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The effect of realistic mathematics learning approach on science literacy ability and science process skills in Islamic Religius education institute

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Abstract

This study aims to determine the effect of the realistic mathematics learning approach on scientific literacy skills and science process skills of mathematics education students at the Muhammad Azim Islamic Institute, Jambi. The research approach is quantitative with a quasi-experimental model. The design used is a one-group pretest-posttest design. Based on the data and discussions that have been carried out, it can be concluded that the learning of a realistic approach to mathematics has an effect on scientific literacy skills and science process skills for mathematics education students at the Muhammad Azim Islamic Institute, Jambi. This is based on the average N-gain value, which is 74%, meaning that the included learning approach affects the two variables, respectively, 74% for scientific literacy and 68% for science process skills. These results are also reinforced by the sig value in the one-way ANOVA test, which is 0.00 for both variables (<0.005), which means that the level of influence is very significant. Namely, 74%, indicating that the included learning approach affects the two variables, respectively 74% for scientific literacy and 68% for science process skills. This research provides potential insights into pedagogy research. Furthermore, it can offer guidelines for future research standards, ensuring that the fundamental literacy component and science process skills are not overlooked or underemphasized for all students.

Keywords: Realistic approach to mathematics, Science process skills, Scientific literacy.

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1. Introduction

Scientific literacy is one of the competencies that must be possessed by all citizens to live more prosperously and more advanced in this digital era. Almost all areas of life today are always associated with digital devices. Meanwhile, to use digital devices wisely and effectively requires scientific literacy skills. This is the main reason why scientific literacy skills are very important to learn and teach to every participant at all levels of education. This is in line with the statement Sumira and Aprida [1] that 21st century education aims to improve students' scientific literacy skills. Kamza et al. [2] he also said that in the 21st century, scientific literacy is considered a staple in education because the ability in science and technology is key to the success of citizens. Naila and Khasna [3] also said that scientific literacy is a crucial skill needed in today's digital era because there are many problems related to knowledge and technology, as well as empowering people to make personal decisions and participate in the formulation of public policies that have an impact on their lives. As well as Sumanik et al. [4] also mentioned that in the 21st century, scientific literacy skills are very important for prospective teachers. The importance of scientific literacy, because it can improve the way someone thinks, is called scientific literacy, and it can help answer the problems of the times.

Scientific literacy is defined as the capacity to use scientific knowledge, identify questions, and draw conclusions based on facts and data to understand the universe and make decisions about changes that occur due to human activities [5]. according to Umiyati [6]. Scientific literacy is a person's ability to ask, find, and determine answers to questions derived from curiosity about everyday experiences. As for Wibowo [7] scientific literacy is the ability of a person to always have the capacity to use scientific knowledge, identify questions, and draw conclusions based on evidence in order to help and make decisions. Other definitions are also mentioned by Murti and Sunarti [8] that scientific literacy related to the ability to understand information, science, and facts in everyday life is very important to provide students to be better prepared to face the era of scientific development and the use of technology in the future. Thus, it can be understood that scientific literacy is closely related to the welfare and safety of present and future life.

Various efforts have been made by the government through curriculum development and teacher training to develop students' scientific literacy skills. Several studies are also being carried out by teacher experts to find the right formula for improving and developing students' scientific literacy skills. This can be seen from several studies related to efforts to enhance scientific literacy skills. The first research was conducted by Kamza et al. [2] whose research aims to find ways to enhance students' scientific literacy in online learning in elementary schools due to the COVID-19 pandemic. Murti and Sunarti [8] in an effort to improve scientific literacy skills, he also conducts research, mainly related to the development of instruments for measuring these abilities. As for Latip and Faisal [9] in an effort to improve scientific literacy skills through learning with computer-based media, to participate in efforts to develop scientific literacy skills,Yunita [10] conduct development research, in this case the development of e-modules that aim to develop students' scientific literacy skills.

In addition to scientific literacy, skills that are very much needed in this digital era are science process skills. This aligns with the opinion Astuti [11] that process skills are the basic skills to develop 21st-century skills. These skills are closely related to scientific methods or principles. They are a set of abilities needed to facilitate science learning so as to enable students to be active in solving problems and developing a sense of responsibility [12]. Other than that, Astuti [11] also said that process skills involve cognitive or intellectual, manual, and social skills. Cognitive skills are involved because by doing process skills, students use their minds. Manual skills are clearly involved in process skills because they involve the use of tools and materials, measuring, assembling, or assembling tools. Science process skills are important to be raised and developed because with that, students not only learn about what already exists but also learn about how to acquire new knowledge. Therefore, with the existence of science process skills, students are encouraged to be more active and creative when finding problems to be solved and relating lessons to everything that goes on in their daily lives [13].

Like scientific literacy, science process skills have also received the attention of experts and the world of education for a long time. Various studies related to science process skills have been and are still being carried out by experts. These various studies are not only in the field of science but also in other fields of study. For example, research conducted by Kitti [14] in an effort to improve science process skills, he conducted research using the discovery learning model. Next Sembiring [15] In an effort to improve science process skills, he conducts research related to the use of appropriate learning resources, namely the surrounding environment, and it has been proven to increase the ability in question. Fatminastiti [16] in his writings, he also describes the steps that teachers can take in an effort to improve the ability of science process skills. Thus, it is clear that the ability of science process skills is one of the most important abilities and, until now, still needs attention to be developed in students.

Like the field of science studies, the study of mathematics is also closely related to everyday life. It is as said by Novitasari [17] that humans in their lives cannot be separated from mathematics. Unwittingly, mathematics becomes a part of life that is needed anytime and anywhere, so that mathematics becomes important. Kamarullah [18] also said that mathematics is a global and borderless field of science. Mathematics is needed, and life continues to evolve in line with the demands of human needs. This is also in line with the opinion Hasratuddin [19] which states that one of the goals of learning mathematics in schools is for students to have the ability to develop an attitude of appreciating the usefulness of mathematics in life, namely having curiosity, attention, and interest in learning mathematics, as well as a tenacious and confident attitude in problem solving. To reinforce the above idea, Habibi and Suparman [20] also mentioned that the goal of learning mathematics is mathematical literacy, namely the individual's ability to formulate, use, and interpret mathematics in various contexts with mastery of information technology. Thus, it can be understood that mathematics has an important role in creating a better human life and is closely related to everyday life. Therefore, mathematics education must be able to play its important role more optimally to create a future generation that is more qualified, has scientific literacy skills, and science process skills so that they are better prepared to compete in the future.

Seeing that scientific literacy skills and science process skills are essential in the digital era, mathematics learning must play a role in enhancing these two abilities for students. Therefore, mathematics learning should be oriented toward developing future skills, such as scientific literacy and science process skills. Permanasari [21] suggested that science learning should be implemented in an integrated manner, namely STEM (Science, Technology, Engineering, and Mathematics), as an alternative for building a generation capable of facing the 21st century.. Sumira and Aprida [1] mentions that someone who has good scientific literacy uses the ability to think rationally and logically, and to reason, and uses it systematically, which is basically the core of mathematical literacy. Therefore, it is clear that mathematics has an important role in developing the scientific literacy skills of students' science process skills.

One model of mathematics learning that is closely related to future abilities, such as scientific literacy and science process skills, is a realistic approach. This is because the approach is implemented by bringing mathematical concepts closer to the real world of students in everyday life. This is in line with the opinion [22]. One of the reasons for the low scientific literacy ability of students is that learning is not contextual. This is also in line with research Kristyowati and Purwanto [23] that the use of a contextual environment, namely the environment, is a unitary space occupied by living things in which there are living and non-living objects as learning resources that can improve students' scientific literacy skills. Learning resources based on a contextual environment in mathematics are known as realistic mathematics. Because learning with a realistic approach to mathematics is believed to play a role or influence the ability of scientific literacy and science skills.

The belief that a realistic approach to mathematics plays an important role in the development of scientific literacy skills and process skills is based on opinion Khotimah and Asâ [24] that the realistic mathematical approach has characteristics: using real-world contexts, using models, using production and construction, using interactive methods, and using linkages. In addition, it is also reinforced by several research results, including those carried out by Usdiyana et al. [25] that the use of a realistic approach to mathematics can improve the ability to think logically. The ability to think logically is the core of scientific literacy skills and scientific process skills. Previous study by Noviyana and Fitriani [26] also found that the application of a realistic mathematical approach can improve students' problem-solving abilities. As for problem-solving skills, they are also part of scientific literacy skills and science process skills. Furthermore, research conducted by Fuadi et al. [22] showed that one of the scientific literacies about interpreting data was still low in mathematical concepts, so it became our evaluation to determine how to increase scientific literacy and science process skills needed in 21st century skills [19]. It's a fact from Fitria that scientific literacy is very important to train our students, especially in this digital era and the era of globalization, where many problems must be faced by everyone, including our students in the field.

This fact in line with Permanasari [21] that stated the ability to solve the problem of students was still low because many teachers in junior high schools were still using conventional methods in the learning process. Apart from that, they used speech methods in teaching science, so the students were never trained in scientific literacy or science process skills.

This thing in line with condition students in mathematics education department before this research. There were so many students who don’t have scientific literacy skills and also science process skills. This was supported by observation and short interview with the lecturer that was held before this research was conducted. It is proven by the results of tests in the middle or final semester that showed the results of mathematics subjects were still low, especially in questions about problem solving, interpreting data, and so on.

Departing with the belief that mathematics learning carried out with a realistic approach can play a role in the development of scientific literacy skills and science process skills, the research seeks to prove how far the effect of a realistic mathematics approach on scientific literacy skills and science process skills is. Therefore, this study aims to determine the effect of learning a realistic approach to mathematics on scientific literacy skills and science process skills.

2. Research Methodology

This study used a quantitative approach with a quasi-experimental method. The quasi-experimental design used is a one-group, pretest-posttest design [27]. Therefore, data on scientific literacy skills and critical thinking skills were obtained through tests that were compiled based on the indicators of these two variables. The sample used in this study consisted of 21 physics education students in their fourth semester. To test the hypothesis, a one-way ANOVA test was conducted using SPSS 25. The flowchart of this research can be seen in Figure 1 as follow.

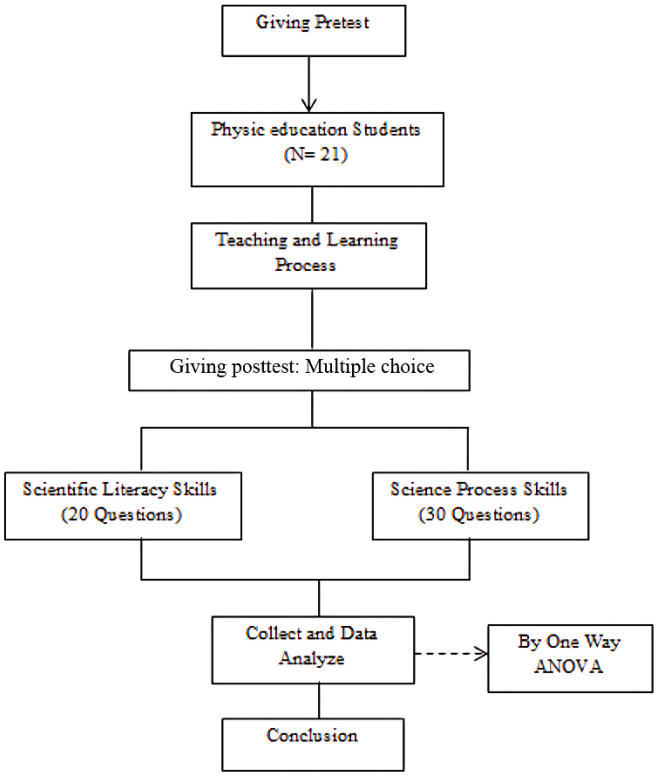

Figure 1.
Research Flowchart.

The scientific literacy skills measured include: (1) Scientific knowledge and the ability to apply it, (2) Understanding the characteristics of science and scientific (research) methods, (3) Scientific awareness, technological understanding, intellectual attitude, and environmental awareness, (4) Involvement in various activities related to scientific issues. Regarding the science process skills, the abilities measured include: (1) observation, (2) classification, (3) measurement, (4) data collection, (5) scientific communication. The instrument used consists of 20 multiple-choice questions for the scientific literacy variable and 30 for the science process skills variable. Thus, each indicator on each variable is measured using five different questions. The student's ability for each variable is determined based on the percentage of the final score. The final score is obtained using the formula:

$$Final\ Score = \frac{attained\ score}{maximum\ score} x\ 100\%$$

Based on the percentage score obtained, the ability of respondents is classified into three groups, namely categories: A (76-100), B (51-75), C (26-50) and D (0-25).

Table 1.
Table Categories of Students' Literacy and Science Process Skills Levels.

No	Score Range	Category
1	76-100	A
2	51-75	B
3	26-50	C
4	0-25	D

3. Results and Discussion

As mentioned above, this study involved 21 students at the 17th Junior High School in Jambi. This study began by conducting a pretest of science literacy skills and science process skills of prospective mathematics teacher students. This is necessary to assess the initial abilities of respondents in these two variables. After all students' answers have been collected and scored, the students' literacy ability data are obtained as shown in Table 2.

Table 2.
Science Literacy Ability and Science Process Skills on Pretest.

Aspect	Range Score	Number	Percentage (%)	Category
Science Literacy	76-100	5	23.81	A
	51-75	5	23.81	B
	26-50	7	33.33	C
	0-25	4	19.05	D
Total 21			100	
Science Process Skills	76-100	4	19.05	A
	51-75	7	33.33	B
	26-50	5	23.81	C
	0-25	5	23.81	D
Total	21		100	

Based on Table 1 it can be seen that, in general, the scientific literacy ability of prospective mathematics teacher students is still dominated by students with a low level at 50.00%, followed by students with moderate categorical abilities at 29.18%. Meanwhile, students with good scientific literacy skills number 5 people, or approximately 20.81%. Regarding science process skills, the ability in the "low" category also still dominates, with 10 people or around 41.64%, while abilities in the "high" and "moderate" categories are equal, each with 7 people or approximately 29.18%. Based on the above situation, efforts to increase the scientific literacy abilities of these students are still very much needed.

Based on the results obtained in the pretest, as many as 21 students were conditioned to participate in the recovery of mathematics courses with a realistic approach to mathematics in the learning process. The teacher held five (5) meetings at the beginning of the odd semester. It is intended that the applied realistic mathematics learning techniques can have a significant impact on the target, namely, increasing students' scientific literacy skills and science process skills.

After five meetings, tests of scientific literacy skills and science process skills were then conducted using the same indicators as the pretest. This means that students' scientific literacy and scientific process skills will remain well-measured. The results of the tests of scientific literacy skills and science process skills can be seen in Table 3.

Table 3.
Science Literacy Skills and Science Process Skills on Posttest.

Aspect	Range Score	Number	Percentage (%)	Category
Science Literacy	76-100	9	42.85	A
	51-75	7	33.34	B
	26-50	4	19.05	C
	0-25	1	4.76	D
	Total	21	100	
Science Process Skills	76-100	7	33.33	A
	51-75	9	42.85	B
	26-50	3	14.28	C
	0-25	2	9.54	D
	Total	21	100	

Based on the table above, it can be seen that, in general, the scientific literacy of prospective mathematics teacher students is better. For the "high" category, there are 11 people or approximately 45.83%, followed by students with a moderate level at 37.50%. Students with good scientific literacy skills number 4 people or around 16.67%. Regarding science process skills, students in the "high" category number 10 people or approximately 41.67%, in the "moderate" category 11 people or about 45.83%, and the remaining 3 people or around 12.50% are capable in the "low" category. Thus, in general, students experience improvements in scientific literacy and science process skills after attending lectures with a realistic mathematical approach.

Furthermore, to determine the significance of the increase in each variable as described above, it is necessary to perform statistical tests. The statistical tests carried out in this study were the homogeneity test and the ANOVA test. The results of the homogeneity test can be seen in Table 4.

Table 4.
Test of Homogeneity of Variances in Science Literacy and Science Process Skill.

a. Science Literacy			
Levene Statistics	**df1**	**df2**	**Sig.**
1.190	5	11	0.314
b. Science Process Skills			
Levene Statistics	df1	df2	Sig.
1,360	6	12	0.412

Based on Table 4, namely, the test for Homogeneity of Variances obtained a significance value of 0.314 for the science literacy variable and 0.412 for the Science Process Skills variable. The significance values in both variables are less than 0.05. It can be understood that the variances of the two tests (pretest and posttest) for each variable are the same or homogeneous.

Furthermore, to determine the significance of the increase, the ONOVA test was carried out. Through this test, it was found that the two variables, namely scientific literacy and Science Process Skills of students, increased significantly after attending lectures with a realistic mathematical approach. In more detail, it can be seen in Table 5.

Table 5.
ANOVA Test Science Literacy and Science Process Skills.

Science Literacy					
	Sum of Squares	**df**	**Mean Square**	**F**	**Sig.**
Between Groups	9410.917	10	855.538	15,031	0.000
Within Groups	640,417	11	53,368		
Total	10051,333	21			
Science Process Skills					
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	10738,542	10	1073,854	13,692	0.000
Within Groups	1027.083	11	79.006		
Total	11765,625	21			

Based on Table 5 namely the ONOVA test, it can be seen that the value of Sig. for the two variables is 0.000 < 0.05, indicating that the two test groups (pretest and posttest) for both the variable of scientific literacy ability and Science Process Skills have different averages. This suggests that the increase in scientific literacy skills and Science Process Skills is very significant. In relation to the data above, it can be understood that the realistic mathematics learning model has a positive effect on scientific literacy skills and Science Process Skill.

As a result of this study, it was found that learning with a realistic approach to mathematics can improve the scientific literacy skills and science process skills of mathematics education students at the 17th Junior High School Jambi. This indicates a close relationship between learning mathematics and natural sciences. Refer to opinion [28] that the essence of natural science, products, processes, and attitudes. The scientific literacy and science process skills are process and attitude categories. Thus, it can be said that learning with a realistic approach to mathematics can strengthen the nature of science learning in terms of attitudes and processes. Thus, this also proves that learning models in mathematics have the potential to be adapted in science learning.

The results of this study also prove that learning mathematics, science and technology can be developed together. It is as opinion Sumira and Aprida [1] that learning with the STEM (science, technology, engineering, and mathematics) approach is a form of innovation in science learning. Even according to Nugroho et al. [29] learning by combining mathematics, science, and technology is a form of learning that is appropriate in the 21st century. Thus, this study provides concrete evidence of the close relationship between learning mathematics and science.

Refer to opinion Narut and Supardi [30] scientific literacy can be defined as the scientific knowledge and skills necessary to identify questions, acquire new knowledge, explain scientific phenomena, and draw conclusions based on facts. It also includes understanding the characteristics of science, awareness of how science and technology shape the natural, intellectual, and cultural environment, and a willingness to engage with and care about science-related issues. Thus, learning with a realistic approach to mathematics incorporating the environment and real objects has been able to trigger various student scientific skills, fostering curiosity in the form of the ability to identify questions. The realistic approach to mathematics has also played an active role in encouraging mathematics education students to acquire new knowledge, explain scientific phenomena, and draw conclusions based on facts, as well as increasing awareness of how science and technology shape the natural environment. This aligns with the opinion [31] that Realistic Mathematics learning has a very high contribution to students' understanding and students' thinking abilities. It is also based on opinion [32] that realistic mathematics learning affects the mathematical literacy of students. Similarly, research results [33] states that realistic mathematics learning can convincingly improve students' mathematical literacy, while mathematics itself is part of science.

Associated with the effect of learning with a realistic mathematical approach to science process skills, this is also understandable. This is based on opinion [34]. That defines science as a system for understanding the universe through controlled observation and experimentation. Controlled observation and experimental activities are part of activities that involve process skills, while in realistic learning, both activities are clearly visible and actually implemented. This refers to the opinion [11] that the realistic mathematical approach is basically the use of reality and the environment that students understand, real or concrete things that can be observed or understood by students through imagining, while what is meant by the environment is the environment in which students are located, both in the school, family, and community environments can be understood by students. Thus, the process of observation and the use of the environment are strongly suspected to be triggers for increasing science process skills. This is based on research results [35] that learning by exploring the surrounding (contextual) environment, as well as a realistic approach to mathematics, can improve science process skills. This finding is

also in line with the definition of science process skills stated by Astuti [11]. Process skills involve cognitive or intellectual, manual, and social skills. In realistic mathematics learning activities, there are cognitive or intellectual, manual, and social skills, as well as the character of the science process skills themselves.

4. Conclusion

Referring to the data and discussion carried out as described above, at the end of this study, it can be concluded that learning with a realistic approach to mathematics has a positive effect on students' scientific literacy skills and science process skills at the 17th Junior High School, Jambi. This is based on the results of the ONOVA test, where the value of Sig. for both variables is 0.000 < 0.05. This result indicates that the two test groups (pretest and posttest), both on the variables of scientific literacy ability and science process skills, have different averages. It means that the increase in scientific literacy skills and science process skills is very significant. In relation to the data above, it can be understood that the realistic mathematics learning model has a positive effect on scientific literacy skills and science process skills.

It can be seen that there was an increase in both skills during the learning process of realistic mathematics learning conducted over five meetings. This research provides potential insights into pedagogical research. To train the skills, teachers must have pedagogical abilities that can be effectively transferred to students, not only in mathematics concepts but also in how teachers can educate and transfer knowledge until the skills are well developed. Furthermore, it can provide guidelines for future research standards, ensuring that the fundamental literacy component and science process skills are not overlooked or underemphasized for all students. As we know, in this globalization era, science literacy and science process skills are essential skills that students need in the 21st century. Therefore, it is highly recommended to provide opportunities for teachers to motivate students to develop appropriate strategies, become more critical, and conduct investigations to solve real problems they face through science literacy and science process skills.

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