

Development of Al-Qur'an-Based Physics Learning Media Applications to Improve Higher Order Thinking Skills and Spiritual Attitudes for Preservice Physics Teacher

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Article Info	ABSTRACT
<p>Article History Received: June 18, 2021 Revision: May 18, 2022 Accepted: June 11, 2022</p> <hr/> <p>Keywords: Al-Qur'an-Based Physics HOTs Physics Learning Media Spiritual Attitudes</p>	<p>This study aims to develop an Android-based Al-Qur'an integrated physics learning media to improve preservice physics teachers' higher-order thinking skills and spiritual attitudes. The development of learning media uses the ADDIE model. Media and material experts assessed the feasibility of learning media through a validation questionnaire. The trial was carried out on 40 preservice physics teacher students. The validation results were analyzed using a descriptive technique. The analysis results show that the learning media developed is suitable for improving Higher Order Thinking Skills and the Spiritual Attitude of Preservice Physics Teachers. So, the Android-based physics learning media integrated with the Quran can be implemented for preservice physics teachers.</p>

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To cite this article:

L. Nuraini et al., "Development of Al-Qur'an-Based Physics Learning Media Applications to Improve Higher Order Thinking Skills and Spiritual Attitudes for Preservice Physics Teacher," *Indones. Rev. Phys.*, vol. 5, no. 1, pp. 32–39, 2022, doi: [10.12928/irip.v5i1.4268](#).

I. Introduction

Physics is a branch of science that studies natural events and processes. Physics is not only studying facts but also studying how to think and work scientifically. Understanding physics requires thinking logically [1], critically [2], [3], creatively [4], [5]. One of the goals of studying physics is for students to understand the greatness of God [6]. Islamic teachings contain values that are influential in life that humans consider in determining decisions to act [7]. Because in Islam, natural science is discussed in a complex manner which is parsed through verses of the Qur'an related to the phenomena of everyday life. By studying physics, students will understand that natural phenomena are the creations of Allah SWT that must be considered so that students can increase their moral awareness and devotion to the Creator. However, in reality, there are still challenges in studying Physics. These challenges include lessons considered less interesting, the direction of learning that tends to be rote, verbal, and unrelated to life, and the thought that learning Physics does not contribute to positive thinking to glorify the power of Allah SWT [8].

Based on these factors, efforts are needed to create students who are not only academically intelligent but also morally and spiritually intelligent so that national goals can be realized. Steps that can be taken using technology-based learning media to support learning activities [9], develop academic abilities [10], [11], and create spiritual abilities [12]. Learning media is used by incorporating religious values as verses from the Qur'an. The purpose of inserting verses of the Qur'an is to improve students' attitudes and spiritual understanding of the Qur'an. Understanding the Qur'an must also be supported by an understanding of science. Therefore, the two elements are interconnected. These efforts maintain science, especially Physics so that students remain active in teachings that align with faith beliefs [13]. This is with the government's efforts in the field of education as stated in Article 31, paragraph 3 of the 1945 Constitution, which states that the government seeks and organizes a national teaching system, increases faith, piety, and noble character in the context of the intellectual life of the nation.

One of the physics materials that can be related to the verses of the Qur'an is the material of waves and optics.

The material on waves and optics are divided into several subjects, including geometric optics, diffraction and polarization, interference, and the spectrum of electromagnetic waves. Geometric optics is one of the physical materials containing many abstract and complex concepts related to the reflection and refraction of light. This material requires a detailed and in-depth explanation of geometric ray diagrams and mathematical rules [14], [15].

The verse of the Qur'an related to geometric optical materials is Q.S. An-Nur verse 35. Another subject of waves and optics is the spectrum of electromagnetic waves. Waves with the widest frequency distribution are called electromagnetic waves [16]. The resulting frequency is in the range of 102 Hz to above 1023 Hz. The smallest electromagnetic wave frequency is 1024 Hz, which gives an approximate range of wavelengths and frequencies for various segments. The frequency and wavelength of electromagnetic waves can differ, but the relationship $c = f \cdot \lambda$ in a vacuum is applied to every electromagnetic wave [17]. Material about the spectrum of electromagnetic waves can be combined with one of the verses of the Qur'an, namely Q.S. Yunus verse 5.

Geometrical optics, a part of optics and waves, is difficult because students are limited in drawing the image formation process on the plane, concave, and convex mirrors. Thube and Saligram [14] stated that students understand the existence of reflection or refraction events in the mirror. Students have difficulty giving scientific and mathematical explanations about the process of forming shadow images. Geometry optics material requires learning media to describe the process of reflection or refraction of light so that students can more easily understand the concepts of physics material. Learning media has been understood as anything that can be used as a tool in educational activities to arouse students' interest, feelings, and attention [18]. Learning media is also described as a tool, both physical and virtual, utilized by teachers to deliver lessons to pupils more efficiently and effectively so that educational resources are well received by all pupils and inspire them to learn more [19]. Therefore, the two-way communication that occurs is precise and efficient. Learning media must be interesting for students [20] and interactive [21] but does not reduce the importance of the material presented. The development of learning media is increasingly sophisticated with various technological advances. One form of learning media that is used is an Android-based application.

Basic Physics Subject III Physics Education at the University of Jember, no teaching material or media integrates Islamic values in physics. Research on Al-Qur'an-based physics learning has been carried out by Nisa et al. [22]. They concluded that learning physics based on the Qur'an is better than learning physics without integrating the Qur'an. This research is also relevant to Aslamiyah's [23] research, which explains that Islamic-based physics learning media can integrate Islamic values with the concept of physics to improve spiritual and intellectual abilities. In addition, the use of media can also

increase students' reading interest. This is following the research of Danaswuri et al. [24]. Diani and Hartati [25] also researched the integration of Islamic values in physics learning media and found that Islamic-based physics learning media could improve student learning outcomes in the "very good" and "very feasible" categories for use in learning. Students need media that can be used for independent learning integrated with Islamic values. The development of modules that follow Islamic values, one of which can provide supporting facilities and infrastructure for the creation of students who excel in achievement and religion. It is expected that students are not only intellectually intelligent but also spiritually intelligent. Technology-based learning media will increase students' interest in learning and motivation in understanding Physics concepts integrated with the verses of the Qur'an.

In addition to spiritual attitude, High Order Thinking Skills (HOTS) is one of the skills students need in dealing with life in the 21st century [26]. Higher order thinking skills (HOTS) are aptitudes that are stressed globally and are now the main area of instruction in an increasing number of courses. By implementing HOTS in teaching and learning, teachers may encourage students' critical thinking and enhance classroom learning [27]. However, the reality is that student HOTS are still quite low.

In the conventional learning process, students cannot experience independent experiences finding new learning concepts. Using technology-based media such as computers or smartphones, students can adjust learning speed, interact, and make observations that foster greater curiosity about physics concepts in an event [28], [29]. Learning media is one of the media used in learning. One of the advantages of learning media is that, in certain cases, it can represent the teacher in presenting the information taught to students. Learning media is expected to facilitate higher-order thinking skills and students' spiritual attitudes.

Android-based digital learning media that has been developed can support the physics learning process well. Various studies have reported the results of the development of android-based physics learning [30]–[33]. However, there are limited reports on developing android-based learning media for those oriented toward Higher Order Thinking Skills and Spiritual Attitudes. Therefore, this study aims to develop an android-based physics learning media oriented toward Higher Order Thinking Skills and Spiritual Attitudes.

II. Theory Physics Learning Media

Media is a communication and a good connector between two parties that function to convey information. The information can be ideas or opinions. Learning media is a tool whose use is as a messenger of learning. Learning media can facilitate the learning process, increase the efficiency of the learning process, and help students concentrate more on the learning process [34].

The purpose of using media in the learning process is not only to complete the learning process itself and attract students' attention but also to facilitate the learning process, as well as to improve the quality of learning, and achieve learning objectives.

In choosing media, accuracy is needed. Thus learning outcomes are optimal, following what is desired by educators. Educators need to consider various foundations. Hence, the chosen media follow students' understanding, thinking, psychological, and social conditions. This is due to avoiding the non-optimal use of media in the learning process [35].

Learning physics will be meaningful for students if the physical processes can be observed visually. More involvement of the five senses will further optimize student learning outcomes. Generally, the characteristics of wave and optical matter are abstract. Therefore, the development of technology-based physics learning media will bridge the activity of observing abstract physical processes on the wave and optical material. Technology-based learning media also allows students to be actively involved because it involves several members of the five senses.

Higher Order Thinking Skills

Thinking skills are skills in managing thoughts or cognitive systems consisting of knowledge, observation, and production. In addition, thinking skills also mean the ability to make decisions to solve problems based on information and experience. Thinking activities aim to find meaning, understand something, look for ideas or creations, and make judgments [36].

Thinking skills are divided into two types. These are low-order and high-order thinking skills [37]. Both lower-order and higher-order thinking are derived from Bloom's taxonomy. Bloom's taxonomy consists of six levels of cognitive thinking these are remembering (C1), understanding (C2), applying (C3), analyzing (C4), evaluating (C5), and creating (C6). Low-order thinking skills (LOTS) are abilities that consist of C1 to C3, while higher-order thinking skills (HOTS) are abilities that consist of C4 to C6 [38].

Higher order thinking has the characteristics of being able to think critically and creatively. Critical thinking ability is an important ability in all aspects of life, including education. This ability can be used in various fields of study. Students need to be trained to think critically so that they can solve problems that exist in the real world [39]. In comparison, creative ability is obtained by students by finding and using rational new ideas in participating in learning. This ability involves creativity to produce new products or combinations or developments of existing ones which are useful and can be accepted or understood [37]

In education, the quality of learning must be improved to increase students' higher-order thinking skills. Technological advances and curriculum changes are important in improving higher-order thinking skills [40]. Advances in technology make it easier to obtain

information in cyberspace. On the other hand, students need the ability to filter information so that the information obtained is good and valid. In ensuring the validity of information, the teacher's role is needed to clarify concepts in learning.

It is important to create a suitable evaluation tool to measure learning achievement to gauge the level of students' higher-order thinking abilities. For example, essay questions, multiple choice, short entries, and other forms are arranged based on the domain levels C4 to C6 [41]. Students' ability to solve problems can only be achieved when they can master how to analyze various alternative problem-solving views from various aspects [42].

Spiritual Attitude

The word spiritual is closely related to Almighty God and its relationship to the beliefs held by individuals [43]. Spiritual attitude is the attitude that individuals have about the beliefs they hold. Spiritual attitudes come in self-awareness as God's creatures, being grateful for the gifts and potential they have both physically and culturally [44].

Based to Hasanah et al. [43], the spiritual dimension consists of four aspects, namely: Relating to something unknown or uncertain in life, Finding meaning and purpose in life, Realizing the ability to use one's resources and strength, and having a sense of attachment to oneself and God Almighty. These aspects indicate the existence of human involvement that comes from feelings and knowledge. There is an ever-growing knowledge of discovering the unknown and finding meaning in life, but there is a sense of engagement with greater power.

Spiritual attitudes need to be possessed by students to create individuals who are faithful and pious. Many studies have been conducted on integrating aspects of spiritual attitudes in learning. Integrating the values of monotheism in learning materials will affect the quality of science. Then, teaching materials integrated with spiritual values will encourage positive attitudes in students, such as gratitude, faith, piety, sincerity, and others, through the awareness that there is a relationship between the knowledge learned and the greatness of God's creation [45]. Presenting religious values in science is a good way to understand scientific and spiritual concepts. Integrating religious values with science is not only about finding arguments in the Qur'an or hadith, nor is it the process of converting science to Islam, but science acts as an intermediary for students to get closer to God. Therefore, the preparation of teaching materials needs to be oriented to religious values as a step to produce students who have intellectual, emotional, social intelligence, and spiritual intelligence [46].

III. Method

The research method used is Research and Development (R&D) with the ADDIE development model [31], [47]. Figure 1 shows the five stages of learning media development.

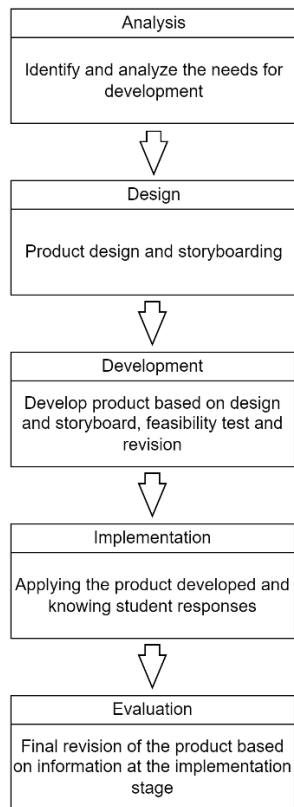


Figure 1. Development stage in ADDIE Model

The results of the development of the AI-Qur'an-Based Physics Learning Media Application were tested on students who took the optical material III Basic Physics course. Participants in this study amounted to 40 students using the purposive sampling technique. Data collection techniques used questionnaires, Higher Order Thinking Skill test questions, and questionnaires on students' spiritual attitudes. The data analysis technique used descriptive analysis. The percentage of the effectiveness of higher order thinking skills and students' spiritual attitudes is shown in Table 1.

Table 1. Category Interpretation of Effectiveness

Percentage (%)	Category
< 40	Ineffective
40 – 55	Less effective
56 – 75	Enough Effective
> 76	Effective

The learning media that has been developed is tested for validity. Validity relates to the accuracy of the assessment tool against the concept to be assessed so as to assess what should be assessed [48]. Experts, users, and audiences can test the validity [49]. This study uses expert validation. Furthermore, the validation results are categorized. Determine the validity category by matching the average total with the validity criteria, as shown in Table 2.

Table 2. Validity criterion

Validity Range	Criterion
$3.25 < V_a \leq 4.00$	Very Valid
$2.50 < V_a \leq 3.25$	Valid
$1.75 < V_a \leq 2.50$	Less valid
$1.00 < V_a \leq 1.75$	Not valid

IV. Results and Discussion

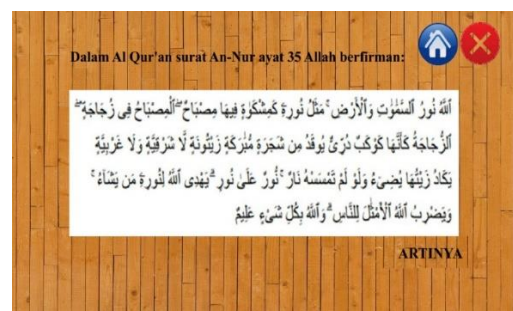
This research was conducted in the odd semester of the 2020/2021 academic year. The research begins by reviewing the curriculum in the Physics Education study program and the physics concepts that will be discussed. Furthermore, developing the application of AI-Qur'an-Based Physics Learning Media. Four materials on optics and waves have been developed: 1) Geometric Optics, 2) Diffraction and polarization, 3) Interference and 4) Electromagnetic Wave Spectrum. An example of the development results is shown in Figure 2.



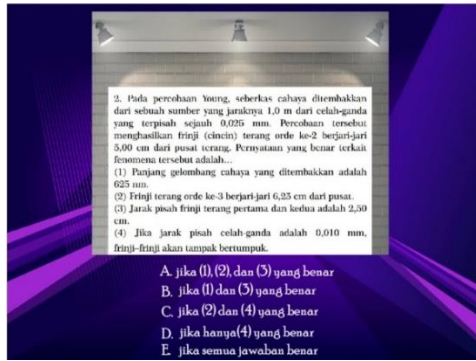
a. Home of Geometry Optics materials



b. Home of diffraction and polarizing materials



c. AI Quran verse integration



d. Sample of quiz

Figure 2. Example of display of learning media

Each AI-Qur'an-based interactive media application that has been developed consists of Course Learning Outcomes (CPMK), Learning Objectives, Materials on waves and optics (optical geometry, diffraction and polarization, interference, and electromagnetic wave spectrum), Practice Problems, Simulation/animation, Verses of the Qur'an and Evaluation/Quiz. After compiling the results of developing an interactive media application based on the Qur'an, validation activities were carried out. Three experts carried out validation. The validation results show that the constructed aspect is 3.58 (very valid), the content aspect is 3.4 (very valid), and the linguistic aspect is 3.47 (very valid). The average validity for all aspects is 3.48, which is included in the very valid category. The validation results are shown in Table 3.

Table 3. Validation Result of AI Qur'an Based on Learning Physics

No	Assessed Aspect	Expert Validating Value			Average
		1	2	3	
1	Construct	3,75	3,50	3,50	3,58
2	Content	3,60	3,40	3,20	3,40
3	Language	3,43	3,43	3,57	3,47

Based on the average validation results shown in Table 3, the resulting learning media is included in a very valid category and can be used in learning. This follows research conducted by Ihwanudin et al. [50] which states that integrated science teaching materials integrated with the verses of the Qur'an are classified as very valid categories. Hence, they can be used as a media for science learning in the classroom. Interactive learning multimedia with light material containing the Qur'an that has been developed is suitable for use as a medium to support the learning process in Muhammadiyah schools [51]. Susilana and Riyana [52] argue that learning media that has been validated undoubtedly can be used because it has gone through a scientific assessment process. Media supports the learning process that can convey the material effectively and efficiently. The process of receiving abstract material will be faster using the media than lectures without tools [53]. By using the media,

stimulation can be given. Thus students are more motivated to learn something new [54].

The AI-Qur'an integrated physics learning media is effectively used in learning physics subjects for Basic Physics III optics, according to Table 1. This is based on the percentage obtained from the Higher Order Thinking Skill test results, which is 85% and in the effective category. Values The Higher Order Thinking Skill obtained by students is 80.1 because, during the learning process, students show good enthusiasm and motivation to study physics in studying the concepts of waves and optics. Some students ask questions and are active during learning if they do not understand waves and optical material.

The results of students' spiritual attitudes after learning using the application of integrated physics learning media with the Qur'an are in the very good and effective category, following Table 1 with 89.8%. This is because when using this Qur'an-based learning media, students can learn physics along with the verses of the Qur'an related to the context and optical concepts being studied. During the learning process, there is no dichotomy between studying physical science and the context of the Qur'an. Therefore, students can glorify the Creator's greatness, be more grateful for the blessings of faith and knowledge, and have a better spiritual attitude. This is in line with research conducted by Cahyati and Suseno [55], which states that learning media oriented to the value of the Qur'an can direct and develop students' spiritual attitudes.

The results of this study are relevant to the research reported by Pratiwi et al. [56], which states that Islamic values-based physics learning media can improve the quality of learning and get a positive response from lecturers and students. Subsequent research by Wati et al. [57] regarding learning media that integrates Islamic values with the concept of physics shows that the media can improve learning outcomes, religious attitudes, and social attitudes.

V. Conclusion

The AI-Qur'an-Based Physics Learning Media Application that has been developed contains four waves and optics materials: 1) Geometric Optics, 2) Diffraction and Polarization, 3) Interference and 4) Electromagnetic Wave Spectrum. The feasibility test results show that the AI-Qur'an-Based Physics Learning media is feasible and effective for developing Higher Order Thinking Skills and students' spiritual attitudes.

This study has limitations, namely that it still focuses on waves and optics. However, the AI-Qur'an-Based Physics Learning media can be one of the innovative solutions for preservice teacher students for online learning, especially amid the covid-19 pandemic. In future research, some suggestions that can be made are to develop a broader physics material, and the basic education level can be a concern.

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Declarations

- Author contribution** : Lailatul Nuraini was responsible for the entire research project. She also collaborate with other author for writing these article manuscript. Firdha Kusuma Ayu Anggraeni, Alex Harijanto and Rayendra Wahyu Bactiar was responsible to check about how to develop these media. Sri Handono, Bambang Supriadi, Subiki was responsible to check the quality theory of physics concept and media, Maryani and Sutarto was responsible to check the result and discussion. All of us is one team of research group in Physics Education Study Program, Faculty of Teacher Training and Education, University of Jember.
- Funding statement** : This research is funded by the internal research group grant from research and community service institutions, University of Jember. Contract number: 11872/UN25/LT/2020
- Conflict of interest** : All of author declare that they have no conflict of interest.
- Additional information** : No additional information is available for this paper.