

# Pre versus Post: Student Perspectives on the Impact of Lecture Quiz Timing

Thomas Elton<sup>a</sup>, Dominic Jia<sup>a</sup>, Joy Ghrayche<sup>a</sup>, Reyne Pullen<sup>\*a</sup> and Stephen George-Williams<sup>\*a</sup>

Corresponding authors: Stephen George-Williams (stephen.george-williams@sydney.edu.au) and Reyne Pullen (reyne.pullen@sydney.edu.au)

<sup>a</sup>*School of Chemistry, The University of Sydney, Sydney NSW 2006, Australia*

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## Abstract

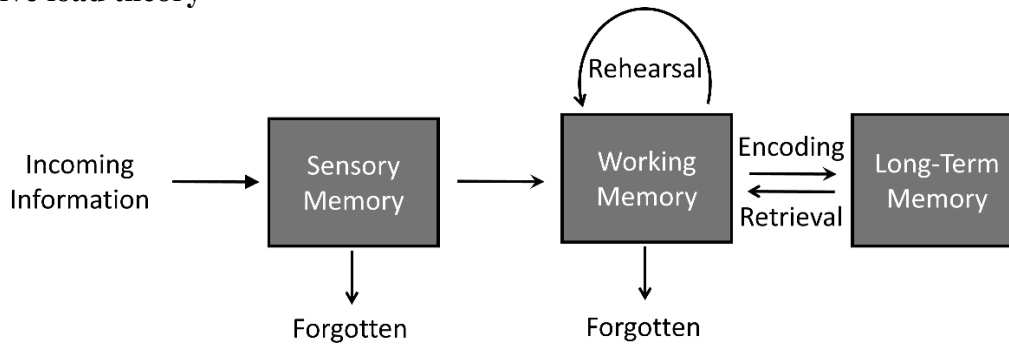
Thematic analysis of student interviews was performed to investigate their perceptions, experiences, and preferences between pre- and post-lecture quizzes. Across both quiz types, students valued their utility for self-assessment, reinforcing knowledge, and deepening understanding of content. Instant feedback was particularly appreciated, as it enabled students to identify and correct misunderstandings. Students mainly used quizzes to maximise marks and for exam preparation, suggesting a performance-oriented mindset. Students (N = 29) understood the intended purpose of pre-lecture quizzes as tools for pre-exposure to upcoming content. However, their actual usage often contradicted this, with many students completing pre-lecture quizzes after the lecture. These quizzes were often seen to be irrelevant to lecture content, likely due to a lack of contextual framing. Many believed they were unhelpful or unnecessary, particularly those in later years of study. However, students who had previously experienced pre-lecture quizzes then had them removed, frequently expressed a desire for their return. Students who encountered both quiz types (N = 10), unanimously preferred post-lecture quizzes due to their perceived alignment with lecture content, timing flexibility, and usefulness in supporting their learning. These findings highlight the value of designing quizzes as flexible tools that support different stages of the learning process.

## Introduction

Students generally perceive chemistry courses as difficult as they often involve reconstructions of meaning through abstract topics, whilst introducing specialised language and nomenclature (Millar, 1991; Woldeamanuel et al., 2014). Traditionally, these courses have been taught by implementing didactic lecture-based approaches. However, many educators deem these approaches as ineffective compared to active learning models (Jungst et al., 2003; Lund & Stains, 2015). The active learning model is a teaching strategy where the student is a partner in the learning process rather than a passive participant and the teacher acts as a facilitator who guides the learning process (Petress, 2008).

One approach to facilitate active learning during class time is the use of flipped learning models. Flipped learning is a pedagogical approach where students are presented with material prior to class, allowing formal class time to be used for active learning tasks, such as problem sheets or student-led discussions (Seery, 2015). The benefits of the flipped learning model include its ability to reduce working memory load spent on encoding novel information to improve knowledge transfer and application (Karaca & Ocak, 2017).

## Cognitive load theory



**Figure 1. Simplified representation of the information processing model (Atkinson & Shiffrin, 1968).**

Cognitive Load Theory (CLT) is grounded within the information processing model and its explanation of limitations in retention of information and learning (Kirschner, 2002). As seen in **Figure 1**, working memory stores intermediate information being synthesised, rehearsed, and manipulated in the planning and execution of cognitive tasks (Atkinson & Shiffrin, 1968; Barak & Tsodyks, 2014). This information can then be encoded within long-term memory and stored for later retrieval when necessary (Cowan, 2014). According to CLT, only a finite amount of novel information can be processed in the working memory at any given time due to its limited capacity (Hulme et al., 1995; Miller, 1956; Service, 1998; Sweller, 2011). If this capacity is exceeded, not only is further incoming information ineffectively processed, but current working memory processes are also jeopardised, resulting in an overall reduction in encoding effectiveness (cognitive overload) (Martin, 2016).

CLT defines the necessary cognitive load associated with learning novel content as intrinsic load. The flipped learning model aims to reduce the total amount of information needed to be processed at any given time, effectively spreading the intrinsic cognitive load of learning content between lectures and asynchronous learning materials. Pre-lecture resources alone have been shown to ameliorate cognitive load (Seery & Donnelly, 2011). By providing fundamental knowledge frameworks prior to learning, students are seen to interpret ‘new’ knowledge faster as they already have pre-formed schemas that support the encoding process (Seery & Donnelly, 2011). Therefore, a key benefit of the flipped learning model is that it allows content to be pre-taught, freeing up working memory during class time, and easing cognitive load (Sirhan & Reid, 2001).

### The benefits of pre-lecture resources

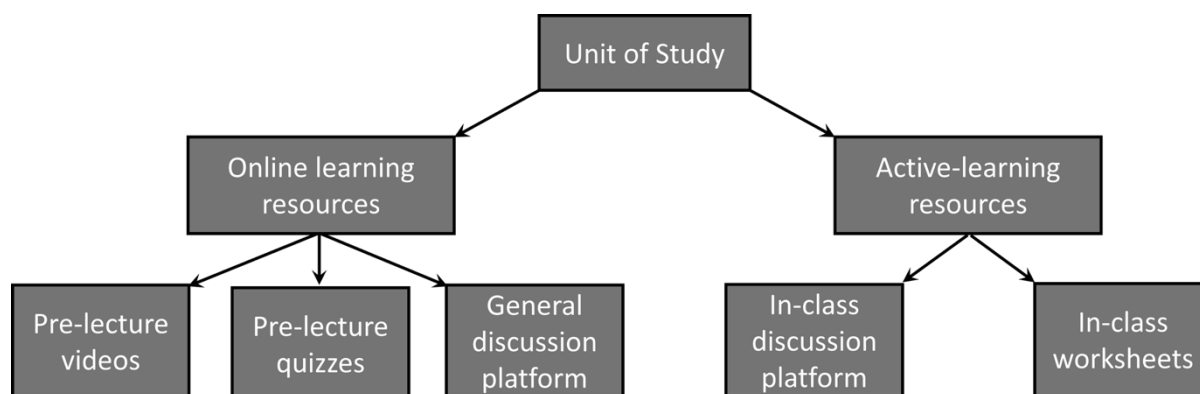
The benefits of pre-lectures resources’ reduction on cognitive load are evident in the literature. Seery & Donnelly (2011) suggest pre-lecture resources in an introductory chemistry course reduced in-lecture cognitive load by pre-exposing students to key concepts. This was evident by the significant grade-improvements of students without prior chemistry knowledge, showing no distinction between the marks of students with and without prior knowledge. Similarly, Harrison’s (2016) research examining a marketing course with additional in-class active learning elements found a 6.5% proportional increase in final exam marks when pre-lecture quizzes were implemented.

Furthermore, studies on students’ perceptions of pre-lecture resources found that students viewed these resources as beneficial for teaching effectiveness, student satisfaction and even exam preparation (Das et al., 2019; Harjoto, 2016; Narloch et al., 2006).

Based on literature surrounding the benefits of pre-lecture resources, the University of Sydney's School of Chemistry adopted a partially-flipped learning model for all first-year chemistry courses as part of a curricula renewal in 2015, wherein lectures only contained portions of didactic teaching.

### Adopting a partially flipped learning model

The aforementioned partially flipped learning model for first- and second-year courses is depicted in **Figure 2**.



**Figure 2. The University of Sydney's School of Chemistry first- and second-year partially flipped learning model.**

Notably, this model included additional pre-lecture videos and quizzes to pre-expose students to content and reduce in-lecture cognitive load. There are one to two pre-lecture videos for each teaching week, with an approximate combined duration of ten-minutes, followed by a short, unlimited-attempt quiz run on the learning management system (Canvas). Students were incentivised to engage in pre-lecture content as the quizzes from each week contributed to a combined ten percent of their final grade. It was intended for students to complete the quiz before the first lecture (out of three) in each week. However, prior to 2021, students were given a fortnight to attempt the quiz, resulting in students having the choice to complete the quiz after the live lectures.

Additionally, previous research by Bokosmaty et al. (2019) from The University of Sydney, School of Chemistry, investigated the effect of this partially flipped learning model when introduced for the semester one first year chemistry courses. By analysing data from before and after the model implementation (data from 2009 to 2016), notable insights were revealed:

- the number of students who received distinction/high distinction level grades remained unchanged or increased, with a 0-31% proportional increase.
- the number of students who failed decreased or remained unchanged, with a 0-7% proportional decrease.
- a 7-24% increase in positive student perceptions on the quality of learning resources.
- student perceptions on teaching quality increased or decreased for different course streams.

Whilst their investigation focused on the overall effect of the partially flipped learning model, it is unknown which intervention (per **Figure 2**, pre-lecture materials or in-class active learning) had this impact. This is of particular interest as the third-year chemistry courses solely utilise a didactic learning approach, with the occasional in-class worksheet. Additionally,

Bokosmaty et al. (2019) only gathered student perceptions using a ‘one size fits all’ university-administered unit of study survey.

### **Pre-lecture versus post-lecture**

Alongside the lack of data on the impact of pre-lecture resources and quizzes on students’ learning, it was also unknown if the pre-lecture quiz structure in our first-year chemistry units was still fit for purpose several years after their original implementation. A multitude of factors such as changes in HSC syllabus (secondary chemistry in New South Wales (NSW), Australia) and course structure, as well as the recent COVID-19 pandemic, may have impacted students’ approaches to learning (Tasso et al., 2021).

Furthermore, the many formative benefits of lecture quizzes, such as their ability to provide immediate feedback and correct misunderstandings (Dixson & Worrell, 2016), may not be present if quizzes are applied before the lecture content is taught (Dixson & Worrell, 2016). Thus, the timing and nature of pre-lecture quizzes may not be ideal and would perhaps be better implemented as overall formative tools that cover *all* the content of a given week (that is, after the associated lectures as post-lecture quizzes). In this vein, by leveraging the benefits of retrieval practice, post-lecture quizzes have been seen to improve learning retention and result in higher student grades (Goradia et al., 2023; Zimanyi et al., 2019).

### **Research questions and aims**

While pre- and post-lecture quizzes are commonly used in higher education to support student learning, there is limited understanding of how students perceive, use, and benefit from these tools. As such, this study aimed to critically explore the implementation and practical efficacy of pre- and post-lecture quizzes through the following research questions:

- 1) What are the perceptions, experiences and preferences of students who encountered pre-lecture quizzes?
- 2) What are the perceptions, experiences and preferences of students regarding post-lecture quizzes of those who encountered both pre- and post- lecture quizzes?

### **Context**

The first-year chemistry cohort at the University of Sydney is substantial, with approximately 2,000–2,500 students enrolled in the first semester and 1,000–1,500 in the second. The University attracts a diverse and academically strong student body, including high-achieving domestic students from both urban and regional areas. International students make up a significant proportion of enrolments, accounting for as much as 25–30% of students in some core courses with similarly high academic standards for entry. The cohort itself is academically varied, comprising chemistry majors, students majoring in other sciences such as physics and biology, as well as those from non-science disciplines.

Pre-lecture quizzes were written by the unit coordinator, the School’s Associate Head of Education, while post-lecture quizzes were written by course tutors. All lecture quizzes were cross-checked by topic lecturers to ensure alignment with content.

It is worth noting that students also had access to the full suite of course materials on the learning management system (LMS), including the syllabus and documents outlining key learning objectives and assessment requirements. These resources were available both before and after the transition to the partially flipped classroom.

## Methods

To address the research areas noted above, this study used semi-structured interviews on:

- first-year students who had either experienced only pre-lecture quizzes or pre- and post-lecture quizzes in chemistry.
- second-year students who had only experienced the pre-lecture quizzes in chemistry.
- third-year students who had only experienced the pre-lecture quizzes in chemistry, followed by the removal of pre-lecture quizzes entirely.

Pre-lecture quizzes were always preceded by a pre-lecture video, detailing slide-based presentations of key concepts in a didactic manner. These videos utilised multimedia use in alignment with Mayer's multimedia principles (Mayer, 2001) and were designed as short-form engagement.

Semi-structured interviews were chosen to expand upon the work of Bokosmaty et. al. (2019), moving beyond a purely quantitative analysis of final grades and end-of-semester questionnaires, offering insights into how teaching interventions are experienced. This approach deepens our understanding by evaluating their effectiveness beyond just academic outcomes. Thematic analysis was performed on interview transcripts to explore student perceptions on the impact of these quizzes and videos on their learning.

### Theoretical framework

This study was guided by a phenomenographic framework (Bodner & Orgill, 2007). Following their methodological guidelines, semi-structured interviews were used to gain deeper insights into student experiences and to allow flexibility in exploring individual narratives.

### Interview data collection

Students enrolled in first-, second- or third-year chemistry courses were notified of the interviews *via* email. Students were offered a \$20 gift voucher in exchange for their participation in the interview which lasted around thirty minutes. Interviews were conducted by the first two authors in accordance with the ethics approval, with the other authors remaining unaware of student identities. Students were asked to reaffirm their consent before interview questions were asked (see Supplementary Material). 29 students participated in the semi-structured interviews, including: the subset of the first-year cohort who had completed only pre-lecture quizzes (N = 7), those who had completed both pre- and post-lecture quizzes (N = 10), second year students who only encountered pre-lecture quizzes (N = 2), and the third-year cohort who had experienced pre-lecture quizzes prior to their removal from these courses (N = 10).

The interview protocol included general questions for the interviewer (see Supplementary Material), with the flexibility to ask follow-up questions based on the interviewee's responses. Interviews were conducted *via* Zoom, with audio-only recordings. Anonymised transcripts were then produced for analysis.

### Interview analysis

Per Bodner & Orgill (2007), thematic analysis is commonly used to analyse semi-structured interviews in phenomenographic research. In this study, the student researcher and one supervisor independently analysed the same transcript, where themes were coded using *NVivo*. Through discussion, a codebook was developed reflecting broad agreement on the interpretation of the transcript. The student researcher then independently conducted the

thematic analyses on remaining transcripts. A second supervisor audited a second transcript to check for consistency in applying the codebook. Whilst undergoing the analysis, and after all transcripts were coded, similar sub-themes were combined into larger parent themes.

### **Limitations**

The present study's sample is not representative of the entire cohort in the School of Chemistry at the University of Sydney. Additionally, the University of Sydney typically attracts highly motivated and strong academic performers. Furthermore, the sample is also not representative given its small size and self-selected participation. As such, these findings offer context-specific insight into the experiences of interviewed individuals, but their generalisability to broader student cohorts may be limited.

Lastly, there is uncertainty surrounding the longitudinal effect of the COVID-19 pandemic on the results of this study. At the time of interviewing students (October 2021), the area in which the University resides was in lockdown, meaning students were solely learning remotely. Additionally, many international students had already been learning remotely for two full years.

## **Results and discussion**

### **RQ1) What are the perceptions, experiences and preferences of students who encountered the pre-lecture quizzes?**

Thematic analysis was conducted on interviews with students who had completed pre-lecture quizzes (N = 29) to explore their preferences, perceptions, and experiences. This section presents both positive and negative perceptions that emerged, as well as insights from students who experienced the removal of pre-lecture quizzes in subsequent units.

#### ***Positive perceptions and experiences with pre-lecture quizzes***

Positive perceptions and experiences of pre-lecture quizzes arising from the thematic analysis are summarised in **Error! Reference source not found.**

The most commonly raised theme was that pre-lecture quizzes provided pre-exposure to upcoming content, raised by 21 students. The students most often found the quizzes helped build familiarity with upcoming content by exposing them to key concepts and terminology. 16 students further noted pre-lecture quizzes helped them gain a better understanding of the upcoming lecture content. They frequently described how building familiarity with the material in advance allowed them to recognise key concepts during lectures, which improved their understanding, and made content easier to follow.

These two themes are consistent with literature findings, where students commonly reported pre-lecture quizzes a) assessed the knowledge gained from lectures, and b) exposed them to important aspects of the lecture (Mandla et al., 2016). This implies students recognised the intended objectives of pre-lecture resources (Bokosmaty et al., 2019). These themes would also suggest that students utilised the pre-lecture quiz as intended (prior to the lecture). However, when the interviewed students were asked when they completed the quizzes, only a small proportion reported completing pre-lecture quizzes before the first lecture of the corresponding week, with most students leaving it until the weekend before the deadline. It is worth noting that some students may have mistaken the pre-lecture videos for the actual lecture and responded accordingly.

The contradiction observed in the students' use of pre-lecture quizzes highlights a disconnect between their intended purpose and how they are engaged with in practice. These findings are in line with previous studies. For example, Kinsella et al. (2017) and Afsar et al. (2020) also found that students continued to use pre-lecture quizzes after the associated lecture. Students who completed pre-lecture quizzes after the associated lecture mostly stated they preferred being able to answer pre-lecture quiz questions more effectively:

*'There's a good chance I'm not going to be able to do it properly, but if I just wait [for the lecture], I will know how to do it properly.'* – Student 29, third year

Despite there being no requirement for full marks, these students continued to delay taking the quizzes until they could guarantee perfect scores. This reflects a performance goal orientation, where students prioritise apparent competence over learning opportunities (Elliot & Harackiewicz, 1996).

This contradiction is further revealed in the remaining themes that arose from this analysis, where students frequently mentioned that pre-lecture quizzes served as a self-test and practice tool (14), and as a way to solidify their knowledge (8). Several of these students particularly enjoyed the instant feedback, with one student noting:

*'The fact that you could do a question, get it wrong and then see why you got it wrong... it meant that for me, when I wasn't understanding something, I could go and find the material that would be helpful to learn it.'* – Student 19, third year

Interestingly, the first-year cohort mainly noted utilising pre-lecture quizzes to reinforce content they had already encountered, reflecting a surface learning approach focused on immediate comprehension. In contrast, the second- and third-year cohorts mainly noted using pre-lecture quizzes more strategically to guide their learning and to help identify gaps in their knowledge. This finding aligns with the theory proposed by Zimmerman (2002), whereby more experienced students tend to have greater metacognitive awareness, and utilise self-directed planning and proactive strategies in their studies.

In addition, six students found value in pre-lecture quizzes giving them a sense of routine. These students noted it helped them in *'keeping up with [their] study'* and to ensure they were *'not falling behind in any specific topic'*. Studies do suggest that quizzes in general are valuable for promoting regular engagement (Salas-Morera et al., 2012). Interestingly, this theme was mainly raised by students in the second- and third-year cohorts, compared to only one student from the first-year cohort. This sense of routine and structure is favourable in later year levels of tertiary education, where students often develop a greater appreciation for how structured practices benefit their learning (Clegg & Bufton, 2008).

Other themes further suggest that pre-lecture quizzes are being used beyond their intended purpose, with four students noting they used them for exam preparation. This reveals a trend in students attempting to use these quizzes to maximise academic success. This aligns with the instrumental approach to learning described by Gibbs & Simpson (2004), where students engage more with tasks they perceive as contributing directly to academic success. Similar findings were reported by Afsar et al. (2020) where students stated the predominant reason for using pre-lecture content was *'preparation of examination'*, with 26.6% of participants suggesting this ahead of *'honour/prize'* (22.8%). Three students directly alluded to this, noting

that a major motivator for completing pre-lecture quizzes was the marks associated with them. One student stated:

*'...there aren't that many opportunities to sort of gain marks in Chemistry along the semester. So you get really dependent on getting as many as you can from those weekly quizzes.'* – Student 3, first year

Two students gave some potential insight into this use, mentioning a perceived lack of practice material provided by the School, with one stating:

*'[The lack of practice material is] probably a consistent sort of concern across people in my cohort that we never really got much practice for exams and stuff.'* – Student 28, third year

As such, while students appear to understand that pre-lecture quizzes are designed to introduce upcoming content, their perceived benefits extend beyond their intended use.

### ***Negative perceptions and experiences with pre-lecture quizzes***

Negative perceptions and experiences of pre-lecture quizzes arising from the thematic analysis are summarised in **Error! Reference source not found.**

Most commonly, 17 students made some comment about pre-lecture quiz content not being relevant or helpful for lecture content. Interestingly, a smaller proportion of students in second- and third-year (6 of 12) raised this theme compared to those in first-year (11 of 17). It is possible that students in later years of their tertiary education are better equipped to connect quiz content to broader conceptual structures, having already developed the foundational knowledge in earlier courses. In the case of first-year students, this perception may have been influenced by a lack of prior knowledge in the subject area, as it was their first time encountering this content. One student theorised this, stating:

*'... for someone that may not have done chemistry having to do like a weekly quiz before they even learn the content in lectures can be quite challenging...'* – Student 4, first year

While many of the interviewed students commented on the applicability of the pre-lecture videos to their learning, some did not. This could further suggest that students may not be engaging with the pre-lecture material before attempting the pre-lecture quizzes. Embedding pre-lecture quiz questions within the respective pre-lecture video may help encourage active engagement with the provided content.

Additionally, among the six first-year students who felt quiz content was not relevant or helpful to the lectures, five had previously undertaken chemistry in high school and raised that there was overlap between school content and the pre-lecture quizzes:

*'I find a lot of the topics are sort of like the same as we've done in high school, but just like more in-depth.'* – Student 1, first year

This suggests that their perception may not just reflect a disconnect between quizzes and lectures, but also a sense of redundancy. Students who already knew the material may have felt that completing the quizzes offered little added value. Additionally, the lack of explicitly mentioning quiz content during lectures may have reinforced this perception. According to Biggs' theory of constructive alignment, students are more likely to engage meaningfully when learning activities, assessments, and content delivery are explicitly connected (Biggs, 1996).

Additionally, eight students stated that pre-lecture quizzes were not impactful for assessment preparation, further echoing the expectation and appeal for pre-lecture quizzes to serve as an exam preparation tool (Afsar et al., 2020; Gibbs & Simpson, 2004). These students mainly noted that quizzes primarily focused on basic understanding rather than the depth they desired for assessment preparation.

Six students also raised that they believed pre-lecture quizzes did not assist with their learning. The main comments related to the perception that pre-lecture quizzes did not provide a sufficient level of detail to assist with content understanding. Some students even expressed that pre-lecture quizzes were not necessary, with one stating they would still be able to engage with lectures '*just fine*' and another mentioning they were a '*waste of time*'. Second- and third-year students, in particular, mentioned they felt confident in their ability to study independently, often stating pre-lecture quizzes were no longer necessary as they had developed their own study habits over the years.

Further, six students revealed they completed pre-lecture quiz question without any real understanding, relying on trial-and-error, brute-forcing answers, or pattern recognition to answer questions correctly. This aligns with findings from Craigie (2023), who observed that students often resorted to guessing strategies to complete online quizzes.

Overall, while pre-lecture quizzes intended to provide pre-exposure to content and encourage preparation before class, many students often expected them to serve a broader function.

#### ***Perceptions of having pre-lecture quizzes removed from their courses***

Third-year students were asked about their perceptions on how removing pre-lecture resources impacted their learning (N = 10). Themes arising from the thematic analysis are given in **Error! Reference source not found.**

Many students felt that removing pre-lecture quizzes negatively impacted their learning. These students mentioned this was especially important in their later-year studies, where they believed the content was more complex. Six students mentioned they valued the quizzes as an opportunity to practice and apply their knowledge, and to assess their knowledge through the quiz feedback. Several of these students mentioned that without the quizzes, it was more difficult to identify key learning objectives each week and to keep up with new terminology, even though learning outcomes were provided in lectures.

Additionally, four expressed a preference for having pre-lecture quizzes for pre-exposure to upcoming lecture content. These students noted this was particularly valuable in later years of education where content becomes more specialised and conceptually dense.

Two students noted that without the quizzes, it was harder to stay on track with the content and manage their study routine effectively. This contrasts with the above findings, where students believed pre-lecture quizzes were unnecessary due to having developed their own study habits in later years. However, one student expressed:

*'I guess the expectation is in third year you're able to manage your time a bit better anyways.'* – Student 26, second year

This perception appears to be common among students, often internalising the belief that they should be able to manage their own time effectively as they progress through their studies, even as academic demand increases (Kosonen et al., 2023). As such, it may be possible the contrasting finding is due to students internalising this expectation.

Furthermore, two students mentioned they preferred having pre-lecture quizzes for easy marks toward their final grades, further echoing the student motivation for maximising their grades. However, one other student mentioned a desire for non-assessable pre-lecture quizzes, citing concerns about having more assessments added to their already busy third-year schedule. The literature does suggest that adding a small grade weighting to quizzes significantly increases student engagement (Evans et al., 2021).

Overall, 10 out of the 12 second- and third-year students expressed the desire to have pre-lecture quizzes re-included in their course units.

### **RQ2) What are the perceptions, experiences and preferences of students regarding post-lecture quizzes of those who encountered both the pre- and post-lecture quizzes?**

To examine student perceptions, experiences and preferences with post-lecture quizzes, thematic analysis was conducted on interviews with students who had completed both quiz types (N = 10). This section presents both positive and negative perceptions emerging from the analysis.

#### ***Positive perceptions and experiences with post-lecture quizzes***

Positive perceptions and experiences about post-lecture quizzes arising from the thematic analysis are summarised in Error! Reference source not found. **Error! Reference source not found..**

In contrast to the theme raised for pre-lecture quizzes, seven students believed post-lecture quizzes were relevant to lecture content. This appears to support the previously discussed concept of constructive alignment (Biggs, 1996). Since post-lecture quizzes are encountered after exposure to the lecture, students can approach them with a clear framework of the material that was covered. This likely allows students to see a clear alignment between what they were taught and what they were expected to learn, making post-lecture quizzes appear more relevant.

Seven students reported that post-lecture quizzes served as a self-test and practice tool. Similar to themes raised by students about pre-lecture quizzes, these students found that having a quiz to test their knowledge after the lectures helped them assess their understanding of certain concepts, and prompted them to revisit lecture materials to help clarify misunderstandings. Many students mentioned the ability to attempt quizzes multiple times was particularly beneficial, as it encouraged repeated practice and deeper engagement with the material. One student stated:

*'I think this is a really good opportunity to practice solving these questions independently with unlimited attempts.'* – Student 5, first year

Other studies have shown that students prefer having multiple quiz attempts as it helped aid their learning (Brazhkin & Strakos, 2023). Allowing multiple attempts for online quizzes has also been shown to positively impact student performance (Davis et al., 2020).

Five students raised that post-lecture quizzes served to improve their understanding of the content, explicitly noting that these quizzes helped with comprehension of key concepts. Five other students further highlighted the value of post-lecture quizzes in reinforcing their knowledge. Several emphasised that engaging with quizzes after learning helped them *'consolidate'* and *'stick'* the knowledge gained from lectures. These themes reinforce the extensively researched benefits of formative assessments and retrieval practice on improving comprehension and long-term retention (Bangert-Drowns et al., 1991; Roediger & Butler, 2011). A recent meta-analysis has further shown that overt retrieval practices, such as post-lecture quizzes, are more effective for learning and long-term retention than covert retrieval strategies (Yu et al., 2025).

In addition to this, four students found value in post-lecture quizzes being used for revision, noting they used them to summarise the content for the week. Beyond reinforcing weekly learning, several students also identified these quizzes as a useful tool for exam preparation. Some students highlighted the quizzes helped them understand *'the sort of frameworks which you might be assessed'*, particularly appreciating their usefulness in practicing multiple-choice questions. This further echoes the themes arising from the use of pre-lecture quizzes.

Overall, when asked about their preference, all 10 students voiced a preference for post-lecture quizzes over pre-lecture quizzes.

### ***Negative perceptions and experiences with post-lecture quizzes***

Overall, our thematic analysis did not yield any themes about negative perceptions or experiences with post-lecture quizzes, as only three students expressed isolated negative comments that were too limited and varied to form any themes.

One student stated that post-lecture quizzes could have been detrimental to their routine. Given that quizzes were open for a week after the associated lecture, the student believed it would be easier to delay taking the quizzes and fall behind. This student also mentioned post-lecture quizzes did not support their learning during the lecture itself.

Another student believed that some questions in the post-lecture quizzes were not discussed during lectures:

*'Sometimes there are questions that they didn't go through in the lectures and you actually had to think for a bit.'* – Student 11, first year

The third student acknowledged that while post-lecture quizzes provided useful practice for the final exam, quiz content was easily forgotten and not retained in a way that helped during their exam.

The lack of negative themes arising could be due to the smaller sample size of students who had completed post-lecture quizzes (N = 10). However, it is also important to note these students had experienced both pre- and post-lecture quizzes. As such, these students may have pre-formed comparisons between the two quiz types. As such, the lack of negative themes could also suggest these students had a more positive overall perception of post-lecture quizzes.

## **Conclusion**

This study sought to investigate the perceptions, experiences and preferences of students who encountered pre- and post-lecture quizzes in a tertiary setting. Across both types of quizzes, students consistently valued the quizzes as a formative assessment tool used for self-testing, reinforcing knowledge, and supporting understanding of content. Regardless of quiz timing, students consistently viewed these quizzes as tools to help with exam preparation and this was a clear motivator for their completion. This highlights the students' preference for activities that support summative assessment outcomes.

Notably, while the function of pre-lecture quizzes was primarily recognised by the students as a means of pre-exposure to lecture content, many did not actually complete the pre-lecture quizzes until after the associated lecture. Students consistently repurposed them as a tool for revision and review, despite them not being designed for this function. This shows that students are likely to adapt learning resources to suit their own study habits, regardless of the intended purpose.

In contrast, post-lecture quizzes were perceived to offer similar benefits to pre-lecture quizzes, but these benefits align more closely to the intended purpose of post-lecture quizzes. Moreover, although the sample size was small, only three students made isolated negative comments about post-lecture quizzes. The lack of negative themes may have been reflective of a more positive view of post-lecture quizzes. This, combined with the students' unanimous preference for post-lecture quizzes, suggests post-lecture quizzes are not only better aligned with their intended pedagogical function, but are also more compatible with students' learning strategies and preferences.

As such, the utility of both pre- and post-lecture quizzes may lie not only in how they are intended to be used, but in their adaptability to diverse learning strategies. We recommend designing and framing quizzes as flexible tools that support different stages of the learning process, thereby fostering engagement across a range of student study behaviours – an approach that aligns with Universal Design for Learning (UDL) principles. This would enable students to use these quizzes in ways that best suit their learning preferences.

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Generative AI (Microsoft Copilot) was used to assist with reducing the wordcount of the introduction and methods sections of the final manuscript.

The introduction and methods section of this manuscript have been adapted from an undergraduate research project report submitted by one of the authors. A copy of this report can be found on GitHub ([tjelton/Resources/Reports/SCDL3991.pdf at main · tjelton/tjelton · GitHub](https://github.com/tjelton/Reports/SCDL3991.pdf)).

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