



## Islamic-Nuanced Mathematics Teaching Material: An Alternative Tool to Improve Students' Understanding on Integers

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### ABSTRACT

The acquisition of mathematical proficiency among university students, particularly within the Department of Elementary Education at Universitas Syiah Kuala, Aceh – Indonesia, often presents challenges. Integrating religious undertones into mathematics pedagogy represents a constructive approach to engender student engagement and augment comprehension. Such integration affords students a familiar contextual backdrop, fostering a more meaningful learning milieu. This article delineates the development of an instructional resource imbued with Islamic motifs, specifically addressing concepts related to integers. The study cohort comprises 115 second-year students enrolled in the Department of Elementary Education at Universitas Syiah Kuala. Methodological stages encompassed preliminary inquiry, developmental endeavors, and evaluative assessments. Research instrumentation encompassed validation protocols for assessing integrity and observation metrics capturing students' instructional engagements. Additionally, assessments, accompanied by post-instructional questionnaires, were administered to gauge student perceptions. Qualitative data analyses were conducted, evaluating the product's viability across dimensions of validity, applicability, and efficacy. Iterative revisions were undertaken during the instructional resource's refinement process. Outcomes underscore the aptness of the Islamic-imbued mathematics instructional material for second-year students within the elementary education domain. The implications of these findings underscore the advantages conferred by familiar-contextualized learning materials in facilitating students' mathematical comprehension.

**Keywords:** design research, integer arithmetic operations

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### INTRODUCTION

The topic of integers is a part of mathematics learning that is closely related to students' daily lives. Integers are used daily, for instance, to count the number of marbles, candies, money, measuring distances, etc. Therefore, it only makes sense that the teaching and learning of integers in the classroom should use daily life contexts that the students are familiar with. Familiar contexts help create meaningful learning experiences (Gunstone, [2015](#)). On the contrary, when integers are taught without context, it may lead to poor understanding. Previous studies show that students taught procedural arithmetic

operations of integers without context struggled to solve simple mathematical word problems involving addition, subtraction, multiplication, and division of integers (Khalid & Embong, [2020](#)).

Students' understanding of integers highly depends on teachers' mastery of the concept and their teaching approaches (Reeder, [2016](#)). Therefore, teachers should employ strategies to help overcome students' learning difficulties and improve deep understanding (Febriyanti et al., [2021](#)). Several factors can influence students' difficulties in learning integers. Brueckner and Bond (in Taufik, [2016](#)) identified the factors causing students' problems in learning mathematics in general: their lack of success in understanding basic concepts, principles, and algorithms, difficulties in abstraction, generalization, deductive thinking, and applying mathematics concepts and principles. Other challenges include solving contextual problems or word problems (Seifi et al., [2012](#)).

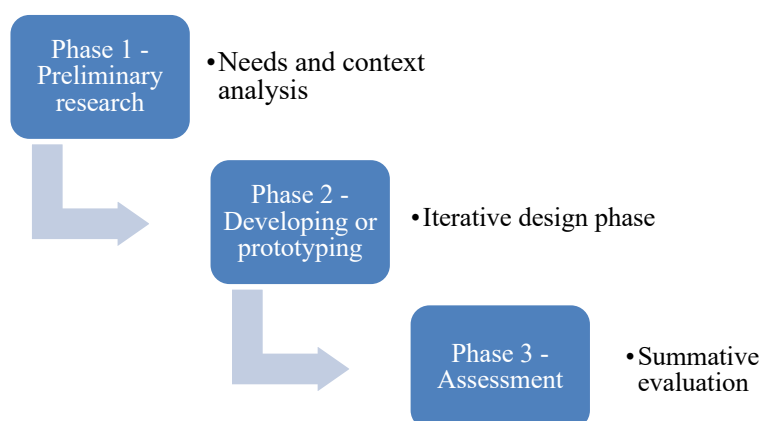
Implementing contextual teaching has been seen as a solution to overcome students' difficulties in learning mathematics because it helps provide context that can give realistic application or familiar presentation of abstract concepts (Ilhan & Akin, [2022](#)). One way to present mathematics in a context that is familiar to students is by incorporating local culture in learning mathematics. According to the literature, cultural internalization in learning mathematics can foster students' positive attitudes toward mathematics, which will ultimately help their understanding (Rosa & Orey, [2011](#)). Teachers need to contextualize learning mathematics by connecting mathematics contents with culture and real-life experiences of students because daily experience in the life of the students, including their culture and religion, impacts their learning experience and knowledge construction (Kurniawan et al., [2022](#)).

At the Department of Elementary Teacher Education, Universitas Syiah Kuala in Banda Aceh, Indonesia, the students are predominantly Muslims. This fact can be constructively utilized in mathematics learning. The students can learn about integers by using familiar Islamic practices, such as the practice of dhikr using fingers. The practice of dhikr with fingers is a sunnah recommended by Rasulullah, and peace be upon him (PBUH). The tradition of counting dhikr with fingers is based on a recount from Abdullah bin Amr, who stated, as narrated by Abu Dawud, "I saw Rasulullah PBUH counting his dhikr with his hands" (Jawas, [2015](#)). Teaching materials using familiar practices such as this can make it easier for students to understand the concepts related to integer arithmetic operations. This is because the students are familiar with the context, so they feel closer to the real-life application of mathematics. This is as stated by Renzulli, Gentry, and Reis ([2004](#)) that mathematics learning should be authentic, which means mathematics learning creates an environment where students can put into practice the knowledge and skills that are relevant to real-life problems (Renzulli et al., [2004](#)). Similarly, Renzulli, Leppien, and Hays ([2000](#)) revealed that the emphasis in developing mathematical creativity is on creating authentic learning experiences where students can think, feel, and do what professional practitioners do.

Previous studies have reported the development of teaching materials, such as modules incorporating Islamic teachings in mathematics learning for elementary and high school students. However, in the case of mathematics learning at PGSD Universitas Syiah Kuala, there have been no publications on the development of Islamic-nuanced mathematics teaching materials. Therefore, this article aims to report a study conducted to develop a worksheet with Islamic context to teach integer arithmetic operations for pre-service teachers at the Department of Elementary Education, Universitas Syiah Kuala. The research question we addressed in the study is as follows: how does the Islamic-nuanced teaching material on integers satisfy the criteria of validity, practicality, and effectiveness?

## METHOD

This study implemented the research and development approach (R & D). Development research is a research process used to develop educational products and validate them for use in academic settings (Sugiyono, [2011](#)). The development model is based on the three phases of Plomp's model. The three phases are preliminary research, developing or prototyping, and assessment. These phases are depicted in Figure 1.



**Figure 1.** The Development Phases of the Islamic-Nuanced Teaching Material

Figure 1 shows the development phases of the Islamic-nuanced teaching material that would be used to teach integers according to Plomp's model. The model was chosen for its straightforwardness with three steps of development that are suitable for the aim of the study (Pratama et al., [2020](#)). The three phases are described as follows.

### ***Phase 1: Preliminary research***

The activities carried out during this phase were to examine the mathematics curriculum used by the second-year students of the Department of Elementary Education, Universitas Syiah Kuala, and to examine the characteristics of prospective students who use teaching materials and, including analysis of verses of the Qur'an related to integer arithmetic operations. The results of this analysis form the basis for formulating the objectives of developing teaching materials.

### ***Phase 2: Developing or prototyping.***

The activity carried out at this phase is compiling Islamic teaching materials on integer arithmetic operations. Teaching materials are designed according to their development goals and adapted to the characteristics of target users (Plomp, [2013](#)). This study's Target users were the second-year Department of Elementary Education students. At this phase, a prototype or draft was produced and tested for validity by validators who were experts in their fields. The validity test includes content and readability tests of worksheets. Cycles of revisions were made according to the results of the validity tests until the prototype satisfied the validity (Plomp, [2013](#)).

### ***Phase 3: Assessment***

The activities carried out during this phase were trials of applying the worksheet involving the target users (Plomp, [2013](#)). According to Nieveen and Folmer ([2013](#)), the trial phase is carried out to test practicality and effectiveness, measuring the implementation and usefulness of the product being developed. The practicality of the worksheet is calculated based on the results of observations of student activities during learning, as well as student responses to the use of the worksheet, which are obtained through questionnaires. At the same time, the effectiveness of the worksheet is measured based on students' learning outcomes.

Four instruments are used in this study, namely 1) validation sheets used to test the validity of the worksheet; 2) observation sheets to obtain data on student activities during learning; 3) learning achievement test; and 4) student response questionnaires.

The data analysis technique was carried out qualitatively, where the assessment of teaching material products is based on the opinion of Nieveen and Folmer ([2013](#)) which states that aspects of assessing the quality of a product include aspects of validity and practicality. The validity of the worksheet was analyzed based on the validators' assessment of the content and readability of the teaching materials in the form of a Likert scale. The validation score is calculated using Aiken's V formula. The product is declared valid if the V score for each aspect assessed is at least 0.6 (Azwar, [2012](#)). Conversely, the product is declared invalid if the score V for each aspect is rated lower than 0.6. The practicality of teaching materials is analyzed based on student activities during learning and student responses to the worksheets. The practicality criteria are fulfilled if 1) student activities are classified as at least in the good category, 2) student learning outcomes achieve completeness with a minimum of 85%, achieving a score of 70, and 3) students' responses on the use of the worksheets are at least 85% positive.

## **RESULTS & DISCUSSION**

The description of this section is organized into three parts. Part 1 is the preliminary research, part 2 is the development or prototyping, and part 3 is the assessment.

## ***Result***

The preliminary research resulted in an analysis of the curriculum and students as the target users of the developed worksheet. According to the mathematics curriculum used at the Department of Elementary Education of Universitas Syiah Kuala, the number theory course is a compulsory subject given in the second semester. Learning outcomes for integer arithmetic operations material in number theory courses are as follows: Students can employ the properties and rules in carrying out operations of addition, subtraction, multiplication, and division of integers. At the same time, the prerequisite abilities that be mastered by students to understand this material are the ability to operate arithmetic such as addition, subtraction, multiplication, and division, as well as an understanding of the concepts of “directly proportional” and “inversely proportional” in performing arithmetic operations. Based on the results of the initial test, 86% or 99 students had mastered the prerequisite skills for basic arithmetic operations well. While the remaining 14% still need improvement. It can be concluded that, on average, the students have mastered the prerequisite operations to learn integer arithmetic operations.

The analysis of students shows that 100% of the target users are Muslims. Therefore, the development of worksheets with an Islamic context is expected to make students more familiar with teaching materials because they are closer to the real-life experiences of students who are predominantly Muslim.

The average age of the students was 19 years old. This implies that the teaching and learning activities can be categorized as learning for adult students (andragogy). In Rogers' view (in Wang, [2016](#)), learning for adult students should be done by applying a student-centered learning approach where students are presented with real problems that need to be solved, equipped with teaching resources in the form of humans or written materials. Lecturers should design learning by considering the relevance of teaching materials to the students' daily lives to facilitate student interaction and discussion and to confidently express their opinions and ideas.

Based on an analysis of the curriculum and students, the development of worksheets with Islamic context aims to make students more familiar with teaching materials because it is closer to the daily life of students who are predominantly Muslim, and it can improve students' abilities in completing integer arithmetic operations which are expected to minimize making mistakes in integer arithmetic operations during this time.

## ***Developing or Prototyping Phase***

Based on the results of the first phase, the prototype of the worksheet was constructed. Two mathematics education experts then validated it. The validity test includes content and readability tests of worksheets. At this stage, revisions continue until a valid draft of teaching materials is obtained. The validation score is calculated using the Aiken formula (Azwar, [2012](#)) as follows.

$$V = \frac{\sum s}{n(c - 1)}$$

V is the validation score; s is the difference between the scores provided by the validators and the minimum score on the Likert scale; c is the maximum score on the Likert scale; and n is the number of validators involved in the validation process. The validation scores are shown in Table 1 regarding the first and second rounds of the validation test.

**Table 1.** Validation scores

No.	Assessment Aspects	First-round Scores	Second-round Scores
1	Content	0.47	0.67
2	Format	0.67	0.67
3	Language	0.52	0.63

As shown in Table 1, the validation of the worksheet was carried out twice. For the first-round validation, the scores were relatively low for the aspects of content and language. The validator gave several inputs on worksheet improvements in content and format. For the format aspect, the validators suggested using pictures and other colors to make it more exciting and not dull. The validators indicated that the teaching materials be adjusted to the target users for the language aspect. The students are pre-service teachers; therefore, the language should be designed in a way that is suitable for them. The validators suggested simpler language. Revisions were made according to the validators' suggestions and validated for the second round. As shown in Table 1, the scores for second-round validation were good. Therefore, the worksheet is deemed fit for use without further revision.

### ***Assessment***

At this stage, ten students tested the application of the worksheet on a minor scale and 105 students on a significant scale at the Department of Elementary Education, Universitas Syiah Kuala, to test practicality and effectiveness. The practicality of worksheets is measured from the results of observing student activities during learning. The observations concentrated on student attention and student interaction for student learning activities. Two observers monitored and assessed The students' activities using a Likert scale of 3 points starting from Good = 3, Moderate = 2, and Bad = 1. The Good category means that more than 70% of students carry out activities; the Moderate category means 50% - 70% of students do activities; and the Bad category implies that less than 50% of students do the activity. Table 2 shows the results of observations of student activities.

The observations in Table 2 show that the two observers rated student learning activities in the Good category. The average score for most items is 3. Overall, student activities during learning activities include paying attention to learning, discussing with group members during discussions, working together in completing assignments, and focusing on doing assignments during learning. This

finding is in line with research conducted by Magdalena, Prabandani, Rini, et al. (2020) where the development of teaching materials is beneficial and influences many things, starting from students who are more active, facilitating understanding of subjects and enabling students to enjoy lessons without feeling bored.

**Table 2.** Observation of student learning activities

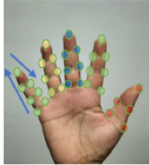
Observation Items	Score			Mean
	3	2	1	
<b>Student Attention</b>				
1 Pay attention to the lecturer's explanation.	2			3
2 Answer questions either voluntarily or by appointment.		2		2
3 Asking question.		2		2
<b>Student Interaction</b>				
4 Discuss with group mates.	2			3
5 Collaborate with group mates.	2			3
6 Helping friends who are having trouble (not during tests).		2		2
7 Focus on learning (stay on task).	2			3

Figure 2 below shows a snapshot of the Islamic-nuanced teaching material.

**1. SIFAT-SIFAT OPERASI HITUNG PADA BILANGAN BULAT**

Tujuan Pembelajaran  
Mahasiswa mampu menerapkan sifat-sifat operasi hitung dalam melakukan penjumlahan, pengurangan, perkalian, dan pembagian bilangan.

Pendahuluan  
Perhatikan hadits berikut ini.  
Abdullah bin Umar Radhiallahu'anhu berkata:  
"Saya melihat Rasulullah SAW bertasbeih dengan (jari-jari) tangan kanannya."  
HR. Abu Dawud dan At-Tirmidzi



Hadits di atas menjelaskan tentang menggunakan ruas-ruas pada tangan kanan untuk berdzikir. Misalnya Dzikir Subhanallah, Alhamdulillah, dan Allahu Akbar yang masing-masing dibaca 33 kali setiap selesai shalat fardhu.  
Tuliskan operasi hitung campuran untuk perhitungan Dzikir Subhanallah berdasarkan hadits di atas.

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Direct translation:  
1. Properties of Operations on The Set of Integers  
Study Objective  
Students can apply the properties of operations in integers' addition, subtraction, multiplication, and division.  
1.1 Introduction  
Consider the following hadith. Abdullah bin Umar Radhiallahu'anhu states: "I saw Rasulullah PBUH counting his dhikr with the fingers of his right hand" HR. Abu Dawud and At-Tirmidzi  
The hadith explains how to use the segments of the fingers on the right hand to do dhikr. For example, Subhanallah, Alhamdulillah, and Allahu Akbar are read 33 times after that.  
State the mixed operations of dhikr Subhanallah as described by the hadith.

**Figure 2.** A Snapshot of the Worksheet with Islamic Nuance

After implementing the major scale worksheet, a learning achievement test is carried out. Table 3 below shows the scores achieved by the students.

**Table 3.** Student Scores on the Learning Outcomes Test with the Broad Scale Test

Value Range	Frequency	Information
60 - 69	6	Not Passed
70 – 79	41	Passed
80 – 89	27	Passed
90 – 100	31	Passed
Sum	105	

As shown in Table 3, most of the students have achieved individual learning mastery, which has achieved a minimum score of 70. As many as 6 students have not completed and 99 students have achieved mastery. The classical completeness level is  $(99/105) \times 100\% = 94\%$ . The average student score is 82.33. Based on the completeness category of learning outcomes that have been described in the Research Methods Chapter, student learning outcomes in mayor-scale trials have reached completeness. Therefore, it can be concluded that the developed worksheet meets the effective criteria.

In the assessment stage, an investigation was carried out on students' responses to the worksheets that had been developed. The instrument used was a questionnaire in which students expressed their opinions on several aspects of the assessment in terms of content, images, and questions using a Likert scale ranging from 1 to 4 points where 4 = Strongly Agree, 3 = Agree, 2 = Disagree, and 1 = Strongly Disagree. Analysis of student response data to worksheet with Islamic context for integer arithmetic operations is presented in the following table.

**Table 4.** Student Responses to worksheets Implementation

No	Assessment Aspects	4	3	2	1	Mean
1	Learning objectives are clearly stated.	73	31	1		3,74
2	The letters or fonts used in worksheet are clear and easy to read.	69	36			3,65
3	The language used is easy to understand.	68	36	1		3,61
4	The questions in the worksheet are in accordance with the learning objectives.	75	28	2		3,69
5	The language of the questions is easy to understand.	58	45	2		3,53
6	The application of worksheet with Islamic context helped me understand the material for integers arithmetic operations	75	29	1		3,70
7	In my opinion, elements of Islamic context make learning interesting.	79	26			3,75
8	Presentation of worksheet encourages me to actively read, discuss, and answer questions.	68	36	1		3,63
9	The time provided is in accordance with learning activities.	66	39			3,62
10	I enjoy learning activities using the worksheet	79	25	1		3,67



As shown in Table 4, students' responses to the worksheet were positive, where the majority of students chose strongly agree or agree for almost every aspect of the assessment. The highest score is for the aspect of clarity and the aspect of application of material with Islamic context with a mean score of 3.74 and 3.75. The lowest score is for the language aspect of the questions with a mean score of 3.53. The table shows that the results of the student response analysis show that the average mean score is at least 3.

### ***Discussion***

The development of the Islamic-nuanced teaching material in integers was carried out based on the needs and context analysis in phase 1, which is the preliminary research. The teaching material was carefully developed to meet the needs of the students, who were predominantly Muslims, in learning the arithmetic operations of integers. The students can learn about integers by using familiar Islamic practices, such as the practice of dhikr using fingers. Teaching materials using familiar practices such as this can make it easier for students to understand mathematical concepts because it makes mathematics more accessible and familiar (Mania & Alam, [2021](#)). When the students are familiar with the context, they will feel more comfortable learning mathematics and have a positive attitude toward mathematics, resulting in better understanding and achievement (Weinhandl et al., [2022](#)).

The results of the present study show that the Islamic-nuanced teaching materials on integers have met the criteria of validity, practicality, and effectiveness. The teaching materials have successfully helped students learn and understand the arithmetic operations of integers. This finding was made by Vitoria and Monawati ([2020](#)), which revealed that developing teaching materials through familiar cultural contexts in mathematics can increase students' understanding of the material. Teaching materials as a learning resource is crucial in students' knowledge construction (Bušljeta, [2013](#)). The teaching materials developed in the present study provide meaningful learning experiences for the students by incorporating cultural contexts that are familiar to them. This aligns with Bruner's learning theory, which states that cultural context plays a significant part in students' learning behavior and success (Wen, [2018](#)). The teaching and learning process should allow students to create meaningful comprehension of a mathematical concept through contextual and familiar examples (Wen, [2018](#)).

Magdalena et al. ([2020](#)) suggest that the critical success of developing a teaching material does not merely depend on the final product during the development process and requires careful implementation. The results of the present study show that the Islamic-nuanced teaching materials satisfied the criteria of practicality and effectiveness, which shows that the teaching materials have been implemented satisfactorily in terms of students' learning activity and learning outcomes. In implementing the teaching materials, the teacher pays attention to the product's suitability with their students' condition and improvement. Being a teacher is a job that requires care, creativity, and

willingness to provide meaningful learning experiences for the students (Žydžiūnaitė & Arce, 2021). Developing familiar learning material, such as in an Islamic context, is an example of a teacher's effort to provide a familiar and meaningful learning experience. By presenting and incorporating cultural values into the teaching and learning of mathematics, students can construct their understanding of mathematical concepts while at the same time appreciating the presence of mathematics in their daily lives (Oktaviyani et al., 2023).

The results suggest that the students agreed that the worksheet has fruitfully helped them learn and understand the arithmetic operations of integers. The students decided that the Islamic nuance made mathematics learning interesting and helped them understand the mathematical concept they were learning. These findings support previous studies which found that the integration of Islamic values into the teaching and learning of mathematics is helpful for students' understanding because it provides the students with familiar contexts and applications of mathematics in daily life (Junarni et al., 2020; Mahmudah & Muqowim, 2022). Furthermore, from the Islamic point of view, incorporating Islamic values into mathematics learning is highly encouraged because science, such as mathematics, is an inseparable part of religion (Triana et al., 2023). Therefore, the result of the present study further strengthens previous studies that Islamic-nuanced learning provides students with meaningful and joyful learning experiences (Mahmudah & Muqowim, 2022; Oktaviyani et al., 2023; Vitoria & Monawati, 2020).

As mentioned earlier in the above paragraph, the Islamic-nuanced teaching materials satisfied the validity, effectiveness, and practicality criteria. However, some limitations should be noted—the minor scale trial of the worksheet to test the practical and effectiveness criteria involved only ten students. To gain more data, further studies could involve more students with varying backgrounds for the minor and major scale trials. Additional studies could also extend the type of teaching materials to incorporate the digital form of the worksheets so that the worksheets could be implemented in online or blended learning circumstances on various mathematical concepts.

The results of the present study strengthen previous studies that contextual teaching materials, in this case Islamic-nuanced teaching materials, are beneficial for students' understanding of mathematics. To further extend the positive impact of this research, educational practitioners are encouraged to broaden the incorporation of Islamic context into the mathematics curriculum to help shape students' characters and attitudes with Islamic values.

## CONCLUSION

This study employs a research and development (R&D) methodology to create Islamic-themed teaching materials tailored for the Elementary Education Department at Universitas Syiah Kuala, specifically focusing on integer arithmetic operations. The resulting worksheets are rigorously evaluated

for validity, practicality, and effectiveness. Content and language validity scores, along with format validity, are noted. Student mastery levels and overall effectiveness are reported, indicating the practical utility of the teaching materials in facilitating student learning activities. These findings emphasize the significance of contextually relevant learning materials in enhancing students' understanding of mathematical concepts.

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