Promoting Cognitive Engagement using Technology Enhanced Book-End Method in Online Active Learning Strategies

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Abstract

This study aims to investigate the effectiveness of active learning methodologies and technology tools in enhancing cognitive engagement among students in an online learning environment. Traditional teaching methods may not be sufficient to be replicated to engage students in online learning, which may lead to lower levels of cognitive engagement and reduced learning outcomes. Thus, it is essential to explore how technology tools and active learning strategy can be used to enhance cognitive engagement in online learning. This study involves the implementation of book-end method in active learning strategy and the adoption of technology tools such as Mentimeter, Padlet, Zoom or Microsoft Teams with breakout function and Canva in online classes. The theory of constructive alignment, how people learn (HPL) framework and scaffolding strategies are employed to ensure a seamless harmony between the provided activities and assessments. The students had to reflect their experience in this online learning classes and thematic analysis was conducted deductively using pre-determined themes based on cognitive engagement theory to analyse whether the students were cognitively engaged during the online lessons. The findings of this study indicate that book-end approach in active learning using higher order thinking skills activities and technology tools can significantly enhance cognitive engagement among students in online learning. The use of recaps infused with Mentimeter and breakout sessions powered by Zoom or MS Teams and Canva as the intermittent discussions tools, contribute to improved cognitive engagement. In conclusion, this study highlights the importance of using active learning methodologies and technology tools to enhance cognitive engagement in online learning. The findings suggest that educators should incorporate these tools and methodologies into their teaching practices to improve learning outcomes in online classes.

Keywords: Cognitive engagement, Online Active Learning, Book-End Method, Educational Tools, and Technologies.

Introduction

The global impact of Covid-19 has been severe, affecting lives, health, and reverberating through socio-economic and educational ecosystem. The shift to online teaching and learning began in early 2020 due to the imperative of maintaining physical distance. Despite this, many educators and students continue to grapple with the challenges posed by this change. Educators strive to maintain strong engagement during online instruction, often unaware that the shift from in-person to virtual classes requires a reimagining of approaches. It's crucial to recognise that strategies effective in physical classrooms cannot be seamlessly replicated in the online environment.

A persistent hurdle in online education is maintaining consistent student engagement within lessons and classes. As students navigate their learning journey from the comfort of their homes, without direct instructor supervision, they're susceptible to experiencing stress, burnout, and mental exhaustion due to the shifting landscape. Consequently, they might find themselves lacking motivation to sustain their learning momentum.

Chiu (2021) reported that among the reasons the students are not engaging in the online class are due to a lack of cognitive engagement. Yet, the instructors use a lot of behavioural engagement, while also lacking emotional attachment. Instead of feeling motivated to learn, students were forced to attend the class and underwent a rather boring session because it is entirely a lecture, with the only interaction taking place through questions such as, "Do you understand this?" or "Do you have any questions?"

Cognitive engagement refers to the active participation process within a class that stimulates students' motivation to delve deeper into subjects covered earlier, fostering the ability to connect the dots. This cognitive involvement leads students towards achieving a better understanding, moving beyond mere behavioural compliance, which primarily aims at enforcing discipline. In online education, behavioural engagement proves challenging as students occupy distinct spaces, disconnected from

both peers and instructors. Hence, directives like "Attendances are mandatory for maintaining your coursework grade" or "Ensure timely submission of online assignments to avoid deductions" lose their efficacy, inadvertently stifling students' curiosity instead of nurturing it.

Redmond et. al. (2018) investigated the student participation in online learning. They assessed how the term 'engagement' is portrayed and understood across various scholarly articles, often finding its interpretation to be unclear or inconsistent. In response, a detailed structure, drawing from repeated themes discerned from the extensive research was introduced. Within this structured approach, they highlighted the various facets of online participation, placing significant emphasis on the concept of cognitive engagement. This form of engagement envelops a variety of educational components, including, but not limited to, critical analysis, self-reflection (metacognition), and a profound grasp of subject matter. Redmond et al. advocate that this structured approach serves a dual purpose. Not only does it provide a theoretical lens for academic discourse, but it also functions as a tangible roadmap for educators. This roadmap can assist teachers in critically assessing their existing online instructional strategies, prompting them to innovate and refine their techniques for the betterment of their students.

As to understand better, Redmond et.al. defines cognitive engagement pertains to the depth and quality of a student's mental involvement in their learning. It's characterized by a student's effort and determination to truly understand and process complex concepts, rather than merely memorizing information. When students are cognitively engaged, they often employ critical thinking, metacognition, and demonstrate a deep disciplinary understanding. These characteristics are vital as they enable learners to interact meaningfully with the content, ask relevant questions, and make connections between new information and prior knowledge. Redmond's study on online engagement highlighted the significance of these aspects in ensuring effective online education.

Meanwhile, earlier, Richardson and Newby (2006) explore the concept of cognitive engagement in online learning. Cognitive engagement refers to how students integrate their motivations and strategies into their learning. The authors argue that cognitive engagement is crucial for success in online learning, and that instructors and designers of online courses should focus on ways to encourage cognitive engagement among learners.

To engage online learners cognitively, Richardson and Newby suggested that the instructors and designers should focus on creating meaningful learning activities that encourage higher-order thinking, such as planning, predicting, and analyzing information. They should also provide opportunities for learners to take responsibility for their own learning, such as through self-assessment and reflection. Additionally, instructors and designers should consider learners' prior experience with online learning, as well as their motivations and strategies for learning. By focusing on cognitive engagement, instructors and designers can create online learning environments that are more effective and engaging for learners.

Fostering enhanced cognitive engagement can be effectively achieved through the application of active learning methodologies. Active learning stands as a pivotal student-centred strategy aimed at refining cognitive skills. Often, educators adopt the book-end model, as articulated by Felder and Brent (2009), encompassing diverse in-class activities like advance organizers, intermittent discussions, and closure sessions. Within these interactions, a spectrum of techniques can be harnessed, including Brainstorming, Focused Listing, Think-Pair-Share, Think Aloud Pairing Problem Solving (TAPPS), Reflection, Muddy Questions, and more. According to Felder and Brent's research, these active learning strategies facilitate the development of critical thinking, problem-solving, and collaboration skills among students.

Felder contributions to engineering education and active learning have had a significant impact on teaching methodologies. Their work emphasizes the importance of engaging students in the learning process by encouraging them to actively participate and interact with the subject matter. For instance, the book-end model proposed by Felder (2008) involves incorporating various active learning techniques at the beginning and end of a class session. This approach not only enhances cognitive engagement but also promotes deeper understanding of the material and its practical applications.

Incorporating active learning methodologies in the classroom involves a dynamic interplay of strategies that not only enhance cognitive engagement but also cultivate skills crucial for real-world applications. The combination of brainstorming, reflection, and collaborative problem-solving techniques recommended by Felder promotes a holistic approach to learning. This approach aligns with the growing consensus that students benefit greatly from hands-on experiences and opportunities to apply theoretical knowledge in practical scenarios.

In online education, the incorporation of engaging tools and technology stands as a pivotal catalyst in fostering dynamic and interactive learning experiences. These tools, such as Canva, Mentimeter, and Padlet but not limited to these, alongside versatile learning platforms like Zoom or Webex, play a crucial role in enhancing the level of student interaction and involvement. For instance, platforms like Zoom, Webex or Microsoft Teams offer features like breakout rooms that facilitate smaller group discussions, replicating the collaborative atmosphere of traditional classrooms.

Read et. al. (2022) discuss the implementation and impact of collaborative small group tasks conducted

via breakout rooms in Microsoft Teams during the 2020/21 academic year. Their study reveal that a majority of students not only enjoyed these tasks but also believed that they significantly enhanced their learning experience during online sessions. The study emphasizes the effectiveness of collaborative documents in facilitating interactions among students and underscores the benefits of maintaining consistent groupings over time. While some students expressed concerns about technical issues and participation levels, the findings overall emphasize the value of online breakout rooms as a tool for enhancing student engagement, understanding, and collaboration in virtual learning environments.

In addition to the breakout rooms features, tools like Mentimeter and Padlet are also important to enable real-time participation, allowing students to contribute ideas, questions, and reflections anonymously, thereby creating an inclusive environment that encourages open expression without apprehension of judgment. The utilization of such engaging tools not only promotes active participation but also strengthens cognitive engagement, deepening the understanding of subjects through peer collaboration and instructor interaction. Ultimately, these technology-driven enhancements contribute significantly to enriching the online learning journey by enabling a more immersive and interactive educational experience.

In a study conducted by Mohin et al. (2022), the use of Mentimeter in online learning has been found to be effective in enhancing student engagement and participation. Mentimeter is a user-friendly and technologically sound tool that allows for anonymous feedback from students, which can help to boost morale and act as an incentive for participation. Students have reported that Mentimeter is enjoyable and helps them to pay attention in class, and it has been found to increase student attendance and improve teaching quality.

Moreover, in a study by Md Deni and Zainal (2018), Padlet was used as an educational tool to support students' learning of Communication Skills. The study found that the use of Padlet enabled learning to be more collaborative, with students having access to other students' work and the teacher's feedback. This aspect of Padlet use assisted students in their learning as they were able to learn from others' mistakes or good answers, how others answered questions, and from the given feedback. However, it is important to note that the use of Padlet must be based on sound pedagogical reasoning to ensure its effectiveness.

Yundayani, Susilawati, and Chairunissa (2019) investigated the effect of Canva on students' writing skills and found that incorporating visual media, such as Canva, significantly improved students' writing performance and helped them apply technology to language learning. The study was conducted with an experimental group that used Canva in their writing process, while the control group received no treatment. The results showed that the experimental group had a significant improvement in their writing performance compared to the control group. The study suggests that incorporating visual media, such as Canva, can be an effective way to improve writing skills in EFL students.

Amidst the pandemic-induced shift to online classes, the implementation of active learning remains viable, albeit with necessary adjustments. Consequently, this study intends to explore the integration of active learning methodologies using book-end model approach, supported by essential tools (apps and mechanisms), tailored to suit the virtual landscape. Its focus is on deciphering how this adapted approach can facilitate cognitive engagement among students during online lessons.

Application Method

In this study, there were three batches of students learning chemical engineering investigated from two universities. Batch A comprised 2nd-year students with only 27 students (September Semester 2020). Batch B consisted of 82 second-year students from another university (March Semester 2021). Batch A students were taught Principles of Chemical Engineering, which is a material and energy balance-related subject, while Batch B learned Heat Transfer, respectively. All these batches were exposed to a similar strategy: online active learning.

The followings are the tools and apps being used for each batch:

Table 1. Type of Apps & Tools used by both batches of students

Type of Apps/Tool	Batch A	Batch B
Online Platform	MS Teams with Breakout Function	Zoom with Breakout Function
Follow-up platform	Telegram	Telegram
Engagement Tool	Mentimeter & Padlet	Mentimeter & Padlet
Collaborative Tool	Microsoft Office (Docs & Power Point)	Canva

In formulating the teaching and learning strategies, three foundational guiding principles were diligently embraced: the How People Learn (HPL) framework by Bransford (2000), Constructive Alignment proposed by Biggs (1999), and effective scaffolding strategies. To ensure comprehensive alignment with the HPL framework, the implementation of advanced organizers and closure were deemed essential to satisfy both knowledge-centred and learner-centred perspectives. For the latter, it became imperative to assess and address any preconceived misconceptions before introducing novel information. Furthermore, a

learner-centric approach entailed delving into students' demographics, enabling the thoughtful curation of activities and tools that resonate with their diverse needs. Given the pandemic-induced shift to remote learning, the accessibility and affordability challenges of internet connectivity emerged. Consequently, camera usage wasn't mandated throughout classes, and a Telegram group was created to allow the students to access materials using low-bandwidth internet. This digital ecosystem, complemented by Canva and the online platform with breakout functionalities, bolstered a sense of communal engagement, fostering collaboration and mutual support among students. The strategic integration of Mentimeter and Padlet, as a recurring formative assessment tool, sustained active student participation and upheld the assessment-centred lens, offering real-time engagement during live sessions.

In addition to fostering cognitive engagement through thoughtfully crafted activities, the framework of constructive alignment is employed to ensure a seamless harmony between the provided activities and assessments. Recognizing the pivotal role of assessments in shaping learning trajectories, it's imperative to acknowledge that students acquire knowledge through the lens of assessments. As the desired outcome revolves around nurturing cognitive engagement, coupled with meticulously designed in-class activities that embrace this objective, assessments—both formative and summative—primarily embrace open-ended formats. This approach veers away from rote drilling, which involves rigorous exercises culled directly from textbooks and tutorials.

A consistent practice was carried out involves scaffolding students regularly. For instance, if students are unfamiliar with Canva, they are offered a tutorial before utilizing it as a collaborative tool. Similarly, if they are new to online collaboration within breakout rooms, instructors traverse these virtual spaces to reiterate instructions, facilitate discussions, and extend additional time to help them acclimate. This approach aids students in becoming comfortable as they engage in solving assigned tasks, case studies, or problems collectively.

A class is usually conducted employing the Book End Model approach. Within a 2-hour session, the customary activities unfold as follows:

Table 2. Typical activities in an active learning class for 2 hours

Duration	Activities
Initial 10 minutes of the class	Commence with a Recap via Mentimeter or Initiate Brief Discussion Questions
10 to 15 minutes into the lecture	Engage in a Mentimeter Activity
After 45 minutes of the lecture	Participate in a 10-minute Breakout Session (using Canva) – Team-Based Activity
After 1 hour of the lesson	Pause for a 5-minute Break
After 1.5 hours of the lesson	Take part in a 10 to 15-minute Breakout Session – Team-Based Exercise
5 minutes before the class concludes	Conduct a Reflection or Initiate a Quiz using Mentimeter

Furthermore, as an additional component, students were assigned biweekly tasks involving reflective writing through the application of the Gibbs Reflective Cycle Template. These reflections were then shared on Padlet using the provided links. Additionally, students frequently engaged in the practice of composing succinct reflections via Mentimeter. While participation in reflection writing was optional, students were regularly encouraged to recognize the benefits of consistently documenting their reflections to enhance their memory retention and learning experiences. The Gibbs Reflective Cycle (Gibbs, 1988), a robust framework, facilitated introspection of their learning journeys.

In order to assess the presence of cognitive engagement within the learning process, a thematic analysis was conducted in deductive way, and the themes were pre-determined, drawn from the research on cognitive engagement presence of Rotgan and Schmidt (2011), who expanded upon the works of Csikszentmihalyi (1975), Krapp and Lewalter (2001), Prenzel (1992), and Schraw et al. (2001). This contextual cognitive engagement encompasses three core facets: (1) involvement with the current task (item: "I was engaged with the topic at hand"), (2) dedication and perseverance (item: "I invested significant effort"; "I desired to continue working for a while longer"), and (3) the experience of flow, complete absorption in the activity (item: "I was so engrossed that the surroundings faded away"). These components are succinctly captured by the following keywords: (1) ENGAGEMENT WITH TASK, (2) EFFORT & PERSISTENCE, and (3) ABSORBED WITH ACTIVITY.

The following sentences in Table 3 are some of possible sentences that came from the students' reflections, which can fall under these three keywords.

Table 3. Possible Sentences from Students Reflections Indicating Cognitive Engagement Presence

Keywords	Activities
Engagement with Task	"I found the topic to be really interesting and wanted to learn more about it."

	"I was curious to explore different aspects of the task and was eager to start working on it." "The assignment was challenging but it captured my attention because it related to real-world problems."
Effort & Persistence	"Even though I encountered obstacles, I kept trying different approaches until I found a solution." "I dedicated extra time to practice and understand the difficult parts of the lesson." "I refused to give up on the problem and kept searching for alternative methods to solve it."
Absorbed with Activity	"I lost track of time while working on the project because I was so immersed in it." "I was so focused on the task that I didn't realize how quickly time passed." "I found myself completely absorbed in the activity, forgetting about everything else around me."

Findings and Discussions

Frequently, a considerable portion, approximately 40-50%, of students consistently engaged in writing and sharing their reflections across all batches. This percentage remained consistent unless reinforced with multiple reminders or some gamification strategies such as rewards, points or in the form of marks. Presented in Table 4 and 5 are excerpts from the reflections spanning different batches.

Table 4. Excerpts of Reflections from Batch A and B Students

Exhibit	Reflection's Snippet Batch A	Reflection's Snippet Batch B
1	I really like *to communicate via mentimeter* as I can say my opinions without any worries **Keyword: ENGAGEMENT WITH TASK**	Thank you sir for your "unique" teaching ! I totally enjoyed it as currently do not have any lecturer doing these kind of breakout rooms and *make us think* instead of spoon feeding us.
		Keyword: EFFORT & PERSISTENCE
2	I really like to communicate via mentimeter as *I can say my opinions* without any hesitation and I no need to scare of people judging the opinions. I really like that idea. I also appreciate sir to sacrifice your precious time to create video on mass balance to make students understand deeply and apply the knowledge in solving problems regarding mass balance. The videos make me more recognize the topic. **Keyword: ENGAGEMENT WITH TASK**	At first I really find it difficult to adapt with the teaching method of Dr because it was new to join in breakouts and interact with other classmate . Later, I feel *energetic* to join heat transfer class because dr really motivate us to learn new things and I get to know the important of skills like *critical thinking* for an engineer. I learned how problems in the engineering world would be. Especially the assignments done using Canva was very fun, I realized *I can be creative, I realized my potential.* **Keyword: EFFORT & PERSISTENCE**
3	Other than that sir also gave us a lot of quiz and activity with teams or menti meter or kahoot and I think that *really really help me to engage better with the lesson* and I thank sir for that **Keyword: ENGAGEMENT WITH TASK**	The teaching style of Dr is very interesting for me. The lecture notes are very creative and the cartoons are very cute. Dr's teaching method is the best because *students are actively involved in the discussion and discussions are always lively and to the point.* **Keyword: ABSORBED WITH ACTIVITY**
4	In my opinion, this experience was good because I had to *think hard.* For example, we had to do a mass balance for each stream, even though there was only one column (evaporator). I understood bypass process better when sir explained it, it uses the same	Dr's teaching styles are way more different which requires us to *think and figure out why things happen* instead of just following a formula and getting the answer without understanding why things happen as they do. To be honest, this is the way how

	concept as what we learnt before such as input is always equal to input. So, I figured as long as I hold on to the concept input = output, I just have to read the question thoroughly and I will have no problem trying to solve the question. **Keyword: EFFORT & PERSISTENCE**	engineering would be in future I guess. In my opinion, this is what students are gonna face in the outer world when they get graduated. **Keyword: EFFORT & PERSISTENCE**
5	I have been learning Material & Energy Balance for 5 weeks, and I was really satisfied with it. I did *a lot of team works together* with the other students, for example, discussing the lecture slides together, getting some questions and so on. It was really a fun and exciting course for us to learn throughout the semester. **Keyword: ENGAGEMENT WITH TASK**	I was initially unsure and scared that I could not cope with it, but it changed due to project which I completed that enabled me to understand the subject and link it to our daily lives and to how I would use it in the future. I believe that the assignment and task provided by Dr. enabled me to *gain a better understanding of the issue.* **Keyword: EFFORT & PERSISTENCE**
6	The videos can help me to understand better rather than just reading from the lecture slides. Then, we also have done some *class activity during lecture.* This is quite interesting for me to *learn through the activities.* **Keyword: ENGAGEMENT WITH TASK**	Since Dr take over the class I feel scared sometimes to join the class because I am the type of student that don't like to interact much during the class but after that I feel that the way Dr used is actually help me a lot *to improve my thinking skill.* **Keyword: EFFORT & PERSISTENCE**

Table 4 presents the snippets of reflections from both Batch A and B, respectively. Upon careful examination, minimal disparities emerge between the two cohorts in terms of their reflections, emotions, and perceptions of the conducted online activities. Interestingly, while certain students embrace the breakout room exercises with enthusiasm, others harbour reservations, possibly due to social apprehensions even within the virtual setting. Notably,

for both Batch A and B, the breakout activities served as novel experiences, uncharted territory in their online learning journey.

A majority of students found Mentimeter particularly appealing due to its anonymous nature, which is similar to the finding made by Mohen et. al. (2022). This platform allows students to freely contribute ideas, pose questions, and share their sentiments without fearing judgment. Furthermore, students engaged in reciprocal interaction, responding to posed questions, fostering a dynamic learning environment. In Figure 1, a compilation of reflections from a Heat Transfer lesson with Batch B is showcased. While students were instructed to provide brief reflections on their learning, they utilized this opportunity not only for self-reflection but also to seek clarification, contemplate their newfound knowledge, and express their thoughts.

Other researchers have also delved into the intricate landscape of cognitive engagement, uncovering its multifaceted effects on various learning scenarios. The findings from studies such as those conducted by Liu et al. (2023) shed light on the intertwined nature of social and cognitive engagement in online discussions. These studies explore how students' interactions within virtual spaces contribute not only to cognitive processes but also to the establishment of a collaborative and participatory learning environment. This resonates with the observed phenomenon where students in this study embraced the breakout room exercises and engaged in reciprocal interactions, creating a dynamic learning atmosphere. The students' reflections are also similar to the findings shared by Redmond et. al. (2018) and Richardson and Newby (2006), of which suggesting that they are cognitively engaged when they are higher order thinking skills (HOTS) activities conducted during the lessons.

In the context of online learning platforms, Xiao and Hew (2023) conducted research on the effects of tangible rewards in gamified environments. Their investigation goes beyond traditional notions of cognitive engagement to explore the intricate connections between intrinsic motivation, behavioural engagement, cognitive engagement, and learning performance. Their findings highlight the complexity of motivating learners and enhancing their engagement, touching upon aspects such as gamification strategies and their impact on cognitive involvement. Similarly here, when the students were given opportunity to be in breakout session with some gamified experience among the teams, they are excited and heavily engaged in the discussion to ensure their team wins.

Moreover, the research by Kumar, Vrontis, and Pallonetto (2023) ventures into AI-enabled technologies and their impact on cognitive engagement. By examining factors that foster cognitive engagement in the context of AI, their study draws attention to the evolving dynamics between learners

and technologies. This aligns with the novel experiences the students encountered in using platforms like Mentimeter. Notably, the observation that students found anonymity appealing on Mentimeter resonates with the concept of cognitive engagement, as individuals are more likely to engage in meaningful discourse when they feel safe and uninhibited. This is also fulfilling the framework of community centred based on How People Learn (HPL) framework by Bransford (2000), for which the students feel they are in a secure learning environment and be able to express their own thoughts freely.

The insights from these studies collectively reinforce the notion that cognitive engagement is not isolated but intertwined with various factors, ranging from social interactions and gamification to technological platforms. As it was observed in this study, the willingness to explore novel experiences and the utilization of platforms that provide anonymity can foster cognitive engagement, leading to more active participation and deeper learning outcomes.

Table 5 depicts the categorisation of Batch B's final reflection using Gibbs Reflective cycle, and to map whether the provided reflections from students reflecting on their learning experiences matched with the Rotgan and Schmidt (2011)'s framework. Out of three main criteria, it can be seen that from 24 submissions of the reflections, either one or two or all the themes based on this framework appeared in the reflections. Another category, OTHERS, is related to their gratitude and appreciation to the instructor.

Table 5. Classification of Students' Final Reflection from Batch B into Cognitive Engagement (Rotgan & Schmidt, 2011) Themes

Themes	Frequency
ENGAGEMENT WITH TASK	16
EFFORT & PERSISTENCE	14
ABSORBED WITH ACTIVITY	16
Others	11

As previously stated, thematic analysis was employed to categorise these reflections into distinct themes. This process allowed to identify recurring patterns, emotions, and concerns that emerged across the responses. According to Gibbs Reflective Cycle, which is often utilized to explore personal experiences and facilitate self-improvement (Gibbs, 1988), these themes can shed light on the different stages of the learning process and students' responses to them.

One prevalent theme is "Engagement with Task." This theme encapsulates students' expressions of how the instructor's unique teaching methods captured their attention and encouraged them to grapple with the course material. Many students noted their initial surprise and uncertainty about this approach but

subsequently acknowledged its effectiveness. As an example, a student acknowledged that the instructor's teaching was "unique," Furthermore, this theme often involves identifying challenges and subsequent efforts to overcome them, as exemplified by another student's statement about the difficulty of adapting to the new learning style.

The theme of "Effort & Persistence" underscores the importance of dedicating time and energy to mastering the subject. Several reflections express the struggles encountered while analyzing questions and managing time during tests. As for instance, one student reveals her initial uncertainty about question interpretation and subsequent adjustments in her approach. Furthermore, other reflections emphasize the need to recognise and rectify mistakes for future learning.

The theme of "Absorbed with Activity" highlights the immersive nature of the learning process, especially in relation to specific test questions and classroom activities. These reflections often mention the students' experiences during tests and their perception of time allocation. A student expresses surprise at the unexpected nature of the exam questions, leading to a realisation about the need for better preparation.

The theme of "Gratitude & Self-Improvement" for OTHERS category emphasizes students' appreciation for the instructor's teaching methods, acknowledging their evolution in learning, and expressing a commitment to self-improvement. These reflections often emphasize personal growth and a realization of the value of skills gained. A student's reflection showcases this theme by expressing gratitude, appreciating the learning process, and planning for better decision-making in the future.

Although online learning during pandemic is hassle that requires greater preparation time, the students can readily be engaged with some activities that were designed that require their active participation. Active learning strategies play a pivotal role in enhancing cognitive engagement among students in various educational settings. These strategies involve interactive and participatory methods that require students to actively process and apply course material, fostering deeper understanding and critical thinking. Students' reflections on their learning experiences highlight the positive impact of active learning on engagement and learning outcomes.

Active learning methods encourage collaborative activities and group discussions. Students find value in team-based interactions, quizzes, and other collaborative tasks that require them to actively apply their knowledge and engage with peers. This collaborative approach aligns with the principles of active learning, which emphasize hands-on, student-centered approaches to enhance learning (Patiño et al., 2023). These interactions stimulate critical thinking and foster a deeper understanding of the subject matter.

Moreover, active learning methods bridge the gap between theoretical learning and practical application. Students appreciate assignments that enable them to apply their knowledge to real-world scenarios. This practical application not only enhances cognitive engagement but also promotes a better understanding of the subject matter's relevance (Mou, 2023). Students' reflections highlight how active learning methods contribute to meaningful and applicable learning experiences.

In conclusion, the reflections provided by students underscore the positive impact of active learning on cognitive engagement. The integration of interactive tools, collaborative activities, problem-solving tasks, and practical applications collectively contribute to fostering a deeper understanding of the content and encouraging critical thinking. Research findings support the notion that active learning strategies significantly enhance cognitive engagement, leading to more effective learning outcomes (Prestridge & Cox, 2023).

Conclusion

In the challenging transition to online learning necessitated by the Covid-19 pandemic, this study underscores the pivotal role of active learning methodologies in fostering cognitive engagement among students. The global shift to virtual classrooms, brought to light the imperative of reimagining traditional instructional approaches for the digital sphere. The integration of engaging tools like Mentimeter and Padlet, which facilitate real-time, anonymous participation, has emerged as a significant strategy to sustain student engagement and foster an inclusive environment that encourages open expression.

The findings reveal that not only does the thoughtful incorporation of such interactive tools and collaborative activities enhance active and cognitive engagement, but instructor support also plays a crucial role in guiding students through the online learning journey. Insights from reflective writing activities and tool-assisted interactive sessions suggest that the tailored application of active learning strategies, coupled with supportive technological platforms and guided social interactions, can indeed navigate the challenges posed by online education.

This confluence of strategies not only enriches the learning experience by promoting deeper understanding and critical thinking but also holds the potential to enhance learning outcomes in the virtual domain. Thus, the research affirms that with strategic integrations of active learning methodologies, technological tools, and instructor-led guidance, educators can sculpt impactful and cognitively engaging online learning experiences, even amidst the unprecedented challenges in a virtual learning environment.

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