

Development of Android-Based Physics Learning Media to Improve Computer Thinking Skills for High School Students

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Abstract- Along with the development of the era, learning media devices are needed to support the learning process, especially physics material. This study aims to develop Android-based physics learning media that can be accessed at any time to help improve students' Computer Thinking and understand learning materials, especially Global Warming material. The method used is the Research and Development (R&D) method with stages from the ADDIE development model (Analyze, Design, Develop, Implement, Evaluate). The research instrument used in this study was a validity sheet filled in by 3 validators, an average total validation value of 0.93 was obtained, a practicality sheet filled in by 32 students of SMAN 1 Pekanbaru obtained a media practicality test result of 87.06%. After that, the implementation of the results obtained obtained an average percentage value of the ability test of 75% with the predicate "Good".

Keywords: *Development of Learning Media, physics, android, Computer Thinking Skills*

1 Introduction

Education is a process that includes three dimensions, namely individuals, society or community nationally from which the individual originates, and all the contents of reality, both material and spiritual, that play a role in determining the nature, fate, form of humans and society. Education is not only about teaching, which can be said to be a process of transferring knowledge, transforming values and forming personality using all related aspects. Education is a learning process that is expected to be able to accept balance and perfection in the development of individuals and society (Fahrozy et al, 2022:3094).

The implementation of good education requires supporting devices in terms of educational curriculum, models, learning media and teaching methods that are appropriate to the learning that will be carried out in order to achieve a learning objective. The challenge for educators today is to create learning media that require logical and mathematical understanding, so that 21st Century learning becomes popular by bringing changes, namely the rapid development of Science and Technology (IPTEK) which results in changes in the learning paradigm marked by changes in curriculum, media, and technology. Because basically 21st century learning is an implication of the development of society adapting to the needs of each era (Rahayu et al, 2022:2100).

Computational thinking or what we often call Computer Thinking is a skill that must be possessed in the 21st century because this thinking will sharpen our critical thinking and analysis in dealing with a problem. To improve this Computer Thinking ability, of course, this cannot be separated from the role of a teacher who is a leader in his class. The professionalism of a teacher has a very important role, hard work for an educator in providing teaching must of course be done so that the learning that will be delivered has meaning because being a professional teacher or educator is certainly not easy to do (Mukarromah et al, 2022:43).

How to Cite :

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Physics is a branch of science which is essentially a process and product of studying natural phenomena. Physics learning has the aim of developing students' knowledge, understanding, and analytical skills towards their environment and students are expected not only to master concepts but also to apply the concepts they have understood in solving physics problems. However, classroom learning tends to emphasize concept mastery and ignores students' physics problem-solving abilities so that many consider it difficult for students to understand, therefore the use of physics learning media to support teaching and learning activities is the right solution to overcome these problems (Nurul, 2022).

The Canva application is an online graphic design application that is easy to use for beginners to create learning media. This application can be accessed on smartphones and PCs. There are many features in this Canva application that make it easier for teachers to convey material to students to create interesting physics learning media (Kharissidqi et al, 2022:109). The development of learning media in learning has also produced various diverse media. One of these media is mobile learning. In simple terms, mobile learning can be interpreted as a learning medium that allows students to learn wherever they are. The use of mobile learning in mathematics learning has several advantages, including 1) it can be operated anywhere and anytime, 2) increasing student motivation, and 3) improving learning according to student needs.

Based on the description, a physics teacher needs the right media to answer the problems and challenges and needs of the current era of globalization. The learning media used is Canva media on the Global Warming material. In designing this Canva learning media, it will be combined with other applications to create applications to answer the challenges of this era. Therefore, the researcher aims to develop Android-based learning media to help improve students' Computer Thinking and be able to understand learning materials, especially Global Warming materials. "Development of Android-Based Physics Learning Media to Improve High School Students' Computer Thinking Skills".

2 Research Methodology

This research was conducted at the Physics Learning Media Development Laboratory, Physics Education Study Program, FKIP, Riau University in the 2024/2025 academic year with Research and Development (R&D) research method. The Research and Development research method can be interpreted as a scientific way to research, design, produce and test the validity of the products that have been produced (Sugiyono, 2019). The development model used in this study is the ADDIE development model which is considered suitable for developing Android-based learning media as in Figure 1.

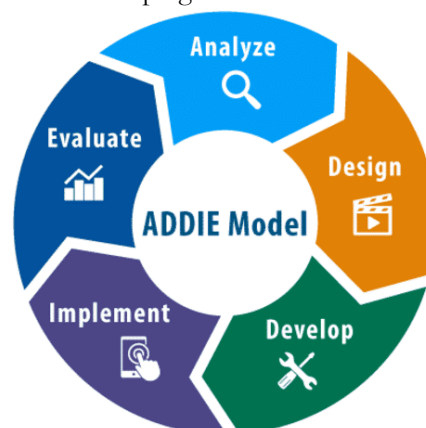


Figure 1:ADDIE Development Model Stages

The data collection instruments in this study consisted of validation sheets, tests, observations, and student response questionnaires. The data analysis technique was the analysis of validator assessments of Android-based Physics learning media which would be validated by expert validators and students. Data

analysis techniques in this study. There are three stages, namely the validity analysis stage, the practicality analysis stage and the computer thinking ability test analysis stage.

2.1. Validity Analysis Stage

In research language refers to the extent to which a measuring instrument accurately measures what is intended to be measured by assessing the instrument can actually measure the variable to be studied can be trusted. If an instrument is not valid, then the conclusions drawn from the analysis are not accurate. The media expert test serves as a reference basis for determining the technical suitability of the creation of visual learning media and the functionality of the learning media created. Which involves 2 lecturers who are experts in the field of learning media. The assessment of the results of the design and learning media expert test is calculated using the Aiken's V Technique which is accumulated as in table 1.

Table 1 : Validation Sheet Assessment Category

Category	Positive Score
Strongly Agree (SS)	5
Agree (S)	4
Doubt (RR)	3
Disagree (TS)	4
Strongly Disagree (STS)	1

(Source: Sugiyono, 2019:789)

The data from the validity test results obtained were analyzed using the Aiken's V index (V) item validity index, which is formulated as follows:

$$V = (\sum S) / (n (c-1)) \dots \dots \dots (2.1)$$

$$S = r - I_0 \dots \dots \dots (2.2)$$

Information:

V = Rater agreement index

c = The highest validity assessment number (in this case = 5)

I_0 = The highest validity assessment number (in this case = 1)

r = Number given by an appraiser

n = Number of raters

To determine the category based on Aiken's V index (V) can be seen in table 3.

Table 2 : Decision based on Aiken's V Index (V)

No	Score Interval	Validity Category
1	$V \leq 0.3$	Low
2	$0.3 < V \leq 0.7$	Currently
3	$0.7 < V \leq 1.0$	Tall

(Source: Hsu, Lin, Chang, Tseng, & Chiu, 2015)

Media is said to be an application if each validator gives an assessment of ≥ 3 for all indicators, if there are < 3 then improvements will be made to the indicator. To determine validity based on the Aiken V index interval, the index value (v) that appears must be in the range of $0.7 < V \leq 1.0$. If one of the indicators is in the range of $V \leq 0.7$ then improvements will be made to the indicator.

2.2. Practicality Analysis Stage

The analysis of the practicality of the product was developed based on the practicality test sheet filled out by teachers and students. The answers from each instrument (teacher and student response sheets) using the Likert scale have score details as in table 3 (Putranadi et al., 2021).

Table 3 :Response Test Questionnaire Score

Alternative	Positive Score
Strongly Agree (SS)	5
Agree (S)	4
Disagree (KR)	3
Disagree (TS)	4
Strongly Disagree (STS)	1

(Source: Sugiyono, 2015)

The assessment of the feasibility of the test questionnaire uses percentages. Calculating the percentage of each subject uses the formula:

$$P = \frac{\sum x}{\sum xi} \times 100\% \dots \dots \dots (3.3)$$

Information:

P = Percentage

$\sum x$ = number of respondents' answers in one item

$\sum xi$ = ideal number of items

The questionnaire score interpretation criteria can be seen in the following table:

Table 4 :Response Test Criteria

Intervals (%)	Criteria
$81\% \leq \square \leq 100\%$	Very Worth It
$62\% \leq \square < 81\%$	Worthy
$43\% \leq \square < 62\%$	Quite Decent
$33\% \leq \square < 43\%$	Less Worthy
$< 33\%$	Not feasible

(Source: Meri Sri Susanti, Nandang Hidayat, Surti Kurniasih: 2020)

The application device on the Global Warming material is practical if each assessment item is stated to be practical and feasible to be tested on a wider scale. The assessment aspect assessed by students if it is below the practical value, namely if X is in the range of $43\% < \square \leq 62\%$, then this aspect will be revised.

2.3. Computer Thinking Test Analysis Stage

The data processing technique of the computer thinking test results was adopted from Syifa's research (2017). This ability test was conducted to produce test analysis results data aimed at determining students' computer thinking abilities by changing the scores obtained by students into percentages using the following formula:

$$NP = \frac{R}{SM} \times 100\% \dots \dots \dots (3.4)$$

Information:

NP = Percentage value sought (%)

R = raw score obtained by students

SM = ideal maximum score from the test conducted

After that, the ability categorization is carried out based on the percentage value obtained. This categorization is carried out based on the categories according to Purwanto (in Diana, 2015:286) as in table 5.

Table 5 :Ability test percentage

Percentage (%)	Predicate
85% $\leq$ NP $\leq$ 100%	Very good
75% $\leq$ NP $<$ 85%	Good
60% $\leq$ NP $<$ 75%	Enough
55% $\leq$ NP $<$ 60%	Not enough
NP $<$ 55%	Not enough

(Source: Purwanto, 2008)

3 Results and Discussion

Research and Development of Android-Based Physics Learning Media to Improve High School Students' Computer Thinking Skills in the 2024/2025 academic year. This study uses the ADDIE development model with the following research results.

3.1. Analysis Stage

The analysis stage is the initial stage to analyze the problems found in learning, especially in global warming material and to identify the suitability of the learning media developed with the learning achievements of global warming material in the learning process. Sonnya Camelia et al (2023) revealed that the lack of teaching materials that support and help students understand the material and the content of the material in the teaching materials has not been systematically arranged and is not adequate to help students in the learning process.

The researcher conducted initial observations with needs analysis. Based on initial observations, it is known that students' interest in physics subjects is still low, students have difficulty in discussing the design stage or real animations used in the learning process, and students still think that physics lessons must only memorize formulas. In order for students to better understand the lesson, innovative supporting learning media, animations, and real simulations are needed to support learning activities.

Global warming material is often not taught and guided in learning, in fact it is not discussed in learning. In fact, global warming material is important material that students need to know because they can feel the direct impact of global warming. In addition, global warming material in schools often encounters obstacles, especially in compiling materials for students to understand and the lack of adequate media to help students in the learning process. Therefore, researchers created a prototype of an application based on which can help support learning activities and can open learning anytime and anywhere. This is supported by the results of research by Meri Sri Susanti (2020) which found that Android-based learning media on protein synthesis material is very suitable for use. Android-based learning media on protein synthesis material can improve student competence. This is indicated by the difference in student competence between classes that learn using Android-based learning media and classes that do not use Android-based learning media.

3.2. Design stage

The design stage is a further stage carried out by researchers after completing the analysis stage. This stage begins with the creation of a multimedia development scheme or what we also call a storyboard. The creation of a storyboard is intended to see what media components are needed in each part. researchers also designed that the resulting media is in the form of an android application that can be accessed anytime and anywhere. At the design stage, it is designed by determining the learning experience that students must have by following learning from the media being developed. At this stage, it must be able to overcome problems in students. This stage begins with the design of teaching materials based on curriculum analysis and then collecting media components that will be used in the learning media that will be developed. Animated videos containing explanations of the material are also used in loading the material

to be delivered. After the design of the material, it is continued with the preparation of a question instrument containing independent and group evaluations. In addition to being used to measure the success of students in mastering learning materials, the preparation of question instruments must also pay attention to supporting students' computer thinking. After that, enter the stage of designing learning media based on curriculum analysis using software to design and create prototypes with supporting applications.

At this design stage, media components such as images, videos and wordwall websites are also collected which are used for quiz simulations and exercises on the media to be developed. Researchers use the Canva application for the initial design stage in designing the application to be created and use power point which helps in designing things that are repeatedly used in the media, such as the back button, exit button, main menu button, and other buttons. In addition, researchers also use the ispring suite application which is integrated with power point for the resulting file to be converted into HTML. After the designed design file becomes an HTML file, the design can be converted into an application file with the help of the website 2 apk builder application.

The creation of applications using these 2 applications is valid, this is in accordance with the results of research conducted by Musdar M et al (2023:64) where data analysis and discussion were obtained from the development of Android-based learning media developed with the ADDIE development model with stages of analysis, design, development, implementation, and evaluation. It was concluded that the Development of Android-Based Learning Media using the Ispring Suite 10 Application & Website 2 Apk Builder on Straight Motion Material to Improve Learning Outcomes of Class X SMA Students has met the criteria of valid, practical, and effective.

In addition, at this stage also designed in the learning media developed to support computer thinking skills through exercises in it. Exercises in the learning media developed are divided into 2, namely Exercises for groups and quizzes as independent exercises. In group exercises there are group assignments that are given instructions and questions that must be completed together with other members. These questions are questions that require thinking and analysis so that they indirectly support students' computer thinking. For independent exercises, namely exercises containing HOTS (Higher Order Thinking Skills) type questions and quizzes containing incomplete sentence type questions. Another thing that is also done at this design stage is the adaptation of the validation sheet used to test the validity of the learning media.

3.3. Development Stage

The stages of developing learning media were initially made according to the plan, but after going through the guidance process there were several changes in the form of design, so that the results were slightly different from the initial design that had been made. Changes and additions to several parts have also been made based on suggestions and input several times so that the resulting application becomes a valid and practical product that can be used in the field of Education. The results of the application as an Android-based physics learning media have the appearance and features as in Figure 2-12.



Figure 2 :Appearance Offerings



Figure 6 :Appearance Competence



Figure 10 :Appearance Exercise

Figure 3 :Appearance How to use Opening

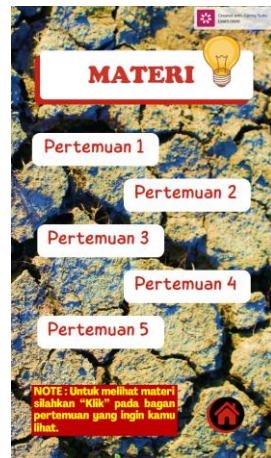


Figure 7 :Appearance Material

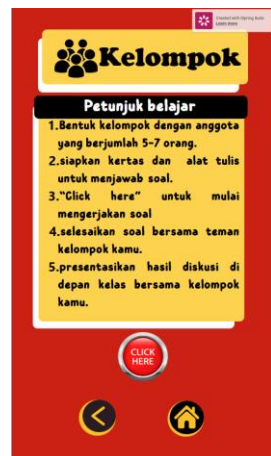


Figure 11 :Appearance Group

Figure 4 :Appearance Menu



Figure 8 :Appearance Meeting



Figure 12 :Appearance Individual

Figure 5 :Appearance



Figure 9 :Appearance Video



Figure 12 :Appearance Quiz

At this stage after the media has been developed, validation is carried out by 3 validators who are experts in the field of learning media. In addition to giving a score, the validator also provides suggestions for improvement in the learning media that has been developed. Improvements are needed in aspects if the score is 2 on the validated indicator. Referring to the initial validation and suggestions from the validator, improvements are made to the learning media that has been developed until all indicators in each aspect are in the valid criteria.

The results of the V index per aspect obtained from the validation of the Global Warming E-Learning application media that was developed can be seen in table 6.

Table 6 :Validation results of the Global Warming E-Learning application media

No	Indicator	V index	Validity Category	Decision
1	Design	0.93	Tall	Valid
2	Pedagogy	0.97	Tall	Valid
3	Content	0.90	Tall	Valid
4	Technical	0.98	Tall	Valid
Average total rating		0.94	Tall	Valid

In table 6 we can see the results of the validation assessment of the developed learning media obtained an average total validation value of 0.93. So when viewed from the validity criteria of the Aiken V index, this value is included in the "high" category ($0.7 < V \leq 1.0$). This means that the three experts gave an assessment that tended to be consistent and in accordance with the indicators and the Global Warming E-Learning application was declared Valid.

Next, practicality was conducted on 32 students. The practicality test took place at SMA N 1 PEKANBARU class X5. The researcher distributed the questionnaire to students to be able to provide responses through the questionnaire.

Table 7 :Practical results according to students

No	Indicator	Average	Presentation	Criteria
1	Interesting application to use	4.38	87.50%	Very worthy
2	Easy to use application	4.47	89.38%	Very worthy
3	Fast application to respond	4.41	88.13%	Very worthy
4	Students can really understand the material about global warming	4.25	85.00%	Very worthy
5	Easy to save application	4.31	86.25%	Very worthy
6	This application helps to improve Computer thinking	4.19	83.75%	Very worthy
7	Global Warming Overview through easy-to-observe student applications	4.28	85.63%	Very worthy
8	Learning objectives in the application can be achieved	4.38	87.50%	Very worthy
9	Application observation activities in the application can motivate students	4.34	86.88%	Very worthy
10	Overall, I am satisfied with this application	4.53	90.63%	Very worthy
Media Practicality		4.35	87.06%	Very worthy

As for the results of the student practicality assessment in table 7 we can see that in the results of the practicality assessment of the developed learning media, the total Percentage value of the media Practicality was 87.06%. So when viewed from the criteria for the percentage of practicality, this value is included in the category of "very feasible". This means that all student practitioners gave assessments that tended to be consistent and in accordance with the indicators and the developed learning media were declared practical.

Based on the results of research and observations during the product trial, it was found that it was in accordance with the results of previous studies such as in the study of Musdar et al, (2023:64) it was found that the android-based learning media ispring suite 10 & website 2 apk builder had met the effectiveness criteria with a percentage of completion of 83.3% which is in the very effective category. Regarding the results of the analysis of the student response questionnaire data above, it is known that the average of all aspects of the student response questionnaire was 92.85% which was in the interval of 81% -100% with a very practical category so that the android-based learning media using the ispring suite 10 & website 2 apk builder application has met the practical criteria.

3.4. Implementation Stage

The aim of developing Android-based physics learning media with this EDDIE development model is to...Improving Computer Thinking Skills of High School Students. To find out the ability of

Computer thinking skills of students is obtained through the Gap Test contained in the application section of the Practice page section of the quiz. Based on the results obtained, the average percentage value is 75% with the predicate "good". This means that this application has a good level in helping to improve students' computer thinking skills.

The research data from the validation and practicality questionnaires can be said that the learning media developed is very good and suitable for use in physics learning. In this ability test, students who have used the application are asked to answer quiz questions to complete or fill in a paragraph gaps in the application with a total of 20 questions. This ability test was carried out by 32 students, the overall results of the ability test are in Figure 13.

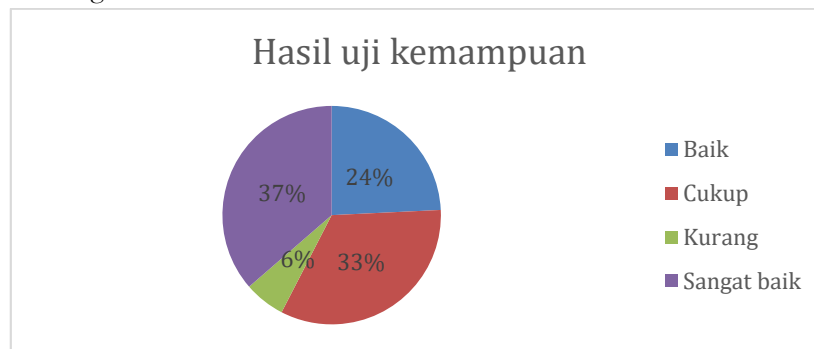


Figure 13 :Ability Test Results *Computer Thinking*

Based on the results obtained, the average value of the ability test percentage was 75% with the predicate "Good". This shows that overall, students' computational thinking abilities are at a fairly good level. Students with the predicate "Very good" achieved scores between 85% and 90% and there were 13 students. This shows that a group of students have a strong understanding of computational thinking.

The predicate "Good" is given with a value of around 75% to 80% which includes 9 students. Students in this category show a fairly good understanding but there is still room for improvement. Furthermore, there are 8 students with scores between 60% to 70% who get the predicate "Enough". This indicates students with adequate understanding but not yet optimal. In addition, there are two students who get a score below 60% with the predicate "less", indicating that they need additional guidance. Students show quite significant variations in ability, with some students reaching 90% while others are below 60%. This indicates differences in understanding or mastery of Computer Thinking between students.

3.5. Evaluation Stage

on the material. This improvement is based on suggestions from the validator so that the researcher improves the material in the multimedia. At the design stage, the researcher made several improvements to the storyboard so that the multimedia was more conceptual. The validation sheet was also adjusted so that it could assess the media more precisely. The validation sheet was born using the results of adaptations from other journals. At the development stage, especially at the validation stage, there were suggestions for the learning media that was developed so that the researcher could improve it according to the suggestions from the validator.

4 Conclusion

Through research with the ADDIE development research model (Analyze, Design, Develop, Implement, and end with Evaluate). The research process of Android-based Physics learning media to improve Computer Thinking Skills of high school students was successfully developed and helped improve students' computer thinking skills. This learning media has been validated by 3 validators and 32 students for practicality tests and computer thinking ability tests. The results of the validation assessment of the learning media developed by experts obtained an average total validation value of 0.93. So when viewed from the validity criteria of the Aiken V index, this value is included in the "high" category. Then the results

of the media practicality test by students were 87.06%. After that, the implementation of the results obtained obtained an average percentage value of the ability test of 75% with the predicate "Good", This shows that overall, students' computational thinking abilities are at a fairly good level. and based on the overall validation results, Android-based Physics learning media to improve high school students' Computer Thinking Skills is suitable for use in learning activities.

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