

RESEARCH ARTICLE



The effect of the Mentimeter-based brainstorming method on secondary school students' critical thinking skills

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ABSTRACT

This study investigates the effect of the Mentimeter-based brainstorming method on students' critical thinking skills in the teaching of Pancasila and Civic Education (PPKn). The research aims to assess the extent to which the integration of Mentimeter-based brainstorming can enhance students' ability to think critically. The study is grounded in the urgency of fostering critical thinking as a key competency in 21st-century learning, where students are expected to analyze, evaluate, and articulate their ideas logically and reflectively. A quantitative approach was employed using a quasi-experimental design with a nonequivalent control group. The sample comprised two classes, with one assigned as the experimental group and the other as the control group. Critical thinking skills were measured through a set of multiple-choice questions aligned with established indicators. Data were analyzed using SPSS version 24. The results indicate a significant difference in post-test scores between the experimental and control groups, with the experimental group demonstrating greater improvement. These findings highlight the potential of integrating interactive technology into active learning models to foster a participatory, reflective, and democratic classroom environment. The study recommends the adoption of Mentimeter as an innovative strategy to strengthen students' critical thinking skills across various educational contexts.

KEYWORDS

Brainstorming, Mentimeter, critical thinking, civic education

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1. Introduction

Civic education holds a strategic role in shaping a generation that is capable of critical thinking, responsibility, and integrity in addressing the complexities of

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contemporary society. It is directed toward equipping students with 21st-century skills such as critical thinking, communication, and collaboration (Usmi & Samsuri, 2022). Globally, civic education has been recognized as a key vehicle for strengthening democracy and promoting civic engagement (Kerr, 2021). As one of the main pillars of national education, it aims to improve intellectual capacity, character, and individual competencies in alignment with national standards and educational goals (Utaminingsih et al., 2023). Despite this, international assessments such as the Programme for International Student Assessment (PISA) have consistently shown that students in several countries, including Indonesia, perform poorly in critical thinking literacy (Rizky et al., 2024). This indicates an urgent need to reform teaching methods to become more participatory and effective.

One of the main factors contributing to students' low critical thinking ability is the continued reliance on conventional teaching methods, which often fail to encourage active student engagement (Suriati et al., 2021; Tamara, 2017). In contrast, brainstorming is considered an effective method to stimulate critical thinking because it allows students to freely express diverse perspectives and develop reasoning skills (Ersa et al., 2023; Rehema, 2024). However, the practical application of brainstorming in classroom settings is often hindered by limitations such as time constraints, unequal participation, and psychological barriers among students. These challenges highlight the need for an innovative approach that maintains the strengths of brainstorming while addressing its limitations through technological integration (Pichardo et al., 2021).

Interactive technology offers a promising solution to overcome these constraints. Mentimeter, a digital polling-based platform, enables anonymous and equitable participation, which can foster student confidence and engagement during discussions (Hidayati & Wahyuningsih, 2021; Zhumabekova et al., 2024). When applied in classroom settings, a Mentimeter-based brainstorming approach can promote inclusive, democratic dialogue that aligns with the principles of 21st-century learning. In addition to promoting critical thinking, civic education plays a vital role in developing responsible and civilized citizens and in preparing students to face the moral challenges of the digital era (Sulianti et al., 2019; Utaminingsih et al., 2023). The rapid advancement of technology brings not only convenience but

also potential threats to the moral integrity of younger generations. Therefore, civic education is expected to serve as a crucial medium for shaping character and values from an early age (Rahmatiani, 2020; Maritsa et al., 2021).

Previous studies have shown that the integration of Mentimeter significantly enhances the quality of classroom discussions and encourages students to voice their opinions more confidently (Risdiyani et al., 2023). Therefore, combining the brainstorming method with interactive tools such as Mentimeter is believed to offer substantial contributions to the innovation and effectiveness of civic education. This study aims to investigate the extent to which the Mentimeter-based brainstorming method affects high school students' critical thinking skills within the context of civic education. The findings of this study are expected to contribute to the development of technology-supported instructional strategies that reinforce students' critical thinking competencies.

Furthermore, although the use of advanced technology and digital tools can enrich the learning process, it must be accompanied by character development to ensure that students remain focused and disciplined in their learning journey (Gani, 2020; Dewi et al., 2020). Civic education plays a key role in this aspect by providing value-based instruction and modeling appropriate behavior through teachers. As such, civic education must be prioritized from elementary through secondary education to ensure the holistic development of students' intellectual and moral character (Larasati, 2016; Utaminingsih et al., 2023).

2. Literature review

2.1. Civic education and the challenges of the 21st century

Civic education is a subject that plays a strategic role in shaping students' character and personality, aiming to develop them into intelligent, civilized, and responsible citizens. In the midst of rapid changes in the 21st century, students are required not only to master cognitive aspects but also to acquire essential skills such as critical thinking, collaboration, communication, and creativity. According to Usmi & Samsuri (2022), civic education must be designed in a way that fosters integrity, democratic values, and adaptability to social changes. Global challenges such as moral crises, disinformation, and the negative impacts of digital technology further emphasize the need to revitalize civic education so that it

becomes more contextual and transformative (Sulianti et al., 2019; Utaminingsih et al., 2023).

2.2. Brainstorming method as an active learning strategy

One of the instructional strategies considered effective in developing students' critical thinking skills is the brainstorming method. This method emphasizes active student participation in expressing ideas and opinions openly and freely without fear of being judged. Ersu et al. (2023) explain that brainstorming allows students to present various perspectives, thereby fostering divergent and reflective thinking skills. However, in practice, this method also faces several challenges, such as the tendency of more dominant students to overshadow others and limited class time that is not always sufficient to accommodate all ideas. Therefore, innovation in the implementation of brainstorming is needed to ensure fair and effective engagement for all students.

2.3. Technology integration in learning: The use of Mentimeter

With the advancement of digital technology, education now has access to various interactive media that can enhance student participation, one of which is Mentimeter. This application enables students to respond, discuss, and share their opinions in real-time through their devices, either anonymously or openly. Hidayati & Wahyuningsih (2021) noted that using Mentimeter in the learning process can reduce psychological barriers such as shyness or fear of being wrong, which are often encountered in face-to-face discussions. A study by Zhumabekova et al. (2024) also found that the use of interactive tools like Mentimeter increases student engagement and improves the quality of classroom interactions. Furthermore, Risdiani et al. (2023) discovered that this application significantly encourages students to voice their opinions and enriches the dynamics of group discussions. Therefore, integrating technology such as Mentimeter offers an effective alternative to enhance the brainstorming method and build a more participatory and inclusive learning environment.

3. Methods

3.1. Research design and procedure

This study employed a quantitative approach with a quasi-experimental design of the nonequivalent control group type. The sample consisted of two Grade XI classes in a senior high school, namely the experimental class and the control class, which were selected using a purposive sampling technique. The entire process was conducted over four meetings: two meetings were allocated for instructional implementation (the experimental class using the brainstorming method based on Mentimeter, and the control class using conventional methods), while the remaining two meetings were used for the pre-test and post-test administration.

3.2. Research instrument and data analysis

The research instrument was a multiple-choice test consisting of 10 items developed based on critical thinking indicators. The items were empirically validated through a try-out conducted with 31 students majoring in Civics Education to ensure the quality of the test items. The results of the validity test indicated that all items were suitable for use. The reliability test yielded a Cronbach's Alpha coefficient of 0.906, indicating a very high level of internal consistency. Data from the pre-test and post-test were analyzed using SPSS version 24. The statistical tests used included the Kolmogorov–Smirnov normality test, Levene's test for homogeneity, and the independent samples t-test to determine the differences in post-test scores between the experimental and control classes. The significance level was set at $\alpha = 0.05$.

Table 1. Quasi experiment method with pre-test post-test non-equivalent control group design

Group	Pre-Test	Treatment	Post-Test
Experimental	O ₁	X	O ₂
Control	O ₃	Y	O ₄

Table 1 presents the research design, where O₁ represents the pre-test in the experimental class, O₂ represents the post-test in the experimental class, and X denotes the treatment using the Mentimeter-based brainstorming method.

Meanwhile, O_3 refers to the pre-test in the control class, O_4 refers to the post-test in the control class, and Y indicates the treatment using the conventional method.

4. Results

This study examined the effect of the Mentimeter-based brainstorming method on the critical thinking skills of Grade XI students in Civics Education. The experimental class received instruction using the Mentimeter-based brainstorming method, while the control class was taught through conventional methods. Both classes completed a pre-test to measure their initial critical thinking abilities (see Table 2). Following two instructional sessions using their respective approaches, a post-test was administered to evaluate the improvement in students' critical thinking skills. Data from the pre-test and post-test were analyzed using SPSS version 24.

Table 2. Pre-test and post-test scores of the control and experimental classes

Description	Control Class		Experimental Class	
	Pre-test	Post-test	Pre-test	Post-test
Highest Score	90	100	100	100
Lowest Score	20	30	20	50
Average Score	54.07	70.00	58.52	80.37

Table 3. Normality test of pre-test and post-test

Class	Test Type	Statistic (Shapiro-Wilk)	Sig.	Interpretation
Experimental	Pre-test	0,967	0,514	Normal
	Post-test	0,930	0,067	Normal
Control	Pre-test	0,949	0,204	Normal
	Post-test	0,960	0,371	Normal

Table 4. Homogeneity test of pre-test and post-test

Test Type	Class	Levene Statistic	Sig.	Interpretation
Pretest	Experimental & Control	0.046	0.832	Homogeneous
Post-test	Experimental & Control	1.607	0.211	Homogeneous

Table 5. N-Gain of critical thinking skills in the control and experimental classes

Class	Pre-test Average	Post-test Average	N-Gain	Classification
Control	54.07	70.00	0,35	Low
Experimental	58.52	80.37	0,53	Medium

Table 6. Hypothesis testing

Assumption	T	Df	Sig. (2-tailed)
Equal Variances Assumed	2,401	52	0.020
Equal Variances Not Assumed	2,401	48,889	0.020

The Shapiro–Wilk normality test indicated that the data were normally distributed (significance value > 0.05) across all groups and test occasions (see Table 3). Levene’s test of homogeneity confirmed that the variances between the groups were homogeneous (significance value > 0.05), fulfilling the assumptions for conducting a t-test (see Table 4). The t-test results for the pre-test showed no significant difference between the experimental and control classes ($t = 0.798$; $p > 0.05$), indicating that both groups had comparable critical thinking abilities before the intervention. In contrast, the post-test results revealed a significant difference between the two groups ($t = 2.401$; $p < 0.05$), with the experimental class showing greater improvement than the control class. The gain score (N-Gain) analysis further demonstrated that the improvement in critical thinking skills in the experimental class fell within the medium category (0.53), while the control class was in the low category (0.35) (see Table 5). These findings support the hypothesis that the Mentimeter-based brainstorming method can significantly enhance students’ critical thinking skills (see Table 6), highlighting its potential as an effective strategy in fostering higher-order thinking in civics education.

5. Discussion

The results of this study indicate that the Mentimeter-based brainstorming method has a significant positive impact on improving students' critical thinking skills. This is evidenced by the difference in post-test scores between the experimental and control classes, showing that students engaged in Mentimeter-assisted learning were better able to develop higher-order thinking skills such as analysis, evaluation, and synthesis. The strength of Mentimeter lies in its ability to create an interactive discussion space where students can express ideas anonymously and equally. This encourages active participation without social pressure, aligning with the findings of Musliha & Purnawarman (2020), who stated that Mentimeter helps reduce psychological barriers in discussions and fosters students' courage to express their opinions.

The brainstorming method itself has long been recognized as an effective strategy for stimulating critical thinking. Kartoni & Alinuridin (2021) argue that brainstorming allows students to express ideas without fear of being wrong, thereby promoting broader cognitive exploration. In this context, integrating Mentimeter as a supporting medium enhances student engagement and creativity in discussion. Furthermore, technology-based learning like Mentimeter aligns well with the characteristics of the digital generation, who require dynamic and contextual learning experiences. According to Jilan Alfarras et al. (2023), the use of Mentimeter significantly increases student engagement and strengthens critical thinking skills through features such as polls, quizzes, and open-ended responses that trigger reflective thinking.

In the field of Pancasila and Civic Education (PPKn), critical thinking skills are crucial, as the subject demands not only theoretical knowledge but also the ability to evaluate, respond to, and take a stance on social and national issues (Rizal & Faradilla, 2024; Sarbaini, 2025; Shofiyatul et al., 2021; Widyatama, 2025). As emphasized by Novita Sari et al. (2021), effective civic education is that which shapes learners into critical, active, and responsible citizens. On the other hand, Mayer's cognitive theory of multimedia learning (Laksana, 2017) emphasizes that the combination of visual and verbal elements—as found in Mentimeter—can significantly enhance students' comprehension and memory retention. Therefore, the use of Mentimeter in brainstorming is not only socially effective but also grounded in a strong cognitive foundation.

The implications of these findings highlight the importance of teachers' pedagogical skills in designing technology-based learning that is adaptive and promotes active engagement. Teachers are expected to act as facilitators rather than merely transmitters of content, so that learning becomes a reflective and collaborative experience. Given the success of this method, future research may explore its application in other subjects, at different educational levels, or in online learning models. Nevertheless, as stated by Mayung et al. (2023), attention must also be paid to technological infrastructure challenges and teachers' digital literacy to ensure that multimedia utilization is optimal and sustainable.

6. Conclusion

This study demonstrates that the brainstorming method supported by the Mentimeter application significantly enhances students' critical thinking skills in the subject of Civics Education at the senior high school level. The experimental group, which engaged in interactive digital brainstorming, showed higher learning gains compared to the control group taught through conventional methods. This improvement is not only reflected in the post-test scores but also in the development of students' analytical, evaluative, and reflective abilities. The anonymous and equitable participation enabled by Mentimeter encourages students to contribute more freely, thereby reducing psychological barriers such as fear of making mistakes or being judged. As a result, students become more confident in expressing their opinions, analyzing social issues, and drawing logical conclusions—skills that are essential in Citizenship Education, which aims to produce intelligent, responsible, and value-driven citizens.

Incorporating Mentimeter into the learning process aligns with the needs of today's digital-native learners, who respond better to participatory, dynamic, and technology-integrated instruction. The success of this method reinforces the importance of adopting innovative teaching strategies that do not solely rely on traditional teacher-centered approaches but instead foster student-centered and collaborative learning environments. Moreover, the findings support the integration of multimedia and digital platforms in teaching to not only improve student engagement but also build essential 21st-century competencies. The study further recommends the exploration of Mentimeter-based strategies in other subjects, levels of education, or hybrid and online settings, to fully realize the potential of technology-enhanced learning in the broader educational landscape.

Conflict of interest

The author declares that they have no conflict of interest.

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