

Development of Mobile Learning App Based on Islamic and Science Integration to Improve Student Learning Outcomes

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ABSTRACT

The integration of Islamic and science in Mobile Learning App (MLA) is an innovative and flexible digital learning media to help students learn during pandemic. This study aimed 1) to develop of MLA integrated with Islamic and science, 2) to determine the effect of MLA integrated with Islamic and science on students learning outcomes. This study used the Gall, Gall, & Borg Research and Development (R&D) model. The product fitness has been tested by the expert validators in learning media, materials, linguistics, and integration of Islamic and science, and the product effectiveness has been tested on students. The result showed that: 1) the integration of Islamic and science in MLA was fit to be used in learning with effective category and 2) the integration of Islamic and science in MLA was effective to improve student's learning outcomes in hydrosphere topic. Suggestions for media users include the following: 1) use media in an area with a strong network or internet connection; 2) conduct an outdoor study using mobile learning media; and 3) provide knowledge about using media before the lesson begins. This research provides positive energy for students as a provision to become agents of change in the 21st century, especially in mobile learning app based on Islamic and science. Research development using technology in science and Islamic curriculum also support to improve learning outcomes.

Keywords: *Development Mobile Learning, Islamic & Science Integration, Learning Outcomes*

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INTRODUCTION

The COVID-19 pandemic has changed all aspects of life, including education (Jamaludin et al., 2020). The education must be conducted with distance learning (online) (Kemdikbud, 2020; Prasetyo et al., 2021). Therefore, education is highly dependent on technology and information in the learning process. However, the flexible and interactive digital learning media does not support this method.

Meanwhile, digital learning media is vital for implementing learning in utilizing information and communication technology in the 21st century. Students must have capabilities in technology, media, and information, as well as learning, innovation, life, and job skills to succeed in the 21st-century (Trilling & Fadel, 2009). Students must be able to use technology to learn content and skills, think critically, solve problems, use information, communicate, innovate, and collaborate (Dede, 2010). Pedagogical content refers to the knowledge required by lecturers to integrate technology into learning in science (Mishra & Koehler, 2006). Therefore, lecturers must be able to prepare learning media in the digital technology era (Voogt et al., 2013).

The development of Mobile Learning App (MLA) media is a rational effort to accommodate the accessibility of digital teaching media. MLA is one of the digital learning media that can help students learn through available features, such as audio, video, animation, images, and text (Behera, 2013). The menu options in the MLA media are highly beneficial for online learning to make the learning process simple and easy. Developing MLA media is important for the following reasons: 1) provides flexible and easy-to-use mobile app learning media (android based); 2) supports online learning, especially during the covid-19 pandemic; 3) increases student learning outcomes. Previous research indicates that using MLA as a learning media can increase student learning outcomes and interest (Handayani & Suharyanto, 2016).

Some research related to MLA has been conducted: 1) challenges and opportunities in mobile learning by Cobcroft et al. (2008); 2) learning effectiveness with mobile learning by Saputra and Kuswanto (2019) and Sarrab et al. (2016); 3) development of mobile learning (android based) media by Handayani and Suharyanto (2016), Maburri et al. (2019) and Oyelere et al. (2018). However, research on the integration of Islamic and science in mobile learning applications (MLA) in Islamic-based universities has not been widely discussed. The integration is due to several advantages: 1) form a religious personality, foster critical thinking, and hold students accountable and responsible (M. Amin, 2020); 2) build students' thinking concepts holistically on the insights, science, and technology gained (Bidin et al., 2020); 3) improve learning outcomes (Khoiri et al., 2017; Permadi, 2018); 4) foster the character of honesty and cooperation (Khoiri et al., 2017) motivation and self-confidence (Pratiwi, 2014); and 5) being able to integrate scientific information with the realities of their individual regions' environmental, social, and cultural environments (Marvavilha & Suparlan, 2018).

Similar research on the integration of Islamic and science with mobile learning media has been conducted by Fahyuni et al. (2020). Moreover, research by Fahyuni et al. (2020) facilitates and assists the learning of junior high school students in finding, collecting, and analyzing data using seamless mobile media. Mobile media content is not self-created but is collected from various applications, social media platforms, and the web. The integration of science and Islam requires developing a curriculum that integrates both scientific and Islamic principles (Arifudin, 2016). Integration is a response to the dualism problem in Islamic and universal education, which has separated religious and scientific knowledge (Within, 2018). The integration is emphasized the university curriculum, especially Islamic-based universities (Zainiyati, 2015). Perguruan Tinggi Keagamaan Islam (PTKI/Islamic Religious Colleges) is an Islamic formal educational institution that managed an integrated Islamic and science curriculum. This can lead to a complete understanding of science and Islam as a generation with knowledge and character of Ulul Albab (rational) UIN Maulana Malik Ibrahim (UIN Maulana Malik Ibrahim Malang, 2019; Zain & Vebrianto, 2017).

Therefore, the integration of science and Islam needs to be developed in this modern era to contribute to society (Zainuddin, 2013). The integrative paradigm can foster student attitudes to respect and appreciate differences in religious beliefs (Arifudin, 2016). Additionally, by integrating Islam and science, students develop an interest and ability to study the relationship between science and Islam (Arifudin, 2016).

One effect of integrating science and Islam can be seen in community research on product development and technology (Arraiyyah, 2019). Existing product development research on science-Islamic integration is still limited to teaching materials development (S. Amin, 2017; Bashith & Amin, 2020; Fauziyah, 2016; Wastyanti, 2016), module development (Faizah, 2020; Muna, 2018; Silviyati, 2018; Yuliawati et al., 2013), and animation media development in science lessons (Fardiana, 2015; Rukayah, 2019). Therefore, it is necessary to develop MLA media that contain science-Islamic integration content.

This research developed the MLA media product integrated with the Problem-Based Hybrid Learning (PBHL) model. PBHL integrates in-class problem-based learning (PBL) with online lectures (S. Amin et al., 2020). The learning model was selected to improve learning outcomes (S. Amin et al., 2020), using MLA media following the PBHL syntax, particularly throughout the problem-solving and investigation planning stages. Students can use MLA media to conduct investigations and collect data in the field due to the flexibility. Therefore, this study aimed: 1) to develop of MLA media products integrated with Islamic and science, 2) to determine the effect of MLA integrated with Islamic and science on learning outcomes.

METHODS

Research Design

The research design is Research and Development (R&D) using Gall et al. model (2006). The stages of development are simplified as: 1) conduct research and collect initial data; 2) develop products; 3) perform product validation; 4) conduct a limited trial; 5) revision; 6) conduct experimental tests; and 7) make the final product.

The product effectiveness was examined using a quasi-experimental design with a pretest-posttest control group design, shown in the following table 1.

Table 1. Quasi-Experimental Design

Groups	Pretest	Treatment	Posttest
Experimental	O ₁	X	O ₂
Control	O ₃	Y	O ₄

Source: Sugiyono (2011)

Information:

- O₁ : Pretest for the experimental class
- O₂ : Posttest for the experimental class
- X : Learning the PBHL model using MLA media in the experimental class
- O₃ : Pretest for control class
- O₄ : Posttest for control class
- Y : Conventional online learning without using MLA media in the control class

Research Subject

The MLA media fitness is determined by expert validators in instructional media design, geography, linguistics, and Islamic and science integration. The research

subjects involved 25 lecturers and students of the Social Sciences Education Department, Universitas Islam Negeri Maulana Malik Ibrahim Malang, Indonesia, and 25 students of the Social Sciences Tadris (Education) Department, Universitas Islam Negeri Sayyid Ali Rahmatullah Tulungagung, Indonesia, in the academic year of 2020-2021. Purposive sampling was used to determine the subjects and resulted in two groups: the experimental group of 32 individuals, and the control group of 32 individuals.

The experimental group was students from the Social Sciences Education Department, Universitas Islam Negeri Maulana Malik Ibrahim Malang, in the 2nd semester of the academic year 2020-2021. The learning topic in MLA media is focused on the hydrosphere.

Instrument and Data Collection

The following data types were used in this study: 1) qualitative data obtained from expert validators in instructional media design, geography, linguistic material, and the integration of Islamic and science using interview guidelines and documentation, 2) quantitative data obtained from validators, professors, and students using questionnaires.

Data on product effectiveness was obtained using an assessment tool based on student learning outcomes in 15 multiple-choice tests and five essay questions. The test questions were evaluated for validity, with the product moment showing valid results before being used for data collection (r count = 0.4883). Furthermore, the reliability was tested with Cronbach Alpha and showed reliable results (Alpha = 0.722). Product effectiveness test was conducted to the control and experimental classes.

The control group used conventional learning (group discussion) with e-learning and google learning media. Learning activities in the control group include: 1) explanation of content and discussion of global environmental issues in various countries (online synchronous with google meet); 2) students analyze problems in a predetermined country (online asynchronously through e-learning); 3) students present and collect discussion results in papers (asynchronous online via google form); 4) students present completed project (online synchronous with google meet).

Furthermore, the experimental group used the PBHL model with MLA media through syntax modification from S. Amin et al. (2020), as shown in the following table 2. Modification of learning syntax with the PBHL model adapted to the current covid-19 pandemic.

Table 2. Modified PBHL Syntax with the Integration of ISLAMIC and Science in MLA

No.	Stages	Activity	Learning Type
1.	Problem orientation	Students are given an explanation about the problem orientation in the surrounding environment, especially water pollution.	Synchronous online/offline
2.	Problem-solving planning	Students grouped and discussed the details of the problems found. Then planned a problem-solving process.	Asynchronous & in-field online meetings using MLA
3.	Investigation	Students conducted investigations to solve problems.	In the field using MLA
4.	Report	Students compiled a problem-solving	Synchronous online

	preparing and presentation of findings	report on the investigation and explained it in presentations.	
5.	Analysis and Evaluation	Students analyzed and evaluated the problem-solving process	Asynchronous online
6.	Actualization	Students visited the field/environment to actualize the problem-solving selected.	In the field

Data Analysis

Data analysis used descriptive qualitative to revise the responses from validators, lecturers, and students. Furthermore, quantitative analysis in descriptive statistics was used to process the criterion score analysis using a Likert scale of 1-5. The subject answers were analyzed using the percentage formula (Arikunto, 2002). The result used the following criteria, showed in table.

Table 3. Criteria for Qualification

Success Rate (%)	Qualification	Report
≥ 86	Very effective	No Revision Needed
≥ 71 - < 86	Effective	No Revision Needed
≥ 56 - < 71	Moderate	Revision Needed
≥ 41 - < 56	Less effective	Revision Needed
< 41	Very Less effective	Revision Needed

Source: Arikunto (2003)

Furthermore, the effect of using MLA media on student learning outcomes was tested using parametric inferential statistics. Analyzing normality test, homogeneity test, and independent sample t-test is used the SPSS IBM 23.0 for Windows program with a significance level of 0.05. The results are based on hypothesis testing as follows. H0: there is no difference in student learning outcomes using the MLA integrated with science-Islamic media in learning.

H1: there are differences in student learning outcomes using the MLA integrated science-Islamic media in learning. The criteria, namely H0 is accepted if sig. > 0.05, and H0 is rejected if sig. < 0.05.

RESULT AND DISCUSSION

Development Product of MLA

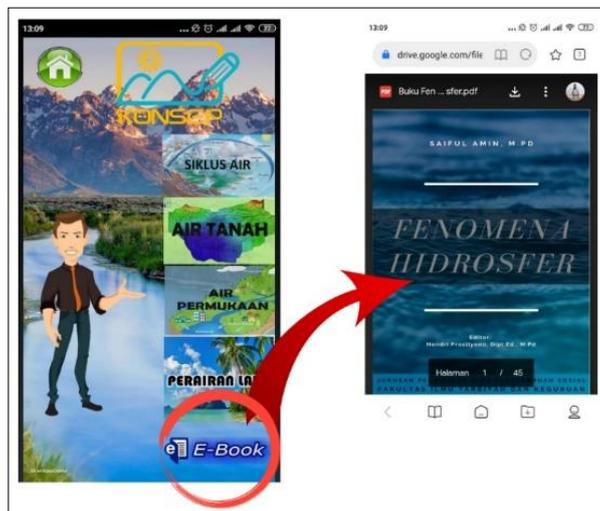
Product development is used as an innovative and flexible learning media using materials integrated with Islamic and science. Lecturers and students can download the application to their smartphones by accessing the link: <https://drive.google.com/file/d/1V-IFr0RTcGkziFYhwLrmw8S0Fp7SEVxl/view?usp=sharing>.

The product development of MLA integrated of Islamic and science media has several advantages: 1) contains hydrosphere topic and the Qur'an verses as content for the integration of Islamic and science (figure 1a); 2) contains with a hydrosphere textbook (figure 1b); 3) has problem-solving guide in student worksheets; 4) contains quizzes.

Figure 1. Product Development of MLA Integrated of Islamic and Science



a) Hydrosphere Topic and the Qur'an Verses as the MLA Content



b) Hydrosphere E-Book

An instrument questionnaire with various questions has been used to acquire answers and perceptions from each validator and respondent. The integration of Islamic and science in MLA has 19 questions for geography experts, 18 questions for linguists, 16 questions for learning media design experts, 18 questions for experts on the integration of Islam and science, 18 questions for students, and 18 questions for lecturers. The result from all validators and respondents to MLA media showed in the following table 4.

Table 4. The Respondent Results

Respondent	Percentage (%)	Category	Result
Materials expert	90.53	Very effective	Fit
Linguist expert	78.89	Effective	Fit
Media expert	90.00	Very effective	Fit
Science-Islamic Integration Expert	95.56	Very effective	Fit
Students	83.08	Effective	Fit
Lecturers	90.00	Very effective	Fit
Average	88.01	Very effective	Fit

The result concluded that the integration of Islamic and science in MLA media had met the standards. It showed by the average results of expert validation and limited trials of 88.01%. The data showed that integrating Islamic and science in MLA media is very effective and fits the qualification to be used as a learning media on hydrosphere topics. The product development of the integration of Islamic and science in MLA media was qualitatively improved by validators of media, material, language, and science-Islamic integration experts. The result is shown in the following table 5.

Table 5. Suggestions to Enhance the Integrated Islamic and Science MLA

No.	Expert	Suggestion
1.	Learning media expert	1. Synchronize animation and sound. 2. The choice of color contrast in the media is even better.
2.	Hydrosphere material expert	1. The examples provided are more up-to-date. 2. Student performance sheets to be made in more detail in order to foster a work ethic.
3.	Language (Indonesian) expert	1. Links between paragraphs in sub-chapters are even more coherent. 2. The integrity of the meaning in the chapter is more detailed. 3. Corrected back spelling in writing.
4.	Science-Islamic Integration Expert	The integration between the verses of the Qur'an and the material is even more unified, it does not seem like just sticking it out, so it needs to be deepened.

As shown in table 5, the conclusion of suggestions for improving the Integrated Islamic and Science MLA needs minor improvements. First, learning media experts focus on synchronization systems. Second, material experts convey deficiencies in terms of examples and details of assignments. Third, linguists say language to be adapted to the audience. Fourth, experts on the integration of science-Islam convey the lack of relevance to the material with the Qur'an.

The Effect of MLA on Learning Outcomes

The integration of Islamic and science in MLA media was implemented with the PBHL model. The integration also following with PBHL stages (showed in table 2).

Evaluation tests were conducted before and after product trials. It is used to measure the student's understanding level of the material. The learning outcomes were compared for the experimental and control groups, as shown in the following figure 2.

Figure 2. Learning Outcomes of Hydrosphere Topic

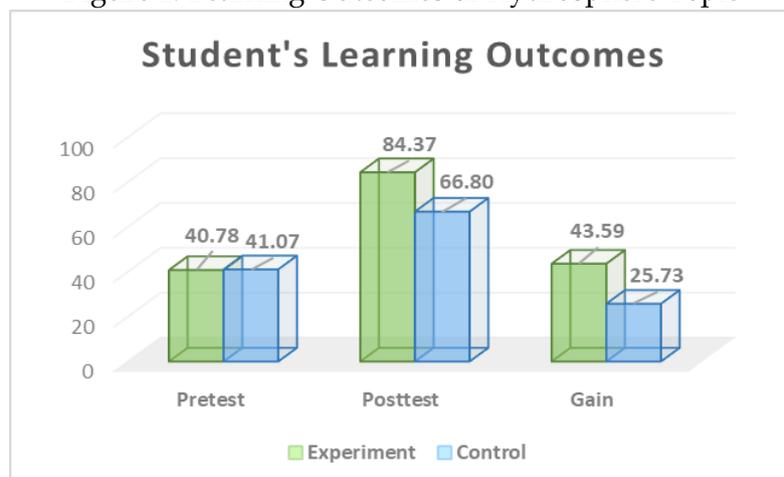


Figure 2 showed that the gain score of learning outcomes in the experimental group using mobile learning media was from 40.78 to 84.37, increased by 43.59. Furthermore, the gain score of learning outcomes in the control group using conventional learning was from 41.07 to 66.80, increased by 25.73. The gain score showed an increase in learning outcomes. Therefore, the integration of Islamic and science in MLA media has been able to improve student's learning outcomes.

Furthermore, the product effectiveness was tested using an independent sample t-test for normality and homogeneity. The normality result is shown in the following table 6.

Table 6. Normality Test

Group	Kolmogorov-Smirnov ^a		
	Statistic	df	Sig.
Experimental	.152	46	.100
Control	.095	46	.200

Based on table 6 obtained sig 0.100 > 0.050 for the experimental class and 0.200 > 0.050 for the control class. It was concluded that the learning outcomes in this study were normally distributed.

Table 7. Homogeneity Test

Levene Statistic	df1	df2	Sig.
.109	7	90	.742

Table 7 showed that the value of sig. 0.742 > 0.050. It was concluded that the learning outcomes of both groups had homogeneous variants. Furthermore, an independent sample t-test was conducted to determine the gain score of experimental and control groups, as shown in the following table 8.

Table 8. Results of Independent Sample T-Test

t-test for Equality of Means					
t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
				Lower	Upper
3.454	90	.001	10.60870	4.50722	16.71017
3.454	89.980	.001	10.60870	4.50720	16.71019

The result in table 8 showed a sig value of 0.001 < 0.050. It can be interpreted that H0 is rejected, or there are differences in student learning outcomes using MLA and conventional learning. The product development of integrating Islamic and science in MLA media is effective in improving learning outcomes on the hydrosphere topic.

The development of mobile learning media based on the integration of Islam and science that is applied to the hydrosphere material has a different power. The difference between this research and the previous one lies in the components of connected mobile learning media based on the integration of Islam and Science. This

connection incorporates the value of the Koran and the logic of science that can be used as a basis for learning.

The t-test analysis found that using MLA media integrated with Islamic science has a significant influence in improving student learning outcomes on the hydrosphere topic. It is because students involved all their abilities such as cognitive, affective and psychomotor abilities in the learning process. Students use their cognitive ability to learn the use of MLA media. Students use affective ability that are manifested in their attitudes while observing the problems in the field. While using psychomotor ability, students have been able to integrate their knowledge and attitudes to solve problems found when conducting observations and investigations in the field. Moreover, students who use MLA media have optimized all their abilities in participating in learning and are different from students who do not use MLA media because they only use one ability, namely cognitive abilities.

This research result was supported the previous research on the development of mobile learning media (android based) by Handayani and Suharyanto (2016), Maburri et al. (2019) and Oyelere et al. The learning media effectiveness also has similarities with previous research conducted by Cobcroft et al. (2008), Saputra and Kuswanto (2019) dan Sarrab et al. (2016). Additionally, the research results of Fahyuni et al. (2020) are related to this study in that learning patterns with Islamic principles and science using seamless mobile media can help students enhance their skills, abilities, and knowledge.

Meanwhile, some differences were found in the subject, material, and MLA media applied to different learning models. Additionally, the material presented in this development research is summarized in a single mobile media application. Unlike the research of Fahyuni et al. (2020) which includes data from many applications, social media, and the web to present mobile media separately. The development product of integrating the Islamic and science in MLA media with hydrosphere topic has several advantages, including: 1) innovative and effective presentation of material helps in student understanding, particularly in studying the integration of Islamic and science, 2) provide simple navigation options for students to access essential concepts detail and according to its specific needs, 3) an attractive display design can increase students' motivation to learn, 4) provide students with worksheets and quizzes based on CBT (computer-based testing) so that they can assess their learning directly, 5) online learning media can be accessed anytime and anywhere. These advantages contribute to the enhancement of student learning outcomes related to the hydrosphere topic.

Meanwhile, the integration of Islamic and science in MLA media has weaknesses that there is no glossary menu to be accessed for the difficult term. According to respondents, a glossary is needed to speed up the application interface. The learning outcomes in the experimental group applied the MLA media is influenced by student's ability in information and technology. Students with good computer and internet skills tend to increase their learning outcomes (Lai & Hwang, 2014). The intensity of students browsing material so far is quite high, so they are used to readings on the smartphone. It creates a sense of pleasure when teaching materials using MLA media (El-Sofany et al., 2014; Najima & Rachida, 2008; Sumarwati et al., 2020).

Furthermore, the integration of Islamic and science in MLA media is influenced by the internet network. A good internet network affects the display quality of MLA (El-Seoud et al., 2014; Suryati, 2019; Tambunan & Batubara, 2020; Umbit & Taat, 2016). MLA can appear flawless using a strong internet connection, but the web display will

be difficult for students to access if the connection is weak. This study conducted a trial for each student with different internet network quality.

Additionally, the access method affects the look of MLA (AlFawwaz, 2017; Galy et al., 2011; Ross et al., 2010; Vitolo et al., 2015). It is due to the visual differences between the desktop and mobile versions. Students use various android versions to study while collecting data in the field. Thus, the lecturer's role as a facilitator to help students understand the application material is essential.

The integration of Islamic and science in MLA media is influenced by the characteristics of the hydrosphere topic. The topic has logical implications for the application of learning in and out of the classroom. Hydrosphere material cannot be taught just through lectures or question-and-answer sessions. However, it must be taught through a scientific method learning model that combines experimental methodologies (Sumarmi et al., 2020). Process abilities involve various abilities, including observation, classification, interpretation, prediction, inquiry, hypothesis, experimentation, and communication (Kartimi et al., 2013). Student's ability contributes to the enhancement of learning outcomes related to the hydrosphere topic.

The PBHL learning integrating Islamic and science in MLA media allowed scientific skills and process skills to find solutions to hydrosphere problems. The PBHL model's syntax encourages students to investigate and solve real-world problems through study and direct observation in the field (S. Amin et al., 2020). The relationship in integrating Islamic and science in MLA media and the students' real lives in this study can help in logical reasoning s (Muspiroh, 2014). Students can acquire critical and analytical thinking abilities to fully and concretely understand situations, facilitating the identification of problem-solving solutions to improve learning results (Nurkhin et al., 2020; Tiruneh et al., 2018).

The format of multiple-choice and essay tests enhances learning results in an experimental group that uses the MLA integrated science-Islamic media. The test questions are designed to assess higher-order thinking abilities in real-world situations. Students need higher-order thinking skills in solving it (Amir, 2013). The problem-based learning used in this study through the PBHL model is also one reason student's learn outcomes are increasing. The PBHL syntax enhances students' critical and analytical thinking abilities to develop actual issues and identify solutions to improve learning outcomes (Amin et al., 2020).

The concept of integrating Islamic and science in MLA media allows students to gain meaningful learning both directly and indirectly (Baba et al., 2015; Purwati et al., 2018). The learning related to daily life will enable students to acquire the significance of each learning material and apply it to various aspects of life (Sahlan, 2011). Integrating studying with Qur'an significantly improves students' understanding during the learning process (Muflihah et al., 2020).

The integration of the Qur'an into the topic is a spiritual technique for learning (Sabki & Hardaker, 2013). Students can relate scientific understanding to fundamental Islamic beliefs and the religious experiences as Muslims (Purwati et al., 2018). The research results by Fahyuni et al. (2020) concluded that seamless mobile media that integrates Islamic values and science has proven to be effective in developing religious potential, self-control, personality, intelligence, noble character, and student skills. (Adawiyah, 2011) stated that the integration of science and Islam in learning has a positive effect on improving cognitive, affective, and conative aspects. Furthermore, Madiyo and Dardiri (2020) explained that using the integration paradigm module with the Qur'an verses confirmative model affects students' cognitive learning outcomes.

This research has a big impact in providing positive energy for students as a provision to become agents of change in the 21st century. The success of MLA being integrated with Islam and science is also due to the interrelated components in the learning materials. These media bring changes in thinking and acting inside and outside the learning classroom. The hydrosphere material cannot be taught using lecture or question and answer methods, but must be based on an integrated approach that is oriented to Quranic knowledge and scientific processes.

The findings can be used as a guide for curriculum development in Islamic universities and offered opportunities for development in Islamic schools. This research followed the study that science and Islam can be applied in balance over the times. This research also supported the use of technology in learning, has not reduce the meaning of science and Islam, and was able to improve students' cognitive, affective and psychomotor abilities.

CONCLUSION

This research concluded that: 1) the integration of Islamic and science in Mobile Learning Application (MLA) was fit to be used in learning with a fitness value of 88.01% and in the effective category, 2) the integration of Islamic and science in Mobile Learning Application (MLA) was effective to improve student's learning outcomes in hydrosphere topic using independent t-test with a significance value of $0.001 > 5\%$. Future studies suggested the production of media in connection with the development of specific learning models. Additionally, the media's effectiveness was evaluated to discover whether it affected or increased other characteristics such as student engagement, motivation, and achievement. The effectiveness test is also advised for other teaching materials and is applied to various study programs. Suggestions for media users include the following: 1) use media in an area with a strong network or internet connection; 2) conduct an outdoor study using mobile learning media; and 3) provide knowledge about using media before the lesson begins.

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AUTHOR CONTRIBUTION STATEMENT

The author has proven the truth in research and realized the final result of the manuscript. This research was conducted by Saiful Amin, product development was designed by Hendri Prastiyono, and evaluated by Sumarmi, Muhammad Aliman, and Ramadhani Lausi Mkumbachi.

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