Personalized Learning Through H5P and Scaffolding

Tanya Linden
lindent@unimelb.edu.au
School of Computing and Information Systems
Faculty of Engineering and Information Technology
The University of Melbourne
Melbourne, Victoria 3183, Australia

Celeste Tipple
c.tipple@latrobe.edu.au
School of Education
La Trobe University

Abstract

Students entering higher education come from diverse backgrounds, making it challenging for instructors to meet individual learning needs. One potential solution to address this challenge is to provide personalized learning paths that tailor to students' individual needs, learning styles, and self-regulated learning skills. This study examined the use of H5P technology for building scaffolding activities for postgraduate students in the Database Systems subject. Using LMS analytics and data from standardized end of semester surveys, this study concluded that providing personalized learning paths through scaffolding H5P activities has significant potential for improving learning outcomes for students, particularly for students with established self-regulated learning abilities.

Keywords: H5P, personalized learning pathways, scaffolding, self-regulated learning, Database Systems, Higher Education

Personalized Learning Through H5P and Scaffolding

Leave this line here to insert author names in the final format

1. INTRODUCTION

The contemporary higher education landscape is marked by increasing diversity in students' academic preparedness, cultural backgrounds, digital literacy, and study skills. An important implication of increased student diversity is the need to adopt pedagogical approaches and technological tools which create a flexible, inclusive and engaging learning environment with equitable access to learning opportunities (Mendoza & Venables, 2023).

Many institutions have shifted towards student-centered learning approaches which emphasize learner autonomy, personalized engagement, and differentiated support (O'Neill & McMahon, 2005). Within this context, blended learning, which involves the combination of face-to-face instruction online and components, has significant potential to support students with different learning styles and can be especially useful for self-regulated learners. Self-regulated learners understand their learning needs, seek help sources to meet these needs, and overcome obstacles that impede their learning (Zimmerman, 1990). Self-regulated learning skills are crucial in both online and blended learning environments because students are expected to manage their time and task completion by themselves, through own motivation and responsible behavior (Pintrich, 2000).

Instructors can provide support to self-regulated learners and foster their self-regulation skills by guiding them through the process of becoming more independent, strategic, and reflective. One of the pedagogical approaches used to foster self-regulation is scaffolding. The concept of scaffolding in education was introduced by Wood et al. (1976) who illustrated how "an expert" (i.e. a more knowledgeable educator) could support a novice during a problem-solving process. Scaffolding aims to gradually decrease the amount of support provided to learners until they can solve the problem by themselves (Van Der Stuyf, 2002). This process of gradually reducing instructional support helps learners build confidence, improve their learning skills, and master how to manage their own learning (Verenikina, 2008), cultivating the capacity for life-long learning. Therefore, helping students to develop and strengthen their self-regulated learning skills by implementing scaffolding in a pedagogically robust manner is important at every level of education.

Scaffolding should be applied within student-centered activities to ensure that the teaching is not returning to a teacher-centered approach, where instruction flows predominantly in one direction – from educator to learner (Verenikina, 2008). Scaffolding is often interpreted as tools provided by instructors to students to support their learning, however, this interpretation is overlooking the important aspect of scaffolding, i.e. gradual knowledge construction while passing the initiative onto the learner (Jacobs, 2001).

Digital technology provides a range of tools which educators can utilize to build scaffolds for learners (Yelland & Masters, 2007). One of such tools is H5P – a free, open-source tool that offers a range of activity types and can be integrated into learning management systems (LMS). H5P offers a range of digital activity types which can be adopted to build a learning path by offering a series of tasks with gradually increased difficulty while reducing provided support for building a solution. Students can follow the offered learning path, or if they find it too slow for their abilities, they can skip easier tasks and jump into more difficult ones. To keep scaffolding effective, the important part of the process is for the educator to ensure that they provide formative feedback on every attempt.

Although H5P holds promise for enabling personalized learning pathways that are tailored to individual student needs (Jacob & Centofanti, 2024), there has been a limited number of studies examining the effectiveness of H5P in higher education. A recent systematic literature review identified only 30 studies focusing on H5P in higher education, highlighting both the potential of H5P and the current gap in the literature (Ping, 2025). Among the studies that have examined whether H5P can improve student learning in grades, some have reported positive effect (Clune et al., 2022; Sharmin et al., 2025), however, the findings are not consistent. For instance, Jacob and Centofanti (2024) and Unsworth and Posner (2022) found no significant difference in student performance outcomes when implementing H5P activities. Notably, despite the lack of measurable

improvement in academic performance, students in Jacob and Centofanti's (2024) study reported positive experiences and high levels of engagement when using H5P activities. However, these limited and mixed findings point to the need for further research to clarify whether H5P contributes to measurable improvements in student performance and learning outcomes in higher education contexts.

To address this research gap, this study aims to explore the use of personalized learning paths scaffolded through H5P technology and their effect on students learning, as measured by materials access analytics in the learning management system, subject grades and student feedback.

2. METHODS

Educational context

We tested the use of H5P activities in teaching a Database Systems subject at the postgraduate level of university studies. A series of weekly tasks was implemented as H5P activities which were based on the topic covered each week (10 weeks of the semester had at least two activities incorporated in the learning materials). Since the main goal of the tasks was learning support, they were not part of the formal assessment and it was students' decision whether to attempt all, some or none of the tasks.

Initial problem-solving tasks were illustrated through the H5P activity type "agamotto", a slide show that can be used to explain the step-by-step solution development from one slide to the next. So a simple case study was presented with the task to create a data model. The slides were developed to show a statement from the case study and how it should be modeled (Figure 1). Although this task is a one-way flow of instruction where students are passive learners, it is necessary to provide examples on how to split a case study into bits that can be easily modeled, as well as demonstrate the modeling notation.

The next step in the pathway would be another simple case study, but this time instead of the solution demonstration, an indirect approach was used. Students were given multiple-choice questions (MCQ) to help them make initial decisions on starting the solution (Figure 2). Then an open-ended question with the solution was implemented as a turn-around dialogue card (Figure 2 and Figure 3). The important aspect of these activities is for the educator to embed feedback into every option of each MCQ. This formative feedback ensures that students learn from selecting incorrect answers as it is often important to understand why a particular decision may be problematic (especially in the long run) during database modeling.

As another step of support withdrawal in scaffolding, we developed more open-ended modeling questions which were presented to students as dialogue cards with a question on one side and the answer on the other side for students to be able to check their answer immediately. As part of the learning process, students were encouraged to post questions on the Discussion forum to seek further clarification or to ask for help in person during consultation hours.

The self-regulation aspect manifested itself in students' decision-making, as they tailored their engagement in H5P activities based on their learning needs, choosing either to complete all scaffolding exercises, or to skip tasks with detailed steps and move to more difficult ones which provide little to no guidance.

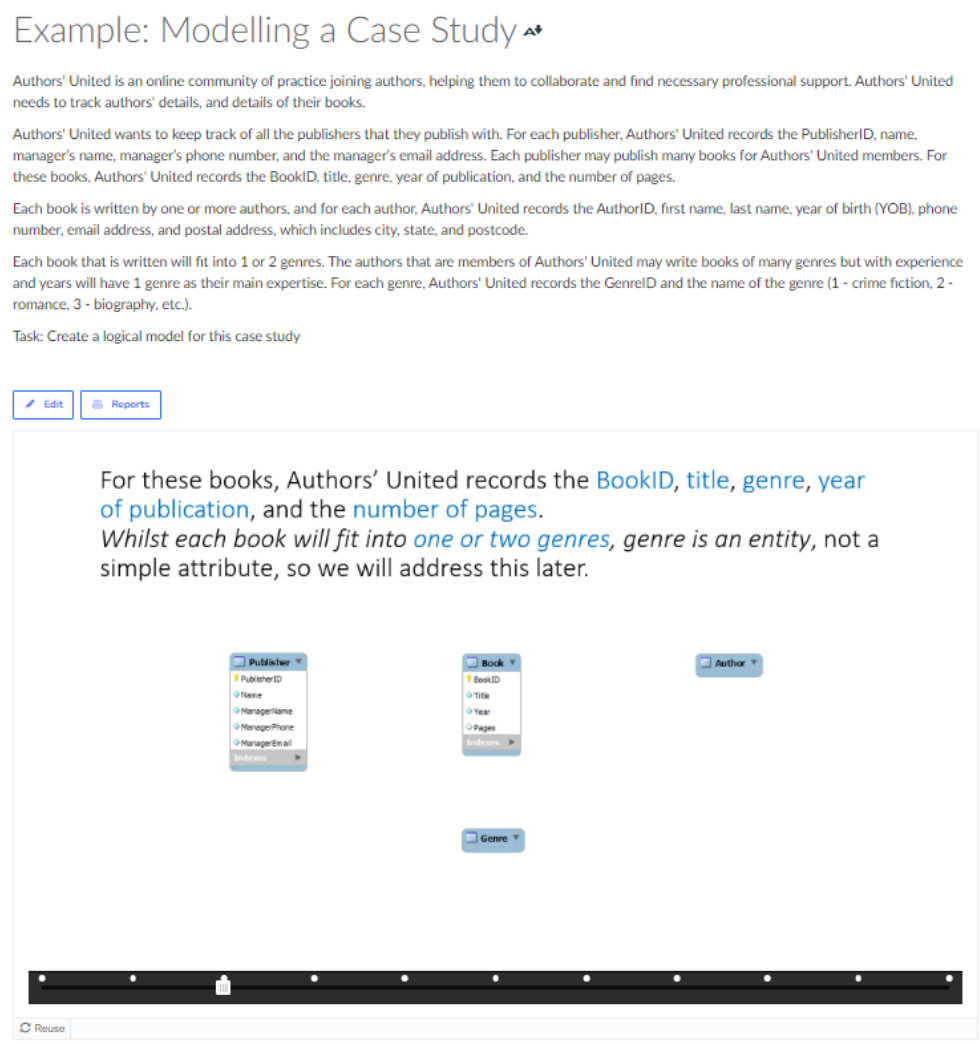

Figure 1: Step-by-step solution development using 11 slides. Currently selected is slide 3 corresponding to step 3 in the solution development.

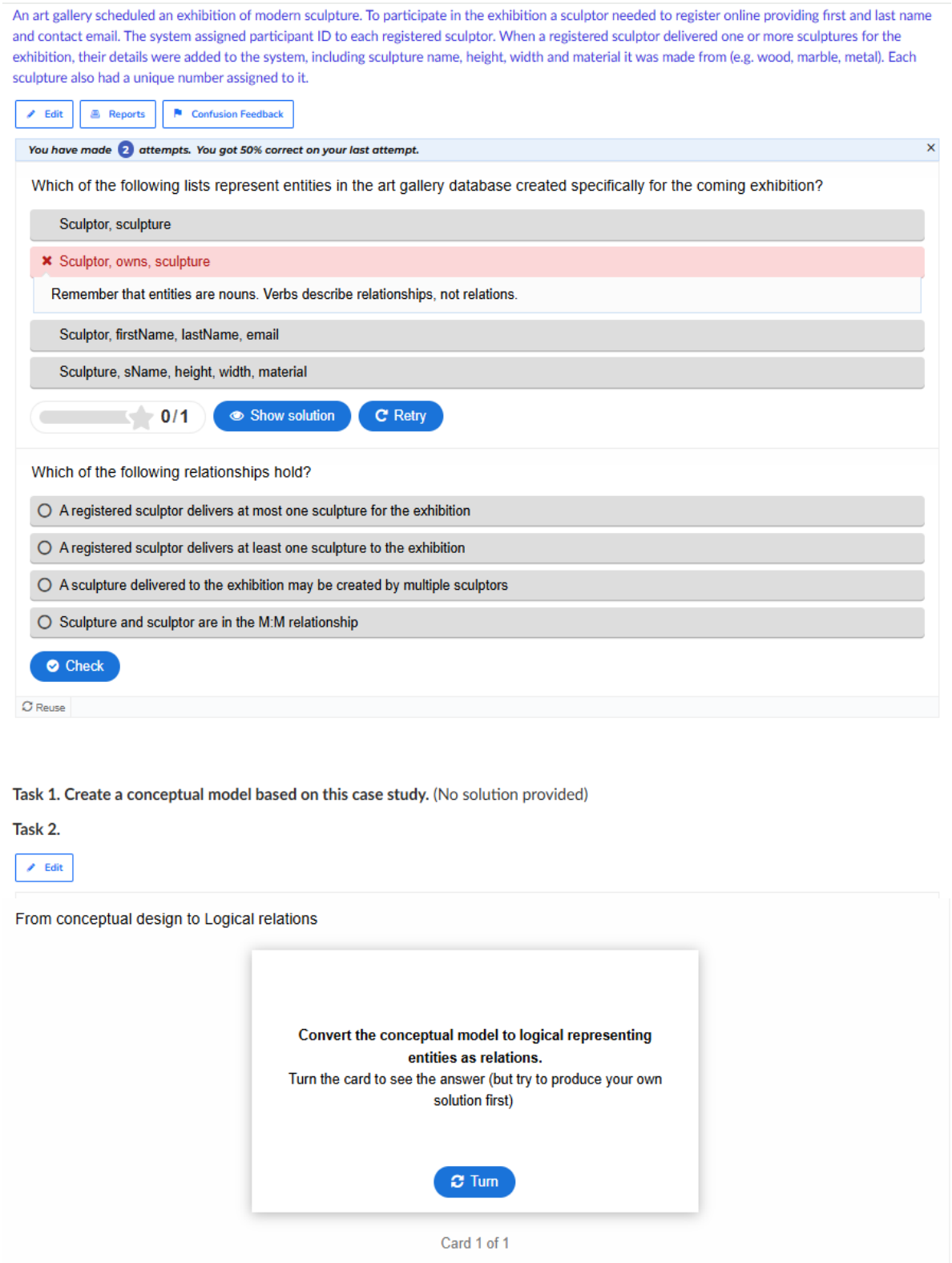

Figure 2: Practice task in week 2. The page shows a case study and questions based on that case study. Incorrect answer in MCQ1 results in feedback.

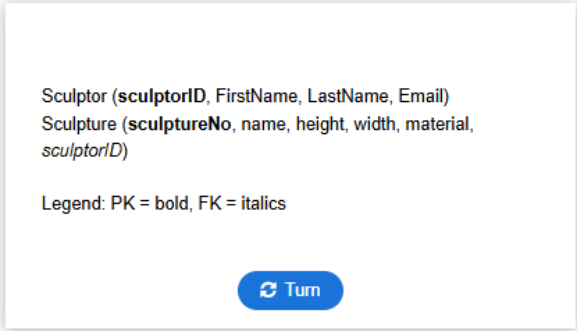

Figure 3: The other side of the dialogue card with the answer (for illustration of how the activity works)

Data Collection

The data was collected using learning management system (LMS) analytics. LMS analytics has been used effectively by educators to evaluate students engagement which in turn could guide educators on which aspects of student learning need attention (Wang, 2017). The students enrolled in the subject are postgraduate students, and are mostly international, i.e. English is their second language, which makes it challenging for some students to understand in-class instruction. Although the subject has no pre-requisites, students come from different backgrounds, i.e. some of them have never studied any IT subjects, whereas others had significant exposure to IT knowledge through previous studies or at work. Importantly, at postgraduate level, students are usually motivated and committed to their studies (Bergann et al., 2025). Table 1 summarizes enrollments over semesters showing one semester before H5) was introduced and semesters where students had access to H5P activities

Semester	**N**
Semester 2, 2022 (pre-H5P)	274
Semester 1, 2023 (H5P introduced)	355
Semester 2, 2023	216
Semester 1, 2024	374
Semester 2, 2024	224
Semester 1, 2025	348
Total	1,791

Table 1: Enrollment in Database Systems per semester

Study Design

This study employed a convergent, multi-source design using learning analytics and student survey data to examine the use and impact of H5P-scaffolded personalized learning paths on students' learning. Analysis of these two data sets is used to triangulate findings.

3. RESULTS

Student Feedback Survey

Student feedback provided at the end of the semester through the standardized university-wide survey was used to determine to what extent the introduction of H5P activities affected students' perceptions of intellectual engagement and usefulness of study materials. Data in Table 2 depicts an observable improvement in the subject evaluations by students starting from the semester when H5P activities were first introduced.

Two questions from the standardized university survey were treated as most important for this study. The question "The study resources and materials provided were helpful in my learning" was directly referring to study materials which included H5P activities. Importantly, there was no change to standard subject materials between semesters included in this study, except the introduction of H5P activities during Semester 1, 2023. However, after the introduction of the bulk of H5P activities (semester 1 2023), the subject coordinator continued analyzing students' needs based on assessment results and on questions on the Discussion forums and has been adding 2-3 activities every semester.

The other question "This subject was intellectually engaging and stimulating" is important because it reflects on students self-reported engagement with the subject materials overall. So improvement in the score reflects on the introduction of H5P materials. However, we acknowledge that there are many variables that affect students' scoring of the subjects (from students' background to individual instructors' performance).

Qualitative insights were also gathered from students' responses to the question "What aspects of this subject were the most helpful for your learning?" in the standardized university questionnaire. There were many comments over semesters but we are showcasing just a few. (Note, italics in student responses was added by the authors to emphasize reference to H5P material on LMS; comments are provided verbatim so some of them contain grammar mistakes).

Sample response from semester 1, 2023:

- "There were *plenty of exercises to test and reinforce our understanding* of topics taught."

Semester	Number of students who responded to the end of semester survey	"The study resources and materials provided were helpful in my learning"	"This subject was intellectually engaging and stimulating"
Semester 2, 2022 (pre-H5P)	63	4.13	4.06
Semester 1, 2023 (H5P introduced)	63	4.32	4.27
Semester 2, 2023	70	4.36	4.34
Semester 1, 2024	144	4.33	4.19
Semester 2, 2024	112	4.30	4.21
Semester 1, 2025	156	4.35	4.31

Table 2: Student evaluation of the subject (out of 5) in the standardized end of semester survey

Sample responses from semester 2, 2024:

- "Exercises presented alongside the content, both in lecture, tutorials and *online modules*."
- "The *"check your knowledge" part in the module* helps me a lot to grasp the focus of the class." – Note, multiple H5P activities were titled "Check your knowledge"

Sample responses from semester 1, 2025:

- "The *additional practices* provided by the lecturer helped to reinforce concepts"
- "The practice exercises provided during tutorials and *additional learning materials* in LMS"

Engagement in H5P Activities and Student Performance

Of the 348 students enrolled in the subject in semester 1 of 2025, the average percentage of completed H5P engagement activities across the semester was 25.02% (SD = 32.28%). Notably, 122 students (35.1%) did not engage with H5P activities at all during the semester. The average final exam score was 31.59 (SD = 7.82) out of a possible 50 marks. Average overall subject grades were 70.29% (SD = 11.98%).

Overall Subject Grade Prediction

A simple linear regression was conducted to evaluate whether engagement in H5P activities predicted students' overall subject grades from the subject data for Semester 1, 2025. The results indicated that H5P engagement significantly predicted overall grades, $F(1, 344) = 12.88$, $p < .001$, $R^2 = .036$, with engagement explaining 3.6% of the variance in overall subject grades. The unstandardized regression coefficient showed that for each additional H5P activity completed, students' overall subject grade increased by approximately 2 percentage points ($B = 0.198$, $SE = 0.055$, $t = 3.589$, $p < .001$).

Final Exam Prediction

A separate simple linear regression was conducted to evaluate whether engagement in H5P activities predicted students' final exam marks from the subject data for Semester 1, 2025. Results demonstrated that H5P engagement was a significant predictor of final exam marks, $F(1, 344) = 11.51$, $p < .001$, $R^2 = .032$, accounting for 3.2% of the variance in exam performance. The unstandardized regression coefficient indicated that for each additional H5P activity completed, students' final exam mark increased by approximately 0.12 points ($B = 0.124$, $SE = 0.037$, $t = 3.392$, $p < .001$).

4. DISCUSSION

The goal of this study was to investigate how providing personalized learning pathways to students affects their learning as measured by their feedback, exam assessment and subject final grades. The approach for personalized pathways was to use digital technology, specifically H5P to implement scaffolding to support student learning needs. The scope of the study was one postgraduate technical subject teaching database concepts to a diverse group of students progressing through their Master degrees.

The first important observation of this study was a significant positive relationship between H5P activity engagement and both final exam performance and overall subject grades. These findings indicate that students who engage with H5P activities tend to achieve measurable improvements in their academic outcomes, which is in line with the findings by Abusalim et al. (2024). However, our result contrasts with the findings from a comparable study by Gil-García et al. (2023) who also used H5P activities in teaching Master level students in a mix of face-

to-face and online modes, but did not report a significant improvement in average grades when teaching with H5P compared to traditional online activities. Yet, there are important distinctions between our study and that of Gil-García et al. (2023) that may explain this discrepancy: a) the research method, and b) how H5P was implemented within the respective subjects. First, in terms of the research method, our study examined within-cohort correlations between individual students' H5P engagement and their academic performance, allowing for dose-response interpretation. In contrast, Gil-García et al. (2023) presented a between-cohort design that treated H5P exposure as a binary variable (engaged vs. did not engage). It is possible that by using a binary variable of H5P engagement and a between-cohort design not only has the potential to obscure nuanced effects of varying engagement levels but also is subject to potential cohort differences given the study analysis being conducted over two different semesters that could influence subject performance. Second, our study integrated multiple scaffolded H5P activities throughout the semester, whereas the study by Gil-García et al. (2023) implemented a single H5P activity containing several questions of different types (MCQ, Fill-in the blanks, Summary, etc.) worth only a small fraction of the total grade. Since our study incorporated multiple H5P activities throughout the semester, our study offered greater opportunities for engagement and a stronger basis for evaluating whether H5P impacts student learning and performance, compared to studies involving only a single H5P activity.

The second important observation is that students' feedback confirms the value of H5P in personalized learning path access and promoting self-regulated learning. This is evidenced by improved ratings on the standardized university survey questions since the introduction of H5P activities in Semester 1, 2023, particularly regarding the usefulness of study resources and the subject's intellectual engagement and stimulation. Importantly, these findings are further supported by qualitative student feedback, with many students explicitly identifying H5P activities (referred to by students as additional exercises) as beneficial to their learning. This finding is in line with previous studies suggesting that students have positive attitudes toward H5P activities and find it helpful for their learning (Gil-García et al., 2023; Jacob & Centofanti, 2024; Masrom et al., 2025; Rahadiani et al., 2023; Sharmin et al., 2025; Suherman & Dewi, 2024).

The third important observation is that only 64.9% of the student cohort engaged with the H5P materials. This could be explained by some students deeming core materials, i.e. lecture slides and video recordings of the lecture, tutorial handouts with solutions and practice exam tasks, as sufficient for their learning needs. This lack of engagement with H5P activities is a clear indication that not all students are capable of making the best choices for their learning and taking full advantage of provided additional materials. The issue of students frequently not engaging with provided resources for the benefit of their learning has been identified in the past research (Clarebout & Elen, 2006). However, lack of engagement with the provided additional materials could also be explained by poor self-regulated learning skills or poor time management. For example, students who struggle to plan, prioritize, or monitor their study progress may be less likely to take advantage of additional, non-mandatory learning activities offered, such as H5P. Importantly, low engagement in H5P activities is not unique to this study. Other studies such as Jacob and Centofanti (2024) and Rahmi et al. (2024) report low and declining engagement in H5P activities, citing reasons such as poor perceived value, visibility and accessibility, technological barriers, reduced novelty, and repetitiveness in activity formats can reduce motivation for students to engage in H5P activities. To address concerns with engagement, educators could consider embedding H5P activities more explicitly into the curriculum and emphasize their relevance, aligning or signposting H5P activities as being closely relevant to assessment tasks, or providing guidance on how and when to use them.

5. CONCLUSIONS

This study examined the use of H5P to implement scaffolding as a means of providing personalized learning paths to students in the context of teaching a Master level subject Database Systems. Unlike past studies which relied on self-reported data (e.g. Gil-García et al., 2023; Jacob & Centofanti, 2024), this study's main findings were derived from LMS analytics, using partially longitudinal data, while focusing on the data from 2025. This approach offers a more objective and scalable means of evaluating student engagement with digital learning tools like H5P. The quantitative data was complemented by students' qualitative comments from end-of-semester surveys, with both data sources converging on the conclusion that H5P activities positively support student learning. This

consistency between data types provides a form of triangulation, strengthening the validity of the findings.

In line with many previous studies, our research confirms that H5P, if used in a pedagogically sound way, has significant potential in supporting students learning, especially for students who mastered self-regulated learning skills.

Although the data was collected from one postgraduate subject only, the alignment of findings with the previous studies enhances their contribution, and supports the potential for broader generalizations to similar higher education contexts.

6. REFERENCES

Abusalim, N., Rayyan, M., Alshanmy, S., Alghazo, S., & Al Salem, M. N. (2024). Revolutionizing pedagogy: The influence of H5P (HTML5 Package) tools on student academic achievement and self-efficacy. *International Journal of Information and Education Technology*, *14*(8), 1090-1096. https://doi.org/10.18178/ijiet.2024.14.8.2137

Bergann, S., Blüthmann, I., Neugebauer, M., & Watermann, R. (2025). Intrinsic and extrinsic motives of undergraduate students for pursuing a master's degree: Applying the Eccles et al. expectancy-value model. *PloS one*, *20*(3), e0317204. https://doi.org/10.1371/journal.pone.0317204

Clarebout, G., & Elen, J. (2006). Tool use in computer-based learning environments: Towards a research framework. *Computers in Human Behavior*, *22*(3), 389-411. https://doi.org/10.1016/j.chb.2004.09.007

Clune, M., Charlton, A., Kam, M., Jowsey, T., Cosignani, D. R., & Singleton, R. (2022). *Strengthening online teaching capability: Medical and health sciences faculty development* ASCILITE, Sydney, NSW, Australia. https://publications.ascilite.org/index.php/APUB/article/download/29/272

Gil-García, I. C., Fernández-Guillamón, A., García-Cascales, M. S., & Molina-García, Á. (2023). Virtual campus environments: A comparison between interactive H5P and traditional online activities in master teaching. *Computer applications in engineering education*, *31*(6), 1648-1661. https://doi.org/10.1002/cae.22665

Jacob, T., & Centofanti, S. (2024). Effectiveness of H5P in improving student learning outcomes in an online tertiary education setting. *Journal of Computing in Higher Education*, *36*(2), 469-485. https://doi.org/10.1007/s12528-023-09361-6

Jacobs, G. M. (2001). Providing the scaffold: A model for early childhood/primary teacher preparation. *Early Childhood Education Journal*, *29*(2), 125-130. https://doi.org/10.1023/A:1012581113983

Masrom, U. K., Jusoh, Z., & Mir, K. (2025). Learners' Experiences in Using Moodle Lesson and H5P Interactive Content in Learning Public Speaking. *MEXTESOL Journal*, *49*(1), n1. https://doi.org/10.61871/mj.v49n1-14

Mendoza, A., & Venables, A. (2023). Attributes of blended learning environments designed to foster a sense of belonging for higher education students. *Journal of Information Technology Education. Research*, *22*, 129. https://doi.org/10.28945/5082

O'Neill, G., & McMahon, T. (2005). Student-centred learning: What does it mean for students and lecturers. In G. O'Neill, S. Moore, & B. McMullin (Eds.), *Emerging Issues in the Practice of University Learning and Teaching*. All Ireland Society for Higher Education (AISHE). https://eprints.teachingandlearning.ie/id/eprint/3345/1/O'Neill%20and%20McMahon%202005.pdf

Ping, K. Y. (2025). Enhancing student engagement and learning outcomes in Higher Education using H5P interactive learning tools: A systematic literature review. *International Journal of Modern Education*, *7*(24). https://doi.org/10.35631/IJMOE.724069

Pintrich, P. R. (2000). The role of goal orientation in self-regulated learning. In M. Boekaerts, P. R. Pintrich, & M. Zeidner (Eds.), *Handbook of Self-regulation* (pp. 451-502). Elsevier. https://doi.org/10.1016/B978-012109890-2/50043-3

Rahadiani, P., Kekalih, A., & Krisnamurti, D. G. B. (2023). Use of H5P interactive learning content in a self-paced MOOC for learning activity preferences and acceptance in an Indonesian medical elective module. *African Journal of Science, Technology, Innovation and Development*, *15*(7), 844-851. https://hdl.handle.net/10520/ejc-aa_ajstid_v15_n7_a844

Rahmi, U., Fajri, B. R., & Azrul, A. (2024). Effectiveness of interactive content with H5P for Moodle-learning management system in blended learning. *Journal of Learning for Development*, *11*(1), 66-81. https://doi.org/10.56059/jl4d.v11i1.1135

Sharmin, N., Houshyar, S., Stevenson, T. R., & Chow, A. K. (2025). Interactive Engagement with Self-Paced Learning Content in a Didactic Course. *Healthcare Informatics Research*, *31*(1), 96-106. https://doi.org/10.4258/hir.2025.31.1.96

Suherman, D. P., & Dewi, B. P. (2024). Students' Perceptions about the Use of Interactive Video. *ODELIA : Southeast Asia Journal on Open Distance Learning*, *2*(1), 49-55. https://odelia-journal.seamolec.org/index.php/current/article/view/29/16

Unsworth, A. J., & Posner, M. G. (2022). Case Study: Using H5P to design and deliver interactive laboratory practicals. *Essays in Biochemistry*, *66*(1), 19-27. https://doi.org/10.1042/EBC20210057

Van Der Stuyf, R. R. (2002). Scaffolding as a teaching strategy. *Adolescent learning and development*, *52*(3), 5-18.

Verenikina, I. (2008). Scaffolding and learning: Its role in nurturing new learners. In P. Kell, W. Vialle, D. Konza, & G. Vogl (Eds.), *Learning and the Learner: Exploring Learning for New Times* (pp. 161-180). University of Wollongong.

Wang, F. H. (2017). An exploration of online behaviour engagement and achievement in flipped classroom supported by learning management system. *Computers & Education*, *114*, 79-91. https://doi.org/10.1016/j.compedu.2017.06.012

Wood, D., Bruner, J. S., & Ross, G. (1976). The role of tutoring in problem solving. *Journal of child psychology and psychiatry*, *17*(2), 89-100. https://doi.org/10.1111/j.1469-7610.1976.tb00381.x

Yelland, N., & Masters, J. (2007). Rethinking scaffolding in the information age. *Computers & Education*, *48*(3), 362-382. https://doi.org/10.1016/j.compedu.2005.01.010

Zimmerman, B. J. (1990). Self-regulated learning and academic achievement: An overview. *Educational psychologist*, *25*(1), 3-17. https://doi.org/10.1207/s15326985ep2501_2