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The Development of Islamic Context Learning Materials to Facilitate the Conceptual Understanding of Mathematics

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ABSTRACT

This research was conducted to develop and produce Islamic context-based mathematic learning material. The presentation of Islamic context for pre-service mathematics teachers was intended to facilitate conceptual understanding. This learning material contains rank and root, ratio and scale, and material for flat shapes and spatial shapes. The material is included in the Mathematics Materials Study course for Junior Secondary Education in the Mathematics Teacher Education program. The method in this study uses design research with the type of development study with a qualitative approach. The research phases include the preliminary research phase, the development or prototyping phase, and the assessment phase. The data were collected by filling out a learning material scoring scale by Education and Language expert and an Islamic Study expert. The quality criteria for learning material have valid results if the experts score it with excellent and valid categories. Thus, they do not need significant revision. Based on the research results, the quality of Islamic context-based mathematics learning material is classified into valid criteria at a percentage of 84% according to Mathematics Education experts and a percentage of 83.3% according to Education and Language experts and classified as an excellent category at a percentage of 94% according to Islamic Study expert. Based on these results, the product of Islamic contextual mathematics teaching materials is suitable for use in mathematics lectures.

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A. INTRODUCTION

Many studies revealed the importance of making learning more relevant to and interesting for students. This study is necessary since many students deem mathematics boring and containing complex concepts to understand. As revealed by the study conducted by Jablonka (2013) in 3 countries, German, Hong Kong, and the United States, students expressed their boredom by comparing mathematics with arts. According to some students, mathematics was boring since it was abstract, and it takes time to comprehend the mathematical language (Prediger, Erath, & Opitz, 2019). This boredom made students disinterested in mathematics, mainly for students with low achievement (Yeh et al., 2019). Indonesian students also assumed that learning mathematics could create fear in students (Mutohir et al., 2018), and such anxiety may affect pre-service teachers' learning achievement (Novikasari, 2017). According to Zamansky and Zohar (2016), mathematics is deemed boring since it is irrelevant to daily life.

Increasing students' involvement in learning with scientific integration can increase students' success.

Mathematics learning activity needs to be attractive to students and, on the other hand, increase learning success. According to Maass et al. (2019), mathematics learning quality can be increased by developing mathematics learning material integrated with other science, such as integration with the other subject. The types of learning materials in mathematics include textbooks, e-books, e-seminars, e-exams, e-learning, and face-to-face learning (Mahir et al., 2021). Quality learning material will guide students and teachers to achieve the learning objective desired by Ngware et al. (2015) and allow the student to learn (Fan, 2013). The study also shows a strong relationship between learning material and students' success in mathematics (Törnroos, 2005). Teaching materials in Indonesia need to be studied to determine the existing quality. One of the studies on mathematics textbooks in schools was conducted by Yang and Sianturi (2017). The study compared books in Indonesia and Singapore, which showed that Indonesian texts have a higher percentage of remembering and connectionless procedures than Singaporean textbooks. Meanwhile, Singapore textbooks are higher in the rate of processes with connections and doing mathematics. The last two categories are included in the level of high-level cognitive abilities.

Learning material is not only used at school but also in a higher education institution. The development of teaching materials is always dynamic in line with the development of knowledge in mathematics education and government policies. So, there is a possibility that this year's learning materials are not relevant to be used for years to come. Teachers and lecturers are needed who are critical of existing learning materials and can utilize all teaching materials to transform knowledge so that they can improve the quality of mathematics education. The learning materials provided are expected to meet the needs of students' mathematics learning. As for the advanced study, learning materials will affect student satisfaction in learning mathematics (Mahir et al., 2021). So, learning materials must pay attention to appearance of learning materials so that they are attractive to students (Tossavainen et al., 2020).

Lecture activities are intended to provide valuable experience for students who will later teach math content in schools. In higher education, lecturers can develop mathematics teaching materials for students. Developing these teaching materials is essential because nowadays, students think that mathematics is tedious and complex (Rahman et al., 2020). A study by Tobias et al. (2010) shows that students in the first year of teacher education perceive mathematics as boring. That mathematics in college is unrelated to mathematics in school. This change in student views then changed after following the contextual-based lecture process. According to Sinclair (2001), Hemmi and Ryve (2014), and Palinussa et al. (2021), contextual-based learning can support students' interest in learning mathematics. Contextual-based learning by integrating Islam into mathematics learning can increase mathematical creativity (Abdillah et al., 2022).

Conceptual understanding in mathematics is essential, as the study of Copur-Gencturk (2021) found conceptual understanding, which the teacher possesses, will affect the quality of teaching mathematics. The Mathematics Education study program as the place for this research to be conducted has the problem of limited teaching materials in lectures. So, it is necessary to

develop teaching materials that can improve students' understanding of mathematics by the university's vision. This study aims to develop mathematics teaching materials to facilitate students' conceptual understanding of mathematics teacher candidates.

In addition, one of the visions of Mathematics Education in the university of this study is the integration of science and Islam in lectures. Based on the researcher's observations, there have not been many university-level teaching materials that integrate mathematics and Islam. As the research results by Muslimin et al. (2020), students positively responded to learning mathematics using an Islamic context. These results are indicated by developing students' creativity, collaboration, and communication skills in learning mathematics.

B. METHODS

This research used a design research method with a development study type. This research consisted of three phases: preliminary research, development or prototyping, and assessment (Plomp, 2013). In the preliminary research phase, the researcher reviewed literature related to Islamic contents and mathematical contents in Mathematics Material Study for Junior High School subjects. Furthermore, the researchers connected the two contents to find a relationship between the Islamic context and mathematical content. In the second phase, the development or prototyping phase, learning material development would be validated and revised through an expert's assessment. In the third phase, learning material intervention would be evaluated by pre-service teacher students through direct use of learning material in the Mathematics Education study program of Islamic University. This third phase involved 37 mathematics pre-service teachers taking lessons using an Islamic context to facilitate mathematical concept understanding.

This research used two data analysis techniques, quantitative and qualitative. The instrument shown to the experts and students was a questionnaire with questionnaires about learning material, visual design, and legibility of learning material. The data obtained from the questionnaire were analysed using a quantitative technique by calculating the percentage of questions given to the respondents. Meanwhile, the qualitative data used the scoring results, suggestions/recommendations, responses, criticism, and improvement. The guideline in determining the validity to revise learning material in this research used scoring qualification criteria as shown in Table 1.

Table 1. Scoring qualification

Percentage (%)	Validity Level	Description
90 – 100	Highly valid	No Revision
80 – 89	Valid	No Revision
65 – 79	Adequately valid	Partially Revised
55 – 64	Less valid	Revised
0 – 54	Not valid	Totally Revised

Furthermore, to find out an increase in understanding of mathematical concepts in using mathematics teaching materials based on Islamic contexts was obtained from the tests given, namely pre-test and post-test.

N-Gain formula found learning outcome improvement.

The interpretation criteria were (Hake, 1999):

N-Gain is high if $0.7 < g \leq 1$

N-Gain is moderate if $0.3 < g \leq 0.7$

N-Gain is low if $0 < g \leq 0.3$.

C. RESULT AND DISCUSSION

The preliminary research phase was carried out to examine the Islamic context related to the power and root, ratio and scale, and plane figure and solid figure materials for pre-service mathematics teacher students. This phase was a literature review on the Islamic and mathematical content. The research then found that Islamic context-based learning effectively improved mathematical concept understanding. As in the previous study by Ulpah and Novikasari (2020), the researcher followed this success by developing learning materials of other mathematical contents. Based on the literature study, preliminary research results, and upon discussion with the mathematic education lecturer, the researcher obtained the initial prototype of Islamic context-based mathematics learning. The initial prototype, as a result this phase, contained Islamic context-based power and root, ratio and scale, and plane figure and solid figure materials. Below is an illustration of the Islamic context in mathematics learning, as shown in Figure 1.

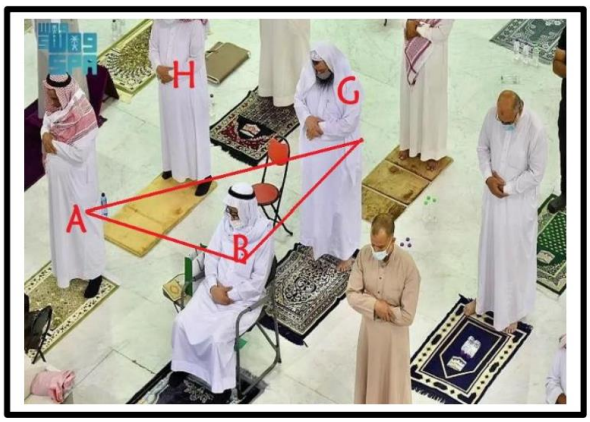

Figure 1. Islamic Context in Power Learning Material

The Islamic context presented in the learning material served as a way for students to construct their knowledge independently. This context was a concrete representation to reach abstract mathematical knowledge. Figure 1 presents the semi-concrete representation as shown in Figure 2.

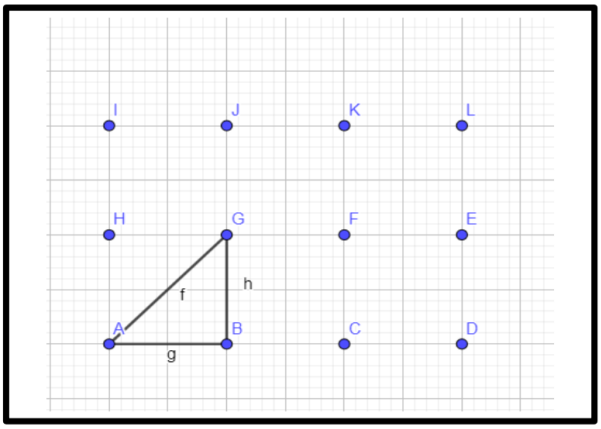

Figure 2. Representation of Islamic Context

Figure 2 and Figure 3 shows how learning material development considers the knowledge presentation process. The context is presented in abstract mathematical concepts, as shown in Figure 3.

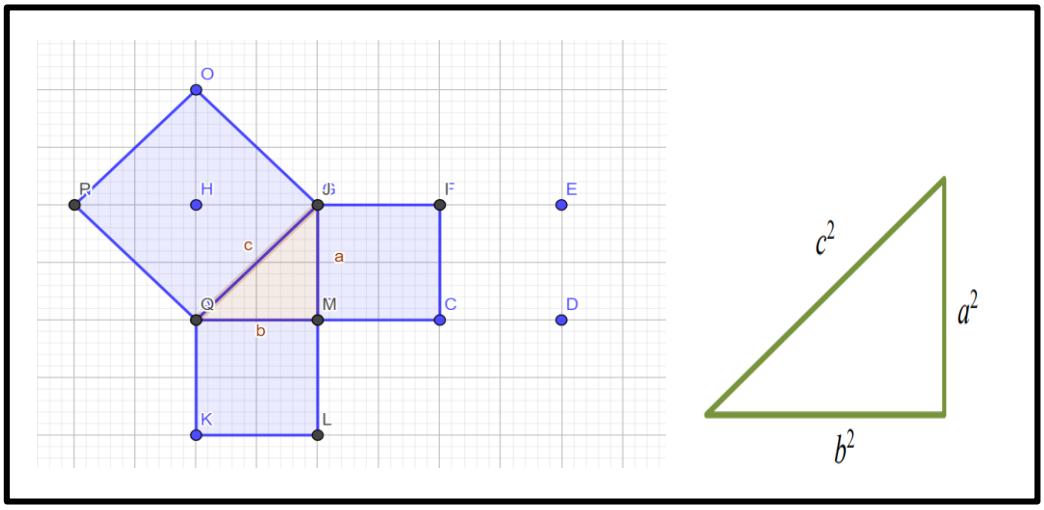

Figure 3. The Concept of Pythagoras

Learning Material is generally presented through the first flow of Islamic context presentation and changed into the semi-concrete form of representation and directed to an abstract form of mathematics. The last step above can direct students to the concept of mathematics as the learning objective. The way of teaching is confirmed by Webel et al. (2016) that mathematical presentation can conform to a representation system that is the existing contextual problems around students and can be solved.

The prototype phase was divided into two, prototype one and prototype 2. Prototype 1 was focused on expert scoring to validate learning material. Besides scoring using a questionnaire, the experts also criticized and suggested prototype one improvement. In prototype 2, the limited test was carried out on six pre-service teacher students.

The second phase outlined the research instrument as the scoring criteria for prototype 1. The research instrument developed the completed instrument outline. The research instrument used was the validation sheet and observation sheet. The feasibility examination

based on an assessment by linguists and Islamic Study experts used a validation sheet. The Linguist scored it based on the Education and linguistic aspects, while the Islamic Study expert scored it based on Islamic aspects. To examine students' responses to Islamic context-based mathematics learning materials using the observation sheet.

The material presented was mathematical material for SMP/MTs in power and root, ratio and scale, and plane figure and solid figure. The material was presented using simple, straightforward language for ease of understanding. The presentation of the text in teaching materials is equipped with colour images and the use of bold and italics to emphasize material keywords such as sub-chapter titles. The font and size in this learning material was Bookman Old Style 10 pt. Picture content was developed using the software GeoGebra 5.0 for accuracy. The colour was used consistently and ready to read since the background was white. The text and pictures were presented close to each other on one page. The picture was presented, serving to illustrate the material.

The validation phase was carried out to examine the feasibility of the developed prototype one based on an expert's examination. The validated learning material product was revised as per experts' suggestions and recommendations during the validation process. After learning material revision, a limited test was carried out. The final results of the research and development were in the form of Islamic context-based mathematics learning material for SMP/MTs products.

Before the test, the developed Islamic context-based mathematics learning material was also validated first by a Mathematics Education expert, Linguist, and Islamic Study expert. The validation by Mathematics Education Expert used mathematical concept understanding as to the development indicator. The maximum score of the statement item in the validation sheet was five, and the minimum score was 1, as shown in Table 2.

Table 2. Results of Mathematics Education Expert' Scoring

Scoring Aspect	Average	Percentage	Criteria
Mathematical Concept Accuracy	4.25	85 %	Valid
Content Appropriateness in Islamic Context	4	80 %	Valid
Algorithmic concept Precision	4	80 %	Valid

Learning material validation by mathematics education experts above totally had an average of 4.2 at a percentage of 84%. The learning material was valid by mathematical content in facilitating mathematical understanding. According to Tomlinson (2016), the learning material was developed using language that was easy for students to understand so that they would gain experience from the language used. Further, a lecturer with an education and language background learned material validation through media and linguistic aspects. The validation results as shown in Table 3.

Table 3. Results of Validation by Linguist

Scoring Aspect	Average	Percentage	Criteria
Clarity of the Used Language	4.3	86.7 %	Valid
Picture Appropriateness to provide representation	4.1	82.2 %	Valid
Variation Accuracy	4.17	83.3%	Valid

The result of learning material validation by linguists shows that the average score was 4.16 at 83.3% with the "valid" category. Based on the validation results, we can conclude that the developed Islamic context-based mathematics learning material is of good quality. Thus, it is entirely appropriate for use.

A lecturer with an Islamic study background validated learning material regarding the Islamic context. The validation by Islamic study learning material experts aimed at obtaining information, criticism, and suggestions for the developed learning material to be of good quality from its completeness and suitability to the chosen Islamic context. The validation results can be observed as shown in Table 4.

Table 4. Results of Validation by Islamic Study Expert

Scoring Aspect	Average	Percentage	Criteria
Islamic Context Accuracy	4.75	95 %	Valid
Islamic Context Appropriateness with Reality	4.5	90 %	Valid
Islamic Context Appropriateness with Mathematical content	4.67	93.3 %	Valid

The validation results by learning material experts show an average score of 4.7 and a percentage of 94% with the "very valid" category. Based on the results of validation by the three experts above, we can conclude that the developed Islamic context-based mathematics learning material has good quality, as shown by the result "valid." Thus, it is appropriate for use.

The limited test was carried out with semester-8 students who had taken all courses in the Mathematics Education study program. The limited test was carried out with six students to assess the Islamic context-based mathematics learning material, and the results are as shown in Table 5.

Table 5. Results of Limited Test

No.	Pre-Service Teacher Initials	Score Average
1.	MFA	3.6
2.	KIK	3.4
3.	DII	3.3
4.	CWM	4
5.	AUA	3.5
6.	NFA	3.1
	Average	3.5
	Percentage	86.75

The limited test results on the learning material show an average score of 3.28 and a percentage of 86.75% with the "valid" category. The six students in the limited test suggested adding Islamic material and examples of non-routine problems. Some improvements have been made related to the learning material presentation technique and the addition of material related to Islamic knowledge. The improvement confirms Darici's opinion (2016) that it is necessary to consider pre-service teachers' opinions and needs.

The assessment phase was carried out by applying learning material in mathematics learning class to examine students' response to the learning material developed and examine students' understanding improvement. Thirty-seven pre-service mathematics teacher students

participated in the learning using an Islamic context. The information obtained is presented as shown in Table 6.

Table 6. Results of Assessment Phase

Treatment	Score
Average Pre-test	24.19
Average Post-test	68.65
Maximum Score	100
N-Gain	0.57

Islamic context as the source of learning in this research shows N-Gain average test result on mathematical concept understanding of 0.57, that is of "medium" category. Students' response to the learning material shows 82%, which means that the quality of the learning material is in a good category. Learning using this learning material can help students develop their mathematical concept understanding. During learning, the pre-service teacher students showed interest in mathematics. Students' increased interest in learning mathematics through learning material innovation may affect their success. As stated in the study carried out by Yeh et al. (2019), exciting learning material can increase students' interest and success in learning mathematics.

As the formulation of the problem in this study, the study program requires appropriate Islamic context-based mathematics teaching materials. Several phases that have been passed in testing the development of Islamic context-based mathematics teaching materials show that the teaching materials are valid to be used and can improve understanding of mathematical concepts. Referring to Chan et al. (2019), the context in the teaching materials can develop the professionalism of prospective teachers in a more holistic field of study. Pre-service teacher students understand mathematics in the contexts they are familiar with, facilitating them to comprehend mathematics related to the Islamic knowledge they believe.

D. CONCLUSION AND SUGGESTIONS

The Islamic context-based learning material developed with power and root, ratio and scale, and plane figure and solid figure materials has passed various phases of development. The earning material has met the requirements and can be considered for use in learning mathematics. The expert validation and limited test show that the learning material is appropriate for use. In addition, after some revisions of the learning material, the experiment shows that the learning material can increase pre-service mathematics teacher students' mathematical concept understanding with an N-gain of 0.57. This N-gain improvement score indicates that after passing the final phase of development, namely limited trials, teaching materials can improve understanding of mathematical concepts. This research can be applied in other studies using teaching materials in Islamic-based schools. Suggestions for future research can expand the scope of research material in school mathematics. Coverage of the material using the Islamic context.

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