


Integrating Qur'an and Integer Learning in Developing Electronic Students' Worksheet through Problem-Based Learning

La Roy¹, Lekë Pepkolaj², Rully Charitas Indra Prahmana^{3*}

^{1,3}Universitas Ahmad Dahlan, Yogyakarta, Indonesia

²Metropolitan Tirana University, Tirana, Albania

2208050017@webmail.uad.ac.id¹, leke.pepkolaj@qiriazi.edu.al², rully.indra@mpmat.uad.ac.id^{3*}

 <http://dx.doi.org/10.30595/alphamath.v10i2.24421>

ABSTRACT

Despite the growing interest in contextualizing mathematics education, research integrating Qur'an contexts into mathematics instruction remains limited. Prior studies have largely concentrated on conventional teaching methods, Qur'an-centered instruction, or Problem-based Learning (PBL) as independent approaches. This study addresses a critical gap by integrating Qur'an contexts into integer learning, supported by problem-based learning and facilitated through a technology-enhanced Electronic Student Worksheet (E-SW). The primary objective of this study is to design and assess the reliability and applicability of a Quran-based E-SW using the PBL framework for teaching integers to 7th-grade junior high school students. Employing a Research and Development (R&D) methodology with the ADDIE development model—comprising analysis, design, development, implementation, and evaluation phases—this research utilizes expert validation sheets and student practicality questionnaires as instruments. The study sample consists of 7th-grade students from SMP IT LHI Yogyakarta, with class 7B selected through purposive sampling. Validation results indicate that the E-SW meets established validity criteria, with scores from subject matter and media experts reaching 99 and 91, respectively, both classified as "Good." Practicality testing revealed positive student responses, yielding a practicality score of 61, categorized as "Practical." Furthermore, a paired sample t-test demonstrated a statistically significant improvement in student performance between pretest and posttest results, with a significance (2-tailed) value below 0.05 and an average N-Gain score of 0.4391, which is classified as moderate. These findings suggest that the Quran-based E-SW, structured around the PBL model, effectively enhances students' problem-solving abilities and is suitable for educational use.

Keywords: 7th-Grade Students, Integer, Problem-Based Learning, Problem Solving Ability, Qur'an

ABSTRAK

Meskipun minat untuk mengontekstualisasikan pendidikan matematika semakin meningkat, penelitian yang mengintegrasikan konteks Al-Qur'an dalam pengajaran matematika masih terbatas. Penelitian sebelumnya umumnya berfokus pada metode pengajaran konvensional, pembelajaran berbasis Al-Qur'an, atau Problem-based Learning (PBL) sebagai pendekatan terpisah. Studi ini bertujuan untuk mengisi kesenjangan penting dengan mengintegrasikan konteks Al-Qur'an ke dalam pembelajaran bilangan bulat, yang didukung oleh pembelajaran berbasis masalah dan difasilitasi melalui e-Lembar Kerja Peserta Didik (e-LKPD) berbasis teknologi. Tujuan utama penelitian ini adalah merancang dan menguji keandalan serta penerapan e-LKPD berbasis Al-Qur'an dalam kerangka PBL untuk pengajaran bilangan bulat bagi siswa kelas 7 SMP. Dengan menggunakan metode Research and Development (R&D) serta model pengembangan ADDIE—yang meliputi tahapan analisis, desain, pengembangan, implementasi, dan evaluasi—penelitian ini memanfaatkan lembar validasi ahli dan kuesioner kepraktisan siswa sebagai instrumen. Sampel penelitian terdiri dari siswa kelas 7 di SMP IT LHI Yogyakarta, dengan kelas 7B dipilih melalui teknik purposive sampling. Hasil validasi menunjukkan bahwa e-LKPD memenuhi kriteria validitas yang ditetapkan, dengan skor dari ahli materi dan ahli media masing-masing mencapai 99 dan 91, yang keduanya diklasifikasikan sebagai "Baik." Uji kepraktisan menunjukkan respon positif dari siswa, menghasilkan skor kepraktisan sebesar

61, yang dikategorikan sebagai "Praktis." Lebih lanjut, uji t sampel berpasangan menunjukkan peningkatan kinerja siswa yang signifikan secara statistik antara hasil pretest dan posttest, dengan nilai signifikansi (2-tailed) di bawah 0,05 dan skor N-Gain rata-rata sebesar 0,4391, yang tergolong sedang. Temuan ini menunjukkan bahwa e-LKPD berbasis Al-Qur'an yang disusun dengan model PBL efektif dalam meningkatkan kemampuan pemecahan masalah siswa dan layak digunakan dalam pendidikan.

Kata kunci: Al-Qur'an, Bilangan Bulat, Kemampuan Pemecahan Masalah, Pembelajaran Berbasis Masalah, Siswa Kelas 7

Received : November 7, 2024

Accepted : November 23, 2024

Published : November 23, 2024

Introduction

Education serves as the foundational pillar of national progress, essential for enhancing the quality of life among citizens (Wulandari et al., 2016). Among the core fields in education, mathematics holds a pivotal role, as it facilitates not only the understanding of fundamental concepts but also fosters critical and systematic thinking skills (Riyani & Hadi, 2023; Putra, 2017). According to the Indonesian Ministry of Education regulation, the overarching objective of mathematics education is to equip students with the competence to effectively address mathematical problems. This encompasses abilities in problem comprehension, formulation of mathematical models, resolution of these models, and interpretation of results (Latifah & Luritawaty, 2020; Spreitzer et al., 2024). These skills are essential not only within academic contexts but also in practical, everyday applications.

Problem-solving skills are among the essential competencies required of students in the 21st century (Kivunja, 2015). In mathematics education, these skills can be developed through complex topics, such as integers, which demand a solid understanding and application of foundational mathematical concepts (Szabo et al., 2020; Verschaffel et al., 2020). However, existing studies highlight that students frequently encounter challenges in understanding and applying integer concepts, particularly in operations such as multiplication and division (Bryant et al., 2020; Sercenia et al., 2023; Shih et al., 2023).

Similar challenges have been observed at SMP IT LHI Yogyakarta. Through classroom observations and interviews with 7B-grade students, it was found that they frequently encounter difficulties in solving integer-related mathematical problems. These challenges include errors in gathering relevant information, selecting appropriate formulas, and structuring their solutions, ultimately leading to incorrect conclusions (Umam & Susandi, 2020). This observation is corroborated by pretest results, which indicate that students' problem-solving skills remain below expectations, with only 9 out of 19 students achieving scores above the Minimum Competency Criterion of 75.

Several researchers have documented findings related to the development of Electronic Student Worksheets (E-SW) that are valid, practical, and effective in fostering students' problem-solving abilities. These studies have explored various approaches, including E-SW based on Liveworksheets (Sarman et al., 2023), Problem-Solving (Panjaitan et al., 2023), Realistic Mathematics Education (Nugraheni & Marsigit, 2021), Problem-Based Learning (Klang et al., 2021), Google Slides (Putri et al., 2022), and Contextual Approach (Annisa et al., 2023). These findings indicate that instructional materials grounded in specific models, methods, or approaches can significantly enhance students' problem-solving skills. Consequently, developing instructional materials based on alternative approaches is necessary to expand the range of resources available for teachers in selecting the most relevant tools for their students.

An intriguing approach in the realm of mathematics education involves the integration of Islamic values, which has been shown to not only enhance the learning experience but also strengthen students' faith and devotion (Brentjes, 2019; Fitriza et al., 2020; Fitri et al., 2023). In a similar point of view, Vasinayanuwatan et al. (2020) investigate the integration of Shura, an Islamic consultative practice, within a STEM professional learning community (PLC) at an Islamic school in Southern Thailand. Their findings highlight how this integration empowered science teachers, fostering transformative changes in their understanding and beliefs about STEM education while remaining sensitive to the cultural context of Islamic pedagogy. Moreover, Shaw (2022) examines the interplay between secular and spiritual interpretations of geometric patterns in Islamic art, asserting that geometric forms serve as a universal, language-like medium of communication that transcends both cultural and religious boundaries. These patterns, according to Shaw (2022), possess an intrinsic meaning that resists the need for intermediary theorization, speaking directly to the viewer's perception, whether in historical Islamic contexts or modern secular applications. In light of these perspectives, incorporating Qur'anic viewpoints in mathematics education offers students a deeper connection to mathematical concepts, fostering an appreciation for the profound insights and spiritual dimensions embedded within them.

Moreover, technological advancements play a crucial role in enhancing mathematics education (Shen et al., 2023; Küçükaydın et al., 2024). The use of E-SW presents an effective learning alternative, particularly in remote learning contexts. E-SW can be accessed through various devices, including smartphones, which are commonly owned by students. This indicates that technology in education not only facilitates access to information and learning materials but also encourages students to learn independently. Therefore, with the development of a Qur'an-based E-SW, it is hoped that students will be more engaged and motivated to enhance their problem-solving

abilities independently, effectively, and efficiently, while simultaneously strengthening their faith and devotion.

To address these challenges, a more innovative and engaging learning model is required. Problem-Based Learning (PBL) has been shown to effectively enhance students' abilities in solving mathematical problems, making it a promising approach (Boye & Agyei, 2023). Moreover, integrating Islamic values into mathematics instruction can offer students a more meaningful and contextually relevant learning experience, while also reinforcing their faith and devotion (Fitrah & Kusrini, 2022; Fitriana et al., 2020; Kinanti & Wulantina, 2023).

The E-SW is an innovative educational tool designed to meet students' needs for interactive and adaptive learning resources. By leveraging technology, the E-SW can captivate students' interest and promote independent learning, thereby fostering deeper engagement in the learning process (Hamilton, 2022; Rais & Zhao, 2024). In response to survey findings indicating a strong student preference for technology integration in learning, this study aims to design a Quran-based E-SW utilizing the PBL model on the topic of integers, with the goal of enhancing problem-solving skills among 7th-grade students at SMP IT LHI Yogyakarta. Therefore, by integrating the PBL model with Islamic values in the development of the e-SW (Kumalasari et al., 2021; Masamah et al., 2023), this approach aims to enable students to not only master mathematical concepts but also internalize essential spiritual values. This dual focus seeks to nurture students who are both competent and morally grounded, equipping them to apply these principles effectively in their daily lives.

Research Methods

This study employs the ADDIE approach to develop a Qur'an-based E-SW learning media that is valid, reliable, and effective in enhancing the problem-solving skills of seventh-grade middle school students through a PBL approach. The developed learning media, in the form of E-SW, focuses on integer topics. The media was initially validated by experts, including media and content specialists, before undergoing trial phases. The trial group in this study consisted of seventh-grade students (72 students from classes 7A to 7D) at SMP IT LHI Yogyakarta, while the research sample comprised 19 students from class 7B. These students were selected for their homogeneous characteristics and had previously been taught by a teacher familiar with the PBL method and the Qur'an context used as the starting point in this learning process. Ensuring these criteria is essential to align the research process with its objectives.

A variety of instruments were employed to collect research data and address the study's problem statement. These included questionnaires featuring statements and multiple-choice responses, validation sheets for feedback from content and media experts, and a practical usability questionnaire (student feedback after using the media). These instruments were designed to ensure comprehensive data collection and support the study's conclusions.

Validity Analysis of E-Student Worksheet

The purpose of the validity analysis is to ensure the accuracy of the Qur'an-based E-SW learning tool developed by the researchers. The process involves gathering validation data from experts, including media and content specialists, summarizing this information based on each criterion in the table, and calculating the average score from the data obtained. The validation instrument used by content experts assesses content feasibility, language feasibility, and presentation feasibility. Meanwhile, the media expert validation instrument evaluates language feasibility and graphic feasibility. The scoring classification employs an interval class system and criteria to categorize the average assessment results of the Student Worksheet (SW), which were evaluated by three validators: two Ph.D. and one with a master's degree, all of whom are experts in the relevant media content. The evaluation results are then compared against a predetermined classification to calculate validity. The assessment classification is based on the validators' average score for the E-SW, which aligns with the class range requirements; the lowest score is 26, and the highest is 130, with categories ranging from "Very Poor" to "Excellent." The media validation data from content experts is summarized in [Table 1](#).

Table 1. Media Expert Validation Results

| Validator | Total Score | Category |
|---------------|-------------|--------------|
| Validator 1 | 104 | Good |
| Validator 2 | 97 | Good |
| Validator 3 | 95 | Good |
| Average | 98,67 | Good |
| Result | | Valid |

The content experts' data indicates an average validation score of 98.67, meeting the minimum criterion of "Good" for a product to be declared valid. Thus, the developed E-SW is deemed valid from the perspective of media experts.

Following this, the E-SW was validated by three content experts, including two Ph.D. holders and one with a master's degree, all of whom specialize in the relevant content area. The evaluation results are compared against a predetermined classification to determine validity. The classification criteria use an average score range from 23 to

115, with categories from "Very Poor" to "Excellent." The validation data from content experts is summarized in [Table 2](#).

Table 2. Content Expert Validation Results

| Validator | Total Score | Category |
|---------------|-------------|--------------|
| Validator 1 | 90 | Good |
| Validator 2 | 92 | Good |
| Validator 3 | 92 | Good |
| Average | 91,33 | Good |
| Result | | Valid |

The content experts' data indicates an average validation score of 91.33, meeting the minimum criterion of "Good," thus confirming the E-SW's validity from a content perspective. Based on the results in [Table 1](#) and [Table 2](#), it can be concluded that the E-SW is deemed valid in terms of both media and content, as assessed by media and content experts.

Practicality Analysis of E-Student Worksheet

The user response questionnaire for the Qur'an-based E-SW, completed by students, revealed that 68% rated the E-SW as "Good" and 32% rated it as "Excellent." The average score from the questionnaire was 61, placing it in the "Good" category. The practicality criterion is met if the average response score from the student questionnaire falls within at least the "Good" category. Therefore, the developed E-SW is considered practical based on the student responses after using the E-SW.

Effectiveness of E-Student Worksheet

The pre-test and post-test scores are used to evaluate the effectiveness of the developed E-SW. If the post-test scores are higher than the pre-test scores, the E-SW is considered effective. The average pre-test score was 73.32, while the average post-test score reached 85.53, indicating a significant increase. The average difference between the pre-test and post-test scores demonstrates the effectiveness of the developed media. The analysis of student pre-test and post-test scores shows that the average pre-test score before the intervention was 73.32, which increased to 85.53 after the learning intervention, resulting in an average increase of 12.21. Subsequently, the researchers conducted an N-Gain test, which yielded an average N-Gain score of 0.4391, indicating a moderate improvement in students' mathematical problem-solving skills. Thus, it can be concluded that the developed media is effective in enhancing students' problem-solving abilities, falling within the moderate category based on the average N-Gain score.

Result and Discussions

The findings of this study indicate that the developed media meets validity criteria according to media and content experts, demonstrates practicality based on student response questionnaires, and proves effective in enhancing students' problem-solving skills, as evidenced by implementation results in a large class setting. Comprehensive explanations of these findings are provided based on the research procedures employed, covering each phase from analysis through to implementation.

Analysis Phase

The analysis process in this study includes three main components: curriculum analysis, student needs analysis, and resource analysis. Each component is conducted to understand the current state of integer learning among seventh-grade students at SMP IT LHI Yogyakarta, with the primary goal of identifying gaps between actual learning outcomes and theoretical concepts in integer material. The analysis reveals that students are expected to understand and apply integer concepts; however, there are obstacles in terms of low learning motivation and suboptimal problem-solving skills. Based on these findings, the development of a Qur'an-based E-SW on integer topics is viewed as an appropriate solution to enhance students' learning interest and support values-oriented learning grounded in the Qur'an.

In this analysis stage, the study focuses on various factors influencing the learning process. First, curriculum analysis at SMP IT LHI Yogyakarta reveals that the seventh grade uses a balanced curriculum integrating religious knowledge and science. The learning process at this school is more diverse compared to public schools, incorporating Islamic studies and facilities that are comparable or even superior. The researchers also examined integer material in the Merdeka Curriculum, which includes operations such as addition, subtraction, multiplication, and division, aligned with the curriculum's learning outcomes and objectives. This material is planned to be delivered in two sessions (2 x 60 minutes) to achieve the intended learning goals.

Direct observation of the learning process shows that teachers still rely on printed textbooks and SW that do not fully emphasize the development of problem-solving skills. This situation affects students' enthusiasm for learning due to the limited variety in teaching methods and the lack of opportunities for independent exploration. Moreover, students face difficulties in solving contextual problems provided by the teacher. In integer topics, for instance, students often struggle to identify relevant information, formulate problems, plan solutions, and draw conclusions.

Based on the observation results, the researchers concluded that there is a need for more interactive and innovative teaching materials to increase student motivation and

support the development of their problem-solving skills. The development of a Qur'an-based E-SW using the PBL approach in integer topics is considered a strategic step to address this need. This E-SW is designed not only to improve students' mathematical skills but also to facilitate contextual learning integrated with spiritual values, aligning with the holistic and integrative vision of SMP IT LHI Yogyakarta.

This analysis also includes the identification of resources required during the development process, such as curriculum guidelines, learning materials, instructional models and methods, facilities, technology, student characteristics, and the involvement of subject-matter experts and teachers in material development. By considering these factors, the Qur'an-based E-SW is expected to serve as an effective learning medium, making a positive contribution to enhancing student interest and problem-solving skills in the integer topic.

Design Phase

In the design phase, researchers develop the Qur'an-based E-SW product to improve students' problem-solving abilities in the topic of integers. This phase begins with selecting the product for development, specifically the Qur'an-based E-SW, designed to facilitate students' understanding of integer concepts through the PBL approach. The design phase includes several core components, such as the initial framework in Word, PDF, and professional PDF application formats, which contain instructional content aligned with the study's objectives. Additionally, research instruments are prepared, including student evaluation questionnaires, teacher feedback, and pre-test and post-test questions, all of which are utilized to assess the product's effectiveness. This phase aims to provide a systematic framework that supports student needs and achieves the study's overall objectives.

The results of the product design indicate that the Qur'an-based E-SW for integer content is structured to enhance students' problem-solving skills through the PBL method. The E-SW design includes clear learning objectives, product identification, and a complete structure, from preface to bibliography. Each PBL phase and problem-solving indicator is marked with specific symbols, enabling users to more easily understand the learning process. Validation instruments, such as student feedback questionnaires and pre-test and post-test questions, are also prepared to assess both the effectiveness and feasibility of this product.

The design process for the Qur'an-based E-SW includes various main components intended to facilitate students' comprehension of integer content. Learning Outcomes and Learning Objectives form the foundation of the product design, wherein students are expected to understand and utilize integers, rational numbers, and decimals,

including applications of basic mathematical operations. In the instructional approach, this E-SW incorporates the PBL method integrated with values from the Qur'an, encouraging students to engage with content by relating it to relevant, real-life issues connected to teachings from the Qur'an. The stages in the PBL syntax include orienting students to problems, organizing learning, guiding inquiry, developing and presenting work, and evaluating the problem-solving process. Each PBL phase is symbolized to facilitate students' engagement in a more structured learning process.

The Qur'an-based E-SW's display and structure are designed to be informative and engaging. The product cover includes the title, instructional approach, and user level, specifically for junior high school students in seventh grade. The product identification includes information such as the author's name, year of production, education level, subject matter, and instructional approach. The preface provides an explanation of the significance of this E-SW in supporting mathematics learning, especially integer concepts from a Qur'an-based perspective. To ensure alignment with the curriculum, this E-SW is designed according to the Merdeka Curriculum Content Standards, with specific sections displaying relevant learning outcomes, sub-topics, and learning objectives. Additionally, a concept map is provided to give students an overview of the learning path, covering integer topics from introduction to operations, such as addition, subtraction, multiplication, and division.

A user guide is also included to help students understand how to use this teaching material effectively. The symbols for the PBL approach and problem-solving indicators are designed to assist students in navigating each phase of learning in a more directed manner. Learning activities in the E-SW involve four main tasks focused on integer operations: addition, subtraction, multiplication, and division. These activities are supplemented by audio explanations from relevant Qur'an verses. Each task is designed in line with the PBL syntax to encourage students to identify information, formulate problems, develop solutions, and evaluate results. The steps to complete these tasks are outlined in detail to help students use the E-SW efficiently.

The product design phase also includes the development of evaluation instruments, encompassing content validation, media validation, and student feedback questionnaires. The content validation instrument emphasizes the appropriateness of content, language, and presentation, while media validation is conducted by experts from the Mathematics Education program. The student feedback questionnaire assesses aspects of appeal and ease of use, after undergoing a validation process. Additionally, pre-test and post-test questions are developed based on problem-solving indicators to measure the product's effectiveness. Following revisions based on

validator feedback, the pre-test and post-test instruments are ready for product evaluation.

The final section includes a bibliography listing references from books and journals used in content development. Author identification, including name, place and date of birth, email address, and educational background, is also provided to enhance the professionalism of the design. With this structured design, the Qur'an-based E-SW is expected to serve as an effective instructional medium for enhancing students' problem-solving skills in integer mathematics.

Development Phase

In the development stage, the researchers prepared a draft of the E-SW in accordance with the results of the preceding analysis and design phases. Once the E-SW draft was completed, it underwent validation and revision by the researchers. Validation was conducted through expert review by subject matter and media specialists, followed by an analysis of the validation results. The researchers then refined the product, in this case, the Qur'an-based E-SW for integer topics, in accordance with feedback from the validators. After the revisions were completed and the product was deemed valid based on the validation analysis, the E-SW was ready for the implementation stage, where it would be applied in an actual learning context. This development stage ensures that the final product has undergone comprehensive validation and revision processes before being used in educational practice.

In this phase, this study developed an E-SW as an instructional medium. The initial development began by using Microsoft Word 2013 to design the content, which was then saved in PDF format. This PDF file was subsequently converted into an interactive application using Flip PDF Professional, resulting in an E-SW that can be accessed via laptop. The application supports offline usage for recording temporary answers but requires an internet connection for submitting final answers to a central platform.

Furthermore, the validation process was carried out by subject matter experts and media specialists to evaluate the quality and feasibility of the E-SW. In the content validation stage, three validators were involved: two lecturers from Universitas Ahmad Dahlan and a doctoral student from Universitas Sriwijaya. The subject matter validators provided various suggestions for improvement, such as enhancing image quality to prevent pixelation, ensuring consistency in the notation of mathematical symbols, and avoiding ambiguous symbols. Additionally, the validators recommended adding appropriate margins, maintaining font consistency, and aligning symbols on each page for a cleaner layout. The validators also highlighted the

need for deeper explanations of certain concepts, enabling students not only to memorize formulas but to understand the properties of integer operations. Based on the content validation results, the E-SW received an average score of 99, categorized as “Good,” indicating that this medium is suitable for use with minor revisions. A summary of the validation results is presented in [Table 1](#).

The media validation focused on the content presentation aspects of the E-SW. Three media specialists identified several areas for improvement, such as organizing the material progressively from simple to complex, enhancing the interactivity of tasks to motivate students to explore concepts, and aligning some tasks with the table of contents. One important suggestion was to present the material gradually, starting from concrete to abstract concepts, to facilitate incremental understanding among students. The validators also recommended including introductory questions at the beginning of each task to stimulate students’ curiosity before beginning the learning activities. Quantitatively, the media validation yielded an average score of 91, which falls into the “good” category, indicating that the E-SW meets quality standards and is appropriate for use as a learning medium. A summary of the media validation results is presented in [Table 2](#).

In summary, the validation results from both content and media experts indicate that the E-SW has a solid foundation as an effective educational tool, with a few minor adjustments to enhance its functionality. The quantitative validation conducted by both groups of experts concludes that the E-SW meets the required validity standards for instructional use. The minor revisions suggested by the validators focused on improving readability, consistency, and the presentation of information to ensure that users, particularly students, can easily understand and utilize the E-SW in alignment with the expected learning objectives. Overall, this process helps improve the quality and reliability of the product as an effective educational tool.

Implementation Phase

During the implementation phase, the developed product will be applied in a real-world setting, specifically to Grade VII students at SMP IT LHI Yogyakarta, who serve as the research subjects. Prior to using the Qur'an-based integer E-SW, the researcher will administer a pre-test to the students to assess their initial conditions. Following this, the E-SW will be introduced to the students, and a response questionnaire will be distributed to evaluate the practicality of the developed instructional material. At this stage, the researcher will also provide a post-test after the implementation to assess the effectiveness of the E-SW. The results of the practicality analysis will be used to determine the product’s effectiveness, thereby allowing the evaluation phase to

provide a comprehensive overview of the quality and benefits of the instructional material that has been developed.

After undergoing the validation phase, the E-SW was deemed suitable for implementation in a small-scale trial involving 19 students. The trial was conducted in a single offline session, during which students were assigned tasks related to integer topics using the E-SW, which is based on PBL. In this session, students were required to solve problems through systematic problem-solving activities provided in the E-SW. Besides solving the problems, students could also submit their completed assignments to the teacher through this platform. After using the E-SW, each student completed a questionnaire to evaluate the practicality and quality of the tool. In a subsequent session, the E-SW was used again in a group setting to enhance collaboration among students in problem-solving. The activities undertaken by students within the E-SW included gathering information related to the problem, formulating the problem or mathematical approach, devising a solution strategy, solving the problem according to the prepared plan, evaluating the results, and drawing conclusions from the problem-solving process.

On Tuesday, May 14, 2024, the students participated in a post-test held offline in the classroom. This test aimed to assess the effectiveness of the E-SW in supporting students' understanding of integer concepts. The results of this post-test were subsequently used to analyze the effectiveness of the E-SW in facilitating the learning process. Additionally, student responses were collected through a questionnaire to evaluate the practicality of the E-SW. This questionnaire was administered to 19 students using a scoring scale of 1 to 5, where the highest score indicated excellent usability and the lowest score indicated lower practicality of the product. Based on statistical calculations, the maximum ideal score was determined to be 75, while the minimum ideal score was 15, with an ideal average of 45 and an ideal standard deviation of 10. From the questionnaire results, the assessment criteria were classified as excellent, good, fair, poor, and very poor. The E-SW was considered practical if the average student response score met at least the "Good" category.

Based on the collected data, the average score obtained from the student response questionnaire was 61, indicating that the E-SW falls within the "Good" category. Approximately 26.32% of students rated the E-SW as "Excellent," while 68.42% rated it as "Good." This suggests that the majority of students felt supported by the E-SW in the learning process for integer topics. Thus, the E-SW is considered practical and feasible as an effective learning aid, especially in enhancing students' understanding of mathematical concepts in Grade VII. These findings indicate that the E-SW not only

supports content comprehension but also promotes student engagement through a more structured and interactive learning process.

Evaluation Phase

In the evaluation phase of the ADDIE model, students will be given a post-test following the implementation of the Quran-based integer E-SW. The post-test results will be analyzed to assess the effectiveness of the E-SW. The E-SW is considered effective if the post-test scores show a significant improvement compared to the pre-test results. This evaluation stage, therefore, provides an overview of how well the E-SW enhances students' understanding and performance in mastering integer material. At the evaluation stage, the researcher identified various shortcomings and errors from the previous phase of E-SW development. These findings served as the basis for continuous improvements to ensure that the E-SW could be more effective and suitable for use in the learning process. The evaluation of the product's effectiveness involved an initial test, or pretest, administered to students before using the E-SW to assess their baseline problem-solving abilities in mathematics. After completing the learning activities with the E-SW, students were given a post-test to gauge the extent of improvement in their skills following the E-SW-assisted learning process.

The effectiveness of the E-SW was tested through a Paired Sample t-Test, comparing pretest and post-test results. Before proceeding with this analysis, the pretest and post-test data were first subjected to a normality test using the Shapiro-Wilk method to verify data distribution. The data were considered normally distributed if the Shapiro-Wilk significance level was greater than 0.05. According to the normality test results, the significance values for the pretest and post-test data were 0.442 and 0.326, respectively, both of which were above 0.05, indicating that the data met the assumption of normal distribution.

Subsequently, a Paired Sample t-Test was conducted to test the hypothesis regarding the difference between the pretest and post-test scores in students' mathematical problem-solving abilities following the use of the E-SW. The null hypothesis (H_0) posited no significant difference between the mean pretest and post-test scores, while the alternative hypothesis (H_1) proposed a significant difference. Based on the analysis results, the mean pretest score was 73.3158, while the mean post-test score reached 85.5263, reflecting an increase of 12.2105. The two-tailed significance (sig 2-tailed) value obtained from this test was 0.000, which is less than 0.05, leading to the rejection of the null hypothesis (H_0). This finding indicates a significant difference in students' mathematical problem-solving abilities after the use of the E-SW, with the average problem-solving ability being higher following the Qur'an-based E-SW in mathematical problem-solving.

To supplement this analysis, an N-Gain test was also conducted to assess the effectiveness of the E-SW in terms of problem-solving ability categories. The average N-Gain score obtained was 0.4391, indicating that the improvement in students' mathematical problem-solving ability fell within the medium category. These findings demonstrate that using the Qur'an-based E-SW in mathematical problem-solving education has a positive impact on enhancing students' abilities.

This study builds upon the findings of prior research conducted by Rahmadhani and Wahyuni (2020) and Fitrah and Kusnadi (2022), while presenting a unique focus and contribution to the field. The research by Rahmadhani and Wahyuni (2020) developed an ICARE-based mathematics learning tool that integrates Islamic principles, yielding practical and effective results, with 89% of students achieving mastery in learning outcomes. Conversely, Fitrah and Kusnadi (2022) explored the incorporation of Islamic values into mathematics education to promote character development among students. They proposed strategies for educators to weave religious concepts and teachings into the curriculum, thereby fostering traits such as honesty, responsibility, and self-confidence.

Additionally, Putri et al. (2022) investigated teachers' perceptions of integrating Islamic values into mathematics education through the use of comics. Their findings indicated that a substantial majority (87.5%) of teachers recognize the synergy between Islamic values and mathematics, and 95% acknowledge the influence of Islamic knowledge on their pedagogical practices. However, it was noted that over half (62.5%) of these educators had not participated in related professional development, highlighting a need for improved resources and training in this domain.

Moreover, strategies for internalizing Islamic values within mathematics education have been proposed, including methods such as Infusion, Analogy, Narration, Interpretation, and Uswah Hasanah, along with a mathematical integration model that connects these values to mathematical concepts. This emphasizes the necessity for educational practices that unify worldly knowledge with spiritual understanding to achieve holistic learning outcomes (Suroso et al., 2018).

Furthermore, the research conducted by Cartagena Beteta et al. (2024) examined how religion teachers in Metropolitan Lima, Peru, manage their socio-emotional competencies while integrating information and communication technologies (ICTs) into their teaching methodologies. The study revealed that while ICTs provide continuous emotional engagement during lesson planning and decision-making, teachers expressed a need for enhanced training to effectively incorporate these technologies into religious education.

Finally, this study advances the discourse by developing a Quran-based E-SW for integer mathematics material, which has demonstrated both validity and practicality in classroom implementation. This initiative significantly improved students' mathematical problem-solving abilities, evidenced by an average score increase from 73.3158 to 85.5263. Consequently, this research reinforces previous findings regarding the practicality and effectiveness of Islamic-based educational materials, while introducing an innovative E-SW specifically designed to enhance students' enthusiasm for learning and mathematical competence.

Conclusion

This study successfully developed a Quran-based E-SW tailored to enhance seventh-grade students' mathematical problem-solving skills, particularly on integer topics. The E-SW, grounded in the PBL approach, was validated by content and media experts, receiving high ratings that confirmed its validity. Through trial implementation, it demonstrated both practicality—reflected in positive student feedback—and effectiveness, with post-test results showing a significant improvement in problem-solving skills compared to pre-test scores. This outcome suggests that the E-SW not only aids students in grasping mathematical concepts but also integrates Islamic values, thereby providing a holistic educational experience.

Despite the promising results, this study encountered several limitations. One key limitation is the relatively small sample size of 19 students, which may impact the generalizability of the findings. Additionally, the E-SW was designed specifically for integer topics, limiting its applicability across a broader range of mathematical subjects. Another challenge was the reliance on technological access, as the E-SW requires devices and an internet connection, which might pose accessibility issues in certain contexts. These constraints highlight areas where further enhancements could make the tool even more effective and accessible.

For future research, expanding the sample size and testing the e-SW across diverse mathematical topics could provide a broader understanding of its impact on student learning. Additionally, developing offline-compatible features would improve accessibility, especially in areas with limited internet access. Integrating interactive elements and real-time feedback options may also enhance student engagement and facilitate continuous learning. By addressing these aspects, future studies can build on this research to further advance the integration of Islamic values and technology in mathematics education, ultimately fostering more comprehensive educational tools.

Acknowledgement

The authors express their gratitude to Universitas Ahmad Dahlan, Yogyakarta, Indonesia, and Metropolitan Tirana University, Tirana, Albania, for their support in facilitating this international collaborative research.

References

- Annisa, R., Suanto, E., & Maimunah, M. (2023). Pengembangan e-LKPD materi aritmetika sosial berbasis pendekatan kontekstual untuk memfasilitasi kemampuan pemecahan masalah matematis [Development of contextual approach-based e-LKPD on social arithmetic materials to facilitate mathematical problem-solving skills]. *AKSIOMA: Jurnal Program Studi Pendidikan Matematika*, 12(2), 2077-2085. <http://dx.doi.org/10.24127/ajpm.v12i2.6955>
- Boye, E. S., & Agyei, D. D. (2023). Effectiveness of problem-based learning strategy in improving teaching and learning of mathematics for pre-service teachers in Ghana. *Social Sciences & Humanities Open*, 7(1), 100453. <https://doi.org/10.1016/j.ssaho.2023.100453>
- Brentjes, S. (2019). Mathematical commentaries in Arabic and Persian—purposes, forms, and styles. *Historia Mathematica*, 47(5), 54-66. <https://doi.org/10.1016/j.hm.2019.03.001>
- Bryant, D. P., Bryant, B. R., Dougherty, B., Roberts, G., Pfannenstiel, K. H., & Lee, J. (2020). Mathematics performance on integers of students with mathematics difficulties. *The Journal of Mathematical Behavior*, 58, 100776. <https://doi.org/10.1016/j.jmathb.2020.100776>
- Cartagena Beteta, M. A., Pedrera Rodríguez, M. I., Revuelta Domínguez, F. I., & Soria Valencia, E. (2024). Management of religion teachers' socioemotional competencies in information and communication technologies integration: A phenomenographic study. *The Qualitative Report*, 29(5), 1443-1471. <http://dx.doi.org/10.46743/2160-3715/2024.6419>
- Fitrah, M., & Kusnadi, D. (2022). Integrasi nilai-nilai islam dalam membelajarkan matematika sebagai bentuk penguatan karakter peserta didik [Integration of Islamic values in teaching mathematics as a means of strengthening students' character]. *Jurnal Eduscience*, 9(1), 152-167. <https://doi.org/10.36987/jes.v9i1.2550>
- Fitri, A., Hasanah, R., Vabiola, S., Putri, M. Y. U., & Imamuddin, M. (2023). Integrasi himpunan dan Al-Qur'an serta implementasinya dalam pembelajaran matematika [Integration of set theory and the Qur'an and its implementation in mathematics education]. *KOLONI*, 2(2), 242-256. <https://doi.org/10.31004/koloni.v2i2.482>
- Fitriza, R., Putra, M. S., & Samad, D. (2020). Pengembangan lembar kerja peserta didik berwawasan Al-Qur'an dan budaya Minangkabau dalam pembelajaran matematika kelas X [Developing student worksheets with Qur'anic insights and

- Minangkabau culture in mathematics education for Grade X]. *AKSIOMA: Jurnal Program Studi Pendidikan Matematika*, 9(4), 1159–1171. <http://dx.doi.org/10.24127/ajpm.v9i4.3212>
- Hamilton, B. (2022). *Integrating technology in the classroom: Tools to meet the needs of every student*. International Society for Technology in Education.
- Kinanti, V., & Wulantina, E. (2023). Pengembangan modul pembelajaran matematika berbasis discovery learning terintegrasi nilai-nilai keislaman [Developing discovery learning-based mathematics learning modules integrated with Islamic values]. *J-PiMat: Jurnal Pendidikan Matematika*, 5(1), 635–644. <https://doi.org/10.31932/j-pimat.v5i1.2280>
- Kivunja, C. (2015) Exploring the pedagogical meaning and implications of the 4Cs “Super Skills” for the 21st century through Bruner’s 5E lenses of knowledge construction to improve pedagogies of the new learning paradigm. *Creative Education*, 6(2), 224-239. <https://doi.org/10.4236/ce.2015.62021>
- Klang, N., Karlsson, N., Kilborn, W., Eriksson, P., & Karlberg, M. (2021). Mathematical problem-solving through cooperative learning—the importance of peer acceptance and friendships. *Frontiers in Education*, 6, 710296. <https://doi.org/10.3389/feduc.2021.710296>
- Küçükaydın, M. A., Çite, H., & Ulum, H. (2024). Modelling the relationships between STEM learning attitude, computational thinking, and 21st century skills in primary school. *Education and Information Technologies*, 29(1), 1-19. <https://doi.org/10.1007/s10639-024-12492-7>
- Kumalasari, M., Rahayu, E. S., & Saptono, S. (2021). The development of Al-Qur'an and hadith integrated guided inquiry students' worksheet to improve students' learning outcomes and religious character. *Journal of Innovative Science Education*, 10(3), 278-285. <http://dx.doi.org/10.15294/IJISE.V10I1.44426>
- Latifah, S. S., & Luritawaty, I. P. (2020). Think pair share sebagai model pembelajaran kooperatif untuk peningkatan kemampuan pemecahan masalah matematis [Think-Pair-Share as a cooperative learning model for enhancing mathematical problem-solving skills]. *Mosharafa: Jurnal Pendidikan Matematika*, 9(1), 35–46. <https://doi.org/10.31980/mosharafa.v9i1.590>
- Masamah, U., Zain, N. K., Salsabila, A., & Maulidani, M. (2023). Integrating Islam on geometry student worksheets to facilitate mathematical and religious literacy of junior high school students. *Jurnal Pengembangan Pembelajaran Matematika*, 5(1), 17-30. <https://doi.org/10.14421/jppm.2023.51.17-30>
- Nugraheni, L. P., & Marsigit, M. (2021). Realistic mathematics education: An approach to improve problem solving ability in primary school. *Journal of Education and Learning (EduLearn)*, 15(4), 511-518. <https://doi.org/10.11591/edulearn.v15i4.19354>
- Panjaitan, S. N., Mansyur, A., & Syahputra, H. (2023). Pengembangan LKPD elektronik (E-LKPD) berbasis problem-solving untuk meningkatkan kemampuan

- pemecahan masalah matematis dan kemandirian belajar peserta didik SMP IT Indah Medan [Developing electronic student worksheets (E-SW) based on problem-solving to enhance mathematical problem-solving skills and student learning independence at SMP IT Indah Medan]. *Jurnal Cendekia: Jurnal Pendidikan Matematika*, 7(2), 1890-1901.
<https://doi.org/10.31004/cendekia.v7i2.2341>
- Putra, F. G. (2017). Eksperimentasi pendekatan kontekstual berbantuan Hands on Activity (HoA) terhadap kemampuan pemecahan masalah matematik [Experimentation of contextual approach assisted by Hands-on Activities (HoA) on mathematical problem-solving skills]. *Al-Jabar: Jurnal Pendidikan Matematika*, 8(1), 73–80. <http://dx.doi.org/10.24042/ajpm.v8i1.1148>
- Putri, N., Maimunah, M., & Armis, A. (2022). Pengembangan e-LKPD berbantuan Google Slide materi program linear untuk memfasilitasi kemampuan pemecahan masalah matematis peserta didik [Developing Google Slides-assisted e-LKPD on linear programming materials to facilitate students' mathematical problem-solving skills]. *Pedagogy: Jurnal Pendidikan Matematika*, 7(2), 101-114.
<https://doi.org/10.30605/pedagogy.v7i2.1894>
- Putri, R., Johar, R., & Munzir, S. (2022). Teachers' perception about Islamic values integration into mathematics learning through comics. *Jurnal Ilmiah Peuradeun*, 10(1), 105-116. <http://dx.doi.org/10.26811/peuradeun.v10i1.606>
- Rahmadhani, E., & Wahyuni, S. (2020). Integrasi pembelajaran matematika berbasis ICARE dan Islam pada materi pecahan [Integration of ICARE-based mathematics learning and Islamic values in fraction materials]. *JNPM (Jurnal Nasional Pendidikan Matematika)*, 4(1), 110-124.
<https://doi.org/10.33603/jnpm.v4i1.2874>
- Rais, D., & Zhao, X. (2024). Elevating student engagement and academic performance: A quantitative analysis of Python programming integration in the Merdeka Belajar curriculum. *Journal on Mathematics Education*, 15(2), 495-516.
<https://doi.org/10.22342/jme.v15i2.pp495-516>
- Riyani, P., & Hadi, M. S. (2023). Upaya meningkatkan kemampuan pemecahan masalah siswa dalam pembelajaran matematika dengan pendekatan keterampilan proses [Efforts to enhance students' problem-solving skills in mathematics learning through a process skills approach]. *Jurnal Riset Pembelajaran Matematika Sekolah*, 7(1), 16–27.
<https://doi.org/10.21009/jrpms.071.02>
- Sarman, A. A., Suastika, I. K., & Murniasih, T. R. (2023). Pengembangan E-LKPD untuk meningkatkan kemampuan pemecahan masalah matematis peserta didik pada materi bangun ruang sisi lengkung [Development of E-LKPD to enhance students' mathematical problem-solving skills on curved surface geometry

- materials]. *Jurnal Tadris Matematika*, 6(1), 49-66. <https://doi.org/10.21274/jtm.2023.6.1.49-66>
- Sercenia, J. C., Ibañez, E. D., & Pentang, J. T. (2023). Thinking beyond thinking: Junior high school students' metacognitive awareness and conceptual understanding of integers. *Mathematics Teaching Research Journal*, 15(1), 4-24. <https://files.eric.ed.gov/fulltext/EJ1391473.pdf>
- Shaw, W. M. (2022). Islamic geometries: Spiritual affects against a secularist grid. *Sophia*, 61(1), 41-59. <https://doi.org/10.1007/s11841-022-00905-4>
- Shen, F., Roccosalvo, J., Zhang, J., Tian, Y., & Yi, Y. (2023). Online technological STEM education project management. *Education and Information Technologies*, 28(10), 12715-12735. <https://doi.org/10.1007/s10639-022-11521-7>
- Shih, S. C., Chang, C. C., Kuo, B. C., & Huang, Y. H. (2023). Mathematics intelligent tutoring system for learning multiplication and division of fractions based on diagnostic teaching. *Education and Information Technologies*, 28(7), 9189-9210. <https://doi.org/10.1007/s10639-022-11553-z>
- Spreitzer, C., Straser, O., Zehetmeier, S., & Maaß, K. (2024). Mathematical modelling abilities of artificial intelligence tools: The case of ChatGPT. *Education Sciences*, 14(7), 698. <https://doi.org/10.3390/educsci14070698>
- Suroso, C. P., Hassan, M. B. A., Bin, S., Mohamed, D. S., & No, J. K. A. S. (2018). How to internalize Islamic values in mathematic learning?. *Opción*, 34(85), 1198-1206. https://www.researchgate.net/profile/Ceket_Suroso/publication/356065932_HOW_TO_INTERNALISE_ISLAMIC_VALUES_IN_MATHEMATIC_LEARNING/links/618aa90b07be5f31b75ca437/HOW-TO-INTERNALISE-ISLAMIC-VALUES-IN-MATHEMATIC-LEARNING.pdf
- Szabo, Z. K., Körtesi, P., Guncaga, J., Szabo, D., & Neag, R. (2020). Examples of problem-solving strategies in mathematics education supporting the sustainability of 21st-century skills. *Sustainability*, 12(23), 10113. <https://doi.org/10.3390/su122310113>
- Umam, K., & Susandi, A. D. (2022). Critical thinking skills: Error identifications on students' with APOS Theory. *International Journal of Evaluation and Research in Education*, 11(1), 182-192. <https://dx.doi.org/10.11591/ijere.v11i1.21171>
- Vasinayanuwatana, T., Teo, T. W., & Ketsing, J. (2021). Shura-infused STEM professional learning community in an Islamic School in Thailand. *Cultural Studies of Science Education*, 16(1), 109-139. <https://doi.org/10.1007/s11422-020-09990-8>
- Verschaffel, L., Schukajlow, S., Star, J., & Van Dooren, W. (2020). Word problems in mathematics education: A survey. *ZDM*, 52, 1-16. <https://doi.org/10.1007/s11858-020-01130-4>
- Wulandari, P., Mujib, M., & Putra, F. G. (2016). Pengaruh model pembelajaran investigasi kelompok berbantuan perangkat lunak Maple terhadap kemampuan

pemecahan masalah matematis [The effect of group investigation learning model assisted by Maple software on mathematical problem-solving skills]. *Al-Jabar: Jurnal Pendidikan Matematika*, 7(1), 101–106.
<https://doi.org/10.24042/ajpm.v7i1.134>