Students' engagement in digital mind mapping-supported collaborative learning during the post-pandemic era

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Abstract: Previous research has demonstrated the effectiveness of digital mind-mapping in improving student learning outcomes, creativity, critical thinking skills, and motivation. However, past studies rarely focused on student engagement when exploring the implementation of collaborative digital mind mapping in higher education. This study explored student engagement in a digital mind-mapping-supported collaborative classroom. The study was qualitative descriptive in nature, involving 20 fourth-semester students from a private university in Indonesia. Purposive sampling technique was used to select the participants. The data were collected through observation and interview and analyzed descriptively. The findings showed that students engaged cognitively, emotionally, and behaviorally in the collaborative mind-mapping activity. The findings mostly describe student-student and student-task engagement. Therefore, further investigations are needed to examine student-teacher engagement in a mind-mapping-supported collaborative learning setting.

Keywords: student engagement; digital mind-mapping; collaborative; post-pandemic

Introduction

The COVID-19 pandemic that occurred in 2019 changed the learning process in higher education quite drastically. Between 2019 and 2022, the learning processes were switched from offline to online, either synchronously or asynchronously. These changes naturally posed various challenges in the field of education, both for the teacher and the students. To keep pace with the changes, many educational institutions had very little time for preparing the curriculum as well as adjusting to students' needs (Daniel, 2020), where for example, some students preferred direct learning in class rather than synchronous or asynchronous online learning (Yuzulia, 2021).

However, after nearly three years of the pandemic, all aspects of life have begun to adapt to these changes, thanks to the work of parties involved in learning at the university (Goodyear, 2022). Education, whether at the elementary, secondary, or tertiary level, is entering a new phase called the new normal phase. During this phase, students and teachers are building internal, interpersonal, and external resilience in learning environments (Raghunathan et al., 2022). Both students and teachers

upgraded their skills in using digital tools to manage work online, engage in online learning, and communicate online.

Many studies have investigated movements toward digital learning during the pandemic, but post-pandemic learning scenarios appear to be receiving less attention from educational academics (Kerres & Buchner, 2022). Our preliminary investigations confirmed that students were taken aback when "returning" to offline classes and communicating with their peers face-to-face. Although some students expressed a desire to return to offline mode, others were hesitant to participate in classroom discussion. Only a few students actively participated in the question-and-answer session, and it was the same students who repeatedly engaged in discussion. Even after receiving positive reinforcement and motivation by the teacher, some pupils did not engage at all. Instructors have also shown resilience in adjusting their teaching style by incorporating technology into the classroom. However, could teacher resilience affect students' involvement in complete offline mode education, given that pupils were accustomed to interactive online learning during the pandemic? As (Kerres & Buchner, 2022) point out, after returning to "normal," education may confront two possibilities. One viewpoint holds that instruction may easily return to pre-pandemic routines, whilst the other believes that the use of technology during the pandemic is solely to bridge the educational system to the digital era. The question remains unresolved. Thus, we were curious to look at student engagement in a higher-education classroom following the pandemic crisis.

In one of the classrooms that we observed during the preliminary research, we found an interesting situation where students were engaged in collaborative learning using digital mind mapping. In such situation, we presumed that students could benefit from both collaborative and digital mind mapping activities. Collaborative learning is rooted in the sociocultural theory developed by Vygotsky (Lin, 2015). Learning is viewed as a social concept in sociocultural theory, deriving from the informal relationship between social contact and individual cognitive growth. There are various characteristics of collaborative learning, according to this view. Lin (2015) outlines numerous Collaborative Learning principles, which are discussed further below. First, Collaborative Learning (CL) allows students to participate in the learning process by working together toward common learning objectives. Furthermore, CL improves the quality of student engagement (Okolie et al., 2021). Learning fosters an environment in which students feel more at ease and relaxed since there are no tight rules governing how they must learn. Students are also free to chat and debate with their classmates about the more challenging aspects of the teacher's subject. Interactions between students and their classmates are formed via conversation and exchange of ideas in Collaborative Learning. The conversation takes place in a very friendly setting, and students may discuss diverse ideas and opinions with one another.

Meanwhile, the mind-mapping technique has been proven effective for improving student learning performance in various disciplines, for example in Chemistry (Redhana et al., 2021), English vocabulary (Wang & Dostál, 2018), and science (Debbag et al., 2021). In addition to improving student learning outcomes, researchers have also reported the benefits of mind-mapping in increasing students' creativity and critical thinking skills (for example, Karim & Mustapha, 2020; Rosba et al., 2021), and motivation (Sabarun et al., 2021).

Along with the development of technology, digital mind maps (DMM) were created to replace manual mind maps to bring modern pedagogy into the era of the fourth industrial revolution (Industrial 4.0). When it comes to writing, digital mind maps enable students to brainstorm and organize their ideas. In other words, digital mind maps help students organize their writing. For example, "Mindomo" helps users brainstorm ideas with colorful digital mind maps and design ideas in a professional manner.

In addition, digital mind mapping can facilitate the writing process because digital tools can integrate ideas with symbols, colors, and other relevant nodes (Karim & Mustapha, 2020). Furthermore, Tavares et al. (2021) suggests that the integration of more technological features, such as videos, notes, and images can make digital mind maps more interactive.

Previous research has demonstrated the effectiveness of mind-mapping or digital mind-mapping in improving student learning outcomes, creativity, critical thinking skills, and motivation. However, although students perceived mind mapping can stimulate their creativity and critical thinking (Karim & Mustapha, 2020) as well as help them organize and remember ideas better (Fadillah, 2019), it does not guarantee that mind mapping always adds benefits to students' learning process and testing (Gavens et al., 2020) or to improving students' concept knowledge (Nyagblormase, et al., 2021). In addition, researchers rarely focused on examining the use of mind mapping to promote students' engagement, which plays a significant role in higher education (Murray, 2018) as it can be used to predict achievement and failure within English courses (Dincer et al., 2019).

Young et al. (2021) believe that active, student-centered, and collaborative learning was effective to promote students' engagement. Collaborative mind-mapping is one of many learning techniques that can be attributed to these characteristics. Therefore, it can be assumed that the integration between collaborative learning and the mind-mapping technique might be effective to enhance students' engagement. Chen et al. (2019) discovered enhanced comfort and engagement among mind-mapping collaborators, and this collaboration allowed participants to explore more ideas. According to Chen et al. (2019), more in-depth research is needed to uncover the process involved in collaborative mind-mapping, as it has been rarely mentioned by researchers in the past. To close this gap, we intended to describe students' engagement in a digital mind mapping-supported collaborative classroom. We did not intervene with any learning activities in the classroom, as the teacher already designed the course using collaborative digital mind mapping. The findings of this study are expected to contribute to a richer understanding of using collaborative digital mind-mapping to promote students' engagement during the post-pandemic era.

Methods

The current study aimed to explore and describe students' engagement in digital mind mapping-supported collaborative learning. This study was designed as a qualitative descriptive study, where the data were collected using observation and interviews. We used the purposive sampling method to determine the study's sample. The research participants consisted of 20 fourth-semester students from the English literature department of a private university located in East Java, Indonesia. Students' engagement in learning activities using collaborative mind-mapping was observed over a two-month period (March-April 2022). Since this study involved the observational research method, we as the researchers observed the participants and phenomena in their most natural settings. Besides field notes, we also documented students' activities through photographs and videos.

After the observation ended, we invited five of the participants to a separate interview session. This number was considered sufficient to collect detailed data via the interviews, as Hagaman & Wutich (2017) suggest that five interviews were adequate for supporting one-theme data analysis to reach saturation. During the session, we asked participants questions regarding their engagement in collaborative digital mind mapping activities.

The questions asked in the semi-structured interview were constructed based on the indicators of student engagement suggested by (Gunuc & Kuzu, 2015). We eliminated the "campus engagement"

and "campus participation" items since this study was limited to examine students' engagement at the classroom level. Table 1 shows indicators of student engagement used in this study.

Table 1. Indicators of Student Engagement [Adapted from Gunuc & Kuzu (2015)]

Types of engagement	Indicators
Cognitive engagement	1. Students are highly motivated. 2. Students try to do their best during classes. 4. Students further study their lesson at home. 5. Students discuss what they have learned in class with their group mates out of class. 6. Students attend classes by getting prepared in advance. 7. Students enjoy intellectual difficulties while learning. 8. Students spend enough effort to learn.
Emotional engagement	1. Students have close friend(s) in class. 2. Students give importance to studying together in a group. 3. Students respect their teacher. 4. Students feel like their classmates respect their thoughts/views. 5. Sudents think that the lessons are beneficial for them. 6. Students respect their team mates. 7. Students like to communicate with their teachers. 8. Students feel anxious when they do not attend classes.
Behavioural engagement	1. Students are active in class. 2. Students carefully listen to the teacher in class. 3. Students carefully listen to other students in class. 4. Students communicate well with their teacher. 5. Students do tasks in time. 6. Students do their best regarding their responsibilities in group work. 7. Students share information with one another.

Data analysis was carried out using a thematic method, where the data from observations (photographs and videos), field notes, and interviews were described according to the indicators of students' engagement suggested by (Gunuc & Kuzu, 2015). Thus, the findings were presented according to the indicators of cognitive, emotional and behavioral engagement.

Results

This study focused on exploring students' cognitive, emotional, and behavioral engagement in a digital mind mapping-supported collaborative learning. Observation and interviews were done to collect the data. The results showed that participants engaged cognitively, emotionally, and behaviorally in the learning process. We used indicators of student engagement suggested by (Gunuc & Kuzu, 2015) to analyze the data. There are eight indicators of cognitive engagement, eight indicators of emotional engagement, and seven indicators of behavioral engagement.

Cognitive Engagement

Students' cognitive engagement was observed through their participation in group work in creating a mind map. Before presenting the mind map in front of their peers in the classroom, students had to work in groups to cover the entire material. The following interview excerpt illustrates the student's effort to explore the material in advance before her group presented in the classroom.

"Kami sudah persiapkan sebelum presentasi di kelas. Kami mencari di google, supaya bisa menjawab pertanyaan dari teman atau dosen." (Student O)
"We have prepared (everything) before the presentation. We searched for the information from Google, so we can answer the questions from the teacher or other students". (Student O)

Student readiness was also seen from how they presented the results of their group discussion in front of the class. They used a well-organized, colorful, and comprehensive mind map to explain the concept to their friends. Figure 1 shows an example of students' mind map.
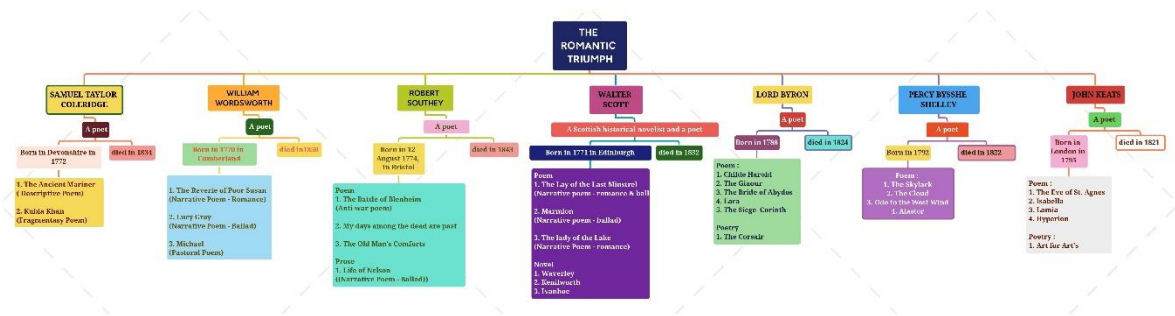

Figure 1. Students' Collaborative Mind Mapping

Figure 1 indicates students' effort in creating a mind map. It shows that the students had prepared themselves at home, which is also one of the indicators of cognitive engagement. Besides, the observation results showed that students tried to do their best in explaining each concept to their friends during the student presentation sessions.

Emotional Engagement

Creating a mind map collaboratively allowed students to engage emotionally in the task. In this study, students demonstrated their respectful attitudes towards other students inside or outside the classroom. Inside the classroom, students showed respect by paying attention to other students when presenting their work. Figure 2 shows the situation where students paid full attention when another group presented their mind map in front of the classroom. Figure 3 shows students' collaborative activity in the classroom.

Figure 2. Students' Group Presentation

Figure 3. Students' Collaborative Activity

Students also showed respect towards their teammates by considering the opinion of each group member regarding how to do the task. In one of the interviews, a student agreed to compromise on how to do the task.

> *"Saling menerima, atau ada yang mengalah. Kita cari jalan tengahnya. Kita rembukan, tambahin lagi" (Student A)*
> "We accept each other's (opinion), or someone gives in. We are looking for a middle way. We break it down, add more (to the mind map)". (Student A)

In addition to respecting opinions, students also realized the importance of working in groups. A student admitted in an interview that group work was better than individual work because he would need a second opinion in designing a mind map, such as shown in the following interview excerpt.

> *"Kamu lebih memilih kerja individual atau kolaboratif?" (Interviewer)*
> *"Saya rasa kelompok, supaya ada yang membantu saya dalam menentukan susunan mind map. Bagaimana bagusnya? apakah horizontal atau vertical? Bagaimana tampilan menariknya" (Student O)*

> "Which do you prefer? individual or collaborative work?" (Interviewer)
> "I prefer collaborative work. I think I need someone to help to organize a mind map. Should I create it horizontally or vertically. What will add to its attractiveness." (Student O)

In conclusion, the students in this study demonstrated emotional engagement by respecting the opinions of their teammates. They also exhibited a display of deference towards other groups by actively engaging in attentive and active listening during the delivery of the presentation within the educational setting.

Behavioral Engagement

In terms of behavioral engagement, the observation and interview results showed that students could communicate well with their group mates, do task in time, share information with one another, and do their best regarding their responsibilities in the group. In the classroom, we observed that all the members of the group took turns presenting the topic, indicating that they were willing to take responsibility for their group work. Outside the classroom, students admitted that they had no problems working with their group members, as all members were willing to cooperate. The following excerpts supported this finding.

> *"Karena saya rasa ada informasi yang kurang, saya minta tolong anggota kelompok lain untuk mencarikannya di google." (Student L)*
> *"Memang ada satu anggota yang tidak mau tau tentang kerja kelompok, tapi saya berusaha untuk menyelesaikan tugas tersebut dengan berdiskusi dengan anggota kelompok lain yang mau peduli (terhadap tugas tersebut)." (Student O)*
> *"Masing-masing anggota kelompok bertanggung jawab terhadap bagiannya masing-masing." (Student R)*

"Because I felt there was missing information, I asked other group members to look for it on Google." (Student L)

"There is one member who did not care about group work, but I tried to complete the task by discussing it with other group members who cared about it (the task)." (Student O)

"Each member of the group is responsible for their respective parts." (Student R)

The findings derived from the interviews and observations conducted in this study indicate that students exhibit a strong inclination towards effective interpersonal communication with their peers. Moreover, they possess the capability to assume accountability for the collaborative tasks delegated to them. In addition to engaging in classroom activities, students engaged in discussions with fellow group members whom they perceive as potential collaborators. In short, students demonstrated behavioral engagement by actively engaging in communication and exchanging information with their peers.

Discussion

Among the eight indicators of cognitive engagement, students showed two of them: getting prepared before class (indicator 6) and spending effort to learn (indicator 8). This finding is possible because before coming to the classroom, participants were assigned to learn a topic in groups. Similarly, Baanqud et al. (2020) found a significant correlation between collaborative learning activities and cognitive engagement. In a collaborative learning environment, students felt more flexible in communicating with peers. In addition, active learning through creating a mind map allowed students to self-construct knowledge (Young et al., 2021).

Before presenting the mind map in front of their peers in the classroom, students had to work in groups to cover the entire material. In other words, the flipped-classroom approach was applied in the classroom. In a flipped classroom, students are encouraged to explore learning materials by themselves (Sakulprasertsri, 2017). Therefore, participants in this study had to spend more effort to read and learn at home before class. The interview results suggested that the mind mapping assignment encouraged the students to work hard at home before presenting their work in front of their peers.

The documentation results showed that participants in this study could assign different colors to the bubbles in their mind map, demonstrating their creativity. They also showed critical thinking in describing the Romantic Triumph era based on the names of its prominent authors. This finding supports previous findings, such as (Karim & Mustapha, 2020; Rosba et al., 2021), which revealed that mind mapping activity could promote students' creativity and critical thinking. Unfortunately, the present study could not prove the effect of the mind-mapping activity on students' creativity and critical thinking using statistical methods.

During collaborative mind-mapping activities, students showed emotional engagement. This finding supports those of (Aubrey et al., 2020), which mentioned that collective social factors, namely group atmosphere, could influence student engagement in the task. Participants in this study had known each other for almost two years. As a result, they were quite familiar with each other. Aubrey (2020) found that student engagement enhanced when they were familiar with each other, allowing them to feel comfortable with dividing the task roles.

Engagement is a collaborative effort rather than the unique responsibility of the teacher (Spiker, 2021). The collaborative mind-mapping activity encouraged participants of this study to take an active role in completing the task. The interview results indicated that even if some students failed to fulfill

their responsibilities, the other group members would step in to finish the assignment. In other words, the disengagement of one student had no effect on the others. Students also displayed a high level of responsibility in completing their assigned tasks, allowing their group to do effectively in class.

The results of the current study imply that students demonstrated cognitive, emotional, and behavioral engagement in a collaborative mind-mapping-supported classroom. Participants in this study demonstrated cognitive engagement by preparing for class and putting in a lot of effort to learn before class. They were also emotionally involved with their peers by respecting their team members' ideas both inside and outside of the classroom and by understanding the value of group work in improving their learning performance. Furthermore, participants could converse well with their peers in groups, complete assignments on time, performed well in their areas of responsibility, and freely exchanged knowledge with one another. These indicators of engagement focused more on student-student and student-task engagement. Therefore, further studies are needed to explore student-teacher engagement in similar learning environments.

Conclusion

The current study was descriptive qualitative in nature, thus there are some limitations that we need to acknowledge. First, the classroom we investigated only used one similar design of task, which is creating a digital mind map and this task was done similarly, which was collaboratively. As a result, future research should investigate a wider range of task kinds or task implementation approaches in order to promote student involvement. To assess involvement throughout the collaborative mind mapping activity, this study relied solely on field notes and interviews. Thus, if students' performance could be measured using tests or students' views or perspectives could be analyzed using a questionnaire, this study may provide further evidence.

Acknowledgment

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