particularly in relation to interactive teaching, engagement, and structured explanations. This suggests that the use of iPads supports clearer content delivery and enhances students' ability to grasp complex concepts. The high positivity observed in Questions 1, 2, 4, 5, and 7 reinforces the idea that technology can make learning more accessible, interactive, and efficient. These findings align with existing literature that highlights the role of digital tools in improving student comprehension and engagement. However, relatively higher neutral responses in Questions 3 and 6 indicate that the impact of iPads on creativity and independent learning may not be uniform across all students. This variation could be attributed to differences in individual learning styles, levels of digital familiarity, or the way the technology is implemented within the classroom. Therefore, while iPads enhance structured learning, their role in fostering higher-order thinking skills may require more targeted instructional strategies.

In Group 2, which examined teaching effectiveness and student engagement, the results also showed strong positive trends, particularly in Questions 9 and 13. This suggests that students feel more confident in applying their knowledge and benefit significantly from recorded lectures and supplementary digital materials. The ability to revisit recorded content appears to play a crucial role in reinforcing learning and improving understanding. On the other hand, Questions 10 and 12 exhibited higher neutral responses, indicating more diverse student perceptions. In particular, the lower positivity in Question 12 suggests that while students

recognise the academic benefits of technology integration, it may not strongly influence their personal or social attitudes. This highlights an important distinction between functional educational benefits and emotional engagement. Furthermore, the findings presented in this paper indicate that integrating iPads into engineering education positively influences student learning. The use of iPads enhances interaction between instructors and students, while also increasing student engagement and sustaining their attention throughout the class. Incorporating iPads fosters an interactive learning environment, encouraging active student participation and supporting the development of educational skills. Integrating iPads into classroom instruction facilitates the shift from a traditional teacher-centered approach to a more student-focused model, actively involving students in the learning process. It also enables instructors to reach a larger number of students and engage them more effectively. Additionally, incorporating iPads benefits lecturers by helping maintain student attention for longer periods and presenting complex topics in a more engaging way. It also provides students with greater access to reading materials and an increased number of tutorial questions, helping them maximise learning outcomes and understand the connections between tutorials and other aspects of the course.

Overall, the findings suggest that integrating iPads into teaching practices enhances student learning outcomes, engagement, and confidence. However, the variability observed in certain areas indicates that the effectiveness of such technology depends not only on its availability but also on how it is pedagogically implemented. Future research could explore strategies to better leverage technology for promoting creativity, critical thinking, and deeper student involvement.

5. Limitation

This study has several limitations. First, four members of staff were involved, and regular meetings were held to agree on a unified approach that all teaching staff would implement during lectures. The relevant module leader had sufficient experience in using digital teaching aids, and basic training was provided to the rest of the teaching team. Teaching materials were prepared in advance by the module leader and uploaded onto the iPads used in teaching to ensure a consistent and uniform delivery style among all participating staff. Students' attendance was not fully recorded, and some participants were observed missing certain lectures and tutorial sessions. However, the recorded attendance rate for all sessions exceeded 75%.

6. Future Work

To enhance the scientific contribution of the current research, the authors plan to provide students with the opportunity to actively participate in designing their own learning processes and to examine how this involvement affects their performance and engagement. Furthermore, the role of Artificial Intelligence (AI) in supporting student learning and delivering real-time feedback will be explored. Investigating the combined impact of student-centred design and AI-driven instruction is expected to contribute to developing more innovative and effective teaching models for future education.

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