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Flexibility or Procrastination? A Longitudinal Study of Lecture Engagement Patterns and Academic Performance

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ABSTRACT

CONTEXT

The widespread adoption of lecture capture systems has increased learning flexibility but is also associated with a marked decline in on-campus attendance. While these systems give students greater control over when and how they learn, their effect on academic performance remains contested. Flexibility can act as a “double-edged sword”: it benefits self-regulated learners but may exacerbate procrastination among those with weaker time-management skills. This study explores how students navigate this flexibility and how their choices influence academic outcomes.

PURPOSE OR GOAL

This study moves beyond a binary comparison of in-person and online lecture use to examine how students engage with flexible learning modes over time. It aims to identify distinct engagement patterns among postgraduate students and analyse their relationship with procrastination and academic performance. Specifically, the research investigates which engagement behaviours support academic success and which contribute to detrimental outcomes such as procrastination.

APPROACH OR METHODOLOGY/METHODS

The study employed a mixed-methods sequential explanatory design over a 12-week semester with approximately 190 postgraduate students. In the quantitative phase, learning analytics data from the university’s system was used to track weekly student engagement with on-campus lectures, live streams, and recordings. Time-series K-means clustering was applied to this data to identify distinct behavioural patterns, which were then compared against academic performance using ANOVA. In the qualitative phase, 15 semi-structured interviews were conducted to provide deeper insight into the students’ experiences and the reasons for their engagement patterns.

ACTUAL OR ANTICIPATED OUTCOMES

The analysis revealed four distinct behavioural clusters: On-campus learners, Flexible learners, Online learners, and Disengaged students. The on-campus and flexible learner groups achieved the highest academic performance. Conversely, the disengaged students, who formed the largest cluster, had significantly lower marks across all assessments, demonstrating a clear link between their lack of engagement and poor performance. Qualitative findings indicated that students’ ability to self-regulate and the presence of peer accountability were critical factors in preventing procrastination.

CONCLUSIONS/RECOMMENDATIONS/SUMMARY

The findings confirm that unstructured flexibility is not universally beneficial; while it empowers highly self-regulated students, it can amplify procrastination and hinder the performance of a substantial portion of the student body. Rather than mandating attendance, institutions should implement supportive scaffolding to help students manage their autonomy. A practical recommendation is to introduce soft deadlines for viewing lecture recordings to provide necessary structure and urgency, mitigating procrastination without removing the benefits of flexible access.

KEYWORDS: Lecture capture systems, student learning patterns, procrastination, performance

Introduction

Lecture capture systems, widely adopted across universities, automatically record live lectures to enhance accessibility and accommodate diverse learning needs. By offering flexibility in both spatial (in-person vs. online) and temporal (live vs. recorded), these systems cater to a range of learning preferences and are often used as a key component of the HyFlex (Hybrid-Flexible) model. However, their adoption has been associated with a concerning decline in on-campus lecture attendance. An earlier study found that only 38% of students regularly attended live lectures when recordings were available (McGaughey et al., 2020). This decline has worsened in the post-pandemic era, as students appear to have developed a strong reliance on online learning and recorded lectures, even after the return of on-campus teaching. For example, a global survey reported that 76% of academics observed decreased student attendance in live, on-campus lectures following the pandemic, while only 4% saw an increase (Times Higher Education, 2022).

This phenomenon has reignited serious debate among educators and researchers regarding the enduring value of traditional, on-campus lectures. Central issues include whether on-campus lectures remain necessary, which students benefit most from them, and the conditions under which on-campus lectures or recorded lectures are most effective for student learning. A key consideration is their impact on academic performance. One line of research argues that physical attendance at live lectures is essential for academic success, suggesting that the availability of recorded lectures may undermine this benefit (Edwards & Clinton, 2019). In contrast, another body of literature finds little evidence that lecture capture systems negatively affect student performance (Doggrell, 2020; Petrović & Pale, 2015). Rather, these studies propose that recorded lectures serve as a valuable supplement, enhancing and extending students' learning beyond the classroom setting.

The fundamental question of whether the flexibility provided by recorded lectures benefits or hinders student learning is likely more complex than it initially appears. This flexibility empowers students to choose how and when to engage with lectures, tailoring their study to individual needs and preferences. Students with strong self-regulated learning skills are more likely to engage effectively with recorded lectures, pacing their study strategically and revisiting content as needed (Petrović & Pale, 2015). However, flexibility does not guarantee positive outcomes for all learners. Those lacking self-regulation or time-management skills may struggle to maintain consistent study habits (Steel & König, 2006). One key factor is procrastination which, in an academic setting, is the tendency to delay academic tasks despite knowing it may result in negative consequences. The on-demand nature of recorded lectures can exacerbate this tendency, as the absence of fixed schedules and accountability structures may encourage students to postpone viewing lectures until shortly before assessments, reducing opportunities for deep learning and retention (Chapin, 2018).

Therefore, we contend that further research is needed to identify and understand the diverse ways students respond to the flexibility afforded by recorded lectures. While some students thrive under self-directed conditions, others may feel overwhelmed by a lack of structure, resulting in procrastination and surface-level learning. Moving beyond a binary comparison of in-person lecture attendance versus recorded lecture use is essential. Instead, research should be directed toward the underlying student characteristics and contextual factors that shape how flexible learning environments influence academic outcomes.

This study conducts a longitudinal analysis of how students' lecture learning patterns change over a semester and how these changes relate to procrastination and learning outcomes. It tracked the learning behaviours of approximately 190 postgraduate students enrolled in a Master of Information Systems course at a leading Australian university. In addition, we conducted 15 semi-structured interviews to gain deeper insight into students' experiences. This study is guided by the following research questions (RQs):

- **RQ1:** What are the distinct learning patterns in students' engagement with on-campus or live-stream lectures and lecture recordings?
- **RQ2:** How are these patterns associated with procrastination and academic performance?

Literature Review

Lecture capture systems, such as Echo360, refer to information technologies that enable the recording and dissemination of lecture presentations, typically including audio and accompanying visual materials such as PowerPoint slides. These systems enable both real-time streaming and subsequent on-demand access through institutional learning management platforms. As a result, lecture capture technologies have enabled a range of lecture learning modes, most notably: (1) on-campus lectures (in-person attendance), (2) live-stream lectures (real-time remote participation), (3) recorded lectures (asynchronous viewing), and (4) any hybrid combinations of these modes.

The value of lecture capture systems has been the subject of ongoing debate since their widespread adoption in universities in the early 2010s. Some studies view live-streamed or recorded lectures as direct substitutes for traditional, on-campus lectures, emphasizing their convenience, spatial and temporal flexibility, and learner pace (Brockfeld et al., 2018). However, despite their advantages, live-stream or recorded lectures are not complete replacements for face-to-face learning. In-person attendance offers benefits such as non-verbal cues, peer interaction, and direct engagement with lecturers, factors that many students find valuable (Skoglund et al., 2020). For some students, recorded lectures are a less preferred alternative used only when attending in person is not possible, while others use them as complementary tools for supporting note-taking, revision, and exam preparation (Chapin, 2018; Nkomo & Daniel, 2021).

Existing research presents mixed findings on the relationship between lecture learning modes and student performance (Doggrell, 2020). Some studies found that lecture recordings, when used as a replacement for on-campus lectures, can undermine academic outcomes. For instance, Edwards & Clinton (2019) found that the use of online recorded modules led to a significant decline in on-campus lecture attendance and negatively affected both exam scores and overall module performance. The use of lecture recordings did not compensate for the negative impact of low attendance. In contrast, other studies suggest that the effectiveness of lecture recordings depends on how they are integrated with in-person attendance and may vary based on students' academic ability. Nordmann et al. (2019) found that both lecture attendance and the use of recordings were positively associated with exam performance. Their findings indicate that lecture recordings were particularly beneficial for low-GPA students when used to supplement high levels of in-person attendance. High-GPA students, by contrast, were more capable of compensating for low attendance through increased use of recordings. The study also identified student year level as a moderating factor, with academic performance being less influenced by attendance and recording use among more senior students. A key insight from the literature is that student characteristics and the way students incorporate lecture recordings into their learning routines, whether as a temporary substitute or a consistent supplement, can significantly affect academic outcomes. However, there is a lack of studies examining how students' lecture engagement patterns change *weekly* as they shift between different learning modes over the semester, and how these evolving behaviours relate to performance.

The literature suggests that the flexibility afforded by lecture recordings can be a double-edged sword. While the spatial and temporal flexibility they offer can enhance accessibility and benefit students who use them strategically, this same flexibility may hinder learning for students who struggle to learn effectively through recordings or lack the self-regulation and time management needed to engage with them consistently. A key concern is procrastination, defined as the voluntary delay of an intended course of action despite expecting negative consequences (Steel, 2007), which can lead to postponed engagement with lecture recordings and ultimately impair academic performance. However, whether the flexibility provided by lecture recordings contributes to students' procrastination and to what extent this depends on their self-regulation skills remains an area that requires further investigation.

Self-Determination Theory (SDT; Deci & Ryan, 1985) and Temporal Motivation Theory (TMT; Steel & König, 2006) provide theoretical frameworks that can help explain how the flexibility afforded by lecture recordings or online learning may potentially contribute to procrastination. From the perspective of SDT, behaviour is driven by intrinsic motivation and the fulfillment of three basic

psychological needs: autonomy, competence, and relatedness. Lecture recordings can enhance students' sense of autonomy by allowing them to choose when and how to engage with lecture content, supporting self-paced learning, and accommodating personal schedules (Nkomo & Daniel, 2021). However, autonomy alone may be insufficient to sustain motivation if students' needs for competence and relatedness are not also met. For example, students managing multiple subjects often experience cognitive overload and fatigue, which can diminish their perceived competence in keeping up with lectures and lead to avoidance behaviours (Petrović & Pale, 2015). When autonomy is decoupled from sufficient support for competence, the result may not be increased motivation, but greater disengagement and delay. In this way, while flexibility can empower students to take control of their learning, it may also increase the likelihood of procrastination, particularly for those who lack the support structures to stay engaged independently.

TMT complements SDT by offering a more granular explanation of how motivation fluctuates based on four key factors: expectancy, value, delay, and impulsiveness. TMT highlights delay sensitivity, closely tied to impulsiveness, as a primary contributor to procrastination. This trait leads individuals to prioritise short-term comfort over long-term outcomes. In the context of lecture learning, the rewards of engagement (e.g., improved exam performance) are typically delayed, reducing motivation for students who are highly sensitive to such temporal gaps. Those with weaker self-regulation may particularly struggle to initiate or sustain engagement with lectures, as these tasks often lack immediate payoff or gratification. Furthermore, the on-demand availability of lecture recordings intensifies this problem by enabling temporal discounting, the tendency to devalue tasks with delayed consequences (Steel & König, 2006). Students prone to impulsiveness may rationalise postponement by assuming they can access the lecture recordings at any time, thereby undermining consistent engagement (Banerjee, 2021). Thus, while flexible access may be beneficial for some students, it can also facilitate procrastination in students with low self-regulation by weakening the urgency to act in the present.

Methodology

This study adopted a mixed-methods sequential explanatory design to investigate how students engage with lectures across different learning modes and how these patterns relate to academic performance. The quantitative phase identified distinct behavioural patterns in lecture engagement and examined their relationships with procrastination and academic outcomes. Building on these results, the qualitative phase sought to explain and enrich the quantitative findings by exploring students' lived experiences (Creswell & Creswell, 2023). The study was conducted over a single 12-week teaching semester and involved two postgraduate Information Systems subjects at a leading Australian university. One was a first-year core subject (Subject A) with 123 enrolled students, and the other was a second-year elective subject (Subject B) with 67 students.

Phase 1: Quantitative Analysis of Student Learning Patterns. The participants for the quantitative phase of the study comprised the entire cohort of students enrolled in the two subjects. This study was conducted under research ethics protocol 29248 secured by the Faculty's Teaching and Learning Laboratory. Student lecture learning behaviours were captured through learning analytics data from the university's Learning Management System (LMS). The LMS tracked all student interactions with course materials on a weekly basis, including logging into subject pages, opening or downloading lecture slides, attending the live-stream lectures, and watching recordings. Importantly, students who interacted with the LMS during lecture times (e.g., necessitated by in-class activities) but were not watching the live stream were identified as a reliable proxy for on-campus attendance, a finding confirmed through comparison with photographs taken during lectures. Each student's academic performance was measured using their assessment results, including assignment marks, exam marks, and overall subject marks in the respective subject. All student data were fully anonymized before analysis.

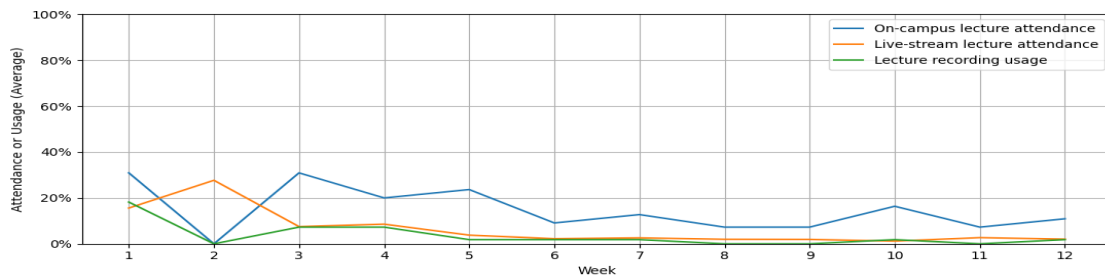
To identify distinct patterns of student lecture learning over the semester, a time-series K-means clustering analysis was applied using Euclidean distance. This method is specifically designed to group temporal data, making it well-suited for analysing the week-by-week learning analytics data collected (Tavenard et al., 2020). The K-means algorithm partitions students into clusters where

each student belongs to the cluster with the nearest mean. To identify the optimal number of clusters, the Silhouette Score and the Davies-Bouldin Index were calculated for a range of cluster solutions, measuring cluster cohesion and separation. Once the distinct lecture learning clusters were identified, a one-way analysis of variance (ANOVA) was conducted to determine if there were statistically significant differences in academic performance between the clusters. It is important to note that for this study, procrastination is not measured directly but is inferred from behavioural patterns of engagement and delay.

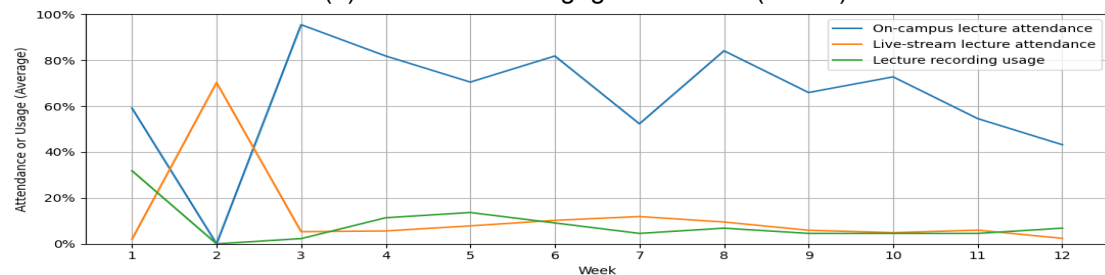
Phase 2: Qualitative Evaluation of Student Experience. Eight students from Subject A and seven students from Subject B were recruited as volunteers through subject announcements to participate in semi-structured interviews conducted by a facilitator. This self-selection sampling approach was used to gather perspectives from students motivated to share their experiences. The final sample size was determined by the point of data saturation, where no new themes or insights were emerging. The interview protocol was guided by the conceptual framework formed by SDT and TMT, and included questions such as: “How important did you feel it was to attend lectures?” and “Did the availability of recorded lectures affect your study behaviour?” The interview questions were pilot tested with two students to ensure clarity and relevance. Each interview lasted approximately 30-45 minutes, was audio-recorded, and transcribed verbatim for analysis. The qualitative data were analysed using thematic analysis (Braun & Clarke, 2022).

Findings

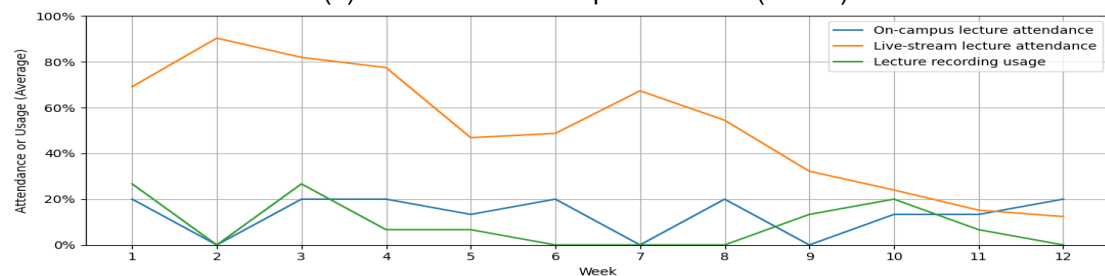
Student Learning Patterns: Analysis of on-campus lecture attendance, live-stream lecture participation, and lecture recordings usage data over the semester revealed four distinct clusters of student lecture learning behaviour in the first-year core subject (Subject A) (Figure 1). These clusters could be categorised as follows: (1) Disengaged students ($n = 55$), (2) On-campus learners ($n = 44$), (3) Online learners ($n = 15$), and (4) Flexible learners ($n = 9$). It should be noted that no on-campus lecture was held in Week 2 for Subject A due to a public holiday.



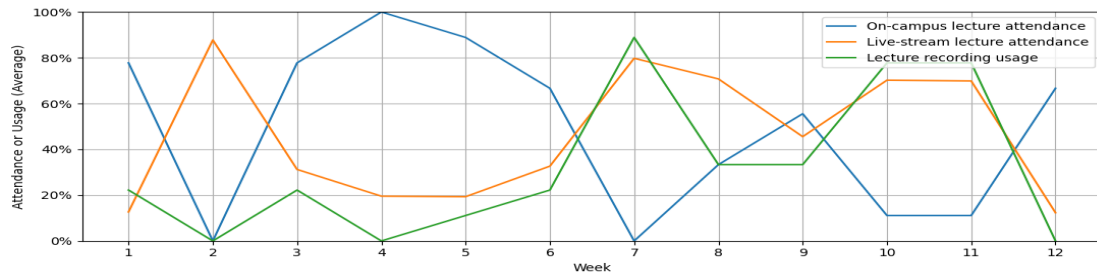
(a) Cluster 1: Disengaged Students ($n = 55$)



(b) Cluster 2: On-Campus Learners ($n = 44$)



(c) Cluster 3: Online Learners ($n = 15$)



(d) Cluster 4: Flexible Learners ($n = 9$)

Figure 1 (a-d): Four Clusters of Student Lecture Learning Behaviour in Subject A ($N = 123$)

The disengaged students showed minimal participation across all formats, including on-campus lectures, live streams, and recordings, indicating a broad lack of engagement. The on-campus learners consistently preferred attending lectures in person, with limited reliance on live streams or recordings. In contrast, the online learners primarily engaged with the subject by attending live online lectures. Finally, the flexible learners demonstrated a dynamic approach, alternating between in-person attendance, online participation, and recorded lectures on a week-by-week basis, adapting their learning mode as needed.

The propensity for procrastination varies across the four clusters. Disengaged students, the largest group ($n = 55$), exhibited the highest tendency toward procrastination, with minimal participation reflecting a classic pattern of delaying academic tasks despite negative consequences. On-campus learners, the second largest cluster ($n = 44$), were the least prone to procrastination, as the structured nature of in-person attendance supported consistent engagement. Online learners ($n = 15$) initially followed a fixed schedule but showed increasing procrastination over the semester, evidenced by a steady decline in live attendance, indicating a growing tendency to postpone engagement. Flexible learners, the smallest cluster ($n = 9$), demonstrated the greatest variability but often effectively used different learning modes to maintain engagement throughout the semester and did not exhibit signs of procrastination. This cluster, along with disengaged students and online learners, exemplifies the “double-edged sword” of flexible learning: while the use of multiple modes offers strategic advantages for students with strong self-regulation to leverage flexibility, the same flexibility can encourage procrastination among those with weaker self-regulation, as seen in disengaged students and online learners who struggle without a fixed schedule.

Similar findings were also observed in the second-year elective subject (Subject B), confirming the consistency of student engagement and procrastination patterns across different subject levels. This subject was smaller, about half the size, and only three distinct clusters of student lecture learning behaviour were identified. These clusters corresponded closely to those in Subject A and could be categorized as: (1) On-campus learners ($n = 20$), (2) Disengaged students ($n = 39$), and (3) Flexible learners ($n = 8$), who showed slight disengagement toward the end of the semester. Notably, the online learners cluster was absent in this elective subject.

Academic Performance: Figure 2 presents the marks of Subject A’s student clusters in the assignments, exam, and overall subject assessment. On-campus and flexible learners emerged as the top academic performers, achieving equally high overall success. The on-campus group stood out in the assignments, while online learners performed strongly in the exams but struggled with assignments. Disengaged students showed the lowest performance across all assessments, underscoring their significant academic challenges.

An analysis of variance (ANOVA) revealed significant differences among the four student clusters in assignment marks ($p = 0.0033$), exam marks ($p = 0.0020$), and overall subject marks ($p = 0.0014$), indicating that student performance varied meaningfully based on lecture learning behaviour. Disengaged students had statistically significantly lower mean scores than on-campus learners across all assessment types, and lower exam scores than flexible learners ($p = 0.0436$). No significant differences were found among the other clusters not involving disengaged students.

In Subject B, on-campus learners continued to be the top academic performers, achieving significantly higher mean scores than disengaged students in both assignment marks ($p = 0.0213$) and overall subject marks ($p = 0.0395$). However, no significant difference was found between the two groups in exam performance. Flexible learners did not differ significantly in performance compared to either of the other clusters.

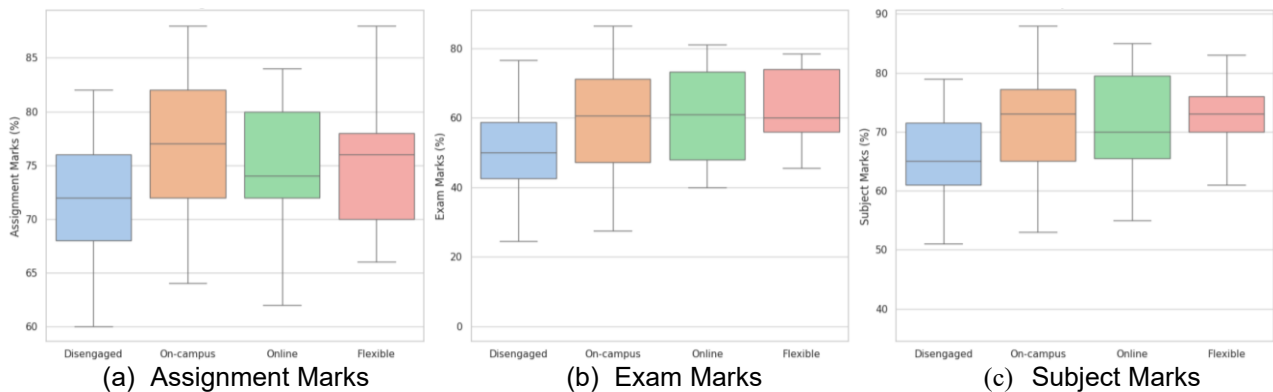


Figure 2 (a-c). Student Academic Performance across Clusters in Subject A ($N = 123$)

Student Experience Evaluation: Among the 15 interview participants, 8 were from Subject A (6 on-campus learners and 2 flexible learners), and 7 were from Subject B (6 on-campus learners and 1 disengaged student). Three themes emerged that help explain the reasons behind students' engagement patterns and their tendencies toward or against procrastination.

Theme 1: Assessment workload as a key driver for lecture de-prioritisation. Participants across all clusters acknowledged the unique value of lectures but consistently reported de-prioritising them during peak assessment periods in favour of completing assignments. Lecture recordings were often used as a substitute; however, students frequently postponed viewing them until other tasks were completed, sometimes not until immediately before exams. This pattern resulted in an unmanageable backlog of unwatched lectures, with some students eventually abandoning them entirely. As P15 (Subject B, Disengaged Student) explained, "the motivation [to attend/watch lecture] might be reduced... [I] need to focus more on the assignment when it's close to the deadline". This behaviour aligns with TMT, which suggests the immediate pressure of assignment deadlines made them a higher priority, while the benefits of lecture viewing seemed remote, encouraging procrastination.

Theme 2: Self-regulated learning as a buffer against procrastination. Participants who demonstrated strong self-regulation described using deliberate strategies to avoid falling behind, such as maintaining learning schedules, creating daily to-do lists, and treating lecture attendance as a non-negotiable "weekly routine." Even when a scheduling conflict arose, they managed it proactively. For example, P12 (Subject A, Flexible Learner), faced with a conflicting assignment deadline, explained: "It was impossible for me to go to the lecture... I watched the lecture online in the night... so it does not accumulate." By successfully managing their workload and taking control of their learning, they sustained their core psychological need for competence as described in SDT and navigated the challenges of a flexible environment without succumbing to procrastination.

Theme 3: Peer accountability as a social structure for engagement. Participants described peers as a critical external regulator that helped maintain consistent lecture attendance. They described how attending lectures with project or study group members and engaging in post-class group discussions provided a sense of accountability that drove sustained engagement. They would "make promises to [groupmates] to go to lectures each week," a commitment that ensured they were prepared for group discussions rather than arriving with an "empty brain" (P6, Subject A, Flexible Learner). In contrast, studying alone could lead to laziness and difficulty concentrating (P8, Subject A, On-Campus Learner). From a TMT perspective, this social accountability mechanism heightened the immediacy and perceived value of lecture attendance. The potential discomfort of letting down a teammate or breaking a promise represented a tangible and immediate cost, thereby mitigating tendencies toward procrastination.

Discussion

This study's findings reveal a complex and stratified landscape of student engagement with lectures in a flexible learning environment. The identification of four distinct behavioural patterns: On-campus learners (approx. 36%), Flexible learners (approx. 7%), Online learners (approx. 12%), and Disengaged students (approx. 45%), quantifies the varied ways students navigate the autonomy offered to them. The research strongly supports the characterisation of learning flexibility as a "double-edged sword." The positive edge is clearly demonstrated by flexible learners. Consistent with the findings reported by Nordmann et al. (2019), in the first-year core subject (Subject A), this group skilfully alternated between learning modes, achieving academic results on par with the consistently attending on-campus learners. The interviews shed light on the mechanisms underlying this success, highlighting the role of strong self-regulation as a buffer against procrastination. These students employed deliberate strategies such as treating lecture attendance as a non-negotiable "weekly routine." This capacity to adapt and strategically combine different learning modes allowed them to meet weekly demands without compromising performance. Furthermore, peer accountability emerged as a powerful social mechanism to mitigate procrastination (and the live lecture may provide a social setting to facilitate peer interaction). Conversely, the negative edge of this sword impacts a much larger segment of the student cohort, for whom flexibility becomes a catalyst for procrastination for others, resulting in consistent but more detrimental findings observed by Chapin (2018). The disengaged students, representing the largest cluster, showed minimal interaction across all modes, indicating that the absence of a rigid structure enabled a near-total postponement of learning activities. The interviews provide an explanation for this behaviour, with students de-prioritising and postponing attending or watching lectures in favour of more immediate tasks, such as assessment preparation.

The consequences of these engagement patterns are most starkly reflected in academic performance, particularly in the distinction between the continuous, formative nature of assignments and the summative, high-stakes nature of final exams. Contrary to prior research (Nkomo & Daniel, 2021), our findings indicate that students who procrastinate are most heavily penalised in their assignment results. Formative assessments, spread throughout the semester, require consistent, week-to-week engagement. Disengaged students, who delay their learning, are likely to miss the incremental building of knowledge and the crucial opportunities for formative feedback from instructors. Their significantly lower assignment marks reflect this cumulative deficit. The dynamic shifts when considering final exams. An exam is a high-stakes, hard-deadline assessment preceded by a dedicated study break. This combination appears to motivate a concentrated burst of catch-up effort from students who were previously disengaged. While in the first-year subject (Subject A), this last-minute effort was insufficient to close the performance gap, the findings in the second-year subject (Subject B) suggest that more experienced students may be able to cram effectively for a final test, consistent with findings by Nordmann et al. (2019).

Conclusion

This study aims to move beyond simple comparisons of lecture delivery modes to examine the nuanced behavioural patterns students adopt within a flexible learning environment. By identifying distinct learner clusters (RQ1), we demonstrate that while flexibility can empower self-regulated students, it may also amplify procrastination and hinder the performance of a substantial subset of the student body. The key finding is that unstructured flexibility is not universally beneficial (RQ2). Institutions must therefore provide appropriate scaffolding to support students who struggle with the autonomy it requires. Importantly, the results do not support a return to mandatory on-campus attendance, which would be overly restrictive and unnecessary. The strong performance of flexible learners shows that, when well-managed, flexible learning supports academic success. A more targeted approach is needed. The primary issue for struggling students appears to be the way on-demand lecture recordings facilitate procrastination. A practical and supportive intervention would be to introduce firmer deadlines for asynchronous learning, for example, requiring students to view lecture recordings within one to two weeks of release could provide needed structure and urgency. Our findings also have implications for the implementation of HyFlex models. These findings

should, however, be interpreted with caution. The study focused on Information Systems' postgraduate students at a single institution, limiting generalizability to undergraduate populations, other disciplines, or different educational contexts. Additionally, the correlational nature of the research precludes causal inferences; unmeasured variables may also contribute to the observed outcomes. Future research should aim to address these limitations.

References

- Banerjee, S. (2021). To capture the research landscape of lecture capture in university education. *Computers & Education*, 160, 104032. <https://doi.org/10.1016/j.compedu.2020.104032>
- Braun, V., & Clarke, V. (2022). *Thematic Analysis: A Practical Guide*. Sage Publishing Ltd.
- Brockfeld, T., Müller, B., & De Laffolie, J. (2018). Video versus live lecture courses: A comparative evaluation of lecture types and results. *Medical Education Online*, 23(1), 1555434. <https://doi.org/10.1080/10872981.2018.1555434>
- Chapin, L. A. (2018). Australian university students' access to web-based lecture recordings and the relationship with lecture attendance and academic performance. *Australasian Journal of Educational Technology*, 34(5), Article 5. <https://doi.org/10.14742/ajet.2989>
- Creswell, J. W., & Creswell, J. D. (2023). *Research Design - International Student Edition: Qualitative, Quantitative, and Mixed Methods Approaches*. SAGE PUBLICATIONS.
- Deci, E. L., & Ryan, R. M. (1985). *Intrinsic Motivation and Self-Determination in Human Behavior*. Plenum Press.
- Doggrell, S. A. (2020). No apparent association between lecture attendance or accessing lecture recordings and academic outcomes in a medical laboratory science course. *BMC Medical Education*, 20(1), 207. <https://doi.org/10.1186/s12909-020-02066-9>
- Edwards, M. R., & Clinton, M. E. (2019). A study exploring the impact of lecture capture availability and lecture capture usage on student attendance and attainment. *Higher Education*, 77(3), 403–421. <https://doi.org/10.1007/s10734-018-0275-9>
- McGaughey, F., Offer, K., Elphick, L., Wesson, M., & Skead, N. (2020, February 23). *Lecture recordings mean fewer students are turning up – does it matter?* The Conversation. <http://theconversation.com/lecture-recordings-mean-fewer-students-are-turning-up-does-it-matter-131988>
- Nkomo, L. M., & Daniel, B. K. (2021). Sentiment Analysis of Student Engagement with Lecture Recording. *TechTrends*, 65(2), 213–224. <https://doi.org/10.1007/s11528-020-00563-8>
- Nordmann, E., Calder, C., Bishop, P., Irwin, A., & Comber, D. (2019). Turn up, tune in, don't drop out: The relationship between lecture attendance, use of lecture recordings, and achievement at different levels of study. *Higher Education*, 77(6), 1065–1084. <https://doi.org/10.1007/s10734-018-0320-8>
- Petrović, J., & Pale, P. (2015). Students' perception of live lectures' inherent disadvantages. *Teaching in Higher Education*, 20(2), 143–157. <https://doi.org/10.1080/13562517.2014.962505>
- Skoglund, E., Fernandez, J., Sherer, J. T., Coyle, E. A., Garey, K. W., Fleming, M. L., & Sofjan, A. K. (2020). Using the Theory of Planned Behavior to Evaluate Factors That Influence PharmD Students' Intention to Attend Lectures. *American Journal of Pharmaceutical Education*, 84(5), 7550. <https://doi.org/10.5688/ajpe7550>
- Steel, P. (2007). The nature of procrastination: A meta-analytic and theoretical review of quintessential self-regulatory failure. *Psychological Bulletin*, 133(1), 65–94. <https://doi.org/10.1037/0033-2909.133.1.65>
- Steel, P., & König, C. J. (2006). Integrating Theories of Motivation. *Academy of Management Review*, 31(4), 889–913. <https://doi.org/10.5465/amr.2006.22527462>
- Tavenard, R., Faouzi, J., Vandewiele, G., Divo, F., Androz, G., Holtz, C., Payne, M., Yurchak, R., Rußwurm, M., Kolar, K., & Woods, E. (2020). Tslearn, a machine learning toolkit for time series data. *J. Mach. Learn. Res.*, 21(1), 118:4686-118:4691.
- Times Higher Education. (2022, June 9). *Class attendance plummets post-Covid*. Times Higher Education (THE). <https://www.timeshighereducation.com/news/class-attendance-plummets-post-covid>

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