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Development of Android-Based Science Learning Media "Wismaya" with an Inquiry Approach in Improving Critical Thinking Ability

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Abstract: This study aims to develop an android-based game learning media by applying the steps of the ADDIE model RnD research method. The data collection technique was in the form of a validated questionnaire for media experts, linguists, materials, teachers, and student responses. The results of media, material, and language validation were 0.917; 0.898, and 0.791 with very feasible criteria for media and material validation, while for language validation it shows feasible criteria. The classical mastery of student learning outcomes reached 94% and the N percent gain of 59.34 indicated that the criteria were quite effective. Student responses were seen from the usefulness, convenience, and satisfaction indicators each of 0.82; 0.9; and 0.92 indicating very good response criteria. The teacher's response questionnaire, seen from the indicators of presentation and use of language, was 0.9 and 0.875 respectively, indicating very good response criteria, while in the indicators of instructions for use, the suitability of the material and suitability for student needs were each 0.75; 0.8; and 0.79 indicates good response criteria. The results of the application of android-based science learning media with an inquiry approach can improve the critical thinking skills of class IV students on style material.

Keywords: Android-based Learning Media; Critical Thinking; Inquiry Approach

Introduction

The quality of education of a nation can be measured through the culture of thinking of its people. The rapid development of technology and information requires that the educational process be able to produce students who have high-order thinking skills, which refer to 21st-century skills. Assessment and Teaching of 21st-Century Skills categorize 21st-century skills consisting of the way of working, tools for working, way of thinking, and skills for living in the world (Azizah, 2019). These skills are considered essential to face the challenges expected to be contained in the 21st century (Moyer, 2016).

The challenges contained in the 21st century are not only related to technological literacy, but also include other skills in the form of critical thinking, problem-solving, communication, and teamwork or collaboration (Cagurangan, 2017). The focus of skills development includes skills in life, career, learning, innovation, and the use of information technology media (Zakiyah & Sudarmin, 2022). Schools as educational institutions are required to produce students who have creative thinking skills, communicate, collaborate, and have critical thinking skills (Syadiah & Hamdu, 2020).

Critical thinking skills are basically thinking in a way out of the usual flow of thought, to learn how to further examine or re-examine something that has become generally accepted knowledge (Gojkov, 2015). These skills form a critical attitude in learning about reality, thinking from several angles, evaluating many aspects, looking for other solutions, verifying and analyzing, evaluating and synthesizing complex information by giving reasoned explanations (Poce, 2020). Critical thinking skills are the heart of the world of education, so they need to be developed and given

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special attention so that they can be trained for students (Widiyatmoko et al., 2021), through the habit of thinking by learning to reason which involves the thinker's own activities (Negoro, 2018). Critical thinking skills training needs to be developed in learning science in elementary schools (Sarwi, 2021).

The relevance of critical thinking skills in science learning is the need to prepare students to become mature decision makers to solve a problem, to become tough problem solvers so they don't easily give up and someone who never stops learning (Yafie & Sutama, 2019). According to Angelo quoted in (Mahrunnisya, 2023) critical thinking indicators include the ability to analyze, conclude, synthesize, solve problems and evaluate. Critical thinking indicators in understanding concepts in science learning include indicators of providing simple explanations, making further explanations, building basic skills, analyzing data, identifying assumptions and analyzing solutions (Ramdani et al., 2020).

Based on the results of observations made at SD N Karangtengah 01 on 4-15 May 2023 in class IV in learning style material, it shows that the percentage of critical thinking skills in indicators of synthesizing (52%), solving problems (57%) and evaluating (55 %). This shows that critical thinking skills in the indicators of synthesizing, solving problems and evaluating are still in the low category. Critical thinking skills seen from the indicators of analyzing and concluding are included in the medium category with the percentage of analyzing (65%) and concluding (68%).

The ability to think critically in understanding concepts, of the five indicators of critical thinking, only the indicators giving simple explanations are met. Students still have difficulty in giving assumptions and analyzing solutions to the problems given. Students also still have difficulty in connecting force material with motion in everyday life. This can be seen from the learning outcomes which show that 16 out of 19 grade IV students have not completed the KKM. The findings obtained are also supported by the findings (Hermita, 2021) which stated that after carrying out a conception test on elementary school students, it was concluded that 54.29% of the total number of students experienced misconceptions about force and motion material.

This problem occurs because the learning done has not fostered students' critical thinking skills. Science learning still tends to be oriented towards textbooks. The material presented in the textbook is only in the form of text and pictures which only explain various styles and examples of their application in everyday life. Illustrations of how the real application of force and the relationship between force and motion are not yet found in textbooks. Learning like this has not been able to increase student activity because learning is still teacher-oriented. This learning also results in the enthusiasm of students in answering teacher questions which is still limited in theory. The answers given by students have not shown development that is in accordance with their potential and thinking abilities. This a learning approach is needed that can develop skills in solving a problem and communicating it so that students can be actively involved in learning.

One of the learning approaches that requires active student involvement in the learning process is the inquiry approach. Appropriate inquiry approach used in the science learning process (Putra, 2017). Inquiry maximally involves all students' abilities to seek and investigate a problem in a systematic, critical, logical, analytical manner, so that students can formulate their own findings with confidence (Fegi, 2021), and communicate it as an important aspect of life skills (Norrizqa, 2016). Inquiry learning will be more optimal if there is a role of learning media, so that the inquiry learning process can achieve more optimal learning objectives.

In essence, learning media helps students to expand or extend their ability to feel, hear or see within the limits of a certain distance, space and time (Mudlofir & Rusydiyah, 2016; Rusydiyah & Fatimatur, 2016). Limitations of distance, space and time are overcome by using learning media that involve the development of technology and information (Firdaus Zakaria et al., 2020), which has become a determining aspect of the speed and success of science by mankind because the world of science is increasingly interconnected, so that the synergy between the two becomes faster (Wardani et al., 2017).

Based on the results of observations made at SD N Karangtengah 01, it can be concluded that the use of instructional media involving the development of technology and information can be applied in schools. The supporting factors are the availability of facilities and infrastructure that support the implementation of learning that involves the use of technology-based learning media. These facilities are in the form of an LCD projector, the availability of several computers and computer training given to students. The availability of an internet network at SD N Karangtengah 01 and several elementary school students who already have cellphones also supports the use of learning media that involves the development of technology and information. One of the learning media that involves the development of technology and information is Android-based learning media.

The use of Android-based learning media can be accessed anywhere, both at school and at home (Ramdani et al., 2020). This learning media is suitable for

use in elementary schools, especially in material that requires abstract thinking (Siswosuharjo et al., 2021). The use of Android-based learning media presents information that significantly influences students' critical thinking skills, so that this learning media can support the mastery of 4C skills (Jannah & Atmojo, 2022). 4C skills include critical thinking skills, creative thinking, communication and collaboration skills. Not only that, Android-based learning media can also improve student learning outcomes (Prasetyo, 2017).

The application of android-based learning media combined with an inquiry approach is needed in the learning process to improve students' conceptual understanding and critical thinking. Research conducted Susilawati (2017) shows that inquiry-based science learning media implemented in tiered inquiry training supports critical thinking and questions. Inquiry learning emphasizes the process of inquiry which is facilitated through various activities. Besides that, Har (2015) states that the process of implementing science learning through an inquiry approach can increase student activity and science learning outcomes, because the inquiry approach to science learning makes learning more fun and can generate enthusiasm and enthusiasm for students in learning (Suansah, 2015).

In several previous studies, the development of android-based learning media using an inquiry approach can improve students' critical thinking skills. The difference between this research and the previous research is that this research focuses more on the development of Android-based learning media using an inquiry learning approach, which presents illustrations of how force works in everyday life and illustrations of the relationship between force and motion, as well as providing exercises that emphasize students' critical thinking training. to face developments in the 21st century. The media that will be developed in this study is named Wismaya (Gaya House Tourism).

Wismaya is a learning medium that is used to understand the concept of style and motion, improve critical thinking skills as well as instill a sense of nationalism in students. Wismaya's learning media is in the form of educational games. This media chooses the concept of a house which contains several rooms that must be passed by students, to be able to pass through these spaces, students must answer questions related to knowledge about the Unitary State of the Republic of Indonesia correctly. These activities are in accordance with the characteristics of elementary school students who like to play and like to be involved in something.

Based on the description that has been described, this research will develop an android-based science learning media "Wismaya" with an inquiry approach in improving the critical thinking skills of class IV students on style material. The purpose of this research is to describe the characteristics, measure the level of feasibility, measure the level of effectiveness and describe the responses of students and teachers to the development of Wismaya media.

Method

The method used in this research is the RnD research method using the ADDIE model which consists of five steps, namely Analyze, Design, Development, Implementation and Evaluation. The subjects of the development research were 121 grade IV students consisting of 19 students at SDN Karangtengah 01 as subjects of a small-scale trial. The large-scale trial in the control class consisted of 44 students from SDN Tuntang 03. The subjects of the large-scale trial in the experimental class consisted of 59 students, namely 18 students from SDN Tlogo, 19 students from SDN Karangnganyar 01 and 23 SD N Tlompakan 01.

The media development stage starts from analyzing learning needs, making flowcharts, storyboards, developing learning media, validating products by validators consisting of 3 media experts, 2 material experts and 2 linguists, then revising the initial product. The repaired product is tested in small and large group trials. Data from trials were analyzed and evaluated.

Data collection techniques used in this study were interviews, questionnaires, observation, documentation and tests. Interview data collection techniques were carried out to identify problems at the time of initial data collection. Questionnaire or questionnaire data collection techniques are used to collect data on product validity, product feasibility and teacher and student responses to media development. Observation data collection techniques are carried out to observe learning activities using Android-based learning media with an inquiry approach. Documentation data collection techniques are used as a complement to the use of observational data. Test data collection techniques in the form of learning achievement tests are used to collect product effectiveness data. Questionnaire data analysis technique using a Likert scale. Giving scores using a Likert scale model according to Habiby (2017) can be seen in Table 1 .

Table 1. Interpretation Criteria

Score	Criteria
1	Very Less
2	Less
3	Enough
4	Good
5	Very Good

Scores from the questionnaire were analyzed using the formulas from Aiken's V as formula 1.

$$V = \frac{\sum s}{n\,(c-1)} \quad (1)$$

The data obtained is converted into a qualitative value in accordance with the assessment criteria according to Prihono (2019) listed in Table 2.

Tabel 2. Learning Media Assessment Criteria

Score	Categories
$0.80 < r_{xy} \leq 100$	Very High/Very Feasible Validity
$0.60 < r_{xy} \leq 80$	High/Decent Validity
$0.40 < r_{xy} \leq 60$	Moderate Validity/Fair enough
$0.20 < r_{xy} \leq 40$	Low validity / Less feasible

Data analysis techniques for students' critical thinking skills through effectiveness tests and improvement tests. The learning process is said to be classically effective if 75% of student scores reach the KKM. The KKM limit for the IPAS subject is 75. Classical completeness can be calculated using the following formula 2.

$$\text{Completeness Presentation} = \frac{t}{n} \text{ x } 100\ \% \quad (2)$$

Information:

t : Many students complete KKM

n : Lots of students

Test the improvement of students' critical thinking skills, using the standardized Hake gain formula 3.

$$\text{Gain (g)} = \frac{\%\ posttest - \%\ pretest}{100 - \%\ pretest} \quad (3)$$

Criteria for improving students' critical thinking skills can be seen in Table 3. The value of the n gain score is then used as a percent and then interpreted into the effectiveness category of n gain percent with the interpretation guide as in Table 4.

Table 3. Classification of Normalized g Value Interpretation

Value	Categories
g> 0.7	High
$0.3 \leq g \leq 0.7$	Medium
g < 0.3	Low

Tabel 4. Category Interpretation of Effectiveness N Gain

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

Result and Discussion

The product developed is in the form of Android-based science learning media with the help of the Adobe Falsh CS6 app. Media development is used to analyze the critical thinking skills of fourth grade elementary school students in the material of style and its application in everyday life as well as the relationship between force and motion. Android-based media development is packaged in an extension (apk) in the form of an educational game called Wismaya (Tourism Rumah Gaya). Wismaya has the concept of a house that has several information rooms, to be able to proceed to the next room, students must answer questions related to the Republic of Indonesia to foster a sense of nationalism in students. The components in the Wismaya learning media are as follows: The initial display is a cover with a start button to enter the menu.

Figure 1. Front view of Wismaya

The menu section contains five menu options, namely instructions, basic competency materials, games which include style material, evaluation menus, and profiles.

When the user selects the instructions menu, instructions for using learning media will appear. When the user selects the CP menu, the basic competencies will appear. When the user selects the game menu, it will bring up a styled material complemented by audio, visuals, and animations. In the game menu, there are 7 rooms, namely the Anya room (Definition of Force), Yasek room (Swipe Force), Yasi room (Gravity Force), Yatot room (Muscle Force), Yanet room (Magnetic Force), Yagas room (Spring Force), and the Yatrik (Electric Force) space. Each room has a brainstorming room that hones students' critical thinking skills. When the user selects the evaluation button, the evaluation section will immediately appear and is already linked to the quizizz application. In the evaluation section, the researcher made 25 multiple choice practice questions and 5 essay. When the user selects the profile button, the learning media creator (researcher) profile button will appear.

Figure 2. Wismaya Menu Display

The Wismaya learning media that had been developed were then validated by 3 media experts, 2 material experts and 2 linguists. The media validators consisted of Lecturers from UIN Salatiga who graduated with a computer master's degree, IT supervisors and IT support. The expert validators consist of the head of basic education study program at UIN Salatiga with a master of science degree and lecturer at UIN Salatiga with a master of science degree. Language validator from the Head of Basic Education Study Program at UIN Salatiga and Indonesian Lecturer at UIN Salatiga.

Product validation is carried out with the aim of obtaining the validity and feasibility of the learning media that have been developed. Indicators Based on the results of the learning media validation test, the results are shown in Table 5.

Tabel 5. The results of the media validation assessment by media, material and language

Validity Test	Validity	Intepretation
Media Expert	0.92	Very High/Very Feasible Validity
Materials Expert	0.90	Very High/Very Feasible Validity
Linguist	0.79	High/Decent Validity

Based on the results of the validation test in table 5, it can be concluded that the development of Wismaya learning media is feasible with revisions. Suggestions and comments from the validator are used to revise the development of learning media. The stage after revising the media development is a small scale trial. Small-scale trials to find out and identify various problems such as lack of strengths and effectiveness when used by students. A small-scale trial was conducted at SD N Karangtengah 01 which consisted of 19 grade IV students. The results of small-scale trials.

Tabel 6. Small Group Response

Indicator	Validity	Intepretation
Usefulness	0,855263	Very Good
Convenience	0,842105	Very Good
Satisfaction	0,907895	Very Good

Table 6 show that Wismaya learning media with an inquiry approach are effectively used in class IV because the classical completeness is more than 75%. Student responses to Wismaya media development with an inquiry approach were also very good. The next stage is a large-scale trial consisting of a control class and an experimental class. The control class is the class that is not given treatment, meaning that learning does not use Wismaya media with an inquiry approach. The experimental class is the class that is given treatment, meaning that learning uses Wismaya media with an inquiry approach. The learning outcomes of the control class and experimental class can be seen in table 8.

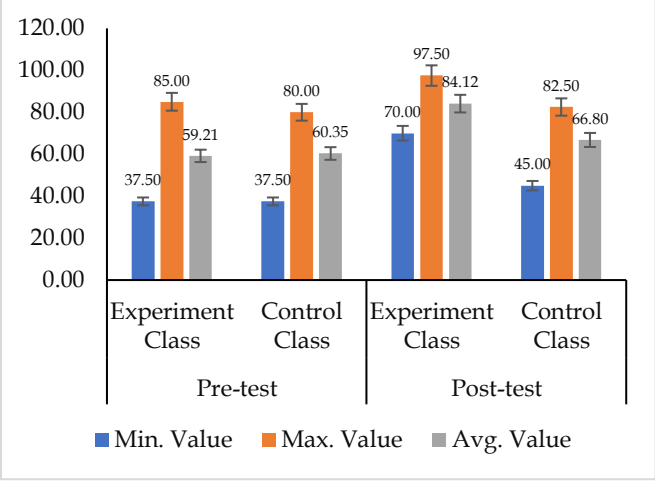

Figure 3. Learning Outcomes of Control and Experiment Classes

The increase in critical thinking skills in the control class and experimental class was tested using the n gain increase test through the independent t test first with the condition that the data must be normally distributed. Normal distributed data can be seen from the normality and homogeneity tests. Data in the normal category is an absolute requirement in the independent t test, while homogeneous data is not an absolute requirement in the independent t test. The results of the normality test, homogeneity and the independent t test.

The sig value is more than 0.05, so the data is included in the normally distributed category. Table 10 shows the sig value is less than 0.05, so the data is not homogeneous. Table 11 shows a sig value of less than 0.05, so it can be concluded that there is a significant difference between the experimental class that uses Wismaya media with an inquiry approach and the control class that does not use Wismaya learning media with an inquiry approach. The next step is to calculate n gain.

The use of Wismaya learning media with an inquiry approach to improve students' critical thinking skills is quite effective with an average n percent gain of 59.34.

Teacher responses and student responses to the development of Wismaya learning media with an inquiry approach to improve students' critical thinking skills.

Table 7. Student Responses to the Development of Wismaya Learning Media

Indicator	Validity	Intepretation
Usefulness	0.83	Very good
Convenience	0.90	Very Good
Satisfaction	0.92	Very Good

Table 8. Teacher Response to the Development of Wismaya Learning Media

Indicator	Validity	Intepretation
Interesting media presentation	0.90	Very Good
Use of communicative language	0.86	Very Good
Clarity of instructions for using the media	0.75	Good
Compatibility of material with CP	0.80	Good
Media According to the needs of students	0.79	Good

Conclusion

Wismaya android-based science learning media with an inquiry approach has the concept of a house that has 7 information rooms, to be able to proceed to the next room, students must answer questions related to the Unitary State of the Republic of Indonesia which aims to foster a sense of nationalism in students. Wismaya learning media with an inquiry approach is suitable for use in class IV learning style material with media expert validity of 0.917; material expert validity 0.898; and the validity of linguists is 0.791. Wismaya learning media with an inquiry approach is quite effective in improving students' critical thinking skills with a Ngain percent percentage of 59.34 and classical completeness reaching 94%. Students' responses to media development seen from indicators of usefulness, convenience and satisfaction showed very good responses. The teacher's response to the development of media seen from the indicators of presentation and use of language shows a very good response, while in the indicators of instructions for use, the suitability of the material and suitability for students' needs shows a good response.

Author Contribution

All authors completed this paper cooperatively. Each stage is carried out together.

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Conflicts of Interest

We declare that the authors in this article do not have a conflict of interest with anyone, either individual or any institution. We are writing as part of reporting research activities and contributions to science.

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