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## Navigating the Terrain:

*Emerging Frontiers in Learning Spaces, Pedagogies, and Technologies*

# Technology-enhanced Learning in Information Systems Education: Innovation and Post-Pandemic Perspectives

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The COVID-19 pandemic significantly disrupted higher education but also accelerated the adoption of technology-enhanced learning and innovative teaching practices to promote student-centred learning in higher education. Nevertheless, traditional, didactic, teacher-centred approaches in university teaching are still prevalent. Specifically, Information Systems (IS) and other technology-related disciplines are expected to adopt technological innovations more readily. Moving beyond the pandemic, there is a need to reassess the current state of Information Systems education and explore technologies that have been effectively deployed to identify best practices. This study involves reviewing thirteen subjects as part of a Master of Information Systems course offered by one of Australia's leading universities. It aims to identify innovative technology-enhanced practices that promote student-centred learning, assess their adoption levels and impact, and reflect on any difficulties hindering their adoption. We identified three innovative technology applications that effectively facilitate student-centred learning: web-based interactive content, online collaborative workspaces, and simulation games. However, we found that these technologies are primarily adopted for tutorials. Nevertheless, the use of technology has led to a notable shift from the traditional teaching approach to a flipped classroom model. The findings highlight the need for university-wide support, policy changes, and investments in time, resources, and staff training to enhance student-centred learning through the use of technology.

*Keywords:* Technology-enhanced Learning, Student-centred Learning, TPACK, Information Systems

## Introduction

Learning is the process through which students acquire new knowledge and skills. Recent research supports Thomas Shuell's assertion: "Without diminishing the important role of the teacher, it is crucial to remember that what the student does is actually more important in determining what is learned than what the teacher does" (Shuell, 1986, p. 429). Consequently, higher education promotes a student-centred learning approach in designing, implementing, and reviewing subjects. In this approach, students actively participate in their learning, with the lecturer or tutor acting as a facilitator (Biggs, 2022). Effective learning occurs when students participate in discussions, interactions, and problem-solving tasks, which challenge their understanding and prompt them to actively apply concepts and skills. This contrasts sharply with passive learning, where students primarily listen to lectures or receive solutions from tutors.

Nevertheless, traditional, didactic, teacher-centred lectures or tutorials remain the primary mode of teaching at many universities. Large class sizes, rigid teaching spaces, and insufficient time and skills are highlighted as significant barriers to implementing student-centred learning (Altena, 2017). However, rapid advancements in teaching and learning technologies, such as Kahoot, H5P, FeedbackFruits, and Padlet, are transforming the classroom (Ahmed et al., 2023). While it may be impractical for a lecturer or tutor to personally engage with every student in discussion or interaction in a large class, these technologies can facilitate interactions, engage students in various learning activities, and provide immediate feedback. They offer a promising solution to empower educators to create more student-centred classrooms.

In response to the COVID-19 pandemic in 2020 and 2021, higher education institutions worldwide swiftly adjusted their curricula and teaching methods, transitioning to remote learning, often referred to as emergency remote teaching. This rapid transition necessitated the integration of diverse digital tools and technologies, including learning management systems, online conferencing platforms, and collaboration tools (Koh & Daniel, 2022). Academics also implemented various technology-enhanced learning initiatives across different subjects to improve students' remote learning experiences. Despite the significant disruptions to higher education, the pandemic accelerated the adoption of teaching and learning technologies, leading to sustained changes within universities (Broadbent et al., 2023). However, there is a lack of systematic studies investigating the extent and types of technology-enhanced practices that promote student-centred learning at universities post-pandemic (Walker & Voce, 2023). In particular, there are no studies examining the Information Systems education.

Therefore, this study poses the following research questions: (1) What are possible innovative technology-enhanced practices that promote student-centred learning in Information Systems education post-pandemic? (2) What are the adoption levels and impact of these practices? (3) What are the key challenges affecting the adoption of innovative technology-enhanced practices? To address these research questions, we selected a Master of Information Systems course offered by a leading Australian university and reviewed 13 Information Systems subjects within the course. Based on the review, we identified three innovative technology-enhanced practices, but their adoption level within a subject and across subjects is relatively low. Our study also highlighted how they changed students' behaviour. As part of the reflection, we highlighted three major adoption challenges. This study is a valuable initial step toward assisting educators in selecting appropriate technologies and achieving a more widespread adoption of technology-enhanced learning.

## Background

### Benefits of Technology-enhanced Learning

Technology-enhanced learning generally refers to the use of technology to improve the learning process (TEQSA, 2019). At universities, integrating technology into teaching and learning is common, with a wide array of technologies adopted for educational purposes. However, not all uses of technology in teaching and learning enhance student-centred learning. The revised Higher Education Funding Council for England strategy for e-learning identified three levels of benefits of technology-enhanced learning (Kirkwood & Price, 2014). The first two levels of benefits are the easiest to achieve and are commonly realized by most universities by using technology solutions like learning management systems (Kirkwood & Price, 2014). At these levels, technology is used to replicate and supplement existing teaching practices, such as offering recorded lectures to increase flexibility for students or enabling online submission of assignments for convenience. In contrast, the final level of benefits focuses on transforming students' learning experiences to become more student-centred. Despite the rapid advancement and development of technologies to support learning since the pandemic, there are multiple avenues for investigating the continuous adoption and use of such technologies post pandemic, how they transform teaching and learning, as well as adoption challenges.

### Technological Pedagogical Content Knowledge (TPACK)

The application of technology in teaching and learning alone is not sufficient to transform students' learning experiences into having a stronger student-centred focus. According to the TPACK model (Mishra & Koehler, 2006), effective technology-enhanced learning practices must incorporate three dimensions: (1) *Technological*: Understanding how to use technology, including its capabilities and functionality, (2) *Pedagogical*: Understanding teaching and learning principles, encompassing instructional strategies, assessment methods, and classroom management techniques, and (3) *Content*: Understanding the subject matter being taught, including key concepts, theories, and methodologies specific to a particular discipline. Therefore, transforming teaching and learning with technology involves creatively applying technology to implement effective pedagogical approaches, with a strong focus on student-centred learning to facilitate meaningful engagement

with the subject matter. While recent studies have explored technologies used in higher education (Ahmed et al., 2023), further research is needed to investigate how to effectively integrate technology into teaching practices to enhance student-centred learning outcomes in the post-pandemic era.

## Methodology

This study employed a qualitative research methodology and utilized the document analysis method to investigate the subjects within a Master of Information Systems (MIS) program at an Australian university. The document analysis method was chosen for its effectiveness in comprehensively reviewing a wide range of teaching materials and artifacts (Creswell & Creswell, 2022). We conducted an in-depth analysis of seven core subjects and six elective subjects, examining various resources within the learning management system, including lecture recordings, tutorial instructions, and end-of-subject reports prepared by subject coordinators. Guided by the TPACK framework, we applied content analysis to scrutinize the integration of technology into teaching practices for student-centred learning across specific subjects. This involves systematically coding and quantifying the content of documents to identify patterns. This process enabled us to draw insights into how technology supported teaching and learning within the MIS course.

## Findings

### Current Innovative Technology-enhanced Practices

Our study identified some innovative use of technology to enhance student-centred learning, summarized in Table 1. Specifically, out of the thirteen subjects reviewed, three innovative uses of technology were identified. These innovations included web-based interactive content, online collaborative workspaces, and simulation games. They were implemented during tutorials. Two distinct technologies, H5P and Miro.com, were used to foster a more student-centred approach. For example, H5P converted tutorial questions into interactive web content, engaging individual students and providing immediate feedback. In another subject focused on learning enterprise systems, students engaged with an online simulation game based on the SAP Enterprise Resource Planning system for experiential and game-based learning in tutorials. While the H5P and online simulation game initiatives began before the COVID-19 pandemic, shared canvases on Miro.com were adopted during the pandemic. This demonstrated that the pandemic created an opportunity to explore and integrate new online collaborative technologies, which significantly enhanced online synchronous learning. Its use has continued even after the pandemic.

**Table 1: Innovative Technology-enhanced Learning Teaching Practices**

| Subject | Technology | Teaching Pedagogy | Subject Content | When did it start? |
|---|---|---|---|---|
| IT Project and Change Management | h5p.org, Interactive HTML5 content embedded in Canvas | All tutorial questions were converted into interactive content using H5P, focusing primarily on scenario-based and problem-based learning. Tutors assumed the role of facilitators. This online interactive format enabled each student to submit their answers and receive immediate feedback. | Engineering requirements, stakeholder management, project scheduling, etc. | This initiative began before the COVID-19 pandemic and was further developed during the pandemic. |
| IS Strategy and Governance | Miro.com, a visual online workspace for team collaboration | All tutorial questions were developed as Miro workspaces, primarily for group activities. Miro workspaces facilitated online brainstorming ideas and solving problems. The learning approach focused on collaborative and problem-based learning. Each student could participate by posting ideas within the workspaces. | IT Value proposition, IT strategies, strategic planning, IT governance, governance design framework, etc. | This initiative began during the COVID-19 pandemic and has continued as a successful learning tool. |
| Enterprise Systems | ERPsim, an online business simulation game for SAP ERP and SAP S/4HANA | ERPsim is an online simulation game built on the SAP Enterprise Resource Planning (ERP) system. It was integrated into four tutorials to teach students about enterprise systems through game-based and experiential learning. Students formed teams and participated in a logistics sustainability simulation game, competing against others. | End-to-end business processes, ERP systems, supply chain management, business analytics, sustainability, etc. | This initiative began before the COVID-19 pandemic and was further developed during and after the pandemic. |

**Adoption Level and Impact of Innovative Technology-enhanced Practices**

Since only three innovative uses were identified out of thirteen subjects, the adoption level remained low across subjects. Furthermore, all three instances of innovation were deployed only in tutorials. However, another significant change observed was the shift of five subjects from traditional lectures to a flipped teaching model. This model involved using pre-recorded short videos for instructional content and reserving in-person lectures for interactive learning activities and discussions, facilitated by tools such as Kahoot or Poll Everywhere. The pandemic created an opportunity for academics to rethink their teaching and learning approaches, develop skills in creating videos, and experience the benefits of a flipped classroom. As a result, some academics chose to continue using this new approach after the pandemic. Additionally, the use of Zoom for student consultations became popular due to its flexibility and convenience, which increased student participation. Post-pandemic, synchronous live lectures were offered, enabling students to attend either in person or online. However, this flexibility led to significantly lower on-campus lecture attendance and made direct engagement with students during lectures more challenging. Consequently, doubts about the effectiveness of synchronous streaming grew, resulting in ongoing discussions about whether to discontinue it.

## Discussion and Conclusion

This study has demonstrated how innovative use of technology can successfully transform teaching approaches in IS education, facilitating student-centred learning. We have also explored the extent to which such practices are adopted and their impact within each subject and across the MIS course. Reflecting on the findings, however, there are several major challenges that hinder the integration of technology into existing teaching practices and its widespread adoption.

**(1) Class Constraints:** Transformative uses of technology were primarily observed in tutorials. This could be attributed to fewer constraints such as class sizes, teaching spaces, and time for student activities during tutorials (Altena, 2017). However, the size of lectures is typically large, which presents a challenge in adopting the flipped teaching model effectively. To incorporate more innovative practices into lectures, it is necessary to restructure large lectures into smaller classes and adopt a more interactive teaching approach.

**(2) Time and Resource Intensive:** Designing and developing learning materials with technology to facilitate technology-enhanced learning demands considerable time and resources. This presents a significant challenge for academics who must balance heavy research responsibilities with limited time and resources available for adopting innovative technologies for teaching activities. Furthermore, increasing the adoption level of technology-enabled teaching practices requires support from senior executives at different levels including department, school/faculty, and university, as well as policy changes and financial investment.

**(3) Technical and Pedagogical Training:** Our study indicates that using innovative technologies to support teaching requires educators to have sufficient technical proficiency. For example, to facilitate the ERPsim simulation game, tutors needed to undergo ERP instructor training. Significant technical and pedagogical training required to effectively teach with innovative technologies may inhibit widespread adoption.

Our study further indicates that although implementing technology-enhanced learning may require a substantial resource investment, the improvement in student learning experience and outcomes can be substantial. For example, the ERPsim simulation game was consistently highlighted as one of the subject's best aspects in student evaluations. However, the effectiveness of different teaching practices was primarily evaluated through students' overall satisfaction ratings and their comments in the end-of-subject surveys. Academics need to adopt more effective methods for evaluating student satisfaction and learning outcomes.

Our study offers modest contribution to research and practice. To the best of our knowledge, this is the first study in Australia to systematically investigate the types of technology-enhanced practices that promote student-centred learning in IS education post-pandemic, their adoption levels, impacts, and challenges. The

study enriches the existing literature and provides educators with a better understanding of the current state of technology-enhanced learning in this field and offers insights into innovative practices, their transformative power, impacts, and key adoption challenges. This enables educators to reassess their strategies, address existing challenges, and seize opportunities to integrate technology-enhanced practices more effectively. Finally, while the study focuses on IS education, the findings may also be valuable for academics in other related disciplines since the technology-enhanced practices identified can also be applied in other contexts.

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