Practicality of Project Model Learning Tools Assisted by Augmented Reality to Improve Scientific Literacy and Creative Thinking Skills

Ahmad Harjono[1,2]*, Gito Hadiprayitno[1,3], & Naf'atuzzahrah[1]
[1]Master of Science Education Program, University of Mataram, Indonesia
[2]Physics Education Program, University of Mataram, Indonesia
[3]Biology Education Program, University of Mataram, Indonesia
*Corresponding Author e-mail: harjonofkip@unram.ac.id

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Abstract - *This research aims to determine the practicality of project model learning tools assisted by augmented reality to improve students' scientific literacy and creative thinking skills. This development research procedure refers to the stages in the 4D model which consists of four main stages, namely definition, design, development and dissemination. Practicality testing is carried out at the development stage after the definition and design stages. The instruments used for the practicality test consisted of observation sheets on learning implementation, teacher and student response questionnaires. The observers involved in filling in the learning implementation observation sheet and response questionnaire were 1 science teacher and 20 class VIII students islamic junior high school (MTs) in West Lombok, NTB. The results of the observation analysis of learning implementation at the first, second and third meetings were 91%, 97% and 99% respectively in the very practical category. The results of the analysis of teacher and student responses have a percentage of 97% and 93% in the very practical category. These results show that the tools developed are practical to apply in science learning.*

Keywords*: Practicality; Project Models; Augmented Reality; Scientific Literacy; Creative Thinking Skills.*

INTRODUCTION

The world development of the 21st century is marked by the use of information and communication technology in various life activities, including in the field of education (Liesa-Orús et al., 2020). The implementation of educational activities must be able to adapt to existing developments. Science is one of the subjects that has an important role in facing and supporting the rapid development of science and technology (Gultom & Alwi, 2024). Some of the skills needed to face the developments that occur include creativity, literacy, communication, problem solving, critical thinking and collaboration (Thornhill-miller et al., 2023). Thus, students need to be prepared and trained to have good competencies including the ability to think critically and creatively, be able to communicate and collaborate and have the ability to master technology and scientific literacy.

Scientific literacy and the ability to think creatively are part of the 21st Century skills demands that students must possess. Scientific literacy is the ability or skill that a person has in using knowledge and understanding of scientific concepts and processes to identify, explain scientific phenomena and make decisions regarding the natural environment (Kristyowati & Purwanto, 2019). In science learning, this ability has an important role in developing skills and creativity based on scientific knowledge that is relevant to everyday life and making decisions to solve problems (Jufrida et al., 2019). Students who have scientific literacy skills will be able to apply the knowledge learned to solve problems

well in everyday life (Arding & Atun, 2020). Determining the level of achievement of students' scientific literacy can be known by referring to the indicators set by PISA which include several aspects, namely explaining phenomena scientifically, designing and evaluating scientific investigations, and interpreting data and evidence scientifically (OECD, 2019). The indicators of scientific literacy skills achieved represent that students have good mastery of scientific literacy. Apart from scientific literacy abilities, students are also required to have creative thinking skills. The ability to think creatively is often described as someone who has many ideas, is used to thinking critically and is able to combine ideas that have never been connected before to produce new, useful ideas. The ability to think creatively is an important aspect in creating innovation and finding ideas to solve a problem. Creative thinking can train students to develop many ideas and arguments (Khoiriyah & Husamah, 2018). Through creative thinking skills, students will be able to modify, reuse, or even create new ideas or products and be able to understand the information obtained from different points of view (Özdas & Batdi, 2017). The ability to think creatively can train students to be flexible and see opportunities in facing challenges in a world that continues to develop rapidly (Ritter & Mostert, 2016). Creative thinking ability is the ability of students to analyze various possible solutions to a problem in learning by thinking fluently, thinking flexibly, thinking originally and thinking in detail (Warodiah et al., 2023). The creative thinking ability possessed by students can help students to develop in the learning process in the classroom. Students who have creative thinking skills will always develop their ideas or concepts by thinking broadly and much more advanced (Septikasari & Frasandy, 2018). The potential for creative thinking skills possessed by students can help them in producing innovative, meaningful and quality work. Indicators of creative thinking skills are used as a reference in compiling assessment instruments based on problems that occur in schools.

Based on the results of observations carried out at one of the islamic junior high school in West Lombok, NTB, conditions in the field show that students' scientific literacy and creative thinking skills are still relatively low. This is because the learning process has not trained and accustomed students to hone their thinking abilities and solve problems scientifically. Apart from that, the learning tools available in schools are not yet complete. The learning tools available are only general components consisting of syllabus, lesson plans and test instruments. Learning resources and supporting media in science learning are also still very limited and have not been integrated with the use of technology, so that the learning carried out is monotonous and unable to facilitate the development of students' scientific literacy and creative thinking skills. Therefore, it is necessary to innovate through the development of learning tools that can support increasing scientific literacy and students' creative thinking skills.

Learning tools are an important component for teachers to prepare before carrying out learning activities at school (Karimulah & Ummah, 2022). In the process of preparing learning tools, teachers must determine and choose the appropriate learning model (Galvis, 2018) as well as the right media so that they can support the learning process well (Mustafa & Zulhafizh, 2019) (Logayah et al., 2023). One of the innovative learning models that can be used in science learning is project based learning

(Susanti et al., 2019). Project based learning is a learning model that has widely been implemented in advanced educational institutions. Some study defines project based learning as a learning model organizing students in the classroom to work on projects in a group atmosphere in solving a real-world problem and preparing themselves for real life (Badaruddin et al., 2024). Learning stages with the project based learning model include start with the essential question, design a plan for the project, create a schedule, monitoring the students and progress of the project, assess the outcome and evaluate the experience (Winangun, 2021). Project based learning is a form of learning that focuses on students. Students are actively involved in the learning process. In implementing the PjBL model, students are guided to solve problems through giving project assignments in groups by the teacher (Nurhidayah et al., 2021). Students when working on project assignments are given the freedom to determine the product that will be created and presented. This PjBL model can help students train critical and creative thinking skills to produce quality products (Elisabet et al., 2019).

The use of a learning model can be combined with the help of media as a support so that learning becomes better, especially technology-based media (Rizaldi et al., 2020) (Putra & Pratama, 2021). In this research, the technology-based media used is augmented reality media. AR technology in the learning process can provide new learning experience and can train skills and knowledge in the 21st century. The development of the learning process by utilizing current technological developments needs to be adjusted to the characteristics of 21st century learning. The fact that learning is still not being implemented well enough and optimally in schools encourages several studies that integrate AR technology into learning, including science learning (Vari, 2022). AR is a technology that integrates three-dimensional objects into a real environment using a camera on a device (Maulana et al., 2019). AR technology can help students understand objects in science learning more realistically with flexible time and impressive experiences. AR media has been developed for science learning, especially physics science material about pressure in substances and its application in everyday life, which based on references from several articles shows that the AR media that has been widely developed is integrated with biology science material (Samsiyanawati et al., 2023). Through innovative AR media, abstract science learning can be presented in a more interesting way so that it can train and develop students' 21st Century skills (Endaryati et al., 2021).

Based on the explanation above, an innovation was carried out in the form of developing project model learning tools assisted by augmented reality to increase students' scientific literacy and creative thinking skills. To be applied in learning, the product that has been developed must go through a practicality testing stage. Practicality is a measure to determine the implementation of learning and shows the responses of teachers and students to a learning tools product being developed (Rejeki, et al., 2022).

RESEARCH METHODS

This type of research is research and development with 4D model design. The research with 4D model design consists of four stages, namely definition, design, development and dissemination (Sugiyono, 2019). The research was conducted in July 2024 at the Islamic Junior High School (MTs) in West Lombok, NTB. The research

population is class VIII students with the research sample being class VIII A with a total of 20 students. The practicality test of this learning device was carried out at the development stage after validation tests were carried out by expert validators. In this research, development activities are intended to develop a learning tool consisting of a syllabus, lesson plans, teaching materials, student worksheet, learning media (augmented reality) as well as scientific literacy test instruments and creative thinking skills. This research aims to determine the practicality of project model learning devices assisted by augmented reality to improve students' scientific literacy and creative thinking skills.

Practicality is the ease of using a product so that it does not make it difficult for users. The practicality meant here is the practicality of a product in the form of a science learning tool. The level of practicality of a learning tool can be known after it is applied in learning activities and then given an assessment by the user (SC, Pattimura; Maimunah; Hutapea, 2020) (Natalia, 2021) (Ramadhani et al., 2021). Practicality testing is carried out after the product being developed is declared valid for testing based on validation results by expert validators (Wicaksono et al., 2020).

Table 1. Practicality Criteria for Learning Tools

Range of Values Percentage	Level of Practicality
81 – 100 %	Very practical
61 – 80 %	Practical
41 – 60 %	Quite practical
21 – 40 %	Less practical
0 – 20 %	Impractical

(Arikunto, 2013).

Data on practical results was obtained through observation sheets on learning implementation as well as teacher response questionnaires and student response questionnaires. The data is analyzed using the following equation:

$$Practicality\ (\%) = \frac{Total\ Score}{Max\ Score} \times 100\% \quad (1)$$

The criteria for percentage calculation results can be seen in Table 1.

RESULTS AND DISCUSSION

Practicality analysis of learning tools is carried out to determine the practicality of the product that has been developed. Data collection was carried out by filling in practical instruments by observers, teachers and students. Practical instruments are in the form of observation sheets on learning implementation as well as teacher and student response questionnaires to the products being developed. Data collection activities were carried out during the learning process, the observation sheet for learning implementation was filled in by the observer, the teacher response questionnaire was filled in by the science teacher and the student response questionnaire was filled in by class VIII students in Islamic junior high school.

1. *Data from Observation Results of Learning Implementation*

Observation activities during learning were carried out to determine the practicality of the product when used in the learning process. Assessments are carried out on the teacher's ability to manage learning and students during the teaching and learning process in the classroom. The observer who provided the assessment in this case was a class VIII science teacher at a private MTs in West Lombok, NTB. Assessment activities are carried out during three learning process meetings in the classroom. Assessment is categorized into three phases of learning activities, namely initial activities, core activities and final activities with details of 5 statements in the initial

activities, 14 statements in the core activities and 2 statements in the final activities. The results of learning implementation can be said to be practical if the minimum average score percentage is in the good (practical) category (Wiratama, 2019). The results of the analysis of the learning implementation observation sheet can be seen in Table 2.

Table 2. Data from Observation Results of Learning Implementation

Learning Activities	Score (%)		
	1st Meeting	2nd Meeting	3rd Meeting
Initial activities	88	96	100
Core activities	96	94	97
End activities	90	100	100
Average score	**91**	**97**	**99**
Category	**Very practical**	**Very practical**	**Very practical**

The results of the practical analysis based on the observer's learning implementation observation sheet can be seen more clearly in Figure 1.

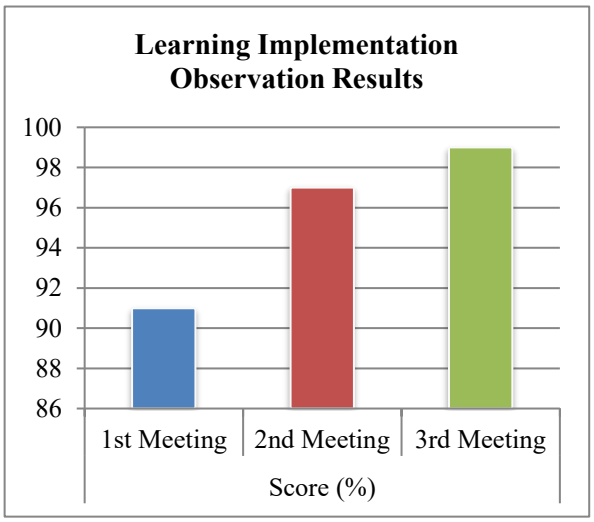

Figure 1. Results of Observation Analysis of Learning Implementation by Observers

Learning activities refer to the steps in the project model which include: determining basic questions, designing project plans, preparing schedules, monitoring students and project progress, assessing the products produced and evaluating experiences. Implementing learning by referring to the project-based learning model is very influential in realizing the 21st Century learning process and can improve 21st Century skills (Rafik et al., 2022) (Undari et al., 2023). Based on the results of the analysis above, the average value of learning implementation at the first meeting was 91% in the very practical category, the second meeting was 97% in the very practical category and the third meeting was 99% in the very practical category. These results show that the implementation of learning at each meeting is very practical and carried out in accordance with the planning contained in the RPP.

The first meeting had a lower percentage of implementation than other meetings, this was because there were several obstacles experienced at the first meeting, namely the school Wi-Fi network which could not be accessed so students used their respective internet quotas for those who had them. Seeing the obstacles that occurred, researchers carried out an evaluation and looked for alternative solutions by preparing additional internet (Hotspot) for students. This can hinder the smooth implementation of learning, so that at the first meeting the reflection activities on the activities and results of projects that have been carried out have not been carried out well. However, at the next meeting, based on the evaluation carried out, learning activities could be carried out better than before.

2. Data on Teacher Response Results

Analysis of teacher responses was carried out to determine the observer's response to the learning tools that had been

developed, in this case a class VIII science teacher. The contents of the statements in the teacher response questionnaire are arranged based on the type of product being developed, including 5 statements related to the syllabus, 8 statements related to lesson plans, 6 statements related to teaching materials, 10 statements related to LKPD, 9 statements related to augmented reality media, 3 statements related to scientific literacy test instruments and 3 statements related to the creative thinking ability test instrument, so the total number of statements in the questionnaire is 44 statements. The results of the questionnaire analysis of teacher responses to learning tools can be seen in Table 3.

Table 3. Data on Teacher Response Results

No.	Product	Response Results (%)	Category
1.	Syllabus	100	Very practical
2.	Lesson Plan	95	Very practical
3.	Teaching Materials	90	Very practical
4.	Student Worksheet	98	Very practical
5.	Learning Media (*Augmented Reality*)	98	Very practical
6.	Scientific Literacy Test Instrument	100	Very practical
7.	Creative Thinking Ability Test Instrument	100	Very practical
Average score		**97**	**Very practical**

The results of the practical analysis based on the teacher response questionnaire can be seen more clearly in Figure 2.

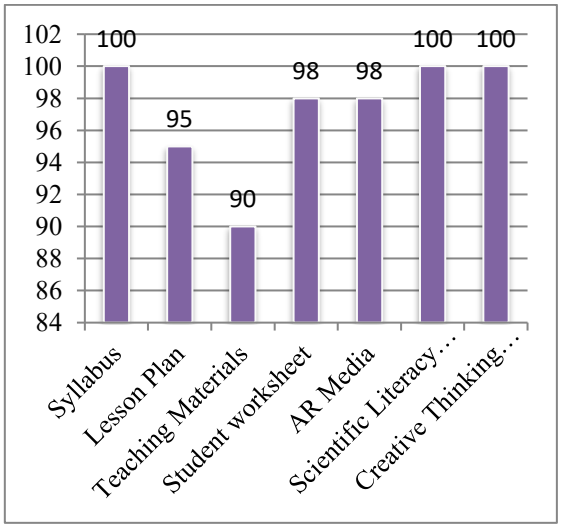

Figure 2. Teacher Response Results

Based on the analysis above, the results of teacher responses to the learning tools developed in detail are 100% syllabus in the very practical category, 95% lesson plans in the very practical category, 90% teaching materials in the very practical category, 98% student worksheet in the very practical category, media AR 98% in the very practical category, 100% scientific literacy test instrument in the very practical category and 100% creative thinking ability test instrument in the very practical category. Data recapitulation shows that teacher responses to the developed RPP are included in the very practical category, but adjustments are needed in the learning steps because the project-based learning model has never been implemented in previous learning. Teaching materials are included in the very practical category because they already contain a complete description of the material. LKPD is included in the very practical category which is adjusted to the steps in the project model. AR media is included in the very practical category because it is interesting to use in science learning and can increase student enthusiasm in learning. The test instruments that have been developed are included in the very practical category because they can be used to measure student competencies related to scientific literacy and creative thinking skills that have never been done before. Based on these results, the learning devices that have been developed are very practical to use in the learning process with a few revisions.

3. Data on Student Response Results

Analysis of student responses was carried out to determine user responses, namely students, to the learning tools that have been developed, in this case consisting of 20 respondents. The respondents were students in class VIII A at islamic junior high school in West Lombok, NTB. The contents of the statements in the student response questionnaire are arranged based on the components of the product being developed, including 12 statements related to the implementation of learning activities, 5 statements related to teaching materials, 10 statements related to LKPD and statements related to augmented reality media that has been used during the learning process, so that the total number of statements in the questionnaire there are 37 statements. The results of the questionnaire analysis of student responses to learning activities and products developed can be seen in Table 4.

Table 4. Data on Student Response Results

No.	Rated Aspect	Response Results (%)	Category
1.	Learning Activities	94	Very practical
2.	Teaching Materials	93	Very practical
3.	Student Worksheet	91	Very practical
4.	Learning Media (*Augmented Reality*)	95	Very practical
Average score		**93**	**Very practical**

The results of the practical analysis based on questionnaire responses by students can be seen more clearly in Figure 3.

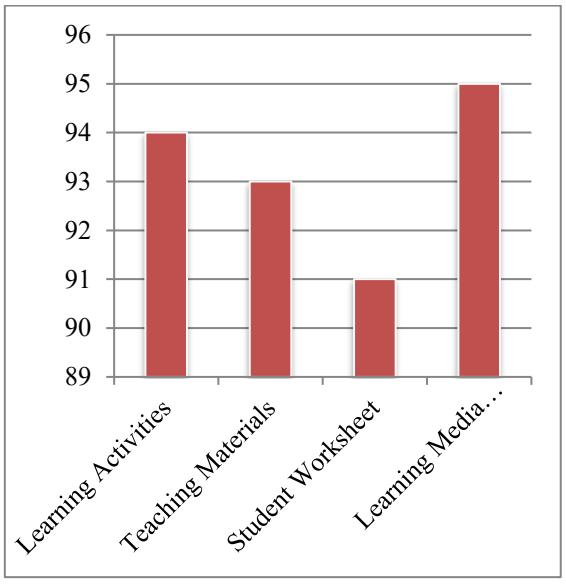

Figure 3. Student Response Results

Based on the analysis above, the results of student responses to the products developed in detail are 94% learning activities in the very practical category, 93% teaching materials in the very practical category, 91% LKPD in the very practical category and 95% AR media in the very practical category . This is in line with research results which show that STEM-based PjBL learning tools are practical for improving students' creative thinking skills and creativity (Fajria et al., 2022) (Ridha et al., 2022). Apart from that, the development of practical project based learning model instructional designs to increase scientific literacy (Nuraini & Waluyo, 2021). Ethno-Augmented Reality is very practical as an alternative digital science learning media (Pusparani & Selamat, 2021). Android Augmented Reality Smart Card media is practical for improving students' creative thinking skills and learning outcomes (Rahmawati et al., 2023).

The results of student responses to learning activities show that learning activities have a positive response with a very practical category. Students responded that project-based learning activities have never been done before, so they are interesting to do, however there are still students who also complain because they are not used to learning using project-based models. Teaching materials have a positive response with a very practical category. Students responded that the teaching

materials that are prepared are interesting because they are integrated with an android-based media. Student worksheet has a positive response with a very practical category. Students responded that they have never used student worksheet based on project based learning, so that it is a new experience to work on, but the obstacles faced are that students still have difficulty in understanding the stages of activities carried out based on the instructions in the student worksheet so that additional explanations are needed directly by the teacher in detail and in detail. AR media has a positive response with a very practical category. Students responded that they were very interested in learning science using media, especially those based on Android. Although there were several obstacles such as students who had difficulty installing the application, overall students were able to access and use the AR application well after being given an example at the first meeting. Although the school is located in a rural area, it turns out that on average students have Android phones that meet the specifications to install the AR application. They are very enthusiastic about using learning media because in previous learning it was rarely integrated with technology-based media.

The practicality of a product in the form of a learning device can be assessed based on the results of testing the product in the learning process at school. Learning device products can be said to be practical if they have been assessed by practitioners through learning implementation sheets, teacher and student response questionnaires. If the results of the assessment by practitioners are included in the practical category, then the product can be applied in learning (Rahayu et al., 2019). Thus, based on the results of the analysis of learning implementation, the results of the analysis of teacher and student responses, the project model learning tools assisted by augmented reality were developed practically to be applied in learning to increase students' scientific literacy and creative thinking skills.

CONCLUSION

The project learning model tools assisted by augmented reality to improve scientific literacy and creative thinking skills that was developed has very practical criteria based on the results of learning implementation analysis with a score of 96%, teacher response results with a score of 97% and student response results with a score of 93%. Thus, it can be concluded that the project model learning tools assisted by augmented reality are practical to be applied in science learning to improve scientific literacy and creative thinking skills that students must master in accordance with the skills needs of the 21st Century.

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