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Enhancing Students' Digital Literacy Skills through Sociolinguistic Studies of Kitābun Marqūm in Arabic Learning

Nasarudin [1,*], Nurul Wahdah [2], Hakmi Wahyudi [3], Rahmawati [4], and Bambang Irawan [5]

[1] Arabic Education Department, Universitas Muhammadiyah Mataram, Mataram 83127, Indonesia
[2] Arabic Education Department, Universitas Islam Negeri Palangka Raya, Palangka Raya 73111, Indonesia
[3] Arabic Education Department, Universitas Islam Negeri Sultan Syarif Kasim Riau, Pekanbaru 28291, Indonesia
[4] Arabic Education Department, Universitas Islam Negeri Imam Bonjol Padang, Padang 25151, Indonesia
[5] Arabic Education Department, Universitas Islam Negeri Jurai Siwo Lampung, Kota Metro 34111, Indonesia
[*] Correspondence: nasar@ummat.ac.id

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Abstract: This study examines the sociolinguistic approach based on Kitābun Marqūm developed in order to improve Arabic digital literacy among university students. Using an explanatory sequential mixed methods design, quantitative data related to learning gains were collected through a quasi-experimental pre-test–post-test control group design, which was then followed up with a qualitative inquiry in order to explain and contextualize the statistical findings. Quantitative results showed that the students who are taught using Kitābun Marqūm's sociolinguistic approach make significantly better gains in digital literacy than those learning through a non-sociolinguistic approach, as shown by *t*-test and N-Gain scores. Qualitative results demonstrate that the CAF (complexity, accuracy, fluency) gains were due to sociolinguistic awareness, use of digital Arabic texts, and contextualized meaning-making, and indicate limitations related to technology infrastructure and access. Instead of advocating a one-size-fits-all model, the study promotes a context-specific pedagogical approach referred to as Sociotechnical Arabic Literacy (SAL), which encourages sociotechnolinguistic and digital technology literacies and uses AI-supported solutions that aim not only at fostering an informed understanding and critical use of digital media in Arabic but also at promoting a broader sociopolitical awareness of the world. The findings add to the emerging discussion on sociotechnical aspects of language learning in digitally enhanced ecologies.

Keywords: Digital Literacy; Kitābun Marqūm; Sociolinguistics; Arabic Language Learning

1. Introduction

The digital literacy skill becomes an essential competency for students in such a digital and globalization world [1–3]. Digital literacy competencies are not only essential for successful academic performance, but also a requirement in response to the pressures of an employment market that is more and more technology and data-related [4–7]. In teaching Arabic as a foreign language, the digital literacy skills are fundamental in order to enhance pedagogical quality and effectiveness [8–10].

Nonetheless, some studies indicate a mismatch between these requirements for digital competences and the learning of the Arabic language, which is currently practiced as still dominated by traditional methods [11, 12]. Lecturers also tend to teach using the same method of lectures and textbooks, limiting opportunities for students to explore digital Arabic text critically and contextually [13–15].

Arabic language learning, in addition to skills, is still teacher-oriented, and no study addressed the exploration of digital data [16,17]. Such learning will make students less involved in analyzing Arabic digital texts [18–21]. The absence of analytical work and less student engagement stands in the way of our future teachers from acquiring the best out of their critical thinking skills, especially to see the Arabic varieties used on digital media [21]. This scenario presents the demand for a learning approach that can simultaneously integrate linguistic analysis, digital data-driven tasks, and digital literacy development.

There is also interest in sociolinguistic analysis, as much can be learned about two views of the Kitābun Marqūm (a document detailing digital literacy and socio-cultural instruction) and expectations from it: text, sense and social context; expectation in a digital media [22]. In this way, they get to know Arabic in its various social contexts including the rapidly changing digital environment [23]. Through the analysis of Kitābun Marqūm, students have an opportunity to investigate linguistic features of digital Arabic text, variations in meanings and interpretation of utterances vary depending on situational context and enable them to become critically aware users of digital technology [26**?**]. A brilliant linguistic analysis has not only to become a tool for broad and deep interpretation of the text, but also to contribute to students' involvement in the process of understanding this text critically by involving them independently through digital media [27,28]. However, as for the intervention of sociolinguistic competence in digital literacy activities in the context of Arabic language learning, it is limited and has not yet been developed systematically.

The idea of Kitābun Marqūm is tremendously useful as it synthesizes a model for pedagogy between linguistic analysis and the contemporary digital world. This way of working allows students not only to learn about the structuring logic of language but also about what texts do in a digitally rich environment that is criss-crossed with social, cultural and ideological relations. The integration enables student development of skills to analyze and create digital Arabic texts in a critical and creative manner. Second, the Kitābun Marqūm-based linguistic-digital approach can facilitate students' comprehension of communication in modern Arabic, also in its interaction on digital platforms, social media, and other virtual domains [29,30].

Despite the need to integrate digital technology into language teaching, previous work has found that research on new literacies integration in relation to learning Arabic still largely comprises studies of the use by a teacher or student of a particular technological tool without reference to linguistic practices [31–33]. On the other hand, despite its partial successes in terms of student engagement at all levels of digital literacy, digital corpora and online texts for Arabic language studies seem to have so far only been considered within a technical analytical framework without any analysis as to how it influenced students' level of digital literacy itself [34,35]. This lack is indicative of the necessity to engage in digital technology, language skills and pedagogical approaches together as part of ongoing research concerning the enhancement of digital literacy.

The objectives of this study are to examine the impact of Kitābun Marqūm's sociolinguistics approach on students' digital literacy skills in the Arabic language and to look into students' attitudes toward Kitābun Marqūmsociolinguistic approach: an analysis.

2. Materials and Methods

2.1. Research Design

The explanatory sequential mixed-methods approach is employed in this research, where the quantitative strand serves as the primary strand and qualitative data are used to explain, question and contextualize the quantitative result [36]. In the quantitative phase, a quasi-experimental pre-test–post-test control group design will be used to assess the effectiveness of Kitābun Marqūm's sociolinguistic approach towards students' digital literacy outcomes. The qualitative part is then used to explore the pedagogic means, learning activities, and contextual influences that underlie patterns of passing and failing found in the quantitative data [37].

Consistent with the fundamental tenets of explanatory mixed-methods design, qualitative results are not simply illustrative but analytically related to further interpret and extend interpretation by providing insight into the mechanisms underlying statistical significance [38,39]. This integrative approach allows for the discovery of sociolinguistic, technological, and instructional vectors that impact differential learning outcomes between aspects of digital literacy to go beyond parallel data presentation to a true integrative mixed-methods model.

2.2. Demographic Sample and Data Collection

The research population was all students in the Arabic Language Education Study Program at Muhammadiyah University Mataram. Through cluster sampling of existing class groups, a total of 112 students (50 males, 62 females) aged between 20 and 24 years were recruited. This method is commonly employed in the field of educational research to maintain the integrity of instruction while making experimental protocols possible.

In accordance with the explanatory sequential mixed-methods design, the data were collected in two successive stages. Quantitative phase was initiated where a digital literacy test was conducted in a pre- and post-test manner. The tool was created using indicators of Arabic digital literacy, such as control of language components (phonology, morphology, grammar, and meaning) and skills (listening, speaking, reading, and writing). A pilot study of 25 students was conducted before use in the main study for clarity and appropriateness.

After completing the numerical stage, qualitative data collection was performed in order to further clarify and set in context the statistical results. A survey with closed- and open-ended questions was given after the instructional intervention to assess students' perceptions, experiences with learning, level of engagement, and what it means to them in a digital-literacy context, knowing the concept of Kitābun Marqūm. Open-ended items allowed for a more detailed investigation of the processes involved in learning and situational factors explaining the quantitative results obtained.

While the tasks featured traditional language elements, they were digitally embedded and text-based in the sense that students' interpretation of Arabic from an online environment was necessary to interpret digital texts, analyze perceptions of pragmatic intent and assess appropriateness also. As such, linguistic proficiency was considered a condition for reflecting contextualized digital literacy, not as an independent learning result.

2.3. Data Analysis

The analysis of the quantitative data was carried out using parametric statistical methods and with the support of SPSS. Independent-samples t-tests were used to compare differences between the experimental and comparison group, respectively, whereas paired-samples *t*-tests were conducted to test the interaction effect of pre-post-differences in both groups. The gains in learning were also analyzed with N-Gain scores to identify the extent and effectiveness of advancement achieved through instruction.

Thematic analysis of the qualitative data was conducted according to the method recommended by Braun and Clarke, including familiarisation with data, initial coding, theme search and extraction. Following the explanatory sequential design, qualitative analysis was primarily used to explainquantitative findings. Emergent themes engaged higher-order aspects of digital literacy involving critical reading of digital texts, sociolinguistic awareness about identity and context, and reflective assessment of digital language use.

3. Results

3.1. Quantitative Effectiveness of the Kitābun Marqūm Sociolinguistic Approach

The statistical results shown herein correspond to the first research question of whether Kitābun Marqūm's sociolinguistic approach enhances students' digital literacy. Statistical analysis: Independent samples *t*-tests, paired samples tests, and N-Gain were applied after testing for normality assumption and homogeneity.

Table 1 summarizes the Kolmogorov–Smirnov and Shapiro–Wilk normality tests results on both data sets. The experimental group was normal ($p > 0.05$), but the control was not. However, the sample size of more than 30 per group (n = 56) made it not unreasonable to assume an approximation to normality. The *t*-test is also known to be large sample robust with respect to the normality assumption in moderate samples according to methodological guidelines [40,41].

As indicated in **Table 2**, the homogeneity of variances assumption was met in all groups ($p > 0.05$), so parametric statistics were deemed appropriate for all procedures applied.

As **Table 3** indicates, there was a statistically significant difference between the experimental and control groups ($t = 2.966$, $p = 0.004$). The mean difference of 9.000, and its confidence interval (2.986–15.014) shows that students who were taught using Kitābun Marqūm sociolinguistic approach scored significantly more in digital literacy than those receiving normal instruction.

Table 1. Tests of Normality.

Class	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Pre-test Experiment (Kitābun Marqūm)	0.089	56	0.200*	0.966	56	0.119
Post-test Experiment (Kitābun Marqūm)	0.122	56	0.037	0.968	56	0.140
Pre-test Control (Conventional)	0.146	56	0.005	0.916	56	0.001
Post-test Control (Conventional)	0.125	56	0.029	0.918	56	0.001

Note: *: This is a lower bound of the true significance; a: Lilliefors Significance Correction.

Table 2. Test of Homogeneity of Variances.

Learning Outcome	Levene Statistic	df1	df2	Sig.
Based on Mean	1.348	3	228	0.260
Based on Median	1.421	3	228	0.237
Based on Median and with adjusted df	1.421	3	217.84	0.237
Based on trimmed mean	1.378	3	228	0.250

Table 3. Independent samples test.

	Levenes Test for Equality of Variances		*t*-Test for Equality of Means							
	F	Sig.	*t*	df	Significance		Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
					One-Sided *p*	Two-Sided *p*			Lower	Upper
Equal variances assumed	1.962	0.164	2.966	110	0.004	9.000	3.034	0.004	2.986	15.014
Equal variances not assumed	1.962	0.164	2.966	109.223	0.004	9.000	3.034	0.004	2.986	15.014

Table 4 also confirms the significant pre- to post-test changes in both groups. The other group receiving experimental treatment also significantly improved from post-treatment to follow-up (mean difference = −11.964; t = −19.806; $p < 0.001$) albeit particularly more than in the control group which received a placebo intervention (mean difference = −5.464; t = −13.509; $p < 0.001$).

Table 4. Paired samples t-test.

		Paired Differences					t	df	Significance	
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				One-Sided *p*	Two-Sided *p*
					Lower	Upper				
Pair 1	Pre-test & Post-test Experiment	−11.964	4.521	0.604	−13.175	−10.754	−19.806	55	0.000	0.000
Pair 2	Pre-test & Post-test Control	−5.464	3.027	0.404	−6.275	−4.654	−13.509	55	0.000	0.000

These results are also supported by the N-Gain analysis (**Table 5**). The experimental group obtained an average N-Gain of 59.01% (medium–high category), and the control only reached an N-Gain of 23.06% (low category). This means the Kitābun Marqūm intervention was 2.66 times more beneficial than traditional classroom teaching.

Table 5. Comparison of N-Gain between the Experimental and Control Groups.

Group	Mean N-Gain (%)	Hake Category	Meaning
Eksperimen	59.01%	Medium–High	Strong and effective improvement
Control	23.06%	Low	Small and insignificant improvements

Collectively, these empirical results substantiate in statistics the success of Kitābun Marqūm's sociolinguistic approach to improving digital literacy among students. Nonetheless, despite the indication on the extent and

significance of learning improvement, these analyses have yet to fully explain pedagogical processes and learning mechanisms responsible for these. To bridge this explanatory deficit, the next subsection introduces qualitative evidence that serves as an explanatory topology for the identified quantitative patterns.

3.2. Qualitative Explanations of the Quantitative Findings

In this subsection, for the sake of clarity and ease of reading, we offer some qualitative insights that are meant to directly interpret and complement the results discussed in Section 3.1. The qualitative findings are not just illustrative affirmations, but they serve to explain why and how the Kitābun Marqūm sociolinguistic approach had a higher learning gain in the experimental group and used it to account for differences among them in different dimensions of digital literacy.

Figure 1 shows that students had mostly positive perceptions towards five dimensions: Experience, Response, Involvement, Utilization and Behavioural Intention. Experience, Response and Involvement were strongly positive and this goes some way to account for the significant learning gains made by the experimental group as they have been further engaged with Arabic digital texts and sociolinguistic analysis. In contrast, the relatively low scores in the Utilization dimension help explain why progress was slower in this area—especially with regard to infrastructure barriers and limited access to digital resources.

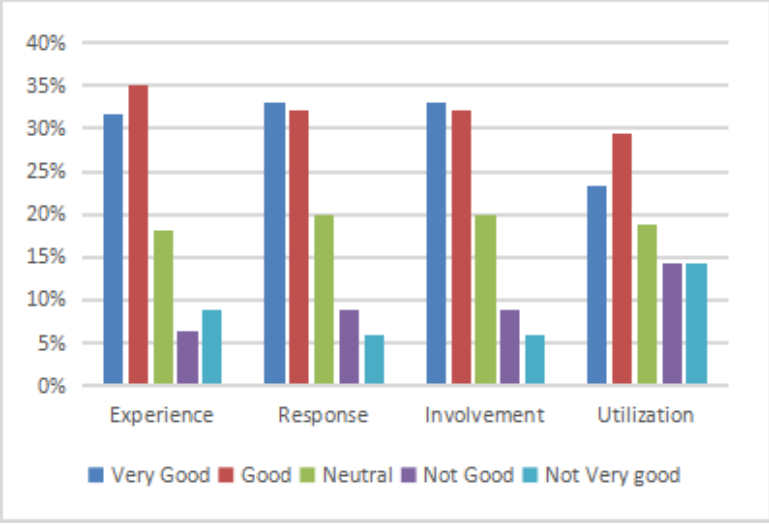

Figure 1. Student Perceptions.

These patterns are further illuminated by the qualitative narratives. R1 elaborated that the Kitābun Marqūm notion offered a cohesive system of categorization for Arabic learning resources in the online space, which could be a reason to justify the considerable improvements gained by the readers in terms of reading comprehension and language accuracy (quantitative aggregated results). R2 stressed the new involvement with modern Arabic digital discourse and its varying language, which might have accounted for a more significant gain on the part of those subjects who were subjected to treatment.

Respondent 3 stressed that the sociolinguistic approach made Arabic digital literacy more effective from the point of truthfulness, readability, and context appreciation. This viewpoint not only explains why the Total of the N-Gain was higher but also justifies the restrictions of the Utilization caused by unreliable internet facilities. Respondent 4′s reflections on collaborative digital practices elucidate how hands-on collaboration led to learning gains but also indicate areas where pedagogical refinement is needed, including digital archiving and genre-based organization of Arabic texts.

Lastly, the store of Respondent 5 demonstrates that being sociolinguistically alert led to more critical reading and production of Arabic digitexts. This is an important finding for understanding the significant increases in literacy reported by the experimental group, as well as technological limitations that dampened the full emergence of digital literacy practices.

The qualitative findings as a whole help to explain and situate these quantitative results by showing that the statistical gains were not just numerical but could represent clusters of identifiable pedagogical processes, such as sociolinguistic expectancy, salient engagement, and situated digital practices. Simultaneously, etic data illuminate structural constraints that constrained some results and together these findings offer a complex and comprehensive understanding of the efficacy of Kitābun Marqūm's sociolinguistic approach.

4. Discussion

4.1. Explaining the Effectiveness of Digital Literacy Improvement

The results of this study demonstrate that combining the Kitābun Marqūm model with a sociolinguistic approach correlates with significant enhancement in students' digital literacy on all four language skill dimensions in the Arabic learning context. From an explanatory mixed-methods point of view, the quantitative benefits detected in the experimental group can be better interpreted by using qualitative data that indicate pedagogical and sociolinguistic processes supporting this evidence.

The quantitative results show that the post-test scores and N-Gain for the experimental group are significantly better than those for the control group. The qualitative results help to account for this difference by demonstrating how Kitābun Marqūm operated not as mere instructional material, but as an epistemic structure that directed students in the reading of digital Arabic texts by means of social context, speaker identity and communicative intent. This framing of sociolinguistic activity allowed students to conceptualize digital texts as social practices rather than isolated units, embedding performance and conceptual levels of digitally literate competencies [42–44].

Sociolinguistically, the students' reading of Kitābun Marqūm as a metonym for writing that is recorded and socially answerable dovetails into current understandings of digital literacy as framed within socially–and not just technically–mediated discourses [45,46]. Qualitative anecdotes also show that our students gradually realize how Arabic texts in a digital space (e.g., social media posts, Qur'anic applications, online forums) are situated within ideological, pragmatic and identity-stamped locales. This increased awareness may account for the fact that the thumbnail group showed greater improvement in contextual understanding and critical interpretation than those who were not exposed to a preview at all.

Furthermore, it is likely that the emphasis on sociolinguistic analysis contributes to an explanation of why learning outcomes go beyond vocabulary and grammar knowledge. Students' encountering practices of pragmatic meaning, register variation, and digital discourse conventions heightened their awareness of the functioning of Arabic in digital communities. This explanation is also in line with sociocultural and pragmatic learning theories that have proposed effective language learning occurs in situations involving meaningful social interaction and contextualized use of the target language [47–50].

The interpretive utility of the qualitative findings is especially useful in understanding how digital literacy was enhanced. Instead of perceiving learning gains simply as a function of increased access to digital tools, the qualitative results suggested that structured activities such as analysing digital texts in Arabic, interpreting sociolinguistic variation and reflecting on communicative intent were key elements in driving higher-order literacy skills. This result is consistent with earlier studies that provided evidence for the advantages of context-embedded and social learning environments in pragmatic competence development and language production [51–53].

Importantly, the qualitative results also assist in framing the quantitative gains. Despite broad progress, these depictions of the constraints of infrastructure and access to digital resources provide insights into why certain aspects (especially utilisation-related skills) seemed to evolve more modestly. This subtlety adds significance to explanation of the quantitative results, i.e., effectiveness is moderated by technology and institution contexts not necessarily instructional design.

In sum, the convergence of quanti and quali findings reveals that the power of the Kitābun Marqūm sociolinguistic approach resides in its ability to frame digital Arabic texts as social spaces. By urging students to interpret structure, register and pragmatic meaning within authentic digital settings, not only are they achieving linguistic competence, but they also develop critical digital literacy consistent with that required for oral language production in the 21st Century [54,55].

4.2. Interpreting Students' Responses and Pedagogical Implications

Students' positive views of the Experience, Response, and Involvement scales account for one possible explanation for the robust learning gains evident in the experimental condition. The high levels of engagement and perceived relevance indicate that the Kitābun Marqūm approach managed to establish a learning environment that addressed the students' digital lives. From a pedagogical point of view, this consistency between within-curriculum content and learners' out-of-school digital experiences is frequently identified as an important cornerstone for stimulating intrinsic motivation and prolonged engagement [56,57].

Meanwhile, students' less positive ratings of the Utilization dimension also account for why some digital literacy outcomes evolved more slowly. Based on qualitative data, barriers in implementing sociolinguistic knowledge into consistent digital practices were frequently associated with restricted internet access, insufficient device availability and time pressures. This is in line with other work on digital literacy that highlights the gap between use skills and conceptual understandings, even when such understanding is relatively advanced [58,59].

In addition, students' reflections highlight the fact that the learning approach facilitated going from teacher-led education to a more student-centered and constructivist learning approach. Indeed, by critically engaging digital data as well as conducting independent investigations and interpreting Arabic texts in social relations, students became meaning-makers rather than recipients of information. Such a pedagogical change is consistent with constructivist views that highlight experiential education and inquiry-based learning and help to account for the quality of reflective thinking described within the experimental condition [60].

Another significant explanatory factor was the intertwining of Qurʾanic textual analysis with digital literacy practices. According to the students, connecting classical writings with modern digital conversation helped them interpret Arabic in contemporary society, thereby reinforcing visual, informational and interpretive literacy. This result is an extension of earlier findings that emphasize the educational merits of integrating digital Islamic resources in language acquisition [61,62].

Moreover, the qualitative results provide insights into how technology-mediated learning (in this case, AI-based tools like ChatGPT) supports digital literacy development. Interaction with the AI was seen to help clarify vocabulary, analyze sentence structure, and see register variation, which led to increased confidence and ability to read and write Arabic digital text. These results are aligned with developing research into AI-mediated language learning, highlighted above: that human–machine interaction supports the scaffolding of higher-order literacy skills [63–67].

Finally, the increasing understanding among students of social and identity-related aspects of digital Arabic texts can, in turn, account for observed gains in critical digital literacy. Their understanding that digital texts index speaker identity and social positioning signals an awareness of the indexical nature of digital discourse, a fundamental facet of 21st century sociolinguistic competence [68].

5. Conclusion

The current research finds that infusing a sociolinguistic treatment with the Kitābun Marqūm framework results in significant gains in students' digital literacy in Arabic language learning. Quantitative results based on t-test and N-Gain reveal that students in the experimental group have significantly higher learning gains than those in the control group. These benefits were not only related to linguistic accuracy, they included students' knowledge of social contexts, communicative purposes and the Arabic language features that occur in digital spaces.

From a sociolinguistic stance, the qualitative results indicate that Kitābun Marqūm served as an epistemological lens with which students framed digital Arabic texts as social objects influenced by identity, pragmatic purpose, and context. This reading is in agreement with the idea that digital literacy for language learning cannot be reduced to a skill but should rather be considered as a socio-technological competence which requires critical interaction with meaning, context and digital discourse practices. However, such findings ought to be considered within the particular instructional and institutional context of the study.

Positive learner experiences are also an indication that the Kitābun Marqūm–based approach actually facilitated a more engaging and relevant learning environment. At the same time, care-related challenges (e.g., digital infrastructure facilities and equipment access, time to allocate) are worth noting, drawing attention that practical contributions of this approach also depend somewhat on technique-practical resources. These limitations can ex-

plain why some dimensions of the digital literacy skills have been more moderately developed, and highlight that in order to be met institutional support is needed.

Instead of advocating a widely-applicable model, this study presents a context-specific pedagogical framework named Sociotechnical Arabic Literacy (SAL) that combines sociolinguistic analysis, the Kitābun Marqūm idea, digital learning tools as well as upcoming AI techniques like ChatGPT. The SAL conceptual model is designed as a micro-guide for the design of Arabic digital literacy instruction in wider educational contexts, such as HE environments that share similar features.

Further research is required to explore the transfer and sustainability of the above approach at different institutions, with diverse end-users and various levels of technological resources. As for the future, it could be useful to carry out both longitudinal and cross-sectional studies in order to contribute to the long-term effects of sociotechnical approaches applicable to Arabic digital literacy as well as continue refining pedagogical implications for integrating these domains into language education based on artificial intelligence.

Author Contributions

Conceptualization, N. and H.W.; methodology, N.W.; software, R.; validation, B.I., N., and H.W.; formal analysis, N.W.; investigation, R.; resources, B.I.; data curation, N.W.; writing—original draft preparation, N.; writing—review and editing, H.W.; visualization, N.W.; supervision, R.; project administration, B.I.; funding acquisition, N. All authors have read and agreed to the published version of the manuscript.

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Institutional Review Board Statement

The study was conducted in accordance with the Declaration of Helsinki and approved by the Research Ethics Committee of the Faculty of Islamic Studies, Universitas Muhammadiyah Mataram (approval number: 115/II.3-AU/FAI-UMMAT/F/II/2025; date of approval: February 2025).

Informed Consent Statement

Informed consent was obtained from all subjects involved in the study.

Data Availability Statement

The data supporting the findings of this study are not publicly available due to ethical and privacy considerations involving student participants. The data are available from the corresponding author upon reasonable request and with permission from the relevant institutional authority.

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Conflicts of Interest

The authors declare no conflict of interest.

AI Use Statement

The authors used ChatGPT (OpenAI, GPT-4, accessed 2025) solely for grammar checking, sentence structure refinement, and improving the readability of the English text. All ideas, data, analyses, interpretations, and conclusions are entirely the responsibility of the authors. The use of AI tools was carefully supervised to ensure academic integrity.

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