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Impacts of integration of learning activities with video modules in asynchronous learning

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ABSTRACT

CONTEXT

Asynchronous learning poses challenges for student engagement such as limited interaction, feedback, and peer collaboration. Therefore, enhancing student engagement in asynchronous learning requires employing various instructional strategies and leveraging digital tools such as online forums, feedback platforms, vodcasting, and game-based applications. However, the effectiveness of these tools depends on the effective integration of learning activities, continuous monitoring, and reinforcement of learning objectives.

PURPOSE

This study evaluates the impact of incorporating student-centred active learning strategies on student engagement in the context of asynchronous learning and teaching modality, which has become the new normal in the post-pandemic era. Therefore, the following research questions are designed to achieve the expected outcomes.

- Does the integration of learning activities with video modules increase students' engagement with study materials in asynchronous learning?
- How can this integration effectively ensure and enhance student engagement with the learning communities?
- Besides the integration of learning activities, what are the other factors that influence student engagement in asynchronous learning?

APPROACH

To address these questions, a quantitative research method is employed. Students are provided with the experience of asynchronous learning with and without integrated learning activities with video modules. Then, the secondary data from the learning management system is analysed to evaluate student engagement with learning materials and learning communities.

OUTCOMES

The outcomes of this study include: i) increased student engagement, ii) improved learning outcomes, iii) positive student perceptions, iv) identification of additional influential factors, and v) insights for instructional design.

CONCLUSIONS

The research provides valuable insights for instructional designers and educators to optimise the integration of learning activities with video modules and enhance student engagement in asynchronous learning environments. It can also help in creating dynamic and interactive learning experiences that promote a positive perception of asynchronous learning among students.

KEYWORDS

Asynchronous learning, student engagement, instructional design

Introduction

Since the outbreak of the global pandemic (COVID-19), there have been a growing trend of delivering courses through asynchronous online modalities in higher education sectors (Han, DiGiacomo, and Usher, 2023). This is primarily to cater to the changing flexible learning expectations of students and higher education institution's objective of efficient use of scarce resources. While this format offers flexibility for both students and teachers, it also poses several challenges including limited opportunities for personal interaction, lack of immediate feedback, lack of sense of belonging, diminished motivation to study, technical difficulties, lack of accountability, and minimal engagement with study materials. Among these, student engagement with study materials is very crucial. Without active engagement, students may only grasp surface-level knowledge, which can hinder their ability to apply concepts, make connections, and achieve a deeper understanding of the subject matter. Most importantly, this can lead to decreased motivation and interest in the learning process. Therefore, enhanced student engagement plays a key role in creating a supportive online learning environment and improving retention and learning outcomes.

The underpinning theoretical framework adopted for this research is Community of Inquiry Framework (Garrison, Anderson, and Archer, 2010) and social learning approach (Vygotsky, 1978) for developing metacognitive and transferable skills through interaction and knowledge sharing. Accordingly, three types of presence are incorporated to support student engagement namely cognitive, social and teacher presence. Facilitating a meaningful and genuine engagement is critical to deal with the challenges of isolation and disconnectedness in an asynchronous modality to improve the sense of belonging (O'Keeffe, 2013). Student engagement in an online environment can be categorised into two distinct types: engagement with learning activities and engagement with learning communities (Kelly and Lock, 2021). The former pertains to the extent and quality of time and effort students invest in educational activities with a clear purpose, while the latter focuses on students' interactions with their peers and instructors. There are a wide variety of tools and mechanisms that are designed to enhance interaction and engagement in online learning. For example, it is recommended to employ multiple modes of delivery methods and communication mechanisms, such as audio, video, and text to overcome the technological barriers whereas the use of customised learning resources can serve as a motivational tool for students (Devlin and McKay, 2016), while also humanising educators and fostering a stronger connection between students and teachers (Pacansky-Brock, Smedshammer, and Vincent-Layton, 2020). In this research, we investigate the effects of integrating learning activities in asynchronous learning, specifically examining the impact on student engagement with both the learning activities and the learning communities. The following research questions are designed to achieve the anticipated outcomes.

- Does the integration of learning activities with video modules increase students' engagement with study materials in asynchronous learning?
- How can this integration effectively ensure and enhance student engagement with the learning communities?
- Besides the integration of learning activities, what are the other factors that influence student engagement in asynchronous learning?

Related Works

As mentioned above, numerous tools and learning mechanisms are introduced by the researchers to stimulate and maintain student engagement in asynchronous learning. For example, Northey et al. examined the efficacy of utilising a social networking site, Facebook, as a means to facilitate asynchronous learning opportunities that complement in-person interactions, fostering a more robust learning ecosystem (Northey, Bucic, Chylinski, and Govind, 2015). The study shows that a student-centred learning approach combining face-to-face and asynchronous online learning can increase student engagement and positively impact academic outcomes, specifically in the context of marketing education. Similarly, Castro, Sridharan, Watty, & Safari (2021) found effective use of

discussion forums to enable more meaningful engagement, and knowledge acquisition through peer-to-peer and teacher-student conversations.

Biswas and Muthukkumarasamy (2017) emphasised on learning platforms and learning styles to enhance student engagement in cybersecurity courses. The study evaluated three learning platforms (Blackboard, Facebook and PebblePad) and three learning methods (Problem-based, Practice-based, Inquiry-based) to determine their impacts on learning outcomes. Although each learning platform comes up with several benefits and limitations, it has been found that practice-based social learning significantly increases student engagement compared to solitary learning.

Kelly and Lock (2021) discuss the design and evaluation of two skills-based first-year courses that were adapted to an asynchronous mode of delivery in response to the COVID-19 pandemic. The evaluation findings reveal that student engagement was high, with students feeling well-supported by the strong teacher presence throughout the course. This support and engagement positively influenced their final grades and overall completion rates. The study suggests that individualised support, teacher presence, and flexibility are crucial for student success in online learning.

Another paper on distance learning examines the impact of synchronous and asynchronous online learning on students' academic achievement (Zeng and Luo, 2023). The researchers conducted a systematic search of studies published between 2002 and 2022, selecting 14 studies that met the criteria. The results indicate that asynchronous learning is slightly more effective in promoting student knowledge compared to synchronous learning, although the effect size is small. The study also found that the overall effect size is consistent across educational levels and disciplines.

Kim et al. analysed student engagement in online learning through the use of the *k*-means clustering algorithm (Kim, Cho, Kim, and Kim, 2023). Data was collected from undergraduate students enrolled in an asynchronous online course at Kyung Hee University during the fall semester of 2021. The study classified students into two clusters based on their engagement perceptions. Differences in attendance, assignment completion, discussion participation, interactions, and perceived learning outcomes were examined between the two clusters. The findings suggest that relying solely on quantitative indicators of online behaviours may not accurately measure student engagement. Online instructors are encouraged to implement strategies to enhance interaction for students with low engagement perceptions.

Prakasha and Srilakshmi (2023) examine student engagement in online learning during the COVID-19 pandemic. The study collected data from 600 students in Bangalore, India. The findings show a positive correlation between intrinsic motivation and student engagement. It has been found that academic pressure and students' interest, competence, and perceived choice influence engagement whereas intrinsic motivation accounts for a significant portion of the variance in student engagement.

Design and Integration of Learning Activities

In this section, we provide a detail description of the participants, process involved in learning activities design, and the experimental procedure conducted in this research. Figure 1 depicts a schematic view of the process for integrating learning activities during weeks 4 to 9, delivered entirely in asynchronous mode.

Participants

The participants of this research were second year undergraduate students enrolled in the ITEC204: Introduction to Cybersecurity course at Australian Catholic University. The course followed a 3-6-3 delivery model, consisting of face-to-face workshops in the first and last three weeks, with the middle six weeks being conducted fully online in an asynchronous format. All lectures were pre-recorded and uploaded to the learning management system (LMS), covering weeks 4 to 9. A total of 38 students were enrolled in the course.

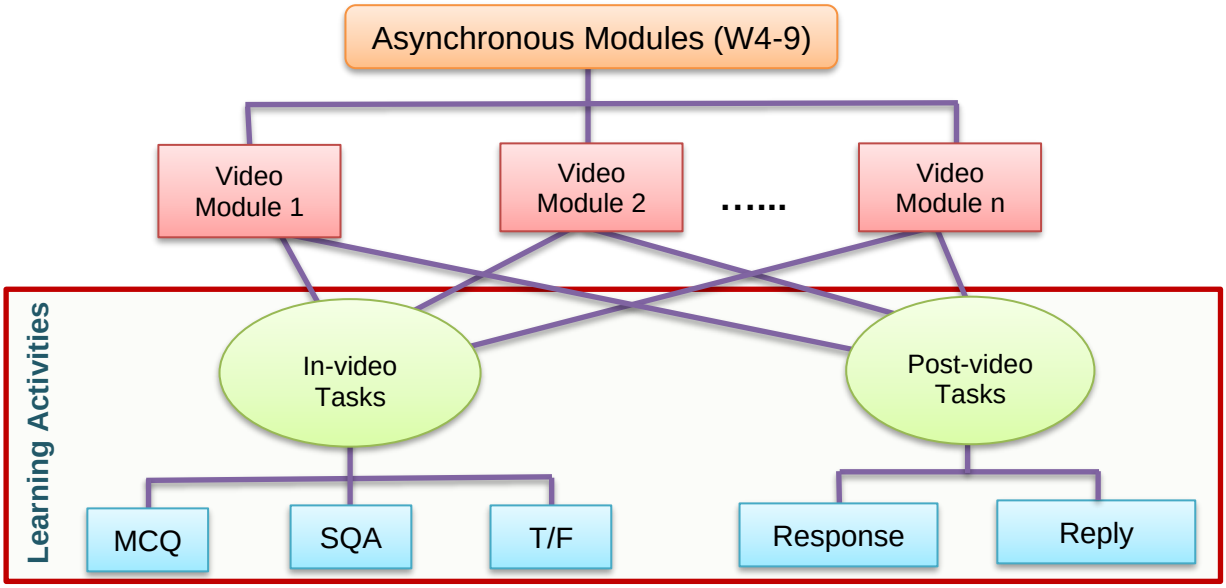

Figure 1: Schematic view of the learning activities integration process

Learning Activities Design

For weeks 4 to 9, we recorded several video segments, with each segment having a duration of less than 15 minutes. Two types of learning activities were designed for week 4, 5, and 6: i) in-video activities, and ii) post-video activities. Engagement with the in-video activities covered the cognitive presence, and post-video activities covered the social and teacher presence. The in-video activities were embedded using the advanced polling feature of Echo360, which included multiple-choice questions (MCQ), True/False (T/F), and short-answer questions (SAQ). On the other hand, the post-video activities used the built-in discussion forum of Echo360 to promote interaction and engagement, facilitate peer learning, and enhance critical thinking and reflection, as shown in Figure 2. For week 7, 8, and 9, we designed only one in-video task and a generic discussion forum (DF) task based on the concepts covered in each week. In short, weeks 4-6 included post-video activities that closely aligned with the topics covered in the respective video modules of each week. In contrast, weeks 7-9 included learning activities that were not based on video modules.

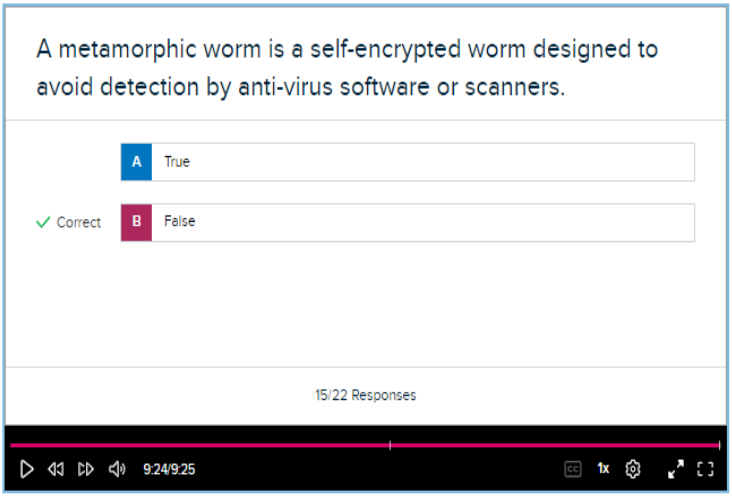

Figure 2: An example of week 4 in-video task

Experimental Procedure

The experimental procedure involved incorporating the in-video and post-video learning activities into corresponding modules. To eliminate internal validity threats and bias, all participants experienced the same experimental process. The measurement methods, materials, and instruments were not changed throughout the research. At the beginning of each week, participants were provided with information regarding workshop topics, video modules, and activity tasks that needed to be completed. At the end of the semester, aggregated data was collected from the LMS for the following criteria.

1. Unique viewers: represent the number of unique students who watched weekly video modules. Although we take average value of unique viewers, it provides insights on how many students are actively engaged with video modules each week in the course.
2. Total views: represent how many times the weekly videos are watched by the students. Note that a video can be watched more than one times by the same student.
3. Total view time: indicates the total duration (in minutes) the videos have been played by students.
4. Average view time: indicates the average viewing time during each view. The value is calculated as total view time divided by total number of views.

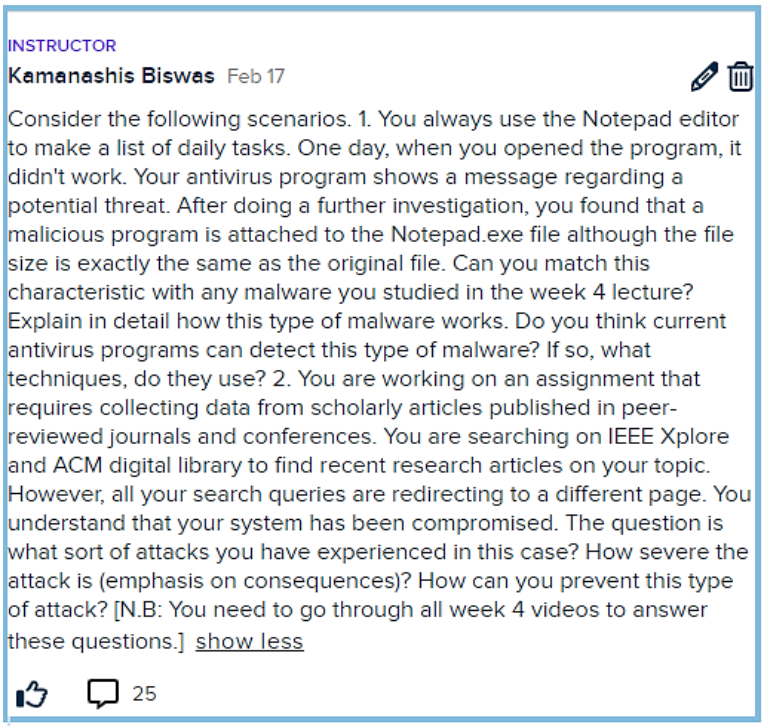

Figure 3: An example of week 4 post-video task

5. Total response rate: represents a percentage of possible responses given to polls. It also shows the number of participants who have submitted, unseen, and seen but haven't replied to a poll.
6. Engagement with DF: presents the number of initial post and replies posted in the discussion forum. It should be noted that this metric assesses students' interaction with their peers, not the quality of the engagement.
7. Engagement with Teacher: while engagement with DF presents interactions with both teacher and fellow students, engagement with teacher shows the number of students who engaged in one-to-one communication with teacher.

Results and Analysis

As mentioned earlier, students were provided with in-video and post-video activities for weeks 4-6. In contrast, weeks 7-9 included in-video activities and a discussion forum task related to a topic covered in the corresponding week's study materials. For both scenarios, aggregated data was collected and analysed to understand student engagement with learning activities and learning communities. The following presents the average outcomes for each week.

Engagement with In-video tasks

It was found that students were more engaged with week 4 - 6 videos compared to week 7 - 9, as shown in Figure 4. The number of unique viewers and total views in the first 3 weeks (weeks 4 to 6) was significantly higher than that of the last three weeks. One reason was that students needed to complete post-video tasks for these three weeks. It was very likely that they watched the videos multiple times to complete the tasks, and this also helped in increasing their engagement with video modules as well as participation in in-video tasks. For example, on average, week 4 videos were watched by 24 unique viewers which was more than two times higher compared to the total number of week 7 unique viewers. A similar trend was observed in the case of the total number of views.

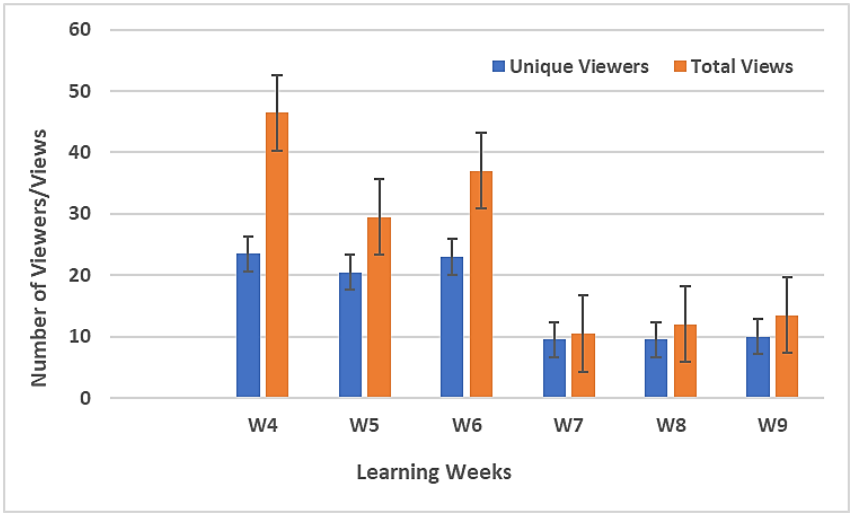

Figure 4: Total number of unique viewers and total views per week

Similarly, Figure 5 indicates that week 4, 5, and 6 videos were watched for a longer duration compared to those of week 7, 8, and 9. It should be noted that the average view time is calculated by dividing the total view time by the total number of views. Therefore, there was an increase noticed in week 8 average view time. This meant that although a few students viewed week 8 video modules, they watched the videos for a long time. However, the sum of the total view time of the first three weeks was almost double of the sum of the last three weeks' total view time. This clearly indicates that students spent more time watching the video modules when the activity tasks were aligned with the corresponding week's video recordings.

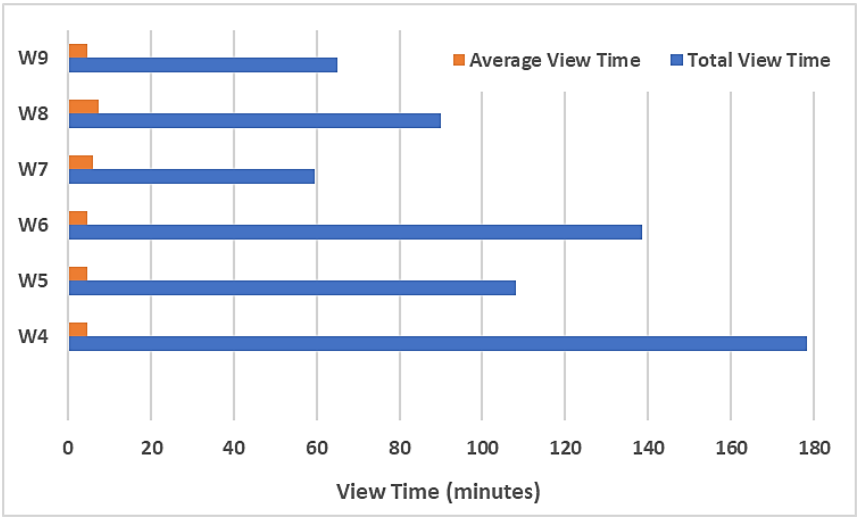

Figure 5: Average view time and total view time per week

Table 1 presents the average total response rate for in-video tasks for each week. It also shows the percentage of users who '*viewed'* and '*viewed, but not completed'* the learning activities. For example, week 4 included five learning tasks embedded in four video modules. 77.27% of participants accessed the in-video tasks but 29.45% of them didn't complete the tasks. This table provides an interesting insight regarding student engagement. Although student participation in first three weeks (weeks 4 to 6) was greater than that of the last three weeks, there was a slight difference observed in the total response rate. Most probably, this was a cohort of students who attempted every learning task and put the same level of effort into solving each task.

Table 1: In-video tasks engagement

Week	Total In-video Tasks	Total Seen (%)	Seen, No Response (%)	Total response rate (%)
W4	5	77.27	29.54	70.45
W5	4	78.26	17.39	60.86
W6	5	84.48	12.06	72.41
W7	4	81.25	12.50	68.75
W8	5	78.94	15.79	63.15
W9	4	73.91	13.04	60.86

Engagement with DF tasks:

Finally, we examined student engagement with discussion forum tasks. Figure 6 shows the total number of initial posts and reply posts received by each week. The number of initial and reply posts gradually increased from week 4 to week 6 where students were required to complete a post-video task. However, there was a decline in the following weeks when students needed to complete a discussion forum task, not aligned with video modules. Although it is hard to say what is the exact reason behind this downfall, it seems they lost momentum and took time to cope with the new process. Another interesting observation is that students have low interaction with their peers as the number of reply posts is less compared to the number of initial posts. This does not necessarily mean students are not engaging as it could be that students are passive in their engagement (just reading posts). This may be due to a range of barriers such as language difficulties, lack of incentives to engage, not being confident in posting publicly, and fear of making mistakes in public amongst others. Further research and investigation need to explore the likely barriers preventing students from engaging in responding to posts and identify strategies for overcoming those barriers. The following is an example of student response to week 5 post video task.

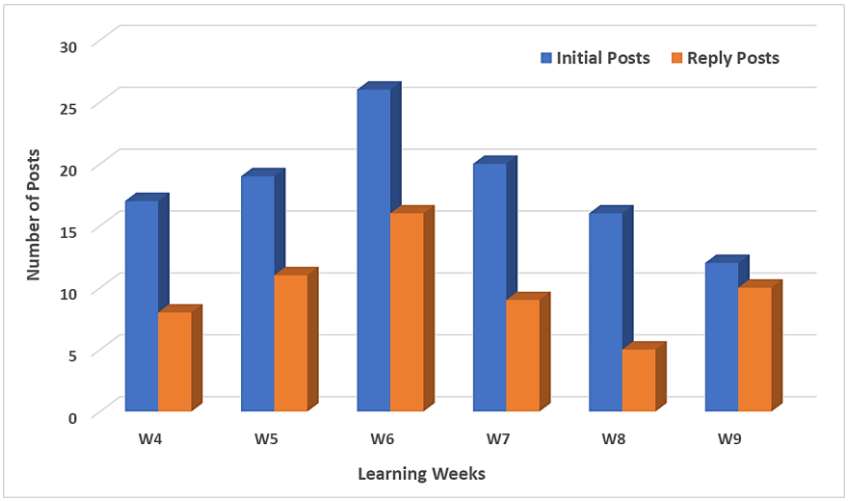

Figure 6: Engagement with DF tasks

Q: *STRIDE: Spoofing, Tampering, Repudiation, Information Disclosure, Denial of Service and Elevation of Privilege.*

While all are threats, which two resonate most with you? Why do you say this? Have you ever been the target of any of these threats (e.g., phishing, data leak)? If yes, explain how these threats are exploited to launch security attacks. If not, identify at least two potential threats that could lead to security attacks.

R: Denial of service and information disclosure are probably the two that resonate with me the most, I've had some experience with DDoS back in my high school days when my mates and I would play games in the arvo, we would occasionally experience it. While I don't have experience with Information Disclosure it is just a generally scary idea.

Well as for my experience from what I could deduce, they used party chats to collect our IP's and flood it with malicious traffic (DDoS) which would result in our home networks losing all connection to the internet or slowing our connection to the point it can't be used.

For Information disclosure, it can lead to a variety of issues. The unintentional leakage of information can leave individuals open to identity theft, theft of funds or accounts, expose sensitive info such as addresses that can lead to in person threats and other items such a blackmail/extortion.

Engagement with Teacher:

Table 2 presents the total number of posts (excluding the initial posts), feedback posts, posts addressing individual students by the teacher, as well as the number of student replies and response rates to the teacher's posts. It can be observed that the response rate was over 50% for the first 3 weeks, but it declined to 33% in weeks 7 and 8. It should be noted that student interaction with the teacher significantly decreased in weeks 7, 8, and 9, as evidenced by the reduced total number of reply posts during those weeks. Consequently, there was also a decrease in the number of feedback posts and individual replies by the teacher. In week 9, students engaged more in discussions with fellow students than with the teacher, as depicted in Figure 6. However, it is essential to emphasise that this does not necessarily indicate a lack of engagement with learning communities. Further research is required to understand the impact of social and teacher presence.

Table 2: Engagement with teacher

Week	Teacher's Posts	Feedback Posts	Posts addressing a particular student	Student Reply	Response Rate (%)
W4	7	4	3	2	67
W5	21	10	11	6	55
W6	19	11	8	5	63
W7	11	5	6	2	33
W8	10	7	3	1	33
W9	6	4	2	1	50

Discussion:

The findings of this research clearly indicate that integrating active learning activities with video modules enhances student engagement with study materials (RQ1). A significant number of students actively participated in and completed in-video and post-video tasks during weeks 4, 5, and 6, as compared to the last three weeks. Additionally, there appears to be a positive correlation between post-video tasks and in-video tasks within the context of integrated learning activities. The post-video tasks during weeks 4 to 6 involved watching weekly videos, which led to increased participation in the corresponding in-video activities. Therefore, it is crucial to thoughtfully design and closely align in-video and post-video tasks to foster higher student engagement with both learning materials and learning communities in asynchronous learning (RQ2). An important observation is that students may require some time to adapt to a new learning approach. For instance, student engagement showed a gradual increase from week 4 and peaked in week 6. However, there was a decline in engagement during week 7 when a new approach was introduced. To address this, we recommend implementing the new learning approach starting from week 3 and maintaining it consistently for all six weeks of asynchronous learning (RQ3). Furthermore, providing incentives or integrating learning activities with assessment tasks can potentially boost student engagement with learning materials and learning communities.

Limitations:

There are a few limitations to this study. Firstly, we utilised aggregated secondary data for our research, which means that we were unable to analyse individual student perceptions and their level of engagement with learning activities and learning communities. Secondly, the view time of video modules cannot guarantee actual student engagement. It is possible that a student may leave the video playing while doing other tasks, and there is no way to verify their true engagement. Thirdly, small sample size in terms of student enrolment mean lack of generalisability. Lastly, the Echo360 discussion forum does not provide information on the number of students who viewed or read a post but chose not to reply. Consequently, if a student does not reply to a DF post, it does not necessarily indicate a lack of engagement with the learning communities. Extending this research addressing these limitations will pave the way for confirmation of findings in this research.

Conclusion

In this research, we adopted the community of inquiry framework and a social learning approach to foster the development of metacognitive and transferable skills through interaction and knowledge sharing. To enhance student engagement, we designed and integrated both in-video and post-video tasks in asynchronous learning, which ensured cognitive, social, and teacher presence. The results demonstrate that these presences play a significant role in fostering student engagement with learning materials and learning communities. Our future work will focus on investigating the impact of incorporating in-video and post-video activities with assessment tasks on student engagement in asynchronous mode. We also aim to investigate whether this intervention mechanism improves students' performance.

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