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Developing English Learning Material with Islamic Context for Pre-Service Mathematics Teachers

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ABSTRACT

Few English materials integrate Islamic values for mathematics teacher education. This study aimed to develop an Islamic context-based English learning material for pre-service mathematics teachers to address the need for integrating language proficiency with religious values. Using R&D approach with the 4D model, the study involved needs analysis, expert validation, limited trials, and effectiveness testing. The material covered mathematics topics such as symbols and operations, plane and solid geometry enriched with Islamic contexts including Qur'anic references and the contributions of Muslim mathematicians. This is among the first to embed Qur'anic references and Muslim mathematicians in English for Mathematics materials. Validation by three domain experts (mathematics, English, and Islamic education) resulted in high scores of 4.12 (82.3%), 4.59 (91.8%), and 4.06 (81.2%), respectively, indicating strong validity. Student assessments further supported its validity with an average score of 4.41 (88.1%). Effectiveness testing using a quasi-experimental design revealed a statistically significant improvement in the experimental group's English proficiency, with an N-Gain score of 0.57 compared to 0.39 in the control group ($p < 0.05$). These findings confirm that the developed material is valid, practical, and effective for improving English skills. However, the study was limited to only two classes in a single institution.

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1. INTRODUCTION

In today's educational landscape, mathematics teachers are expected not only to master mathematical concepts but also to communicate them effectively and contextually. Learning is essentially an interactive process between teachers and students, where the success of knowledge transfer greatly depends on communication effectiveness (Knight & Shum, 2022). Mathematics

teachers, therefore, act as communicators who must understand their students' characteristics, needs, and backgrounds to ensure that instructional messages are received and internalized. Recent studies further highlight that effective teacher–student communication in mathematics classrooms significantly enhances students' conceptual understanding, motivation, and problem-solving skills, especially when integrated with culturally relevant and technology-supported pedagogies (Rott & Barton, 2023). Moreover, research indicates that fostering dialogic interaction and multimodal communication strategies can bridge gaps in mathematical literacy, making abstract concepts more accessible to diverse learners (Choppin et al., 2024; Mosvold et al., 2022).

At the higher education level, pre-service mathematics teachers must be equipped with strong communication skills, including the ability to use English effectively. This requirement aligns with the demands of globalization and the digital society era (Society 5.0). English proficiency is essential for accessing global references, mastering mathematical terminology, and engaging with international developments in mathematics education (Al-khresheh et al., 2025; Hardika Saputra et al., 2025; Panjaitan, 2025; Zhang, 2025). Communication skills are widely recognized as a critical component of effective mathematics instruction, alongside content mastery and positive dispositions toward the subject (Shidiq, 2015). Supporting this view, recent studies highlight that mathematical communication, both verbal and written, is central to students' conceptual understanding and problem-solving abilities (Grootenboer, 2021; Khadka, 2024; Mursalin et al., 2025).

However, preliminary observations and interviews at the Mathematics Education Study Program of UIN Prof. K.H. Saifuddin Zuhri Purwokerto reveal that many students still struggle with speaking, discussing, and presenting in English. Their limited vocabulary and inadequate understanding of mathematical terminology in English are the primary contributing factors. A diagnostic test confirmed that only 25% of students had a basic grasp of key mathematical terms in English. This problem is further compounded by insufficient learning materials, despite the widely acknowledged importance of instructional resources in supporting independent learning and academic achievement (Prastowo, 2015). Studies show that well-designed instructional materials significantly enhance student engagement, promote autonomy, and foster learning success online and face-to-face (Alt, 2022; Wahyuni & Purwanto, 2021).

Several studies have addressed this issue by designing English materials tailored to mathematics learning. Ningsih (Ningsih, 2021) developed English materials that were aligned with the linguistic needs of mathematics students and reported improvements in reading comprehension and vocabulary mastery. Deswita and Niati (Deswita & Niati, 2018) created collaborative learning-based English materials that enhanced students' communication and teamwork skills. Wijayanti (Wijayanti, 2018) integrated digital tools such as Videoscribe into instructional materials and found that multimedia resources improved student engagement and retention. Kaptiningrum (Kaptiningrum, 2024) producted English for Islamic Education books for the Faculty of Teacher Training and Education with Analysis, Design, Development, Implementation and Evaluation (ADDIE) Method. The results of the evaluation showed that English for Islamic Education book was effective and it could be used for students and lecturers. While these efforts are valuable, they remain limited in scope. None of these studies has systematically addressed the integration of Islamic values or contexts into English materials for mathematics.

This represents a significant gap, particularly for Islamic universities such as UIN Prof. K.H. Saifuddin Zuhri Purwokerto, where integrating science and religion is a core educational paradigm. The Mathematics Education Study Program explicitly states the integration of Islamic and scientific knowledge as one of its core learning outcomes. Therefore, developing learning materials that embed Islamic values into English for mathematics instruction is strategic and essential. Such materials may incorporate examples and problem contexts drawn from the Qur'an, Hadith, Islamic practices, or

historical contributions of Islamic scholars to mathematics, thereby aligning academic content with students' religious identity and lived experiences.

The use of Islamic context in developing mathematics learning materials can be implemented through six integration models. First, the Mathematics from Al-Qur'an model uses the Qur'an as a source for learning mathematical concepts, both explicitly, such as numbers, arithmetic operations, sets, and measurement and implicitly, such as relations, functions, statistics, and mathematical models. Second, the Mathematics for Al-Qur'an model applies mathematics to facilitate the practice of Islamic teachings, for example, in determining prayer times, zakat distribution, inheritance (mawaris), and religious observances. Third, the Mathematics to Explore Al-Qur'an model uses mathematics to uncover numerical miracles hidden within the Qur'anic text, such as the patterns involving the numbers 19 or 7. Fourth, the Mathematics to Explain Al-Qur'an model employs mathematics to interpret Qur'anic verses related to numerical or quantitative concepts, such as the duration of the People of the Cave's sleep or the years Prophet Nuh lived with his people. Fifth, the Mathematics to Deliver Al-Qur'an model utilizes mathematical concepts, like sets, to help deliver Qur'anic content to students through categorizing the names of prophets or angels. Lastly, the Mathematics with Al-Qur'an model integrates moral and spiritual values from the Qur'an into mathematics instruction, emphasizing that mathematics is not merely a technical subject but also a means to cultivate character and spirituality (Abdussakir & Rosimanidar, 2017). These models aim to create meaningful, value-based mathematics learning grounded in Islamic principles.

Mathematics and the Qur'an share a profound connection, as both encourage order, balance, and logical reasoning in understanding the universe. The Qur'an frequently alludes to numerical patterns, proportions, and natural phenomena that reflect mathematical principles, such as the alternation of night and day and the precise measurement in creation. These verses inspire Muslim educators to integrate mathematics learning with Islamic values, showing that numbers and patterns are not only abstract concepts but also signs of Allah's wisdom. Recent studies emphasize that embedding Qur'anic perspectives into mathematics teaching can strengthen students' spiritual awareness while improving critical thinking skills in problem solving (Nurhayati, 2023; Rauf & Rahmawati, 2022). This integrative approach aligns with holistic education paradigms and supports character development, bridging scientific inquiry and religious understanding (Al-Sharif & Basri, 2021; Hussain & Iqbal, 2023).

Such materials are expected to engage students more effectively, encouraging them to communicate in English while also thinking critically and creatively actively. By aligning with students' religious identity and lived experiences, the instructional materials will foster deeper understanding and motivation in learning mathematics through English. Based on the background above, this study aims to develop Islamic context-based English learning material for pre-service mathematics teachers. Against this background, this study aims to develop Islamic context-based English learning materials for pre-service mathematics teachers. Unlike previous English materials for mathematics, this study systematically integrates Islamic content using the 4D model, offering linguistic and spiritual enrichment.

2. METHODS

This study employed a Research and Development (R&D) approach to design, validate, and evaluate the effectiveness of a learning material product. The R&D method was selected because it facilitates the creation of practical, empirically-based educational solutions through systematic procedures (Creswell & Guetterman, 2019). Specifically, the development process adopted the 4D model proposed by Thiagarajan, Semmel, and Semmel, which comprises four stages: Define, Design, Develop, and Disseminate. This model is widely regarded as appropriate and efficient for producing instructional tools that meet validity and usability standards (Rahmi & Yusnia, 2022).

Figure 1. The stages of 4D model

The research subjects included sixth-semester students of the Mathematics Education Study Program at UIN Prof. K. H. Saifuddin Zuhri Purwokerto enrolled in the English for Mathematics Learning course. The population consisted of 105 students, comprising 72 male and 33 female students across three classes, from which two classes were randomly selected as samples (one serving as the experimental group and the other as the control group). Based on the preliminary test, 80 students did not understand mathematical terminology in English and experienced difficulties in communicating mathematical ideas in English. The sampling technique followed a cluster random sampling method to ensure the results' applicability in similar educational settings (Sugiyono, 2021).

The research process began with a preliminary stage involving a needs analysis through questionnaires and interviews to assess students' requirements for learning materials. This was followed by topic selection aligned with the existing curriculum, a study of learning outcomes, and a content analysis of textbooks available on the market. This stage was essential in ensuring the developed materials' contextual relevance and pedagogical adequacy (Widodo & Wahyudin, 2021).

The development stage included drafting the learning material, expert validation, and limited trials. The materials were validated by three content experts, one specializing in English language teaching, one in mathematics education, and another in Islamic education. The validators were lecturers with expertise in their respective fields and held doctoral degrees, ensuring that competent authorities carried out the validation process per the required academic standards. The validation phase was followed by a revision process based on feedback. A set of instruments was constructed to evaluate the product, including questionnaires and pre and post-tests. The questionnaires were designed to assess various aspects of the teaching material, such as objective alignment, content suitability with curriculum and Islamic values, language clarity, visual appeal, and presentation quality (Putra & Maulidya, 2022).

Data analysis utilized both quantitative and qualitative approaches. Quantitative data obtained from the questionnaires were analyzed using simple percentage calculations to determine the validity level of the product. Qualitative data, derived from expert feedback and student responses, were analyzed descriptively to provide a comprehensive overview of the material's strengths and areas for improvement. N-gain is used to see an increase in students' understanding of learning before and after being given treatment.

Table 1. N-gain score criteria

Interval (g)	Criteria
$g > 0,7$	High
$0,3 \leq g \leq 0,7$	Moderat
$g < 0,3$	Low

Table 1 describes the N-gain value criteria by Hake (Ulpah & Novikasari, 2020) for students' english skills while using Islamic context-based learning materials.

3. FINDINGS AND DISCUSSION

The Islamic context-based english learning material was developed for pre-service mathematics teachers using the 4D model by Thiagarajan et al., consisting of four systematic stages: Define, Design, Develop, and Disseminate. The define stage began with a review of the topics to be developed in

the learning material, which included symbols and operations in mathematics, plane geometry, solid geometry, perimeter, area, and volume in both plane and solid geometry. After determining the topics, a literature review was conducted to gather relevant references for these materials. The references were drawn from junior high school mathematics textbooks, Islamic education textbooks, and English language books. This process aimed to ensure that the integrated content aligned with the competency standards and basic competencies outlined in the curriculum.

Following this, the design stage focused on developing an instrument blueprint that served as the assessment criteria for the learning material. Once the blueprint was completed, it was further developed into research instruments, namely validation and observation sheets. The validation sheet was intended to assess the feasibility of the learning material based on expert evaluations, which examined both the content aspects and visual presentation. Meanwhile, the observation sheet was used to gather responses and feedback from teachers and students regarding their experience with the learning material, focusing on aspects such as readability, feasibility, attractiveness, and overall usability in the learning process.

At develop stage, the Islamic context-based english learning material for pre-service mathematics teachers was developed. The development process included preparing content and components within the material, consisting of texts, images, example problems, games and exercises. The material presented focused on English for mathematics learning and was explicitly designed for sixth-semester students of the Mathematics Education study program. Islamic integration was implemented by exploring the relevance of mathematics in the Qur'an and including readings on prominent Muslim mathematicians and related topics.

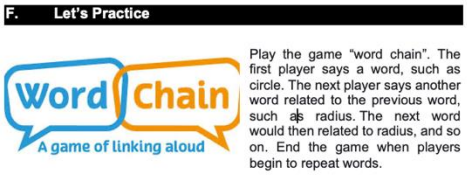

Figure 2. One of game in learning material

The material was written using clear and straightforward language to ensure ease of understanding. The text was complemented with images, the use of colors, and the application of bold and italic fonts to emphasize key terms, such as subchapter titles. The font used throughout the material was Arial, with a size of 11 pt to maintain readability. Visual content was developed using software such as GeoGebra 5.0 to produce accurate illustrations. Moreover, the color scheme for the images was consistent and legible, supported by a clean white background. Text and pictures were placed adjacent on the same page to facilitate comprehension, with the images serving as visual aids that reinforced the presented material.

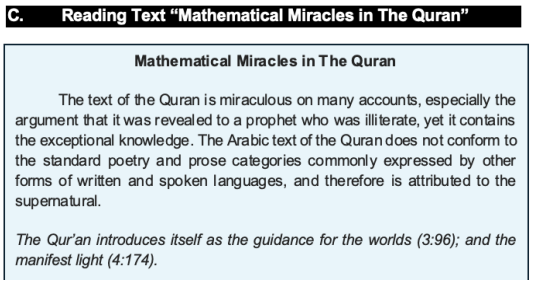

Figure 3. Reading text in learning material

Following the completion of expert validation and subsequent revisions, a limited trial stage was conducted to evaluate the practicality of the developed material in dissemination stage. This trial involved students as the direct users of the English for Mathematics Learning: Islamic Context-Based material. This stage aimed to gather students' responses regarding the material, including its readability, clarity of content, and overall appeal. After using the material, students were asked to provide written suggestions and constructive feedback concerning its strengths and weaknesses. The feedback collected was systematically analyzed and served as the basis for further revisions, thereby enhancing the effectiveness and usability of the material. This process ensured that the final version of the teaching material was more refined, aligned with the learners' needs, and ready for subsequent broader implementation.

Three domain experts evaluated the product to assess its validity. The mathematics expert awarded an average score of 4.12, corresponding to a validity percentage of 82.3%. In comparison, the English language expert scored 4.59 (91.8%), and the Islamic education expert assigned a score of 4.06 (81.2%). These results categorized the material as either "valid" or "highly valid" across all three domains. The higher score the English language expert gave may indicate that the material was well-structured regarding language use, clarity of instructions, and alignment with communicative aspects of English for mathematics learning. Meanwhile, the relatively lower score from the Islamic education expert suggests that, although Islamic values were integrated, it may not have been as comprehensive or deeply embedded as expected compared to the linguistic dimension. This discrepancy highlights the importance of continuous refinement to ensure a more balanced integration of linguistic accuracy and contextual Islamic values within the learning material.

Several key revisions were implemented following expert feedback, including changing the font from Agency FB to Arial (11 pt) to enhance readability, correcting grammatical and typographical errors, designing a more meaningful front cover, incorporating additional images, and adjusting image placements to better align with the Islamic and mathematical contexts presented in the material. After these revisions were completed, the teaching material proceeded to the limited trial stage to evaluate its practicality and gather user feedback from students and instructors. Figure 4 shows adding images to the learning material according to reviewer's suggestion.

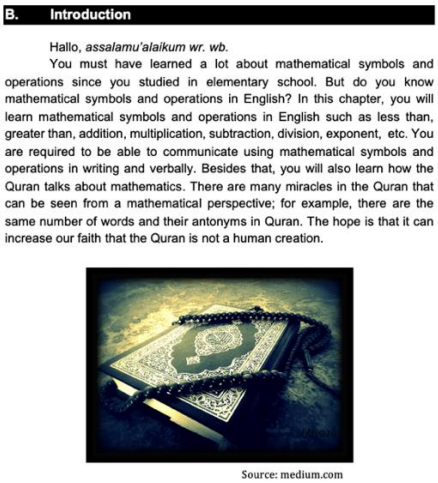

Figure 4. Adding images to learning material

A small-scale evaluation involving five students was conducted to assess student perceptions of the learning material. The results showed a high average rating of 4.41 (validity percentage = 88.1%), indicating positive reception regarding readability, relevance, and motivational appeal. Students

appreciated the integration of visual elements, the clarity of instructions, and the way Islamic values were embedded in mathematical topics.

To evaluate the effectiveness of the developed material in improving students' English proficiency within mathematical contexts, a quasi-experimental design was implemented involving two classes: an experimental group using the developed material, and a control group using conventional materials. The experimental group (n = 29) achieved an average N-Gain score of 0.57, categorized as "moderate." The control group (n = 29) showed an average N-Gain of 0.39, also within the "moderate" range but significantly lower.

Before comparing the groups statistically, normality and homogeneity tests were conducted: 1) normality (Kolmogorov-Smirnov test), the N-Gain data for both groups were normally distributed (Sig. = 0.166 for experimental, 0.200 for control); 2) homogeneity (Levene's Test), the results indicated equal variance between groups (Sig. = 0.217). Subsequently, an independent samples t-test was applied. This ensured that the assumptions for parametric testing were met, thereby validating the use of the t-test to determine the significance of differences between the experimental and control groups.

Table 2. Independent sample t-test for n-gain

Independent Samples Test										
		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
N-Gain English	Equal Variances assumed	1.551	.217	7.099	58	.000	.18	.01321	.11211	.23162
	Equal Variances not assumed			7.099	55.617	.000	.18	.01321	.11201	.23165

Table 2 shows that the Sig. (2-tailed) value was 0.000 (< 0.05), leading to the rejection of the null hypothesis. This confirms a statistically significant difference between the experimental and control groups regarding improvement in English language proficiency. These findings confirm that using the Islamic-context-based teaching material positively and significantly impacted students' English performance in mathematics.

The initial small-scale evaluation of the developed learning material with five students yielded highly positive feedback. The average rating of 4.41, corresponding to a validity percentage of 88.1%, indicates that the material was well-received in terms of readability, relevance, and motivational appeal. These findings suggest that the design successfully addressed essential aspects of learner-centered material development. Including visual elements and the clarity of instructions were highlighted as particularly effective features, consistent with previous research emphasizing the importance of multimodal representation in fostering engagement and comprehension in mathematics learning contexts (Mayer, 2021). Furthermore, integrating Islamic values into mathematical topics resonated strongly with the students, reinforcing the view that religiously contextualized materials can simultaneously promote academic and moral development (Alhassan & Salim, 2022).

The quasi-experimental phase provided further insights into the effectiveness of the material in improving English proficiency within mathematical contexts. The experimental group utilized the developed material and achieved an average N-Gain score of 0.57, categorized as "moderate." The control group using conventional materials recorded a lower average N-Gain of 0.39, also within the "moderate" range but significantly less than the experimental group. This difference demonstrates that the developed material had a more substantial impact on enhancing students' learning outcomes. These results align with studies that highlight the role of culturally and religiously relevant content in promoting deeper learning and sustained motivation (Rahmawati & Widodo, 2023). Similar findings are reported by Yusuf and Fauzan (Yusuf & Fauzan, 2022), who argue that integrating Islamic values in STEM subjects contributes to students' critical reasoning and spiritual growth. More recently, Khalid and Ahmed (Khalid & Ahmed, 2024) highlight that faith-based contextualization in mathematics fosters not only better problem-solving skills but also resilience and perseverance in learning. However, the moderate improvement level in both groups suggests that additional scaffolding and extended implementation may be necessary to achieve higher gains.

The findings confirm that integrating Islamic values with mathematical content in English learning materials positively influences students' academic achievement and moral awareness. The experimental group's improvement underscores this integrative approach's potential as an innovative pedagogical strategy. Nevertheless, the results also indicate the need for refinement, particularly in developing more advanced tasks that can elevate the learning gains from a moderate to a high level. Future studies with larger and more diverse populations are recommended to validate these findings' generalizability and explore long-term effects on students' language proficiency and values internalization.

This study reinforces the significance of developing contextualized learning materials that integrate content knowledge with cultural and religious values. The design process emphasized content alignment with academic and spiritual goals, which is crucial in Islamic educational settings. The material's integration of Islamic values with mathematics topics helped create deeper engagement and relevance, a principle emphasized by Polman who argue that meaningful learning emerges when students see connections between academic content and their everyday lives (Polman et al., 2021; Ulpah & Insani, 2025).

Additionally, Tomlinson underlines the importance of comprehensible language in material development to ensure accessibility and meaningful engagement (Tomlinson, 2016). The high validation scores from experts and students reflect that this principle was successfully applied. Feedback from students and experts shaped the revisions, highlighting the importance of iterative development and responsiveness to learner needs. This supports Darici's (Darici, 2016; Hidayat & Novikasari, 2023) argument that learning material development must be participatory and reflective of end-user perspectives.

The N-Gain score of 0.57 falls into the "moderate" category, which suggests that although the Islamic context-based English learning material effectively improved students' proficiency, it did not yet produce a high level of improvement. This result indicates that the material successfully facilitated learning but requires further refinement and enrichment to maximize its impact. Several factors may have contributed to the moderate outcome: the relatively short duration of the intervention, students' initial low proficiency levels, or the limited scope of contextual integration. Therefore, while the findings demonstrate the material's potential, they also highlight the need for continuous development, such as expanding the range of tasks, incorporating more interactive or technology-enhanced features, and providing longer-term implementation to achieve higher learning gains.

The current study advances beyond these earlier works by explicitly incorporating Islamic values into English for Mathematics Learning, extending the scope from purely linguistic or pedagogical

innovation to religious-contextual integration. While prior research (Deswita & Niati, 2018; Ningsih, 2021; Wijayanti, 2018) focused mainly on language skills (reading and vocabulary), teamwork, or the use of digital, this study provides a more holistic framework that not only validates the material across three expert domains, mathematics, English, and Islamic education, but also demonstrates its effectiveness empirically through higher N-Gain scores in the experimental group. In this way, the present study offers a distinctive contribution by bridging domain-specific English instruction with Islamic contextualization, which earlier studies had not explored in depth.

The improvement in students' English language proficiency, demonstrated by significant N-Gain scores and t-test results, confirms the findings of Ulpah & Novikasari (Novikasari & Ulpah, 2022; Ulpah & Novikasari, 2020), who noted that the integration of Islamic contexts in instructional materials can enhance not only cognitive understanding but also learner motivation and identity formation. This alignment suggests that embedding culturally and religiously relevant content within language learning materials provides a dual benefit: it supports language acquisition while fostering deeper engagement and contextual relevance for learners, particularly in faith-based educational settings (Mukaromah et al., 2025; Ulpah et al., 2023).

In summary, the Islamic context-based english learning material for pre-service mathematics teacher proves valid and effective. It is a practical model for integrating Islamic values into domain-specific English instruction, particularly in Islamic teacher education programs. The results obtained from the research have to be supported by sufficient data. The research results and the discovery must be the answers, or the research hypothesis stated previously in the introduction. The results obtained from the research have to be supported by sufficient data. The research results and the discovery must be the answers, or the research hypothesis stated previously in the introduction part.

The findings of this study are supported by comprehensive data derived from expert validation, limited and broader trials, and statistical analyses including N-Gain scores and paired sample t-tests. These data collectively demonstrate that the Islamic context-based English learning material meets the validity, practicality, and effectiveness criteria, affirming the research hypothesis stated in the introduction. The consistency between the empirical results and the theoretical framework underscores the robustness of the model in addressing both linguistic and pedagogical needs within mathematics teacher education. Moreover, the integration of Islamic contexts enhanced learner engagement and motivation, aligning with previous studies emphasizing the pedagogical value of culturally and religiously relevant learning materials. Thus, the outcomes of this research not only validate the proposed model and provide a data-driven foundation for its broader application in similar educational contexts.

4. CONCLUSION

This development research produced an Islamic context-based English learning material for pre-service mathematics through four stages: define, design, develop, and disseminate. The findings indicate that the material is valid for use with pre-service mathematics teachers, as evidenced by expert validation scores from mathematics (4.12; 82.3%), English (4.59; 91.8%), and Islamic education (4.06; 81.2%) experts, as well as positive student assessments (4.41; 88.1%). Furthermore, the material proved effective in improving students' English proficiency, with the experimental group achieving a higher N-Gain score (0.57) than the control group (0.39), thereby demonstrating its potential as an effective model for integrating Islamic contexts into domain-specific English instruction. These findings suggest incorporating culturally and religiously relevant contexts into instructional materials can enhance language acquisition and learner engagement. This material demonstrates how Islamic integration can enrich English for Specific Purposes in mathematics teacher education, marking a novelty that distinguishes it from previous studies, which mainly focused on linguistic or technological aspects

alone. Nevertheless, the study has certain limitations, as it was conducted with only two classes in a single institution, which restricts the generalizability of the findings. Future research should therefore include a larger and more diverse sample and expand the development of Islamic context-based English materials to other courses and disciplines, thereby strengthening its applicability and contribution to broader educational settings.

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