
DEVELOPMENT OF ANDROID-BASED INTERACTIVE LEARNING MEDIA ON GLOBAL WARMING MATERIAL TO IMPROVE STUDENT LEARNING OUTCOMES

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Abstrak

Pembelajaran konvensional membuat siswa kurang termotivasi untuk belajar sehingga berdampak pada hasil belajar yang kurang baik. Penelitian ini bertujuan untuk mengembangkan dan menghasilkan media pembelajaran berbasis Android pada materi pemanasan global yang valid, praktis dan efektif dengan menggunakan software *Smart Apps Creator*. Penelitian ini dilakukan dengan menggunakan metode 4D (*Define, Design, Develop, Disseminate*). Instrumen yang digunakan adalah angket validasi ahli, angket respon guru dan siswa. Pada tahap validasi, hasil penelitian ahli materi memperoleh persentase rata-rata 88,46% dengan kategori sangat valid. Hasil penilaian ahli media memperoleh rata-rata persentase 93,75% dengan kategori sangat valid. Hasil uji praktikalitas oleh guru memperoleh persentase rata-rata 100% dengan kategori sangat praktis dan uji praktikalitas pada kelompok kecil memperoleh persentase rata-rata 87,88% dan pada kelompok besar 87,98% dengan kategori sangat praktis. Hasil uji keefektifan diperoleh nilai N-Gain sebesar 0,79 dengan kategori tinggi, sehingga media pembelajaran berbasis android dikategorikan efektif. Hasil yang diperoleh menunjukkan bahwa media pembelajaran berbasis android sangat valid, sangat praktis, dan efektif digunakan sebagai media pembelajaran dalam pembelajaran fisika.

Kata Kunci: Media Pembelajaran, Media Interaktif, Pemanasan Global, Hasil Belajar

Abstract

Conventional learning makes students less motivated to learn so that it affects learning outcomes that are not good. This study aims to develop and produce Android-based learning media on valid, practical and effective global warming material using Smart Apps Creator software. This research was conducted using the 4D method (Define, Design, Develop, Disseminate). The instruments used were expert validation questionnaires, teacher and student response questionnaires. At the validation stage, the material expert's research results obtained an average percentage of 88.46% with a very valid category. The results of the media expert assessment obtained an average percentage of 93.75% with a very valid category. The results of the practicality test by teachers obtained an average percentage of 100% with a very practical category and the practicality test in small groups obtained an average percentage of 87.88% and in large groups 87.98% with a very practical category. The effectiveness test results obtained an N-Gain value of 0.79 with a high category, so that android-based learning media is categorized as effective. The results obtained show that android-based Learning Media is very valid, very practical, and effective to use as a learning media in physics learning.

Keywords: Learning Media, Interactive Media, Global Warming, Learning Outcomes

1. Introduction

Indonesia's education sector has transitioned into the Disruption Era, necessitating transformative changes through technological integration (Nuraeni et al., 2024). Education is required to innovate by utilizing technology. The strategic deployment of technology in educational settings targets improved learner outcomes by mitigating difficulties, augmenting motivation, cultivating autonomous learning capacities, and facilitating unfettered access (Susanti et al., 2021). The use of technology in learning has changed the learning process from using the lecture method to using interactive learning media. The paradigm shift from traditional print media to interactive multimedia has revolutionized educational resources (Fitriya et al., 2024).

Learning media that is suitable for use in learning in accordance with student characteristics is interactive multimedia, where the media provided does not only provide one content in the form of text only, audio only but presents a combination of these content contents (Anggraeni et al., 2021). The interactive learning media developed included valid, practical and effective media used in the learning process because it succeeded in increasing the value of student learning outcomes (Kristanti et al., 2024). Based on research conducted Interactive multimedia affects learning outcomes on student effort and energy material (Wulandari et al., 2022).

Android devices embody a strategic technological innovation in pedagogical practices (Utami et al., 2022). The multifunctional nature of android devices enables their utilization as interactive learning mediums (Akhmad, 2023). Interactive android-based learning environments stimulate student engagement and optimize knowledge retention (Ignasius et al., 2024).

Based on the description and background above, it is necessary to develop research to examine these problems with the title “Development of android-based interactive media on global warming material to improve student learning outcomes” with the formulation of the problem What is the validity, practicality, and effectiveness level of android-based learning media for class x global warming material at SMA Negeri 1 Berastagi.

2. Method

This research was conducted at SMA Negeri 1 Berastagi which is located on Jalan Jamin Ginting No.12, Berastagi, Karo Regency, North Sumatra Province. This research tested in the

odd semester of the 2024/2025 school year with global warming topics. The subjects in this study were class X students at SMA Negeri 1 Berastagi that use random sampling technique.

The research procedure that will be carried out in this study is to use the 4D model. 4D is an extension of Define, Design, Development, and Dissemination (Siregar et al., 2023).

2.1 Define

Define is the defining stage, Community-driven product development necessitates an initial phase of needs analysis and effectiveness evaluation (Kornelia & Nurmala, 2022). There are several things that must be defined, including:

a. Front End Analysis

Front-end analysis facilitates a needs assessment, highlighting knowledge deficits and informing the design of targeted instructional interventions (Syam, 2017). Initial diagnosis is carried out by research to improve the effectiveness of learning. Through this analysis, researchers will identify key issues, expectations, and potential solutions to guide the design of effective learning materials.

b. Learner Analysis

The purpose of learner analysis is to examine the characteristics of learners who are in accordance with the design of the development of learner devices.

c. Concept Analysis

Concept analysis, at this stage an analysis of the physics syllabus is carried out, so that an outline of the material to be presented in the learning media to be developed is produced.

d. System Requirements Analysis

- Analysis of input requirements. The input (input) of making physics learning media on the subject matter of global warming is data information about global warming material, images or photos needed, additional animation needed.
- Output needs analysis. Output (output) of the making physics learning media global warming subject matter is in the form of text displays, images, and animations that have been processed. With the display of images, animations and also text is expected students as users can enjoy and understand the learning presented in physics learning media newton's law material.

- Analysis of hardware requirements. Specifications of hardware components used for the manufacture of physics learning media global warming material is a PC or laptop with a processor core i3 gen 7, 4 GB RAM, Keyboard and mouse as input devices.
- Analysis of software requirements (Software). The software needed in the development of learning media is Smart apps Creator (SAC)

2.2 Design

Design is the stage of designing the initial design of learning media in the form of making activity diagrams, making flowcharts, making overall media design (storyboard), making backgrounds, images and buttons that will be included in the application (Nyoman et al., 2022).

2.3 Development

The development phase utilizes instructional design models to produce engaging and effective learning materials (Maharani & Hanesman, 2022). During this stage, the researcher conducts feasibility testing and validation of the developed teaching materials with two expert validators: a subject matter expert and a media expert. After receiving validation from the experts, the next step is to make revisions according to the input and suggestions of the experts. Following expert validation, the researcher incorporates feedback and revises the instructional materials accordingly.

a. Feasibility Test/Validation

Feasibility testing or validation serves to see whether or not the media is valid with certain criteria. A panel of experts (media and material specialists) evaluates product design feasibility, providing constructive criticism and suggestions (Harmila et al., 2021). Validation outcomes drive improvements to the developed interactive media.

b. Revision

The validation data obtained is then analyzed for revision. The revised product is a development and refinement based on the results of the validation of experts (linguists, media experts and material experts) then after that do a trial to students.

c. Product trial

Products that have been completed are made based on expert advice and educational practitioners, then tested on students in learning activities at school. In this trial, researchers used 2 ways, namely small group tests and large group trials as follows:

1) Small group test

This stage is carried out with the aim of knowing the response of students and providing an assessment of the quality of the product developed. The trial was conducted on 10-15 learners who represented the target population. The trial was conducted to find out the learners' response to the product developed so that they could provide an assessment of the product developed.

2) Large Group Test

At this stage the media developed or made is certainly close to perfect after going through the first stage. In the large group trial there were about 20-30 more students with various characteristics according to the characteristics of the target population.

d. Product Revision

Based on product trials, if the responses of educators and students state that android-based interactive media on global warming material is more interesting and good for use in learning, it can be said that the interactive media developed has been completed so as to produce the final product. But if it has not reached the perfect point, improvements and refinements are needed in the development of this media, so that it is suitable for use in learning at school.

e. Learning Media

After the product is declared valid, the learning media is ready.

2.4 Dissemination

The dissemination stage is the final stage of development research. This stage aims to make learning media products can be used by all class X students of SMA Negeri 1 Berastagi. 4D Model development stage that will used in this research we can see in the Figure 1 bellow:

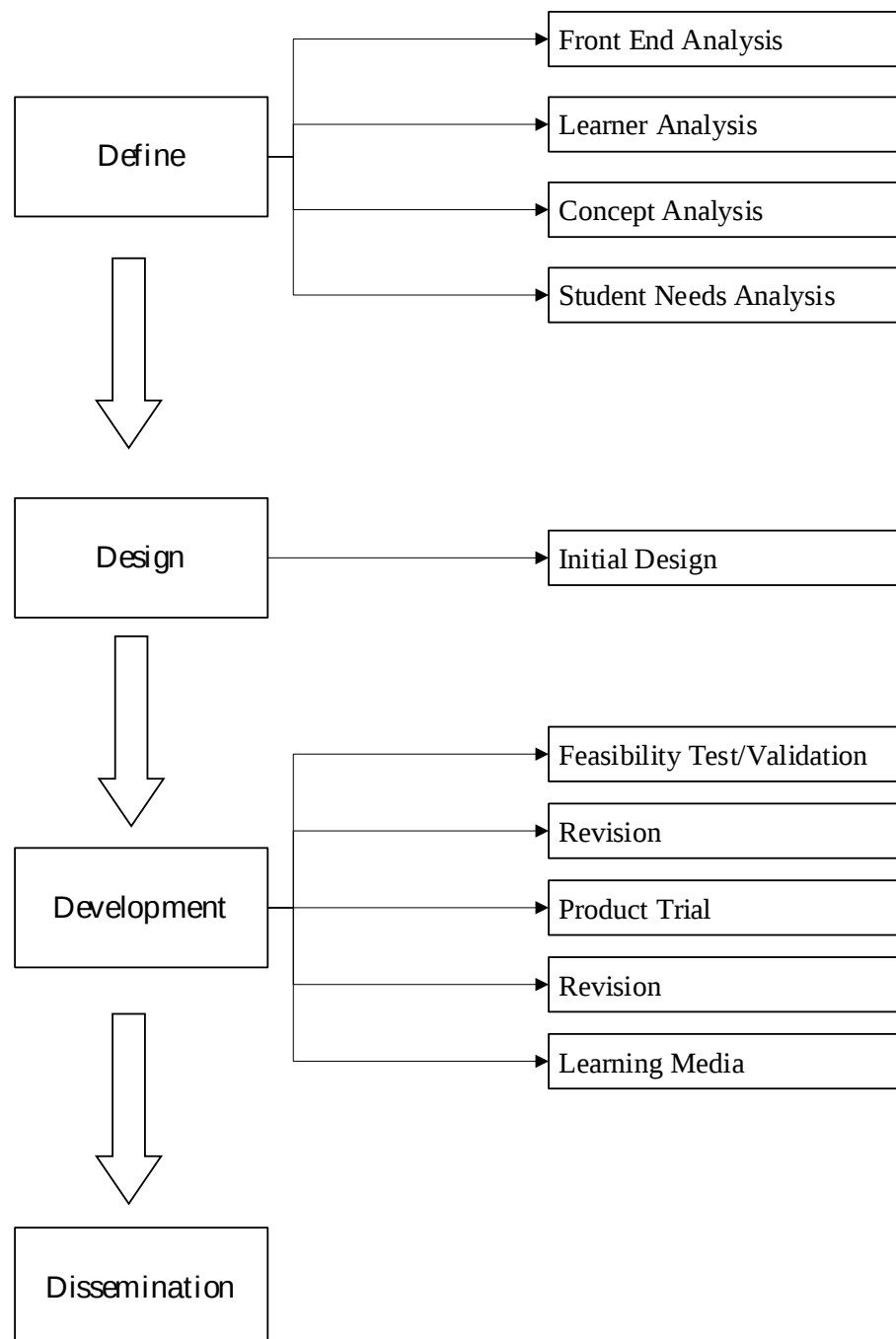


Figure 1. 4D Model development Stage

3. Results and Discussion

The research is the development of a product in the form of learning media that can be accessed using the device. The method that is used to develop the learning media is the 4D development research (Define, Design, Development, and Dissimination). Learning media is an android-based application on Smart Apps Creator (SAC) software equipped with Global Warming topics in class X. The results of the research developed are described as follows

3.1 Define Stage

The first stage in this research is to analyze the needs of students to obtain information related to what is needed by students, to obtain this information, interviews were conducted with physics teachers at SMA Negeri 1 Berastagi. Based on the results of preliminary studies conducted by direct observation and interviews with class X physics teachers at SMA Negeri 1 Berastagi, it was found that after the change of curriculum from the 2013 Curriculum to the Merdeka Curriculum there were several obstacles experienced by teachers and students in learning. Based on the teacher's information, the learning resources used by students to learn are teaching materials in written form which are distributed in pdf form. The use of these teaching materials is not responded positively by students, most students are lazy to open and read these teaching materials. And this affects student learning outcomes which currently still have not reached the target.

It is known that almost all students in one class have a communication device in the form of a smartphone. Smartphone has not been used optimally in learning. So it is necessary to develop android-based learning media that is effective in learning.

3.2 Design Stage

After using the Define stage, the next stage is design design. The design that has been made in the storyboard and flowchart then adds material to the media. Media display can be seen in Figure 2



Figure 2. Barcode of Media Display

3.3 Development Stage

The learning media that has been made, then carried out the feasibility and practicality stages. The media was tested by 2 validators consisting of 1 material validator and 1 media expert

validator to get a feasibility score and tested by 1 physics teacher to get the practicality score of the media. The following are the results of the validation of learning media using SAC on Global Warming material.

3.3.1. Material Expert Validation

The learning media developed was validated by material experts. The aspects assessed are presentation, content and language. The results of the validation by material experts are in the figure 3 bellow:

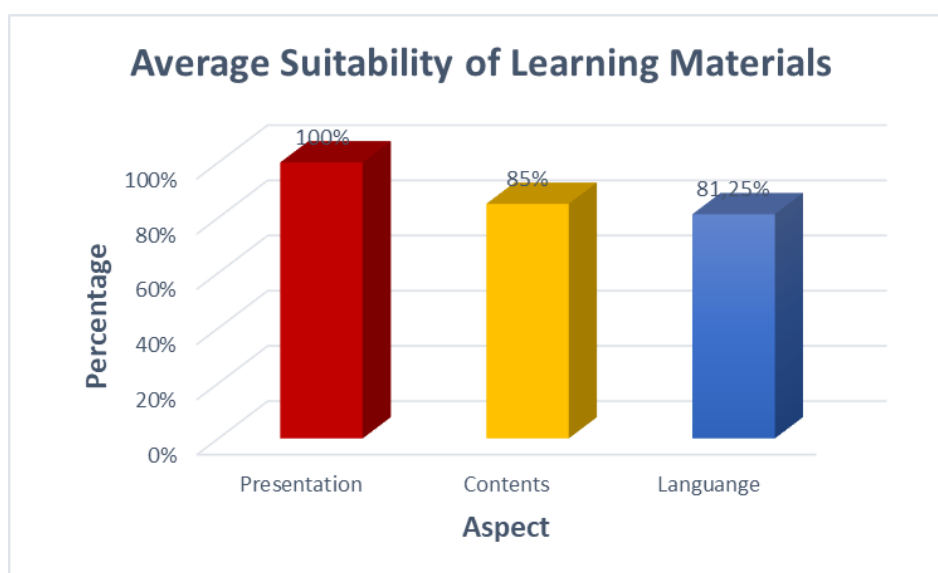


Figure 3. Graph of Material Expert Validation Results

3.3.2. Media Expert Validation

Learning media products that have been developed are validated by media experts. The aspects assessed are visual appearance, font use, physical criteria, sound, and ease of use. The results of media expert validation data can be seen in Figure 4 bellow:

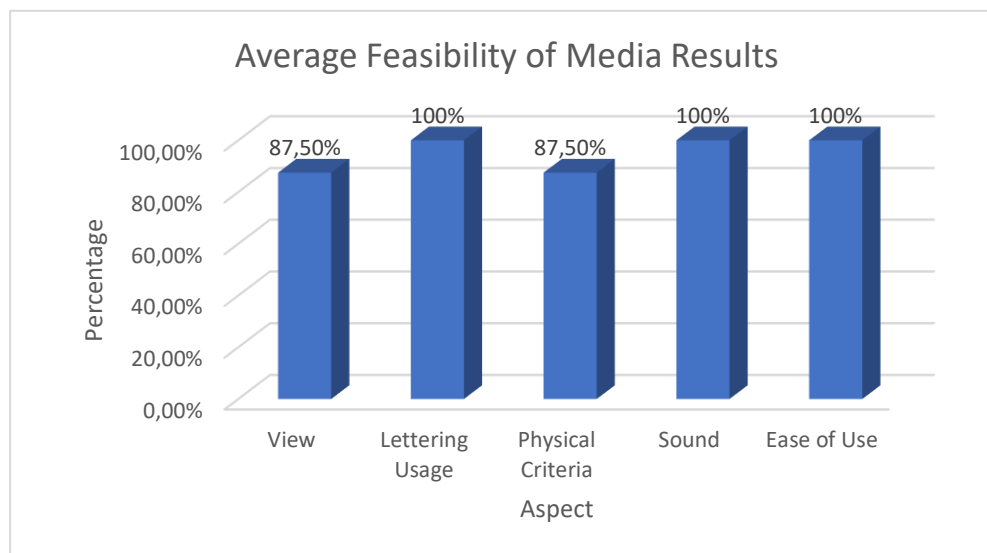


Figure 4. Graph of Media Expert Validation Results

3.3.3. Product Revision

This stage aims to improve learning media based on suggestions from validators, namely:

a. Revision from Material Expert

Based on the assessment of the material expert, the Learning Media developed is very feasible and does not need to be revised.

b. Revision from Media Expert

There are some revision from media expert

1. To add animation in the cover that related with the material
2. To add back button at every material

And the suggestion have already done with revise the Media

3.3.4. Physics Teacher Practicality Response

After the developed learning media product is validated by material and media experts, it is then given to the teacher to get a practicality response by filling the questionnaire. The results of the assessment can be seen in the table of assessment results from teachers bellow:

Table 1 Teacher Assessment Results

Statements	Percentage Score	Criteria
The appearance of this media is interesting	100%	Very Practical
The display on this media adds enthusiasm in learning	100%	Very Practical
Using this media can make the learning atmosphere not boring	100%	Very Practical
With this media can make the learning atmosphere more independent	100%	Very Practical
The presentation of material, images, and videos is very good	100%	Very Practical
The combination of colors in this media is very good	100%	Very Practical
Images and videos help in understanding the concept of material	100%	Very Practical
The material presented in this media is easy to understand	100%	Very Practical
Information on this media provides new knowledge	100%	Very Practical
The font used in this media is clear and easy to understand.	100%	Very Practical
The sentences and paragraphs used in this media are clear and easy to understand.	100%	Very Practical
The language used in this media is simple and easy to understand	100%	Very Practical
This media can be used easily	100%	Very Practical
The application used is in accordance with everyday life	100%	Very Practical
The images and videos in this media are interesting and appropriate.	100%	Very Practical
Average	100%	Very Practical

Based on the table above, it is concluded that it is considered practical by teachers to be used as learning media with global warming material.

3.3.5. Product Trial

a. Small-scale Group Test

This stage aims to get an initial response from students as many as 10 respondents and test the learning media developed whether it is effective to use in learning. The results of the small trial can be seen in Table 2 below:

Table 2 Small-scale Student Response

Statement	Percentage Score	Criteria
The appearance of this media is interesting	92,50%	Very Practical
The display on this media adds enthusiasm in learning	87,50%	Very Practical
Using this media can make the learning atmosphere not boring	90,00%	Very Practical
With this media can make the learning atmosphere more independent	87,50%	Very Practical
The presentation of material, images, and videos is very good	85,00%	Very Practical
The combination of colors in this media is very good	87,50%	Very Practical
Images and videos help in understanding the concept of material	85,00%	Very Practical
The material presented in this media is easy to understand	85,00%	Very Practical
The information in this media provides new knowledge	87,50%	Very Practical
The font used in this media is clear and easy to understand	90,00%	Very Practical
The sentences and paragraphs used in this media are clear and easy to understand.	85,00%	Very Practical
The language used in this media is simple and easy to understand.	90,00%	Very Practical
This media can be used easily	90,00%	Very Practical
Average	87,88%	Very Practical

Based on the table above, it can be concluded that the learning media developed is practically used in learning with the Practical category.

Table 3 Small-Scale Students Learning Outcomes

Respondents	Pre-test Sore	Post-test Score	Maximum Score	N-Gain	Criteria
R1	65	90	100	0,71	High
R2	70	90	100	0,66	Medium
R3	30	85	100	0,78	High
R4	50	90	100	0,80	High
R5	55	85	100	0,66	Medium
R6	40	90	100	0,83	High
R7	65	95	100	0,85	High
R8	30	80	100	0,71	High
R9	50	85	100	0,70	Medium
R10	30	80	100	0,71	High
Total	550	870			
Average	55	87	1000	0,71	High

From table 3 it can be seen that there is an increase in student scores in the very high category.

b. Large Scale Group Test

This stage aims to get student responses by distributing questionnaires to be filled in and conducting effectiveness tests by giving pretest and posttest questions. There were 36 respondents used in the large group test. The response results can be seen in table 4

Table 4 Large Scale Student Response Results

Statement	Percentage Score	Criteria
The appearance of this media is interesting	91,66%	Very Practical
The display on this media adds enthusiasm in learning	84,02%	Very Practical
Using this media can make the learning atmosphere not boring	90,97%	Very Practical
With this media can make the learning atmosphere more independent	86,80%	Very Practical

The presentation of material, images, and videos is very good	85,41%	Very Practical
The combination of colors in this media is very good	86,80%	Very Practical
Images and videos help in understanding the concept of material	87,5%	Very Practical
The material presented in this media is easy to understand	83,3%	Very Practical
The information in this media provides new knowledge	89,58%	Very Practical
The font used in this media is clear and easy to understand	91,66%	Very Practical
The sentences and paragraphs used in this media are clear and easy to understand.	85,41%	Very Practical
The language used in this media is simple and easy to understand.	90,27%	Very Practical
This media can be used easily	90,27%	Very Practical
Average	87,98%	Very Practical

Based on the table above can be concluded that learning media is practical to use

Table 5 Student Learning Outcomes

Respondents	Pre-test Score	Post-test Score	Maximum Score	N-Gain	Criteria
R1	55	90	100	0,77	High
R2	60	85	100	0,62	Medium
R3	45	90	100	0,81	High
R4	45	90	100	0,81	High
R5	50	90	100	0,80	High
R6	70	95	100	0,83	High
R7	65	80	100	0,42	Medium
R8	70	95	100	0,83	High
R9	75	100	100	1,00	High
R10	40	85	100	0,75	High
R11	65	100	100	1,00	High
R12	40	85	100	0,75	High

R13	45	95	100	0,90	High
R14	65	95	100	0,85	High
R15	70	100	100	1,00	High
R16	40	80	100	0,66	Medium
R17	50	95	100	0,90	High
R18	35	85	100	0,76	High
R19	45	80	100	0,63	Medium
R20	45	90	100	0,81	High
R21	40	95	100	0,91	High
R22	30	85	100	0,78	High
R23	40	80	100	0,66	Medium
R24	60	95	100	0,87	High
R25	75	100	100	1,00	High
R26	40	90	100	0,83	High
R27	60	100	100	1,00	High
R28	50	90	100	0,80	High
R29	60	95	100	0,87	High
R30	40	95	100	0,91	High
R31	75	95	100	0,80	High
R32	40	85	100	0,75	High
R33	65	80	100	0,42	Medium
R34	40	85	100	0,75	High
R35	45	80	100	0,63	Medium
R36	65	95	100	0,85	High
Total	1900	3250			
Average	52,777778	90,27777778	3600	0,79	High

Based on the table, it can be seen that there are changes after using the media. The resulting gain value is 0.79 which is categorized as high. So, it can be concluded that the media is effectively used.

3.4 Desimination Stage

This stage is the last stage in the development of android-based learning media on global warming material. After testing the feasibility of material experts and media experts, testing the practicality of Physics Teachers and Students on a small and large scale, as well as testing the effectiveness of the learning media developed in small groups and large groups and getting satisfactory results, namely very feasible, very practical and very effective, android-based learning media on global warming material can be distributed to all class X to be used as learning media.

4. Conclusion

Based on the formulation, objectives of the results, and discussion of the development of Smart Apps Creator learning media on Global Warming material at SMA Negeri 1 Berastagi, it is concluded as follows: the validity level of android-based learning media with global warming material at SMA Negeri 1 Berastagi produces a percentage of 88.46% of material experts with indicators of presentation, content, and language assessment, also produces 93.75% of media experts with indicators of appearance assessment, physical criteria, sound, and ease of use, so this learning media is very valid to use. The level of practicality on android-based learning media with global warming material at SMA Negeri 1 Berastagi produces a percentage of 100% teacher assessment and 87.98% of students so it can be concluded that this learning media is very practical to use. The level of effectiveness in android-based learning media with global warming material produces a gain value of 0.79 which is categorized as high, so this learning is considered effective to use

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