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Development of an English Language Book for Mathematics with an Islamic Context for Prospective Mathematics Educators

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ABSTRACT

Understanding and proficiency in English are essential for prospective mathematics educators, as they influence the quality of teaching and learning processes. However, the limited availability of appropriate learning resources has become a major challenge. This study aims to develop an English for Mathematics textbook with an Islamic context to support students in understanding contextual mathematical problems. This research employed a Research and Development approach using the ADDIE model, comprising analysis, design, development, implementation, and evaluation. The developed textbook was evaluated in terms of validity, practicality, and effectiveness. The validation results showed a 90% score, indicating that the textbook is highly valid. The practicality assessment yielded a score of 94.46%, categorized as very practical. Furthermore, the effectiveness test revealed that students' correct responses exceeded incorrect ones. At the junior high school level, 66.7% of students answered perfectly, while at the senior high school level, 60% achieved perfect solutions. These findings indicate that the developed English for Mathematics textbook with an Islamic context is valid, practical, and effective for prospective mathematics educators.

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INTRODUCTION

The ability to understand and use academic English has become an essential requirement for aspiring mathematics educators in the contemporary global context [1], [2]. Proficiency in English is crucial for accessing advanced scientific literature, conducting research communication, publishing internationally, and developing evidence-based instructional materials, particularly when mathematical terminology and symbolic representation predominate [3], [4]. This necessity is becoming increasingly pertinent for aspiring mathematics educators who will instruct at the secondary school level (junior high and high school), as the complexity of mathematical content at this stage requires a deeper understanding of concepts, technical terminology, and the structure of academic language. Prospective instructors may encounter challenges in enhancing their professional knowledge and in applying pedagogical methods aligned with national and international curriculum developments if they lack competence in reading and comprehending English-language mathematics resources [5], [6].

Nonetheless, numerous studies indicate that potential mathematics teacher candidates continue to have challenges in understanding academic English, especially in understanding mathematical

terminology and interpretingathematical discourse [7]-[9]. This barrier significantly affects their preparedness to engage in the Teacher Professional Education (PPG), which requires global literacy competencies and a profound understanding of mathematics. Conversely, the availability of pertinent English-language Mathematics textbooks for aspiring junior and senior high school educators remains exceedingly limited. The predominant English for Mathematics teaching resources utilized at universities are generic, do not include students' daily experiences, religious beliefs, and local culture, and are not tailored to address the pedagogical requirements of future secondary school educators [7], [10].

Islamic principles significantly impact mathematics education in Indonesia, especially in Islamic universities. Incorporating Islamic context into mathematics and language education has been demonstrated to enhance learning engagement, fortify academic-spiritual identity, and offer a more authentic educational experience [11]-[13]. The accounts of Muslim scholars such as Al-Khwarizmi and Ibn Haitham, mathematical elements in religious practices, and geometric designs in Islamic architecture offer substantial contextual avenues for the simultaneous enhancement of mental and linguistic comprehension [14], [15].

This contextual methodology corresponds with the tenets of Indonesian Realistic Mathematics Education (PMRI), which prioritizes real-world circumstances and local culture as the foundation for learning [16], [17]. PMRI enables students to develop their mathematical comprehension through guided reinvention and the use of significant context[18]. Incorporating an Islamic context into English language teaching materials for mathematics enables prospective secondary school teacher students to learn mathematical concepts in a foreign language while integrating it with cultural, spiritual, and pedagogical experiences relevant to their lives [19], [20].

To date, there is no systematic teaching resource that cohesively integrates English for Mathematics, Islamic principles, and the professional requirements of aspiring junior and senior high school teachers into a unified educational framework. The absence of such integrated resources indicates a substantial gap that requires attention through developmental research.

This research is novel because of several crucial factors: (1) The incorporation of an Islamic context into English for Mathematics Purposes materials, which had not been systematically established previously; (2) the implementation of the PMRI principle in the development of English for mathematics teaching materials, using the Islamic context as an experiential reality that facilitates simultaneous mathematical and linguistic comprehension for students; (3) a targeted focus on prospective junior and senior high school mathematics educators who face additional pedagogical and content demands compared to prospective elementary school teachers; (4) the integration of language literacy, mathematical literacy, and islamic literacy into an integrated teaching material design; and (5) product development with a rigorous design and academic validation process, resulting in a book that is useful, practical, and pertinent for secondary school teacher education.

This research seeks to innovate the creation of contextual, culturally significant, and pertinent English language teaching resources for mathematics, designed to meet the professional requirements of future secondary school mathematics educators.

METHODS

This research follows the Research and Development (R&D) technique, employing the ADDIE development model published by Dick and Carey in 1996. This paradigm comprises five primary stages: Analysis, Design, Development, Implementation, and Evaluation, which are used to develop learning products that are systematic and quality-tested. This development research was

conducted at the Mathematics Education Study Program of UIN Jambi, specifically in the English for Mathematics course offered in the odd semester of 2025/2026. The subjects of this study were all students enrolled in this course, a total of 35 third-semester students. At the analysis stage, the researcher did a series of preliminary tasks, including a needs analysis to determine what students needed in the English for Mathematics course, ensuring that the book design developed was truly contextual and connected with user characteristics. Additionally, the researcher conducted a content analysis of the course's Semester Learning Plan (RPS) to ensure the book's content aligned with the defined learning outcomes. Simultaneously, an analysis of the learning environment was conducted to determine the classroom conditions and lecture situation in which the book would be used, so that the product design could be matched to the real learning context.

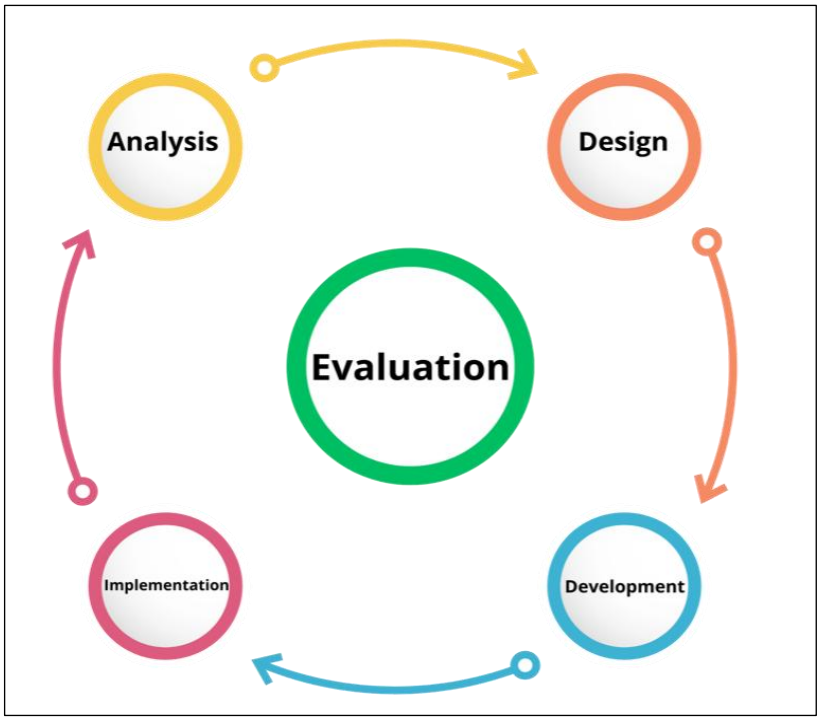

Figure 1. Research and Development Process Based on the ADDIE Model

The design process is carried out after all basic needs and attributes have been examined. At this step, the researcher acquires various necessary supporting information, including the project's implementation timeframe, classroom settings, students' English proficiency levels, and predicted learning outcomes. Next, the researcher constructed a flowchart or workflow diagram to depict the book development procedures visually. This flowchart serves as a guide to help the researcher understand the workflow from start to finish, ensuring that book development progresses consistently and thoughtfully. The analysis of instrument validation data and practicality tests uses the following formula.

$$P = \frac{\sum_{i=1}^{n} x_i}{k} \times 100\% \quad (1)$$

Where :

P : Percentage of Scores

$\sum_{i=1}^{n} x_i$: Total Scores from Validators/ Total Scores from Student Assessments

n : Number of validators/ number of students

k : Highest number of scores

Table 1. Validity Test Criteria

Validity Criteria	Persentase	Follow-up	Validity Criteria
Invalid	30-39	Revised	Invalid
Less Valid	40-55	Revised	Less Valid
Quite Valid	56-65	Revised	Quite Valid
Valid	66-79	No Revised	Valid

Table 2. Practicality Test Criteria

Practicality Criteria	Persentase	Follow-up
Not Positive	30-39	Revised
Less Positive	40-55	Revised
Quite Positive	56-65	Revised
Positive	66-79	No Revised
Very Positive	80-100	No Revised

RESULTS AND DISCUSSION

This development research began with the analysis stage, which included an analysis of student needs in the English for Mathematics course, content analysis, and environmental analysis. All activities in this analysis stage were based on the results of curriculum reviews and previous development and research. The first activity, analyzing student needs in the English for Mathematics course, was conducted to ensure that the project design being developed was contextual and effective. The results of the student needs analysis in the English for Mathematics course revealed that (1) students in the Mathematics Education program ideally use a special textbook for this course because it introduces English vocabulary in the field of mathematics and teaches how to teach the material in English, (2) the books used are still limited and general, and there is no level restriction on the mathematical material presented, (3) the books used do not explain in detail the process of solving mathematical problems, even those students in the Mathematics Education program are prospective teachers who must understand how and the steps to solve mathematical problems, including in English, and (4) there is no context in each mathematical problem given, including Islamic context, which should have been introduced and understood by students as prospective mathematics teachers. In addition to examining the English for Mathematics course syllabus, the researcher analyzed the course's learning outcomes and its ultimate goals. The learning outcomes for the English for Mathematics course are: (1) students are proficient in reading English texts related to mathematics; (2) students master mathematical grammar and vocabulary in English; (3) students understand the meaning of English texts related to mathematics; and (4) students are proficient in explaining mathematics using English.

Next, the third activity is environmental analysis, which is useful for examining the conditions of the learning environment where this textbook development project will be implemented. The results of this analysis revealed that (1) the learning environment regarding the ideal number of students is that classes consist of 20 to 25 students, making the classes healthy and competitive, (2) the facilities, both infrastructure and equipment, are very good; for example, every classroom has an infocus and a screen or board that can be used, (3) the internet network conditions are also adequate, so the developed textbook can be accessed online, and (4) every student has a gadget or laptop, allowing them to use it to access the developed textbook.

The next stage is the design stage, which consists of two activities: data collection and flowcharting. The results of the data collection activity regarding the total time for the textbook

development project are in September 2025, which aligns with the course schedule for English for Mathematics, held in the odd semester of 2025/2026. Next, regarding the condition of the lecture classrooms, information was obtained that the classroom conditions are ideal and that the textbooks to be developed can be used in the lecture process. In line with this, the material for the English for Mathematics course developed in this textbook is in accordance with the course syllabus, but the presentation is in the form of contextual problem-solving questions aligned with PISA.

The PISA mathematics test includes Quantity, Change and Relationship, Shape and Space, and Uncertainty and Data. After familiarizing themselves with the PISA content and the material content for the English for Mathematics course, the researchers analyzed the mathematics material content for junior high school and senior high school levels, and then classified it based on PISA content. The classification of school material content based on PISA content is shown in Table 3 below.

Table 3 Classification of School Material Based on PISA Content

PISA Content	School Material
Quantity	Numbers
	Ratio
	Proportion
	Scale Calculation
	Measurement
Change and relationship	Patterns
	Relationships between Variables
	Functions
	Basic Algebra
Shape and space	Plane and Space Geometry
	Position
	Visualization
Uncertainty and data	Data
	Probability
	Simple Statistics

The next analysis result is related to the English language proficiency of students, particularly in the field of mathematics learning. It was found that students' English proficiency remains very limited, especially in mathematics learning. Students do not have much knowledge of English for mathematics, such as mathematical vocabulary in English or how to read mathematical notation in English. Next, the results of this textbook development project are in the form of a textbook containing contextual mathematics problems whose content aligns with PISA standards and with middle and high school mathematics materials, and that embeds Islamic values from these problems.

The next activity is the development stage, which is the realization phase of the previously carried out design stage. At this development stage, the researcher also conducted expert assessments and development tests, namely the practicality test of the previously revised English for Mathematics book based on expert suggestions and comments from the product validation activity. This English for Mathematics book, developed in English as the primary language, contains contextual problems that align with PISA content and school mathematics material. The contextual problems are presented in two forms: those with complete solution steps and those without, accompanied by answer keys. This dual-format design allows problems with solutions to serve as learning materials for developing problem-solving skills, while problems without solutions encourage students to practice independent problem-solving. In addition, all problems in the English for Mathematics book are accompanied by Islamic values that serve as reminders and sources of moral and spiritual reflection.

When the design realization activities are complete, meaning the English for Mathematics book has been developed, the next activity is expert evaluation. This expert assessment activity was given to the validators, who are experts in this case, specifically to the lecturers of the Mathematics Education Study Program at the Faculty of Education and Teacher Training, UIN Sulthan Thaha Saifuddin Jambi, namely AM and DDB. The validated instruments consist of the generated English for Mathematics, questionnaires for faculty and student practicality, and instrument validation sheets. Each validation sheet, whether for the English for Mathematics book or the practicality questionnaire, uses a Likert scale for its assessment.

The aspects assessed for the English for Mathematics book include the media/technology aspect of the English for Mathematics book, the content aspect of the English for Mathematics book, the language aspect of the English for Mathematics book, and the practicality aspect of the English for Mathematics book. The aspects assessed from the student and lecturer practicality questionnaires include the content feasibility aspect of the English for Mathematics book, the construction aspect of the English for Mathematics book, and the language aspect of the English for Mathematics book.

As for the validation results for the book given to the validators, a 90% validation rate was achieved, indicating the textbook is suitable for use with minor revisions. Meanwhile, the validation results for the practicality questionnaires for students and lecturers teaching the English for Mathematics course yielded a validation percentage of 89.17%, indicating that the student and lecturer practicality questionnaires are valid and can be used to collect data. After all the instruments, namely the English for Mathematics book, the practicality questionnaire, and the evaluation questions, were declared valid and usable, the next research process, development testing, was carried out. This development testing activity includes testing the initial draft of the English for Mathematics book with a limited group. This development trial was conducted to gather direct feedback in the form of responses, reactions, and comments from students and observers on the compiled book. This development testing activity is carried out in two stages: the first is limited testing, involving third-semester students currently taking the English for Mathematics course. Development testing at this stage is conducted offline in one of the lecture rooms.

Students reported both advantages and disadvantages of the developed book. Among the main advantages, nearly 90% of the students participating in the limited-group trial expressed strong interest in using the English for Mathematics book as a learning companion. This positive response was attributed to the book's usefulness in supporting students' understanding of mathematical English and in contextual problem-solving. In addition, students expected the book to be published soon because they needed relevant reference materials. After the trial, all participants completed a practicality questionnaire administered through Google Forms. This questionnaire was presented in the form of a Google Form.

The implementation phase is carried out after the limited development testing is completed. This implementation includes distributing the English for Mathematics textbook to students taking the English for Mathematics course, excluding students participating in the limited group development trial. The purpose of this implementation stage is to assess the effectiveness of the developed book. The implementation phase was conducted offline, specifically in the lecture hall. Similarly to the limited trial, at this implementation stage, the researchers explained the results of the development work carried out, namely the English for Mathematics book and its content.

Similarly, during the limited development testing activity, when implementation was carried out with all third-semester students, it was found that the students were very enthusiastic about reviewing

and paying attention to the developed book. In fact, even when looking at the layout of the English for Mathematics book that was developed, they tried to understand the questions and solutions displayed on the screen. At the same time, the researcher explained the book's contents.

In line with the implementation stage's goal to assess the effectiveness of the developed book, the researcher also asked students to complete evaluation questions during this stage. These questions were contextual and aligned with PISA content. The context used was consistent with the book's development context, namely, the Islamic context. The questions provided were also mathematics questions for the secondary school level. Each student was given two evaluation questions, and the questions given were different for every four students. These two questions represented mathematics questions for both junior and senior high school levels.

Based on the evaluation questions, students were able to solve the mathematics questions presented in English well. They were observed solving them systematically, writing down the solution steps, as demonstrated in the developed English for Mathematics textbook. As for the effectiveness of the English for Mathematics book, it falls under the effective criteria based on students' evaluation of problem-solving. This criterion is based on the problem-solving steps outlined on the answer sheets and the correctness of the solutions.

Upon completion of the implementation phase, the researcher proceeded to the next stage, the evaluation phase. At this stage, the researcher conducted an FGD (focus group discussion) with lecturers from the mathematics education program. This activity aims to disseminate, discuss, and gather feedback and suggestions on the results of the development work carried out, namely the English for Mathematics book. Before conducting the FGD activity, the researcher rechecked the results of each development stage and the improvement and evaluation processes for each stage. From this check, it was found that all improvement processes had been completed, so the FGD activity to disseminate the development product could proceed.

During the FGD, it was evident that the lecturers from the Mathematics Education Study Program strongly supported the research team's development activities. The resulting development product, an English book for Mathematics, was also considered very relevant and beneficial for the implementation of lectures. Additionally, the lecturers also stated that the content and context in the development of the English for Mathematics book are very good because they link PISA content and Islamic elements in contextual mathematical problems. The contextual problem-solving process presented is also very systematic and coherent, allowing students to use this English for Mathematics book as a reference for solving and teaching English for Mathematics to their future students.

This English for Mathematics book, specifically developed with an Islamic context, is evident in its layout through the contexts used in the problems and the inclusion of Islamic values for each problem. Of course, integrating mathematical concepts with Islamic teachings will make the learning process easier [21], [22]

The development of English language books for mathematics also utilizes PISA content, which consists of quantity, change and relationship; shape and space; and uncertainty and data. Because the users of this book are specifically prospective mathematics educators in Indonesia, this PISA content is also adapted to the curriculum for mathematics at the junior and senior high school levels in Indonesia. Additionally, the problems presented have varying difficulty levels, namely high, medium, and low. This difference in problem difficulty levels is useful for assessing the extent of students' understanding and ability to grasp the mathematical material [23], [24]

In the process of developing this English language book for mathematics with an Islamic context, a book has been produced that is valid, practical, and effective. The development procedures carried out include five stages: analysis, design, development, implementation, and evaluation. Each stage involved several continuous activities, resulting in an English for Mathematics book with an Islamic context. This English for Mathematics book with an Islamic context consists of two parts for each school level: problems with solution steps and those without. As for problems without solution steps, they are useful as a platform for students to learn how to solve mathematical problems systematically. Given the number of problems presented, the total is 90, divided into 45 contextual mathematics problems for junior high school and 45 for senior high school. Of the 45 problems for each school level, 30 have solution steps, and the remaining do not. Although without solution steps, the researchers provided an answer key that can be used to verify users' answers in the book.

In solving the evaluation questions, it was observed that students still used Indonesian to answer and write down the problem-solving steps on this evaluation answer sheet. This tendency is consistent with previous studies [25], [26] which indicate that language habits influence students' language use and problem-solving performance. The effectiveness of the developed English for Mathematics book was demonstrated through students' performance on the evaluation tasks. The evaluation consisted of two questions: a contextual mathematics problem at the junior high school level and another at the senior high school level. At the junior high school level, 66.7% of students provided the correct solution steps, 23.3% provided partially correct solutions, and 10% provided incorrect solutions. At the senior high school level, 60% of students answered perfectly, 33.3% answered partially correctly, and the remaining students answered incorrectly. These findings suggest that students demonstrate greater confidence and competence in solving junior high school mathematics problems than senior high school problems.

After all the stages of the development model were completed, an English for Mathematics book with an Islamic context for prospective mathematics educators was created, which is valid, practical, and effective. As for this book, it contains a collection of specifically contextual mathematical problems.

CONCLUSIONS AND SUGGESTIONS

The research and development of an English book for mathematics with an Islamic context for prospective mathematics educators that has been produced meets very valid criteria for the book, practicality questionnaires, and evaluation sheets. Meanwhile, the results of the practicality questionnaires completed by the limited development test participants showed that the English mathematics book with an Islamic context met the practicality criteria. The evaluation questions, used as a data source to assess the effectiveness of the book, showed that the English for Mathematics book with an Islamic context was effective.

As for suggestions related to the research on the development of an English textbook design for mathematics with an Islamic context for prospective mathematics educators, they concern the implementation time for product development, which should ideally be longer to allow the development and implementation process to be carried out more frequently. In addition, data analysis activities can draw on more theory to yield more accurate results.

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