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Effectiveness of experiment-based learning method in improving elementary school students' understanding of Islamic physics concepts

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ABSTRACT
This research is driven by the importance of developing effective learning methods to improve the understanding of Islamic physics concepts in elementary school students. The experiment-based learning method was chosen because it provides opportunities for students to learn actively through direct experience, observation, and reflection. Research that specifically evaluates this method in terms of students' understanding of Islamic physics in primary schools is limited. The purpose of this study is to fill the gap on the understanding of Islamic physics concepts in elementary school students by determining whether the experiment-based learning method is effective in this regard. This research method is using quantitative method, which collects data through distributing questionnaires using google from to educators. Quantitative methods are data that contain numbers. Then the questionnaire results are processed using SPSS, which is presented in the form of graphs or tables. This method is used to obtain clearer and complex results that can strengthen the data to be carried out and interviews provide written text of educators. The results showed that there was a significant increase in understanding of physics concepts between students who were taught. The experimental approach provides direct experience to students, allowing them to see and feel the principles of physics in a real context and relevant to Islamic values.

Keywords: *Experiment, Physics, Elementary School Students*

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INTRODUCTION

The learning method refers to students who are in the age range from birth to about 9 years old and individuals who are going through a period of rapid growth (Adamy & Rani, 2022). This is an early developmental period in a person's life that has a major impact on growth, development and, in the student's world, play (Barrett dkk., 2019). Primary school students are at a time when the brain and nervous system are developing

very rapidly (Kooli, 2023). And the brain will contribute to regulating all forms of activity and also the immune system of the individual (Wilmot dkk., 2022). This is a critical period where students are very capable of absorbing information and learning quickly, and this period really needs the role of parents and teachers in providing food to help the growth and development of students in this period physical growth and conditions are very important.

Therefore, good education and appropriate stimuli are essential during this period. Play is the main way for students to learn, it provides stimulation for students to learn and explore their potential (Kasneci dkk., 2023). They develop their motor, social, cognitive and emotional skills through play. That's why primary school education often emphasises play school learning (Kasneci dkk., 2023). Therefore, good education and appropriate stimuli are essential during this period. Play is the main way for students to learn, it provides stimulation for students to learn and explore their potential (Patel & Lam, 2023). They develop their motor, social, cognitive and emotional skills through play. That's why primary school education often emphasises play school learning.

One of the main issues is the quality of content in experiment-based learning methods. The content should be relevant, developmentally appropriate, and follow the current curriculum ("ChatGPT," 2023). Inappropriate or overly complex content may make it difficult for students to understand the material. Students may become overly dependent on technology if the use of this experiment-based learning method is not well supervised (Baihaqi dkk., 2023). This can interfere with social development and traditional learning abilities (Sugita dkk., 2021). The effectiveness of learning methods can make students less physically active, it is important to ensure that there is a balance between screen time and physical activity (Dewi dkk., 2022). Parents should be actively involved in monitoring the use of experiment-based learning methods in improving the understanding of Islamic physics concepts (Ebimgbo dkk., 2019). Uncontrolled use can bring safety risks and also disrupt students' sleeping habits (Van Huis, 2021). Not all students have access to the technological devices required to utilise experiment-based learning methods.

Conventional learning methods, such as lectures or reading textbooks, may be less effective in teaching Islamic physics concepts to primary school students. This approach may not be engaging enough for students who need more hands-on and interactive experiences (Hatmal dkk., 2021). The concept of Islamic physics may be considered complex by elementary school students because it combines two fields of science that they may consider different (Cai dkk., 2021). The use of experimental learning methods can help students to understand such concepts in a more concrete and visible way (Qiao dkk., 2019). Primary school students tend to learn better through hands-on experience. Through experiments, they can see the principles of Islamic physics firsthand, which can help them understand the concepts better than just listening to explanations (Chun dkk., 2020). It is important to ensure that the learning approach used not only teaches physics concepts, but also integrates Islamic values.

What problems to solve Primary school students may face difficulties in understanding physics concepts integrated with Islamic principles (Ramadhan dkk., 2024). Conventional learning methods may not be effective enough in delivering this material adequately (Zou dkk., 2020). Uninteresting and unengaging learning methods may cause students' lack of interest in learning Islamic physics concepts. This may hinder their understanding of the material being taught (Nikat dkk., 2019). Hands-on experience is often necessary to facilitate better understanding of concepts, especially for primary school students (Wang dkk., 2019). Experiment-based learning methods offer opportunities for students to see and experience Islamic physics concepts first-hand. It is important to ensure that the physics concepts taught are integrated with relevant Islamic values.

Studying Islamic physics is not only important to understand the principles of science, but also to understand how science interacts with religious values and teachings. Experiment-based learning methods allow students to experience and understand the relationship between physics and Islam (Dewi dkk., 2022). Understanding physics concepts in an Islamic context helps students to develop a holistic understanding of their world (Xu dkk., 2021). Experiment-based learning methods tend to be more interesting for students because it involves them actively in the learning process, this in increasing student engagement and their motivation to understand physics concepts.

Design experiments that match the understanding and interests of the primary school (Ahmad dkk., 2019). Provide training to teachers on experiment-based learning approaches in the context of Islamic physics (Azzam & Kildishev, 2021). Encourage active student involvement in the learning process, both during preparation, implementation and analysis of experimental results.

This research will provide valuable insights into the effectiveness of certain learning methods in improving the understanding of Islamic physics concepts among primary school students, the information gained from this research can be used to improve educational practices in schools and optimize student learning (Yuziani dkk., 2023). This research recognizes the importance of integration between science and Islamic religion, the research helps convey the message that science and religion do not contradict each other, but complement each other (Egirani dkk., 2021). This research responds to the need for a relevant and powerful curriculum for students (Arrazola dkk., 2021). With a focus on Islamic physics, this research identifies new ways to deliver subject matter that is important and meaningful to students.

The research contributes through an experimental approach to learning, it can offer a more effective way to integrate physics concepts with Islamic principles in a context that is relevant and engaging for students (Cardoso Dos Santos dkk., 2020). This research will use a structured and measurable approach in implementing experiment-based learning methods (Jaja dkk., 2020). The steps to be taken include the selection of experiments that are relevant to physics concepts and Islamic values to be conveyed, the development of learning materials that are in accordance with the level of understanding of elementary

school students, and the implementation of learning that involves students actively in experimental activities.

Curriculum development that integrates physics concepts with Islamic values and teachings (Ababor dkk., 1970). Designing interesting and meaningful experiments that reflect physics principles while linking to Islamic teachings. Providing comprehensive training to teachers in experiment-based physics learning (Lee, 2023). Conducting a comprehensive evaluation to measure the impact and effectiveness of the use of experiment-based learning methods in improving the understanding of Islamic physics concepts.

The research questions aim to answer these research questions. First, how can the use of experiment-based learning methods help elementary school students and understand Islamic physics concepts better? Second, what are the types of experiments that are suitable for teaching Islamic physics concepts to elementary school students, and how can students' engagement with these experiments improve their understanding? With this research, it is hoped that teachers can recognize that experiment-based learning methods.

The research will continue with the implementation of experiment-based learning methods that have been designed, carried out in a suitable elementary school environment and involving students as the object of the research.

RESEARCH METHODOLOGY

Research Design

This research uses a quantitative research design by distributing Google form questionnaires online (Petit dkk., 2020). The use of quantitative data in this study is due to several factors, such as counselors being able to measure how effective the Islamic physics concepts program is for elementary school students, comparing different groups of children, and increasing program accountability with the help of quantitative data. However, it is important to remember that quantitative data is only one source of information that counselors should use to assess the program (Lo, 2023). Using the right type of method can allow researchers to consider the aspects of the influence of Islamic Physics in primary schools to increase self-confidence and self-esteem, learn how to solve problems and relieve stress (Eisenberg dkk., 2020).

The questionnaire used in this study includes several sections. There were twenty questions about improving concept understanding (Shields dkk., 2020) . There are 2 answer options, namely yes / no. From the results of these data, researchers can also provide broad insights into the understanding of the concept of Islamic physics for elementary school students. Researchers can also test students with the aim of knowing the understanding of physics concepts. Thus it can be seen to what extent students' understanding can be applied by students or not (Lestari dkk., 2020).

Research Subject

This research can be conducted within the scope of formal education. Researchers examine the measurement of lower-level educational institutions, more precisely elementary schools. The initial stage of the researcher will choose a school that has

implemented an understanding of the concept of Islamic physics, especially elementary school students. Therefore, researchers decided to choose SDN 03 Sijunjung. The research subjects were children of elementary school age (6-12 years). Students were divided into experimental groups (receiving physics concepts) and (not receiving physics concepts). Researchers can observe changes in student behavior and positive attitudes in the classroom. As well as students who have difficulty understanding the concept of Islamic physics (Stern dkk., 2020).

Data Collection Technique

The research data obtained according to the facts using quantitative methods, namely by collecting the results of distributing questionnaires in the form of google from the respondents, it will be presented and calculating what percentage of each answer to the questions made related to the effect of understanding the concept of Islamic physics on elementary school students (Rusmana et al, 2020). With this data can be relevant information with numbers that are easy to understand when presented to people to find the problem under study.

Figure 1

Flow of data collection

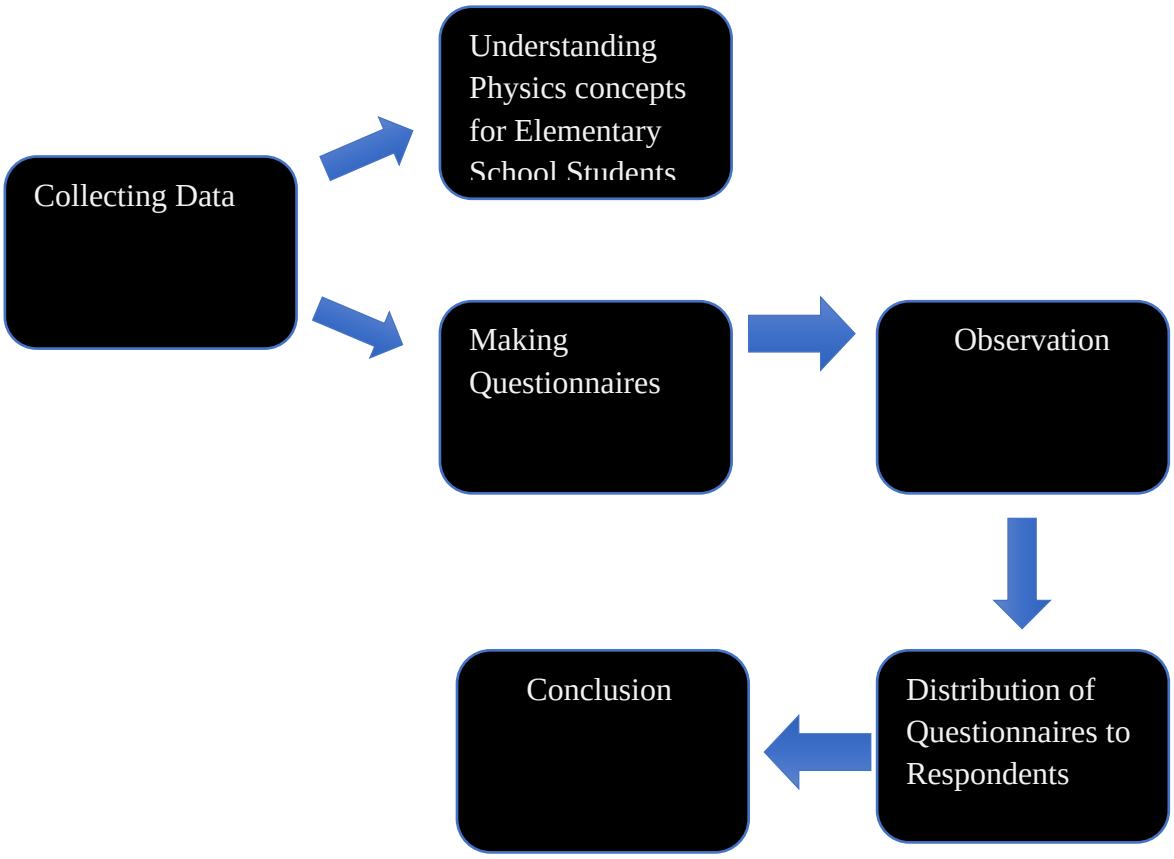


Figure 1 is a sequence of the flow of data collection and processing that researchers do in collecting answers from students. There are several stages that researchers do, first researchers make questions as many as twenty questionnaire items through Google from. Second, researchers made indirect observations or listened to explanations from sources. Third, researchers share it online via WhatsApp. The last step is to draw conclusions from the results of the data.

RESULT AND DISCUSSION

Effectiveness of experiment-based learning method in improving elementary school students' understanding of Islamic physics concepts

Experiment-based learning method is a teaching strategy centered on students' direct experience in conducting experiments to learn a concept or theory. Students are actively involved in the learning process by designing, conducting, and analyzing experiments. The teacher acts as a facilitator guiding students in the learning process and helping children understand the concepts underlying the experiment.

The understanding of the concept of Islamic Physics in elementary school shows that this method students have a high curiosity about natural phenomena related to Islamic teachings. They are enthusiastic about learning Physics concepts through an Islamic perspective, which strengthens their understanding and beliefs. Learning Islamic Physics can foster a sense of love and gratitude to Allah SWT for His amazing creations. Students have a high curiosity about natural phenomena and its relation to Islamic teachings.

Table 1.1 Results of Questionnaire Distribution

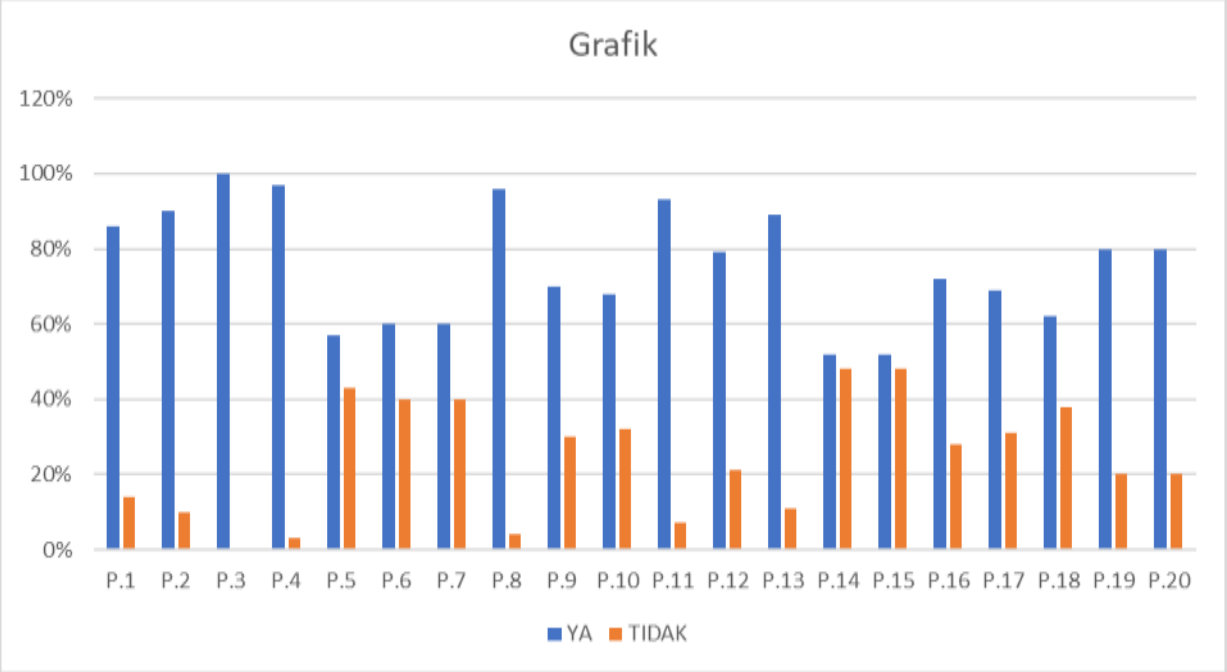
NO	Question	Respon	
		Yes	No
1.	Is there a significant difference between the level of understanding of Islamic physics concepts in students taught with experimental methods compared to traditional learning methods?	83%	17%
2.	Are there any obstacles or challenges in implementing experiment-based learning method for elementary school Islamic physics?	90%	10%
3.	Can experiment-based learning method increase elementary school students' interest and motivation in learning physics?	100%	-
4.	Can experiment-based learning methods help elementary school students in developing Islamic characters and values in learning physics?	97%	3%
5.	Is there a difference in understanding the	57%	43%

	concept of Islamic physics between male and female students who are taught with experimental method?		
6.	Is there a difference in understanding the concept of Islamic physics between students with different learning ability levels who are taught with experimental methods?	60%	40%
7.	Is experiment-based learning method more effective to improve the understanding of Islamic physics concepts among elementary school students in urban areas compared to rural areas?	60%	40%
8.	Is there an influence of culture and religion on the effectiveness of experiment-based learning methods in improving the understanding of Islamic physics concepts in elementary school students?	96%	4%
9.	Are there adequate resources and teaching materials to support the implementation of experiment-based learning methods in elementary school Islamic physics?	70%	30%
10.	Is it necessary to conduct further research to determine the effectiveness of experiment-based learning methods in improving the understanding of Islamic physics concepts in elementary school students with different contexts and variables?	68%	32%
11.	Does experiment-based learning method allow students to learn actively and constructively?	93%	7%
12.	Can experiment-based learning help students in understanding the concept of Islamic physics?	79%	21%
13.	Are there different types of experiment-based learning methods applied in Islamic physics?	89%	11%
14.	Does constructivism learning theory support the use of experiment-based learning methods?	52%	48%
15.	Does previous research show positive evidence of the effectiveness of experiment-based learning methods in improving	52%	48%

	understanding of physics concepts?		
16.	Are student learning outcomes in the experimental group higher than the control group using traditional learning methods?	72%	28%
17.	Is there a statistically significant difference between student learning outcomes in the experimental and control groups?	69%	31%
18.	Is the experiment-based learning method proven effective in improving elementary school students' understanding of Islamic physics concepts?	62%	38%
19.	Do students show a positive response to the application of experiment-based learning methods?	80%	20%
20.	Do the results of this study have significant implications for the practice of learning Islamic physics in elementary schools?	80%	20%

From the table above, there are several questions regarding the effectiveness of experiment-based learning methods in improving elementary school students' understanding of Islamic Physics concepts. The questions generated from some of these questions can be known understanding of the concept of Islamic Physics elementary school students. Which, understanding the concept of Islamic physics is very influential for elementary school students, because with the concept of physics students are helped to understand it, confident in participating actively. The questions asked in this study were 20 questions containing the understanding of the concept of Islamic physics of elementary school students. Questions containing differences in understanding the concept of Islamic physics in students taught by experimental methods and traditional learning methods obtained a presentation of 83% in the yes category. Questions about challenges in applying learning methods with a presentation of 90%. The question of increasing the interest and motivation of elementary school students in learning physics obtained a presentation of 100% with the category yes. The question of developing character and Islamic values in learning physics obtained a percentage of 97%. Questions on the concept of Islamic physics between male and female students taught by the experimental method obtained a percentage of 57%. The question of students with different learning ability levels obtained a percentage of 60%. The question of understanding the concept of Islamic physics in elementary school students in urban areas compared to rural areas obtained a percentage of 60%. The question of improving the understanding of Islamic physics concepts in elementary schools received a percentage of 93%. The question of resources and teaching materials in elementary school Islamic physics obtained a percentage of 70%. The question of improving the understanding of Islamic physics concepts in elementary school students with context and variables obtained a percentage of 68%. The

question of students to learn actively and constructively obtained a percentage of 93%. Questions experiment can help students in understanding the concept of Islamic physics obtained a percentage of 79%. The question of experiment-based learning applied in Islamic physics obtained a percentage of 89%. The question of positive evidence of the effectiveness of learning methods obtained a percentage of 52%. The question of student learning outcomes in the experimental group obtained a presentation of 72%. Statistically significant difference questions obtained a percentage of 69%. The question is effective in improving the understanding of Islamic physics concepts of elementary school students obtained a percentage of 62%. The question of students showing a positive response to the application of experiment-based learning methods obtained a percentage of 80%. Significant questions for Islamic physics learning practices in elementary schools obtained a percentage of 80%.



The graph above is a graph of the effectiveness of experiment-based learning methods in improving understanding of the concept of elementary school Islamic physics. The graph above explains that the study used 20 questions about understanding the concept of Islamic physics elementary school questions that get the highest percentage of yes there are 20 questions, namely 1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19, and 20 which is the highest percentage result of 100%. And the lowest was in question 3 with a percentage of 0% in the no category. So the highest data acquisition is in the yes category and the lowest is in the no category.

The test data on the increase in the effectiveness of experiment-based learning methods in improving the understanding of Islamic physics concepts of elementary school students can be explained that in the yes category with the highest first data acquisition at a percentage of 100% in question 3, while the acquisition of the lowest yes category is

52% in question 14 and 15. The highest no category is question 5 with a percentage of 43% and the lowest no category in question 3 which is 0%.

In general, the experiment-based learning method has shown potential in improving the understanding of Islamic physics concepts in elementary school students. This approach allows students to be actively involved in the learning process, conduct experiments, and observe phenomena directly. The advantages of experiment-based learning method in the context of Islamic physics are increasing motivation and interest in learning students become more enthusiastic and interested in learning Islamic physics because students can work and discover the concepts themselves. Strengthening concept understanding students can visualize and understand the concepts of Islamic physics more deeply and concretely. Developing critical thinking skills students are encouraged to analyze, introspect.

The results of this study indicate that experiment-based learning methods are effective in facilitating concept understanding, especially in science fields such as physics. In the context of Islamic Physics, this approach could be a very useful tool to teach physics concepts related to the principles found in Islamic teachings. Improved understanding of concepts, experiment-based learning methods tend to allow students to experience physics concepts directly, which can improve their understanding, in the context of Islamic Physics the use of experiments relevant to Islamic principles can help students to better connect with the subject matter.

DISCUSSION

Kinds of Islamic Physics concepts of elementary school students

Teaching physics to elementary school students can be a fun and rewarding experience (Nasir dkk., 2021). One way to make physics learning more interesting and meaningful for Muslim students is to connect it with concepts in Islam.

Here are some examples of physics concepts that can be taught to elementary school students using an Islamic approach. 1) Improving concept understanding through experiment-based learning. 2) Integration of physics concepts with Islamic values. 3) The effectiveness of the experiment method in the context of physics learning in elementary schools (Zamfirache et al., 2022).

Development of Islamic Physics Concept Understanding of Elementary School Students

The understanding of elementary school students can develop, but the level of development varies depending on the student's background, students with a religious family background generally have a better understanding of Islamic physics. Teachers who have a good knowledge and understanding of Islamic physics can help students to understand the concepts better. Schools that have a strong religious education program generally have students with a better understanding of Islamic physics (Nearing dkk., 2021). The development of elementary school students can be seen from cognitive abilities, students with more cognitive abilities generally have a better understanding of Islamic physics. Students also have a high interest and motivation towards Islamic physics generally easier to understand the concept. Students who have a learning style that is in

accordance with the learning approach of Islamic physics generally easier to understand the concept.

The development of Islamic physics concept understanding of elementary school students is a process in which students not only learn physics concepts conventionally but also relate them to Islamic teachings. This process involves several steps of physics concept development of elementary school students. 1) Introduction to the basic concepts of physics, at the beginning students are introduced to the basic concepts of physics such as force, motion, and energy. 2) Integration with Islamic teachings, the physics concepts taught are integrated with Islamic teachings (Hu dkk., 2021). Understanding the concepts of Islamic physics in elementary school students is an important aspect of religious and science education to connect natural phenomena with Islamic principles and develop a sense of awe towards Allah's creation. Several studies have been conducted to examine the development of students' understanding of Islamic physics concepts varying as, age and cognitive maturity of students, older students generally have a better understanding of Islamic physics concepts compared to younger students. Quality of learning, effective learning with appropriate methods and competent teachers can improve students' understanding of Islamic physics concepts. Students' experience and exposure. Students who have more experience and exposure to Islamic physics concepts, both at school and outside school, generally have a better understanding. It is important that the development of understanding of Islamic physics concepts in elementary school students is a continuous process. Teachers, parents and communities need to work together to create an environment conducive to the learning of Islamic physics and help students to develop a sense of love and faith in Allah SWT through students' understanding of the universe. The development of elementary school students' understanding of Islamic physics concepts includes several important aspects that involve the integration of modern science with values. Islamic-based curricula often combine physics concepts with Islamic teachings. For example, the laws of physics such as gravity can be linked to Quranic verses that talk about the creation of the universe, Islamic values. Physics is integrated with Islamic values such as honesty, justice and responsibility. This helps students understand that science and religion can go hand in hand and complement each other. Holistic approach, the learning methods used are often holistic, where physics is studied not just as pure science, but in the context of application. Active and Interactive learning, physics learning is done in an interesting and interactive way, using experiments and demonstrations that are associated with daily events that are explained in an Islamic perspective. Materials and learning resources, Islamic textbooks and teaching materials used often contain material that connects physics concepts with verses of the Quran and Hadith, providing explanations. Digital learning resources using technology and digital learning resources containing Islamic physics content are also widely used to enrich learning materials. Development of critical thinking skills, students are taught to analyze physics phenomena in a critical and logical way, while considering aspects of Islamic faith and ethics. Experimentation and observation, through experimentation and observation students learn to understand and appreciate the greatness of Allah in creating the universe, as well as develop the ability to

investigate and solve problems. Morals and ethics, physics education in the Islamic context also aims to shape the morals and ethics of students, students are taught to use science wisely and responsibly in accordance with Islamic values. Care for the environment. Students are taught the importance of protecting the environment as part of worship to Allah, understanding physics concepts related to nature conservation (Li et al., 2021). Introducing Islamic physics concepts to elementary school students can be an interesting and meaningful way to connect science with students' religious beliefs. Important points to consider for elementary school students' Islamic physics concepts such as, instill curiosity and wonder of the universe, encourage students to observe and question natural phenomena, such as the movement of the sun and moon. Connecting science concepts with Quranic verses and hadith, Quranic verses and hadith that explain natural phenomena, such as the creation of heaven and earth, the movement of stars, and the nature of water. Integrating Islamic physics concepts in science learning, encouraging creativity and experimentation, instilling Islamic values in science learning. The development of understanding of Islamic physics concepts in elementary school students involves the integration of basic physics concepts with Islamic values and perspectives. Islamic physics education in elementary schools includes teaching that focuses not only on understanding physics concepts, but also on concepts aligned with Islamic values. This includes the understanding that the universe is God's creation and that studying nature is a form of worship and appreciation of his creation. Curriculum integration designed to combine physics and Islamic teachings usually covers several aspects, such as the tawhid of the oneness of Allah, teaching that all natural phenomena are signs of Allah's greatness. Human leadership

The importance of improving elementary school students' understanding of Islamic physics concepts

Improving elementary school students' understanding of Islamic physics concepts has several important benefits. 1) Fostering a sense of love and gratitude to Allah SWT, a branch of science that studies natural phenomena from an Islamic point of view. 2) Strengthening faith and belief, in understanding the various propositions of the Qur'an and hadith related to natural phenomena. 3) Increase student interest and motivation to learn, Islamic physics is packaged in an interesting way and easily understood by elementary school students (Shields et al., 2020).

In addition, the concept of Islamic physics teaches moral and ethical values that are important in everyday life, such as honesty, responsibility, and cooperation. By understanding Islamic physics, elementary school students can learn to apply these values in their lives and become noble individuals. Then Islamic physics can help elementary school students to understand the meaning of life and the purpose of its creation. It can help elementary school students to develop their spiritual and emotional intelligence, and become more resilient and enduring individuals. In addition, Islamic physics teaches leadership based on Islamic values, such as justice, deliberation, and servant leadership (Hemalatha et al., 2021). By understanding Islamic Physics, elementary school students can learn to be competent and characterized leaders who can bring benefits to society. And

Islamic Physics shows that Islam is a universal religion and can be applied in all aspects of life, including science and technology (Djuric et al., 2015). By understanding Islamic Physics, students with elementary school can learn to harmonize science and technology with Islamic values, and contribute to the progress of the nation and state (Y. Chen et al., 2021). Improving the understanding of Islamic physics concepts in elementary school students has important benefits such as strengthening faith and piety, increasing interest and ability in science, developing critical and creative thinking skills, forming Islamic character, preparing a capable and noble Muslim young generation. Islamic physics education combines scientific concepts with Islamic values. Thus, students not only understand science technically, but also see the connection between natural phenomena and religious teachings. This helps students to appreciate God's creation and see science as part of their faith. By linking physics concepts with religious contexts familiar to students, their interest and motivation to learn physics can increase. For example, learning about the laws of motion can be linked to stories in the Quran related to the movement of objects or natural phenomena. The concept of Islamic physics not only teaches about science, but also shapes students' character and morals. For example, understanding the orderliness of the universe can foster a sense of awe and gratitude to the creator, and increase awareness of the importance of protecting the environment as a mandate from Allah. Linking physics with Islamic principles can help students more easily understand abstract physics concepts. For example, the law of conservation of energy can be linked to the concept of balance taught in students, learning physics through an Islamic approach encourages students to think critically and analytically. Students are invited to analyze natural phenomena from a scientific and theological point of view, so that students' thinking skills develop more holistically. Developing an understanding of Islamic physics from an early age can give birth to a generation that is able to integrate science with values. This has the potential to increase the contribution of Muslims in the development of science and technology based on Islamic values, and teaching local and cultural contexts with an Islamic approach makes learning materials more relevant
with students' local and cultural contexts. This helps students to feel more connected to the material learned and see its relevance in everyday life (Hu et al., 2021).

CONCLUSION

Experiment-based learning methods are proven to be effective in improving elementary school students' understanding of Islamic physics concepts. This is evidenced by several studies showing that students who follow learning with this method have higher scores on learning outcomes, concept understanding, learning motivation, concept understanding, learning motivation, and science process skills compared to students who follow learning with conventional methods. (Thomsen et al., 2020)

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REFERENCES

Ababor, S., Birhanu, Z., Defar, A., Amenu, K., Dibaba, A., Araraso, D., Gebreyohanes, Y., & Hadis, M. (1970). Socio-cultural Beliefs and Practices Influencing Institutional Delivery Service Utilization in Three Communities of Ethiopia: A Qualitative Study. *Ethiopian Journal of Health Sciences*, *29*(3). https://doi.org/10.4314/ejhs.v29i3.6

Adamy, A., & Rani, H. A. (2022). An evaluation of community satisfaction with the government's COVID-19 pandemic response in Aceh, Indonesia. *International Journal of Disaster Risk Reduction*, *69*, 102723. https://doi.org/10.1016/j.ijdrr.2021.102723

Ahmad, T., Bustam, M. A., Irfan, M., Moniruzzaman, M., Asghar, H. M. A., & Bhattacharjee, S. (2019). Mechanistic investigation of phytochemicals involved in green synthesis of gold nanoparticles using aqueous *Elaeis guineensis* leaves extract: Role of phenolic compounds and flavonoids. *Biotechnology and Applied Biochemistry*, *66*(4), 698–708. https://doi.org/10.1002/bab.1787

Aljanabi, M. (2023). ChatGPT: Future directions and open possibilities. Dalam *Mesopotamian Journal of …*. journals.mesopotamian.press. https://journals.mesopotamian.press/index.php/CyberSecurity/article/download/33/51

Arrazola, J. M., Bergholm, V., Brádler, K., Bromley, T. R., Collins, M. J., Dhand, I., Fumagalli, A., Gerrits, T., Goussev, A., Helt, L. G., Hundal, J., Isacsson, T., Israel, R. B., Izaac, J., Jahangiri, S., Janik, R., Killoran, N., Kumar, S. P., Lavoie, J., … Zhang, Y. (2021). Quantum circuits with many photons on a programmable nanophotonic chip. *Nature*, *591*(7848), 54–60. https://doi.org/10.1038/s41586-021-03202-1

Axelrod, R. (2021). Preventing extreme polarization of political attitudes. *Proceedings of the National Academy of Sciences of the United States of America*, *118*(50). https://doi.org/10.1073/pnas.2102139118

Azzam, S. I., & Kildishev, A. V. (2021). Photonic Bound States in the Continuum: From Basics to Applications. *Advanced Optical Materials*, *9*(1), 2001469. https://doi.org/10.1002/adom.202001469

Baihaqi, A., Romano, R., Hamid, A. H., Indra, I., Kasimin, S., Ulya, Z., Bakar, B. A., Aziz, A., Idawanni, I., & Wahyuni, I. (2023). Coconut farming development strategy in Bireuen Regency using hierarchy process analysis. *IOP Conference Series: Earth and Environmental Science*, *1183*(1), 012026. https://doi.org/10.1088/1755-1315/1183/1/012026

Barrett, C. F., McKain, M. R., Sinn, B. T., Ge, X.-J., Zhang, Y., Antonelli, A., & Bacon, C. D. (2019). Ancient Polyploidy and Genome Evolution in Palms. *Genome Biology and Evolution*, *11*(5), 1501–1511. https://doi.org/10.1093/gbe/evz092

Cai, Z., Li, Z., Ravaine, S., He, M., Song, Y., Yin, Y., Zheng, H., Teng, J., & Zhang, A. (2021). From colloidal particles to photonic crystals: Advances in self-assembly and their emerging applications. *Chemical Society Reviews*, *50*(10), 5898–5951. https://doi.org/10.1039/D0CS00706D

Cardoso Dos Santos, M., Algar, W. R., Medintz, I. L., & Hildebrandt, N. (2020). Quantum dots for Förster Resonance Energy Transfer (FRET). *TrAC Trends in Analytical Chemistry*, *125*, 115819. https://doi.org/10.1016/j.trac.2020.115819

Chun, K. S., Yeng, C. M., May, C. P., Yeow, T. K., Kiat, O. T., & How, C. K. (2020). Effect of coupling agent content on properties of composites made from polylactic acid and chrysanthemum waste. *Journal of Vinyl and Additive Technology*, *26*(1), 10–16. https://doi.org/10.1002/vnl.21710

Dewi, C., Nichols, J., Izziah, I., & Meutia, E. (2022). Conserving the other's heritage within Islamic society. *International Journal of Heritage Studies*, *28*(4), 444–459. https://doi.org/10.1080/13527258.2021.2010233

Dubin, J. A., Bains, S. S., Chen, Z., Hameed, D., Nace, J., & ... (2023). Using a Google web search analysis to assess the utility of ChatGPT in total joint arthroplasty. *The Journal of …*. https://www.sciencedirect.com/science/article/pii/S0883540323003522

Ebimgbo, S. O., Obi-Keguna, C. N., Chukwu, N. E., Onalu, C. E., Abonyi, S. E., & Okoye, U. O. (2019). Culture-based Social support to Older Adults in Nnewi, South-East Nigeria. *African Population Studies*, *33*(2). https://doi.org/10.11564/33-2-1402

Jaja, I. F., Anyanwu, M. U., & Iwu Jaja, C.-J. (2020). Social distancing: How religion, culture and burial ceremony undermine the effort to curb COVID-19 in South Africa. *Emerging Microbes & Infections*, *9*(1), 1077–1079. https://doi.org/10.1080/22221751.2020.1769501

Kasneci, E., Sessler, K., Küchemann, S., Bannert, M., Dementieva, D., Fischer, F., Gasser, U., Groh, G., Günnemann, S., Hüllermeier, E., Krusche, S., Kutyniok, G., Michaeli, T., Nerdel, C., Pfeffer, J., Poquet, O., Sailer, M., Schmidt, A., Seidel, T., … Kasneci, G. (2023). ChatGPT for good? On opportunities and challenges of large language models for education. *Learning and Individual Differences*, *103*, 102274. https://doi.org/10.1016/j.lindif.2023.102274

Khan, R. A., Jawaid, M., Khan, A. R., & ... (2023). ChatGPT-Reshaping medical education and clinical management. Dalam *Pakistan Journal of …*. ncbi.nlm.nih.gov. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC10025693/

Kooli, C. (2023). Chatbots in Education and Research: A Critical Examination of Ethical Implications and Solutions. *Sustainability*, *15*(7), 5614. https://doi.org/10.3390/su15075614

Korzynski, P., Mazurek, G., Altmann, A., Ejdys, J., & ... (2023). Generative artificial intelligence as a new context for management theories: Analysis of ChatGPT. Dalam *... Management Journal*. emerald.com. https://doi.org/10.1108/CEMJ-02-2023-0091

Lee, H. (2023). The rise of CHATGPT: Exploring its potential in medical education. *Anatomical Sciences Education*, ase.2270. https://doi.org/10.1002/ase.2270

Lo, C. K. (2023). What Is the Impact of ChatGPT on Education? A Rapid Review of the Literature. *Education Sciences*, *13*(4), 410. https://doi.org/10.3390/educsci13040410

Nikat, R. F., Munfarikha, N., Henukh, A., & Samritin. (2019). Implementation e-learning as a formative assessment to explore mastery concept's student on magnetic field material. *IOP Conference Series: Earth and Environmental Science*, *343*(1), 012214. https://doi.org/10.1088/1755-1315/343/1/012214

Petit, L., Eenink, H. G. J., Russ, M., Lawrie, W. I. L., Hendrickx, N. W., Philips, S. G. J., Clarke, J. S., Vandersypen, L. M. K., & Veldhorst, M. (2020). Universal quantum logic in hot silicon qubits. *Nature*, *580*(7803), 355–359. https://doi.org/10.1038/s41586-020-2170-7

Qiao, J., Zhou, G., Zhou, Y., Zhang, Q., & Xia, Z. (2019). Divalent europium-doped near-infrared-emitting phosphor for light-emitting diodes. *Nature Communications*, *10*(1), 5267. https://doi.org/10.1038/s41467-019-13293-0

Ramadhan, G. A., Azzam, A. B., Mahendra, T. T., Zainal, M., Nanda, M., Asyqari, A., & Ismail, N. (2024). *Identification of the distribution of archaeological artifacts in the area of wastewater treatment installation in the city of Banda Aceh using magnetic methods*. 040022. https://doi.org/10.1063/5.0202411

Sugita, A., Ling, L., Tsuji, T., Kondo, K., & Kawachi, I. (2021). Cultural Engagement and Incidence of Cognitive Impairment: A 6-year Longitudinal Follow-up of the Japan Gerontological Evaluation Study (JAGES). *Journal of Epidemiology*, *31*(10), 545–553. https://doi.org/10.2188/jea.JE20190337

Van Huis, A. (2021). Cultural Significance of Beetles in Sub-Saharan Africa. *Insects*, *12*(4), 368. https://doi.org/10.3390/insects12040368

Wang, Y., Htwe, Y. M., Li, J., Shi, P., Zhang, D., Zhao, Z., & Ihase, L. O. (2019). Integrative omics analysis on phytohormones involved in oil palm seed germination. *BMC Plant Biology*, *19*(1), 363. https://doi.org/10.1186/s12870-019-1970-0

Wilmot, E., Wong, J., Tsang, Y., Lynch, A. J., Infante, D., Oleson, K., Strauch, A., & Clilverd, H. (2022). Characterizing mauka-to-makai connections for aquatic ecosystem conservation on Maui, Hawai‘i. *Ecological Informatics*, *70*, 101704. https://doi.org/10.1016/j.ecoinf.2022.101704

Yuziani, Rizka Sofia, & Harvina Sawitri. (2023). Prediction of hypertension risk as an occupational health disease in palm oil factory workers at Gandapura District, Bireuen Regency, Aceh, Indonesia. *Bali Medical Journal*, *12*(1), 490–494. https://doi.org/10.15562/bmj.v12i1.4019

Zou, Y., Ge, X., Guo, S., Zhou, Y., Wang, T., & Zong, S. (2020). Impacts of climate change and host plant availability on the global distribution of *Brontispa longissima* (Coleoptera: Chrysomelidae). *Pest Management Science*, *76*(1), 244–256. https://doi.org/10.1002/ps.5503