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THE EFFECTIVENESS OF THE MENTIMETER-BASED 5E MODEL IN ISLAMIC RELIGIOUS EDUCATION

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Abstract

This study examines the effectiveness of integrating the 5E learning model with the Mentimeter application in enhancing students' critical and creative thinking skills in Islamic Religious Education courses at three universities in Semarang. Using a quantitative pre-experimental design with a multi-group pretest–posttest structure, the study involved 133 first-semester students from three universities selected through purposive sampling with a minimum attendance criterion of 80%. The data were drawn from pretest and posttest scores obtained through essay-type test instruments, with data collection carried out at the beginning and the end of the semester. Data were analyzed using paired statistical tests (Paired Sample t-Test and Wilcoxon Signed Rank Test), N-Gain calculations, and the Kruskal–Wallis test to examine the consistency of improvement across institutions. The findings indicate significant increases in critical thinking skills (N-Gain = 0.48) and creative thinking skills (N-Gain = 0.40) with a high level of significance ($p < 0.01$). These improvements were consistent across universities with different institutional characteristics ($p > 0.05$), indicating that the 5E syntax based on Mentimeter is robust and adaptive to various learning contexts. The results suggest that technology-based contextual learning can bridge the gap between traditional religious instruction and the cognitive demands of the Society 5.0 era. This study offers a new pedagogical framework for religious education by combining structured inquiry stages with interactive digital technology, and recommends further research employing longitudinal or experimental designs that consider variables such as digital literacy, learning styles, and socio-economic background.

Keywords 5E Syntax, Mentimeter, Critical Thinking, Creative Thinking.

INTRODUCTION

Religious education in Indonesian higher education continues to face significant challenges, particularly in adapting to the demands of digital transformation and the competencies required in the Society 5.0 era (Fukuda, 2020; Sihombing et al., 2024). Despite rapid technological advancements, the pedagogical practices in Islamic Religious Education (PAI) courses at the tertiary level persist predominantly in conventional, instructor-centered approaches. In this context, students tend to become passive recipients of information, thereby constraining opportunities for exploration, dialogue, and the development of higher-order thinking skills. Numerous studies affirm that traditional instructional models have not been substantially effective in cultivating students' critical and creative thinking skills necessary to address complex socio-religious issues, while also enabling them to contribute meaningfully within a pluralistic society (Rahmatiah et al., 2022; S. L. Ridwan, 2021). In line with the demands of higher education shifting toward digitalization and student-centered learning, the necessity for innovative instructional designs capable of integrating technology with modern learning theories has become increasingly pressing.

The state of Islamic education in higher education institutions further reflects a growing demand for students to become independent thinkers capable of engaging meaningfully with contemporary religious issues. However, didactic instruction remains the dominant pedagogical approach in classroom settings. While efficient for content delivery, this method offers limited scope for inquiry-based learning (Nur et al., 2023; Tohari & Rahman, 2024). When instruction fails to encourage students to question, explore, and engage in reflection, they often struggle to contextualize religious concepts within real-life situations. This gap becomes increasingly evident as students are expected to master 21st-century competencies, including critical thinking, creative thinking, collaboration, and digital literacy, while the learning environment remains insufficiently conducive to the optimal development of these skills (Sulisworo et al., 2016).

Based on a preliminary study conducted by the researcher involving first-semester students at Semarang State University (UNNES), Sultan Agung Islamic University (UNISSULA), and Muhammadiyah University of Semarang (UNIMUS), initial data indicate that students' critical thinking skills remain in the moderate category, with mean scores of 63.56 for UNNES, 61.71 for UNISSULA, and 60.78 for UNIMUS on a 100-point scale. A similar pattern is observed in creative thinking skills, with mean scores of 62.13 for UNNES, 60.73 for UNISSULA, and 59.48 for UNIMUS. Analysis of the Semester Learning Plan (RPS) reveals planned variations in contextual learning

approaches, such as the Case Method at UNNES (72%), case studies at UNISSULA (68%), and Discovery Learning at UNIMUS (78%). However, interviews with lecturers and students indicate that the actual pedagogical practices in PAI courses across these three institutions remain relatively uniform, predominantly characterized by lecture-based methods, limited discussion, and minimal use of interactive technology. This situation results in students being less actively and reflectively engaged in PAI learning.

This gap between the intended learning outcomes and the reality of classroom practice has generated significant academic concern for the researcher. On one hand, PAI in higher education is expected to cultivate students who are critical, reflective, and contextual in their understanding of Islamic teachings. On the other hand, the prevailing instructional design has not yet fully supported the achievement of these objectives. This condition is consistent with findings from various studies indicating that PAI instruction at the tertiary level still tends to emphasize knowledge transmission over the development of students' higher-order thinking skills (Amin, 2015; Jamil et al., 2019). Meanwhile, these critical and creative thinking skills are explicitly outlined in the learning outcomes of the PAI course and constitute essential competencies for addressing the complexities of contemporary religious issues.

In response to the aforementioned issues, this study proposes the implementation of a Mentimeter-based SE learning model as an antithetical approach. This model was selected because its structured phases support scaffolded learning for early-semester students and have been empirically proven effective in enhancing learning outcomes and higher-order cognitive abilities, with an effect size of 0.82 (95% CI) (Polanin et al., 2024). Furthermore, Mentimeter has been empirically demonstrated to be more effective than other interactive platforms such as Kahoot, Padlet, and Quizizz in enhancing student participation, motivation, and critical thinking, achieving an engagement rate of 89% and a motivation effect size of d = 1.2. This effectiveness is supported by its anonymity feature, which is particularly significant for facilitating discussions on sensitive religious values (Boateng, 2022; Dwi Anggriani & Eko Atmojo, 2022; Madiseh et al., 2023; Pichardo et al., 2021; Sari, 2021; Tetambe & Marzuki, 2025). The integration of the SE learning model and Mentimeter creates a pedagogical synergy that aligns with the TPACK framework, in which technology, constructivist pedagogy, and PAI content mutually reinforce one another to produce effective and meaningful learning.

In accordance with Vygotsky's social constructivism, effective learning occurs when students operate within their Zone of Proximal Development, a state in which social interaction and the provision of scaffolding play a crucial role in the gradual construction of student understanding (Vygotsky, 1978). Empirical findings from the preliminary study indicate that PAI instruction across the three universities has not yet fully provided adequate space for interaction, exploration, and reflection, nor has the potential for students' cognitive development been optimally facilitated. One model aligned with these principles is the SE learning model, which consists of the stages Engage, Explore, Explain, Elaborate, and Evaluate. The SE model enables students to activate prior knowledge, investigate problems, articulate their understanding, apply concepts, and evaluate learning outcomes (Bybee et al., 2006). Although widely utilized in science education, the SE structure also aligns with the learning objectives of PAI, such as inquiry, reflection, contextual understanding, and the application of values (Schallert et al., 2022). Numerous studies demonstrate that the SE model enhances academic achievement and conceptual understanding (Nisa et al., 2022; Polanin et al., 2024; Salong & Lasaiba, 2024; Wiriani & Ardana, 2022). However, its application in higher education, particularly within PAI courses, has not yet been widely implemented or subjected to comprehensive empirical validation.

In line with pedagogical developments, the integration of digital technology has become a vital component of modern instruction. Platforms such as Mentimeter provide features that enhance interaction, foster active participation, and reduce social barriers that often discourage students from expressing their opinions (Gokbulut, 2020; Moorhouse & Kohnke, 2020). Given that discussions in PAI courses often involve sensitive and complex topics, the anonymity and interactive features of Mentimeter can significantly enhance student engagement. Additionally, the real-time visualization of responses provides instructors with immediate insight into student understanding, enabling more informed and targeted instructional decisions (Khan, 2025; Pichardo et al., 2021). Thus, Mentimeter possesses strong potential to optimize the implementation of constructivist models such as SE.

Critical and creative thinking constitute core competencies in religious education. Critical thinking assists students in analyzing arguments, evaluating interpretations, and assessing the validity of exegesis (Ennis, 1985; Facione, 2016). Meanwhile, creative thinking facilitates the ability to generate novel ideas and connect religious teachings with contemporary realities (Anjarsari et al., 2022; Rochmat et al., 2023). In the context of the 21st century, these two competencies are essential

in confronting increasingly complex challenges (Vincent-Lancrin et al., 2019), facilitated through pedagogical approaches and a collaborative learning environment (Anaktototy, 2023). Several studies indicate that discovery-based learning models can enhance critical thinking skills and improve learning outcomes (M. Ridwan et al., 2021). However, despite being strongly emphasized in the PAI curriculum, students continue to face difficulties in attaining these competencies due to passive learning environments that lack technology-enhanced or inquiry-based activities (Amin, 2015; Jamil et al., 2019).

Prior research on digital technologies in religious education has predominantly focused on enhancing motivation or participation. Studies on the use of platforms such as Mentimeter, Kahoot, or Google Classroom generally demonstrate improved engagement; however, they rarely evaluate their efficacy in supporting higher-order cognitive outcomes such as critical or creative thinking (Boateng, 2022; Intan Nabila et al., 2024; Madiseh et al., n.d.; Risdiani et al., 2023). On the other hand, studies on the SE model often highlight improvements in conceptual understanding but do not specifically examine its impact on higher-order thinking skills (Polanin et al., 2024). Moreover, research on the integration of digital technology into PAI instruction remains limited. This gap is further underscored by a scarcity of multi-site quantitative research capable of evaluating the consistency of a learning model's effectiveness across diverse types of institutions (Akbari & Pratomo, 2022; Aripradono et al., 2024).

This study presents several significant novel contributions. First, it integrates the SE learning model with the Mentimeter application, a combination rarely implemented in PAI instruction at the higher education level. Previous research has tended to examine pedagogical models and digital technology separately (Nisa et al., 2023), in contrast, this study integrates both within a single constructivist framework. Second, it employs a multi-site design across three universities with distinct institutional characteristics, thereby yielding findings with greater comparative robustness and enhanced potential for methodological generalizability. Third, the research assesses the improvement of two higher-order thinking skills simultaneously, namely critical and creative thinking, whereas most prior studies have focused on only a single cognitive domain. Consequently, this study provides a significant and novel empirical contribution to the development of technology-enhanced PAI pedagogy.

Collectively, these gaps underscore the necessity for an instructional model that not only integrates modern pedagogical approaches with digital technology but also generates empirical

evidence regarding its effectiveness across diverse educational contexts. Therefore, this research is designed to evaluate the effectiveness of the Mentimeter-based SE model in enhancing students' critical and creative thinking skills within PAI courses at three universities in Semarang. By addressing the limitations of prior studies, this research provides both theoretical and practical contributions to the development of religious education in the digital era.

METHOD

This study employs a quantitative pre-experimental design, specifically a multi-group pretest-posttest structure without a control group (Sugiyono, 2023). This design was selected to measure changes in students' critical and creative thinking skills following their engagement with the Mentimeter-based SE learning model. The multi-site approach, implemented across three universities with distinct institutional characteristics, was chosen to strengthen external validity and assess the consistency of the model's effectiveness within diverse Islamic higher education contexts. The adoption of a pre-experimental design was also based on the consideration that all three universities mandated the implementation of the same learning model for all students, rendering the formation of a control group unfeasible.

This research was conducted in first-semester Islamic Religious Education courses at three universities in Semarang: Semarang State University (UNNES), Sultan Agung Islamic University (UNISSULA), and Muhammadiyah University of Semarang (UNIMUS). These three institutions represent distinct educational environments: a state university, a private Islamic-based university, and a private Muhammadiyah university, enabling the study to capture variations in learning conditions. A total of 133 first-semester students participated in the study. The sampling technique employed was purposive sampling, with criteria of a minimum 80% attendance and completion of both the pretest and posttest (Etikan, 2016). Instructors from each institution were also briefed to ensure consistency in the implementation of the learning model. To guarantee implementation consistency, the researcher developed a standardized learning guide that included a semester lesson plan (RPS), detailed learning scenarios for each SE phase, and assessment rubrics. Instructors were also provided with access to pre-designed Mentimeter templates specifically tailored for each learning stage.

The learning intervention was implemented over one semester, structured according to the five phases of the SE (Nisa et al., 2023) includes: 1) instructional model, comprising: 1) Engage, where the instructor activated students' prior knowledge using Mentimeter features such as word clouds, polls, and stimulating questions, aiming to foster curiosity and create an inclusive learning environment; 2) Explore, in which students worked in small groups to explore religious issues through case analysis, with Mentimeter's open-ended question feature used to collect ideas anonymously to reduce social anxiety, particularly when discussing sensitive topics (Pichardo et al., 2021); 3) Explain, where the instructor facilitated concept clarification by displaying aggregated student responses from Mentimeter, utilizing this collective visualization to help students compare perspectives, provide reasoning, and correct misconceptions without fear of judgment (Gokbulut, 2020); 4) Elaborate, which applied knowledge to new contexts through Mentimeter-based case studies, interactive quizzes, and simulations, emphasizing knowledge transfer and the reinforcement of higher-order cognitive processes (Schallert et al., 2022); 5) Evaluate, where assessment was conducted via Mentimeter quizzes, written reflections, and essay tests, designed to measure the development of both critical and creative thinking skills while promoting student metacognition.

Collectively, Mentimeter functions as a digital application that progressively fosters equitable participation, dynamic interaction, and a learning environment congruent with constructivist theory (Darling-Hammond et al., 2020). Two essay-based test instruments were employed to measure critical and creative thinking abilities. The critical thinking test comprised five questions (one for each selected topic) based on Ennis's (1985) indicators: analysis, evaluation, and inference. Students were required to identify arguments, uncover assumptions, and draw evidence-based conclusions. The creative thinking test consisted of five questions based on the Torrance (1974) framework, encompassing fluency, flexibility, originality, and elaboration (Almeida et al., 2008). These questions required students to generate diverse ideas, reinterpret concepts, and design innovative solutions to religious issues.

The instrument was validated by three experts in Islamic education and educational assessment. Each item was evaluated for clarity, content relevance, and alignment with cognitive indicators. A pilot test was conducted with 30 students outside the research sample, resulting in minor revisions to the question wording. The reliability test yielded Cronbach's alpha values of 0.84 for the critical thinking test and 0.89 for the creative thinking test, indicating strong internal

consistency. Data collection consisted of three stages: (1) administration of a pretest at the beginning of the semester to measure baseline ability; (2) implementation of the Mentimeter-based SE learning model over several class sessions; and (3) administration of a posttest at the end of the semester.

Data analysis was conducted through several steps. Normality (Shapiro-Wilk) and homogeneity (Levene) tests were employed to determine the appropriate statistical techniques. For normally distributed data, a Paired Sample t-Test was used; for non-normal data, the Wilcoxon Signed Rank Test was applied. Learning improvement was calculated using the N-Gain score (Hake, 1999). Subsequently, the Kruskal-Wallis test was utilized to examine differences in improvement across universities. Effect sizes were calculated using Cohen's d for parametric data and effect size r for non-parametric data (Field, 2018). This study obtained ethical approval from all three institutions. All participants provided written consent, participation was voluntary, and data confidentiality was strictly maintained.

The hypotheses proposed in this study are Ho: There is no significant difference in students' critical and creative thinking skills before and after the implementation of the Mentimeter-based SE learning model. H: There is a significant difference in students' critical and creative thinking skills before and after the implementation of the Mentimeter-based SE learning model. Whereas the hypotheses for consistency across institutions are Ho: There is no significant difference in the improvement of students' critical and creative thinking skills across universities. H: There is a significant difference in the improvement of students' critical and creative thinking skills across universities.

FINDINGS AND DISCUSSIONS

Findings

Research Sample Description

The distribution of the research sample encompasses three universities with distinct characteristics, as presented in Table 1.

Table 1. Research Sample Distribution

University	Number of participants	Percentage (%)	Institutional characteristic
UNNES	36	27	State University
UNISSULA	34	25	Islamic Private University
UNIMUS	63	47	Private University (Muhammadiyah-affiliated)
Total	133	100	

A majority of respondents were from private universities (UNIMUS), followed by UNNES and UNISSULA. All respondents were first-semester students enrolled in a mandatory religion course with a minimum attendance rate of 80%.

Descriptive Statistical Results

Critical Thinking Ability

The descriptive statistics for students' critical thinking skills are presented in Table 2. An increase in mean scores from pretest to posttest is evident across all universities.

Table 2. Descriptive Statistics of Pre-Post Critical Thinking Skill Scores

University	Pretest (Mean)	Posttest (Mean)	N-Gain	Category
UNNES	63,56	83,89	0,5121	Moderate
UNISSULA	61,71	80,47	0,4683	Moderate
UNIMUS	60,78	78,52	0,4632	Moderate
Average	61,98	80,96	0,4800	Moderate

The mean score increased from 61.98 to 80.96, with an N-Gain index of 0.48, indicating a moderate level of effectiveness. This demonstrates that the contextual learning approach using the Mentimeter application had a significant effect on improving students' critical thinking skills.

Creative Thinking Ability

The comparison results of pretest and posttest scores for creative thinking ability are presented in Table 3.

Table 3. Descriptive Statistics of Pre-Post Creative Thinking Skill Scores

Universit	Pretest (Mean)	Posttest (Mean)	N-Gain	Category
UNNES	62,13	80,20	0,4335	Moderate
UNISSUL	60,73	78,98	0,4441	Moderate
UNIMUS	59,48	74,06	0,3339	Moderate
Average	60,78	77,75	0,40	Moderate

The overall mean increased from 60.78 to 77.75 with an N-Gain value of 0.40 (moderate category). This improvement indicates that the use of Mentimeter within the SE learning model also contributed to the development of students' creative thinking skills.

Results of Normality and Homogeneity Tests

Normality Test for Critical Thinking Ability

The results of the normality test using the Shapiro-Wilk test are displayed in Table 4.

Table 4. Normality Test Results for Pre-Post Critical Thinking Skills

University	Data type	Sig. (Shapiro–Wilk)	Distribution
UNNES	Pretest	0,125	Normal
	Posttest	0,032	Non-Normal
UNISSULA	Pretest	0,162	Normal
	Posttest	0,068	Normal
UNIMUS	Pretest	0,010	Non-Normal
	Posttest	0,000	Non-Normal

The results of the normality tests indicate that most pretest data for critical thinking are normally distributed, while the posttest data for UNNES and all data for UNIMUS are not normally distributed. The data from UNISSULA meet the normality assumption for both stages. Consequently, the effectiveness analysis was conducted using a mixed-methods approach: parametric tests for normally distributed data and non-parametric tests for non-normally distributed data.

Normality Test for Creative Thinking Ability

The normality test results for the pre-post scores of creative thinking ability are presented in Table 5.

Table 5. Normality test results for pre-post creative thinking skills

University	Data type	Sig. (Shapiro–Wilk)	Distribution
UNNES	Pretest	0,076	Normal
	Posttest	0,034	Non-Normal
UNISSULA	Pretest	0,316	Normal
	Posttest	0,287	Normal
UNIMUS	Pretest	0,135	Normal
	Posttest	0,029	Non-Normal

The data show that the posttest results at UNNES and UNIMUS are not normally distributed, whereas all data from UNISSULA are normally distributed. Therefore, the analysis was performed using a mixed approach: the parametric Paired Sample t-Test for normally distributed data and the non-parametric Wilcoxon Signed Rank Test for non-normally distributed data.

Homogeneity Test

Homogeneity was assessed using Levene's Test to ensure variance equality across universities. The results for both critical and creative thinking abilities are presented in Table 6.

Homogeneity Test for Critical Thinking Ability

Table 6. Homogeneity Test Results for Critical and Creative Thinking Skills

Skill	Data	Sig. Value	Result
Critical Thinking	Pretest	0,341	Homogeneous
	Posttest	0,287	Homogeneous
Creative Thinking	Pretest	0,259	Homogeneous
	Posttest	0,231	Homogeneous

Based on Levene's test results, the data for both critical and creative thinking skills across the three universities have significant values greater than 0.05. This indicates homogeneous variance across universities. Although some data are not normally distributed, the homogeneity assumption is met, allowing for a consistent mixed-methods approach in the effectiveness analysis.

Results of Paired Sample T-Test/ Wilcoxon Signed Rank Test

Critical Thinking Ability

The results of the statistical tests for differences before and after the intervention are shown in Table 7.

Table 7. Results of Statistical Tests for Significant Differences (Critical Thinking Ability)

University	Test used	Statistic test	p-Value	Mean Difference	Effect size	Interpretation
UNNES	Wilcoxon Test	-4,595	0.000*	N/A	r =0,77	Large
UNISSULA	Paired T-Test	-6,739	0.000*	-3,765	d=1,16	Large
UNIMUS	Wilcoxon Test	-5,901	0.000*	N/A	r =0,74	Large

All universities showed a significant improvement ($p < 0.05$) with a large effect size, indicating that the contextual learning model using Mentimeter is effective in enhancing students' critical thinking skills.

Creative Thinking Ability

The results of the statistical tests for differences in creative thinking ability are displayed in Table 8.

Table 8. Results of Statistical Tests for Significant Differences (Creative Thinking Ability)

University	Test used	Statistic Test	p-value	Mean Difference	Effect Size	Interpretation
UNNES	Wilcoxon Test	-4,595	0.000*	N/A	r =0,77	Large
UNISSULA	Paired T-Test	-6,739	0.000*	-3,765	d=1,16	Large
UNIMUS	Wilcoxon Test	-5,901	0.000*	N/A	r =0,74	Large

The improvement in creative thinking ability was also significant across all universities with a large effect size, demonstrating that the Mentimeter-based learning model is effective in fostering students' creative aspects.

N-Gain Score Calculation

To assess the proportional magnitude of improvement in student learning outcomes, N-Gain scores were calculated, as presented in Table 9.

Table 9. N-Gain Score Results for UNNES, UNISSULA, and UNIMUS

University	Skill	N-Gain Score	SD	Min	Max	N	Category
UNNES	Critical Thinking	0.5121	0.36921	-0.33	1.0	36	Moderate
UNISSULA		0.4683	0.29484	0.0	1.0	34	Moderate
UNIMUS		0.4632	0.31843	0.0	1.0	63	Moderate
UNNES	Creative Thinking	0.4335	0.37954	-0.5	1.0	36	Moderate
UNISSULA		0.4441	0.36639	-0.5	1.0	34	Moderate
UNIMUS		0.3339	0.36494	-0.67	1.0	63	Moderate

The average N-Gain score across all universities falls within the moderate category, indicating an improvement in students' critical and creative thinking skills following participation in the Mentimeter-based contextual learning program. Overall, the average N-Gain for critical thinking (0.48) is slightly higher than for creative thinking (0.40). Both skills demonstrated moderate gains, confirming the proportional effectiveness of the Mentimeter-based contextual learning model in enhancing students' cognitive and creative aspects.

Kruskal-Wallis Test (Comparison Across Universities)

Table 10. Kruskal-Wallis test results for critical thinking ability across UNNES, UNISSULA, and UNIMUS

Test Statistics[a,b]	
	Deviation
Kruskal-Wallis H	1.161
df	2
Asymp. Sig.	.560

Table 11. Kruskal-Wallis's test results for creative thinking ability across UNNES, UNISSULA, and UNIMUS

Test Statistics[a,b]	
	Deviation
Kruskal-Wallis H	.642
df	2
Asymp. Sig.	.725

The Kruskal-Wallis test results show significance values > 0.05 for both critical thinking (Sig. = 0.560) and creative thinking (Sig.=0.725) abilities. This indicates that there is no significant difference in improvement across the universities. Therefore, the implementation of the Mentimeter-based contextual learning model produced a relatively equivalent enhancement effect across all three institutions.

Discussion

Effectiveness of the Mentimeter-Based 5E Learning Syntax

The findings from three universities in Semarang-Semarang State University (UNNES), Sultan Agung University (UNISSULA), and Muhammadiyah University of Semarang (UNIMUS), clearly demonstrate that implementing the Mentimeter-based SE model effectively enhances students' critical and creative thinking skills. This effectiveness is supported by consistent empirical evidence from all statistical tests, which show significant improvement ($p < 0.01$) from pretest to posttest across all research sites. The average N-Gain scores were 0.48 for critical thinking and 0.40 for creative thinking, both categorized as moderate according to Hake (1999), indicating substantive instructional effectiveness. The Kruskal-Wallis test results show no significant differences among universities ($p > 0.05$), suggesting that the Mentimeter-based SE syntax yields consistent results across different institutional contexts. These empirical findings align with Polanin et al. (2024), who reported a large effect size (0.82; 95% CI) for the SE model, and Khan (2025), who demonstrated that Mentimeter increases student engagement through its interactive features and anonymous responses in learning.

The underlying pedagogical mechanism explains why this model is effective. The SE syntax is designed with five systematic phases, Engage, Explore, Explain, Elaborate, and Evaluate, that stimulate progressive cognitive development from lower to higher levels, creating a structured learning experience (Schallert et al., 2022). The integration of Mentimeter strengthens each phase with interactive features such as polls, word clouds, quizzes, and open-ended questions, providing real-time feedback (Ardita et al., 2024; Khan, 2025). These interactive features create an adaptive and

meaningful learning atmosphere, encouraging students to connect religious concepts with real-life contexts (Sailer et al., 2021). This combination results in a significant improvement in students' critical and creative thinking skills, as the learning process becomes more contextual, reflective, and participatory.

In this context, Mentimeter acts as a pedagogical mediator that strengthens the interaction among students, content, and instructors (Hasyyati & Zulherman, 2021). The anonymity feature in Mentimeter reduces social anxiety when discussing religious issues (Pichardo et al., 2021), while the visualization of responses allows instructors to quickly identify misconceptions (Khan, 2025; Moorhouse & Kohnke, 2020). Other research also indicates that interactive technology enhances engagement, motivation, technological literacy, and self-regulated learning (Sailer et al., 2021; Tarazi & Ortega-Martín, 2023). This integration aligns with digital constructivism and inquiry-based learning (Schallert et al., 2022). Meanwhile, the greater improvement in critical thinking compared to creative thinking can be explained by the more structured nature of critical thinking, whereas creativity requires a longer developmental period (Mayarni & Yulianti, 2020). Nevertheless, the significant improvement in both skills demonstrates that the Mentimeter-based SE syntax can effectively facilitate idea exploration, thinking flexibility, concept understanding, and innovation (Sartika, 2018), meeting the demands of 21st-century competencies.

Consistency of Effectiveness Across Institutions

The finding of no significant difference in instructional effectiveness across universities has important implications for generalizing the learning model. It indicates that despite the differing characteristics of the three universities (state vs. private, Islamic vs. general), the instruction produced consistent impacts, suggesting that the pedagogical principles of the SE syntax possess universal validity (Polanin et al., 2024). This flexibility is reinforced by its constructivist design and the interactive features of Mentimeter, which support participatory exploration, elaboration, and evaluation processes (Darling-Hammond et al., 2020; Schallert et al., 2022).

This flexibility is rooted in the constructivist principle underlying the SE syntax, where knowledge is built through active, reflective, and contextual learning experiences (Darling-Hammond et al., 2020; Faizah & Handayani, 2022). The support from Mentimeter's interactive features enables this principle to materialize in various academic environments, regardless of institutional type (Gokbulut, 2020). The average critical thinking score increased from 61.98 to 80.96 with an N-Gain of 0.48 (moderate category), while the average creative thinking score increased

from 60.78 to 77.75 with an N-Gain of 0.40 (moderate category) (Hake, 1999). The statistical significance ($p < 0.01$) across all universities indicates that this improvement is a real effect of the instructional model's implementation, not a result of chance. These results confirm that the integration of the SE syntax and Mentimeter constitutes a contextual learning approach proven effective and consistent across higher education institutions (Faizah & Handayani, 2022; Maskur Dwiputro et al., 2021; Nisa et al., 2023). This consistency affirms the strength of the model and its potential for broad replication with minimal adaptation.

This finding carries significant implications for PAI instruction in the Society 5.0 era. The integration of technology within the SE syntax demonstrates that religious education can remain substantively profound while simultaneously relevant to 21st-century competencies (Gois, 2025; Tohir et al., 2025). Technology-enhanced learning has proven effective in improving learning outcomes in higher education (Sailer et al., 2021). Institutions need to provide technological support and training for instructors (Mekheimer, 2025). This research also shows that investment in interactive platforms like Mentimeter yields significant benefits for instructional quality and student competency development (Khan, 2025).

CONCLUSION

This research empirically demonstrates that integrating the SE learning syntax with the Mentimeter application effectively enhances students' critical and creative thinking skills in PAI courses. This effectiveness is consistent across universities with different characteristics (Kruskal-Wallis' test, $p > 0.05$), indicating the model's potential for universal application. The N-Gain values of 0.48 for critical thinking and 0.40 for creative thinking, along with statistically significant improvement ($p < 0.01$), confirm that constructivist, technology-based learning can bridge the gap between traditional PAI instructional methods and the demands of Society 5.0. This finding simultaneously presents a new pedagogical framework that combines constructivist stages with interactive technology, a synergy previously under-researched in Indonesian higher religious education.

Nevertheless, several limitations should be noted, such as the sample being limited to religion courses at a few universities, a one-semester implementation duration, and the lack of analysis on moderating factors like digital literacy, learning styles, and socio-economic background. Despite these limitations, the results offer strong practical implications. Higher education

institutions are encouraged to integrate this model into their curricula and provide professional training on implementing the SE syntax and using Mentimeter. Future research is recommended to employ experimental or longitudinal designs with larger and more diverse samples to deepen understanding of the model's effectiveness across various contexts, thereby supporting the formulation of more adaptive and relevant PAI instructional strategies in the digital era.

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