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DEVELOPMENT OF INTERACTIVE MULTIMEDIA FOR CLEAN AIR FOR BREATHING IN THE CONTEXT OF CLIMATE CHANGE FOR ELEMENTARY SCHOOLS

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Abstract
In the digital era, conventional learning methods in schools are not effective enough to convey important concepts, so more interactive and interesting learning media are needed in accordance with the nature and times of students, so this research aims to produce interactive multimedia products that are valid, practical and effective using applications. Canva and Power Point to improve students' understanding and learning outcomes. The subjects of this research were fifth grade students at SD Negeri 10 Palembang. The development model used is Hannafind and Peck. Data collection techniques include walkthroughs, interviews, questionnaires and tests. From the research results, validity tests were carried out by design, material and language experts whose results were declared very valid with an average of 93%. For the practicality test carried out by students, the results were stated to be very practical with an average of 83%. For the effectiveness test, it can be seen from student learning outcomes which increased from a pretest average of 60.65 to a posttest of 91.74. So it can be concluded that Interactive Multimedia on the Importance of Clean Air for Breathing in the Context of Climate Change in Class V Elementary School is declared valid, practical and effective on student learning outcomes.
Keywords: *Breathin; Clean Air; Climate Change; Interactive Multimedia*

Abstrak
Diera digital metode pembelajaran konvensional di sekolah tidak cukup efektif untuk menyampaikan konsep-konsep penting sehingga diperlukan media pembelajaran yang lebih interaktif dan menarik sesuai dengan kodrat alam dan zaman peseta didik, sehingga penelitian ini bertujuan menghasilkan produk multimedia interaktif yang valid, praktis dan efektif menggunakan aplikasi *Canva* dan *Power Point* untuk meningkatkan pemahaman dan hasil belajar peserta didik. Subyek penelitian ini adalah siswa kelas V SD Negeri 10 Palembang. Model pengembangan yang digunakan yaitu *Hannafind dan Peck*. Teknik pengumpulan data meliputi walkthrough, wawancara, angket dan tes. Dari hasil penelitian di dapat untuk uji kevalidan dilakukan oleh ahli desain, materi dan bahasa yang hasilnya dinyatakan sangat valid dengan rata-rata 93%. Untuk uji kepraktisan yang dilakukan ole peserta didik hasilnya dinyatakan sangat praktis dengan rata-rata 83%. Untuk uji keefektifan terlihat dari hasil belajar siswa yang meningkat dari rata-rata *pretest* 60,65 menjadi *posttest* 91,74. Jadi dapat disimpulkan bahwa Multimedia Interaktif Pentingnya Udara Bersih untuk Pernapasan dalam Rangka Perubahan Iklim di Kelas V SD dinyatakan valid, praktis dan efektif terhadap hasil belajar siswa.
Kata Kunci: Pernapasan; Udara Bersih; Perubahan Iklim; Multimedia Interaktif

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Introduction

Technology is developing rapidly and is widely used to develop learning media, such as interactive multimedia. Interactive multimedia presents material effectively, efficiently and more interestingly to help students achieve learning outcomes. Interactive multimedia can be used to improve good understanding in order to improve students' abilities in solving problems in science,

especially regarding the structure of the earth and rocks. The availability, sophistication and use of devices such as computers and smartphones have the potential to increase efficiency and effectiveness in the teaching and learning process, learning outcomes and skills (Morris et al., 2017).

Technological developments also bring changes in various fields, including education (Abduvakhidov, 2021). The development of information and communication technology directly and indirectly has a positive influence on our lives (Raja, 2018). The ability of technology in the educational aspect can involve students in several activities as active participants, providing opportunities for teachers to create a child-centered learning environment so that learning is effective. For example, the 2013 Curriculum (K13) has become the main focus in developing the education system. The article entitled "Strengthening the Implementation of the 2013 Curriculum" published by the Ministry of Education and Culture of the Republic of Indonesia in 2018 can be a reference to support this statement. In the article, it is explained that one of the goals of K13 is to create student-centered learning and encourage teachers to adopt collaborative and technology-based learning approaches. Apart from the 2013 curriculum, Indonesia is currently using an independent curriculum with rules that can be used as a reference, namely the Decree of the Minister of Education, Culture, Research and Technology of the Republic of Indonesia Number 718 of 2021 concerning the Independent Curriculum. In this document, there is an emphasis on the use of information and communication technology as a means to support student-centered learning and increase learning effectiveness. The Merdeka Curriculum also emphasizes the importance of integrating technology in learning which allows students to be actively involved in the learning process. This is in accordance with research results which state that technological capabilities in the educational aspect can involve students in various activities so that learning becomes more effective.

Interactive media is a combination of several other media elements, including text, images, graphics, animation, audio and video, which can be controlled and operated by the user, so that the user can choose what will be executed first according to the existing choices and instructions (Jailani, 2015). The ability of interactive multimedia is to increase understanding of concepts related to display so that it can help students visualize abstract concepts and improve learning to be more effective (Nusir, 2013). In this era, educators not only have broad knowledge, high skills in science, high ability in choosing and using models, methods, techniques or strategies, but also have to create, use and use learning technology. Apart from that, teachers must develop innovative and research-based learning technology (Oktarina, 2021). It is the teacher who is the key issue for the successful integration of various digital learning media features into the classroom and depends on the teacher's ability to structure the learning environment in a non-traditional way, combine new technology with new pedagogy, develop socially active classrooms, encourage cooperative interactions, collaborative learning , and group work (Graça Magro, 2014).

Through this interaction, students will be active so that the goals in the learning process can be achieved. The learning process cannot be separated from two necessary components, namely learning methods and learning media, because these two components are interrelated. The choice made by the teacher in one particular learning method will influence the type of learning media that is appropriate and effective (Suryani, 2016). The era that has shifted to the digital era certainly has its own impact on teachers in teaching science content concepts.Science learning process skills are scientific skills that can be used in scientific activities to discover something, which include basic science process skills and integrated science process skills. One alternative that can make students more active in learning activities and give percentages is by paying attention to a comfortable and pleasant atmosphere and is closely related to the development of learning process skills (Hartono, et al, 2021).

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Climate change is a change in climate variables, especially air temperature and rainfall, which occurs gradually over a long period of time between 50 and 100 years (inter centennial). In addition, it must be understood that these changes are caused by human activities (anthropogenic), especially those related to the use of fossil fuels and land use change (Khambali, 2019). The negative potential or risk of climate change on health has been seen as a global challenge that can threaten human livelihoods. Climate change is expected to contribute to air quality problems (Oksfriani, 2019).

Respiratory problems are also one of the dangers of climate change for human health that needs to be watched out for. This disturbance is caused by none other than the increasingly severe air pollution in the surrounding environment. High levels of dust, ozone and fine particles in the air can reduce air quality. One of the causes is forest fires as occurred in Indonesia in the last six months, namely in August 2023. Forest and land fires have caused damage to a number of areas in Indonesia, such as in the cities of Palembang and Jambi is hit by smog, so the air quality is deteriorating and this is very detrimental to human health, especially respiratory diseases. such as asthma, cough and throat irritation, and pneumonia.

This material is a challenge for educators so that it can be understood well by students, considering that science content is abstract material so tools are needed to make it easy for students to understand. One of them is by presenting interactive learning multimedia that can be operated independently by students so that it can make students more active in learning both classically and individually. The selected multimedia must be adapted to the characteristics of students, students' backgrounds, socio-economic conditions, facilities and infrastructure, and students' learning styles. Currently, students are faced with information technology which shapes their learning styles and learning methods. This is in line with research from Garcia, A., et al (2022) entitled "Adapting Multimedia Learning to Diverse Learner Characteristics". This research examines strategies for adapting multimedia learning to the characteristics of diverse learners. The results show that an approach that takes into account students' backgrounds, individual needs, and learning style preferences can increase the effectiveness of multimedia in learning.

Students in the digital era consider that using technology in the learning environment is important. Most of them have experience using online tools in their education (Roberts, 2015).They learn best through interaction, and they require special use of technology to communicate quickly with each other. Additionally, they learn by creating, editing, commenting, and sharing documents and ideas (McNeely, 2015). Today's students consider technology to be an integral part of their learning experience. They realize that technology has an important role in facilitating access to information, expanding the scope of learning, and improving the overall quality of learning. This is reflected in their awareness of the benefits of technology and the belief that using technology can enrich their learning experience. In this way, educators can optimize the potential of technology to improve the learning experience and achieve better learning outcomes for students in the digital era.

Research on the development of interactive learning multimedia was carried out by Suwito, et al (2020). The aim of this research is to analyze products in the form of interactive learning media based on PBL learning models that are valid and suitable for use in theme 9 subtheme 3 for class V elementary school. This type of research is development research using the ADDIE model. The results of this research show that the percentage obtained was 84.89% by media experts and 82.67% by material experts, while teacher responses from the three elementary schools showed percentages of 96%, 82%, 96% and student responses from the three elementary schools showed percentages of 97.39%, 96.09 %, 97.5 %. So it can be concluded that interactive learning media is very valid and very suitable for use.

Further research was conducted by Pratiwi &Agung (2021). This research was developed based on the results of an analysis of learning media needs in elementary schools, due to the lack of them varied learning media and limited learning resources. The research results showsubject matter experts obtained a percentage of 92.50 in the very good category, the results of the assessment of learning design experts obtained a percentage of 92.31 in the very good category, the results of the media expert's assessment obtained a percentage of 92.64 in the very good category, product assessment results from the test individual obtained 94.20 in the very good category. Based on the validation results from experts as well as individual tests, it can be decided that interactive multimedia for display material content

The natural and diverse flora and fauna of Indonesia are suitable for use in the learning process in grade 5 elementary schools. Research on the development of interactive multimedia was also carried out by Ningsih, et al (2019). This study aims to develop problem-based interactive learning media on respiratory system material. The results of the research show that the material score achieved by the media developed is 90% (very good), while the media presentation score is 83% (very good); in addition, the language score obtained was 99% (very good). Thus, the average score is 91% (very good), which means that the interactive learning media developed is considered very good for implementation in learning the respiratory system.

Several things that inspired this research with previous research are that this research will be carried out on science content on the importance of clean air for breathing in the context of climate change. This research selects material on the importance of clean air for breathing in the context of climate change, which is an issue that is increasingly urgent and relevant in everyday life. By choosing an actual context, this research has the potential to increase students' understanding of the importance of maintaining clean air in the face of global climate change. Researchers will design learning media by combining video, audio and image features to produce interactive media. Based on the description above and the success of previous research in improving student learning outcomes and by looking at needs analysis, researchers will conduct research on "Development of Interactive Learning Multimedia on the Importance of Clean Air for Respiration in the Context of Climate Change in Class V Elementary Schools."

Research methods

This research was conducted using descriptive methods with a quantitative approach. This research describes an achievement without manipulating treatment which aims to obtain direct information available in the field, namely critical thinking skills (Azizah et al., 2018). This research was conducted in November 2023. The subjects of this research were 23 students of class V of SDN 10 girls whose address is Jl.Sultan Muh.Mansyur Lrg.Sungai Itam Kel Palembang, consisting of 9 boys and 14 people.Bukit Lama Kec. Ilir Barat I Palembang in the 2022/2023 academic year. Data analysis techniques use questionnaires, interviews, walkthroughs and tests. The instruments used are student needs analysis instruments, one to one and small group practicality instruments, pretest and posttest instruments, interview instruments, walkthrough instruments consisting of media, material and language expert validation instruments. This research is development research using the Hannafin and Peck model with 3 stages, namely the needs analysis stage, the design stage and the development & implementation stage. The following is a flow diagram of the Hannafin and Peck development model :

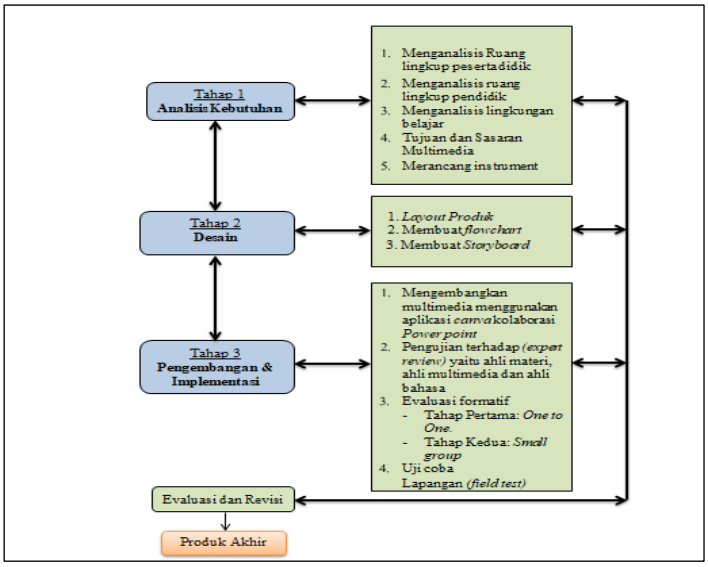

Figure 1 Research Flow Diagram of the Hannafin and Peck Model

Data collection techniques in this research are questionnaires, interviews, walkthroughs and tests. Data analysis techniques are methods used to process data into information by determining the results of research (Helaluddin & Wijaya, 2019). The data analysis techniques used in this research include analysis of student needs questionnaire data, walkthrough data analysis consisting of (media, material and language experts), product practicality questionnaire and analysis of learning outcomes test data.

There are three data collection techniques in this research, namely questionnaires, interviews, walkthroughs and tests. The grid for each data collection technique can be seen in the tables below:

Table 1. Student Needs Analysis Questionnaire Grid

Aspects	Indicator	No Statement
Method	a. Methods used vary	1
Material	b. Barriers to understanding the material	2
		3
	c. Use of IT in material	4
	d. Use of interactive multimedia in the material	
Media	e. Media use	5
	f. The need for media Preferred media	6
		7,8
Infrastructure	g. Supportive capacity of facilities and infrastructure	9,10

The table above is a questionnaire grid to determine students' needs regarding infrastructure, methods, materials and learning media. By knowing the needs of students, teachers can create learning according to students' needs.

Table 2. Unstructured Interview Guide Grid

Aspects	Indicator
Learning	Barriers, learning resources, media, methods
Student competency	Student abilities
Facilities and infrastructure	Infrastructure that supports IT-based learning

The table above is a grid table for Unstructured Interview Guidelines conducted with grade 5 science teachers to determine the needs of teachers and students in creating learning.

Table 3. Multimedia Expert Grid

Aspects	Indicator	No Statement
Appearance	Image suitability for purpose	1
	Matching colors and writing	2
	Suitability of image to material	3
	Accurate type and size of letters	4
	Interesting background	5
	The images presented are quality	6
	The cover matches the material	7
	Continuous background	8
	Motivating	9
Command Aspect	Clarity of commands	10
	Consistency of symbol accuracy	11
	Accuracy of navigation use	12
	Neatness of multimedia product design	13

The table above is a multimedia expert validation questionnaire grid which functions to find out whether the product being developed is valid and suitable for testing in terms of design.

Table 4. Material Expert Validation Grid

Aspects	Indicator	No Statement
Introductory Aspects	a. Suitability of material to learning objectives	1
Content Aspect	a. The consistency of the content of the material description	2
	b. Into the material	3
	c. Clarity of language	4
	d. Interrelationships between materials	5
	e. The attractiveness of the material content	6
Evaluation Aspect	a. Material suitability	7
	b. Clarity of instructions for working on questions	8
	c. Difficulty level of questions	9
Closing Aspect	a. Accuracy of providing feedback	10
	b. Presentation of bibliography	11

The table above is a material expert validation questionnaire grid which functions to determine whether the product being developed is valid and suitable for testing in terms of whether the material presented is in accordance with the learning material.

Table 5. Linguist Expert Validation Grid

Aspect	Indicator	No Statement
Grammar	a. Use of EYD	1
	b. Easy to understand language	2
Informative and Communicative Level	c. Communicative and informative language	3
	d. Language suitability	4
Clarity	e. Sentence effectiveness	5
	f. Writing readability	6
Consistency	g. Conformity of sequence and completeness of components	7
	h. Consistency in the use of terms and symbols	8
	i. Sequence and cohesiveness of each paragraph	9

The table above is a linguist validation questionnaire grid which functions to find out whether the product being developed is valid and suitable for testing in terms of language.

Results and Discussion

This research aims to develop an interactive multimedia product that is valid, practical and effective using a collaborative application between Canva Collaboration and Power Point on the importance of clean air for breathing in the context of climate change for class V elementary schools. This research activity uses the Hannafind and Peck development model, where in this product development activity there are three stages, needs analysis stage, design stage and development and implementation stage.The first step taken by researchers was to analyze the needs of the scope of students and educators located at SD Negeri 10 Palembang. This activity was carried out by researchers in order to obtain information in the form of important points needed to analyze matters related to the process of creating interactive learning multimedia on the importance of clean air for breathing in the context of climate change. The following are the results of the analysis of student needs.

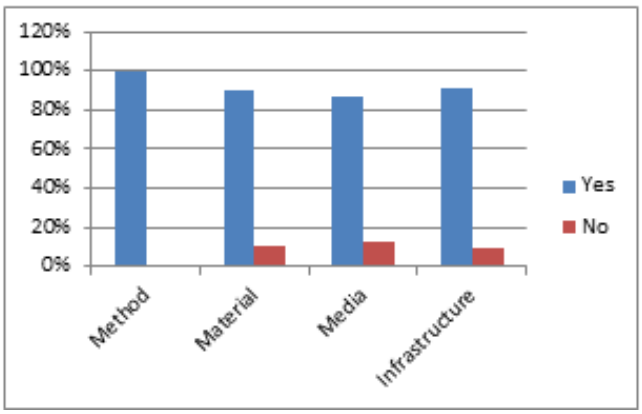

Figure 2. Recap diagram of student needs analysis results

Based on the recap of the results of the analysis of student needs, it is known that Class V students at SD Negeri 10 Palembang require 100% varied learning methods, 90% respiratory materials, 87% interactive media, and 91% carrying capacity of infrastructure. So researchers or developers conclude that students requires interactive learning media on the importance of clean

air for breathing in the context of climate change for class V elementary schools.

Table 6. Facilities and Infrastructure at SDN 10 Palembang

No	Facilities and Infrastructure	Available/No	Information
1.	Croombook	There is	17 Croombook Units
2.	Internet Connection (wifi)	There is	Fluent
3.	Smartphones	There is	Every student
4.	LCD	There is	2 Units

Based on the results of questionnaires from students and interviews with class V teachers at SDN 10 Palembang, it was found that students need interactive learning multimedia on the importance of clean air for breathing in the context of climate change to increase student motivation and learning outcomes. In using interactive learning media at SDN 10 said to be worthy and supportive. The following are the results of the analysis of school facility needs.

In the second stage, namely the design stage, create a media design that has been designed in the form of flowcharts, layouts and storyboards which are then developed into complete media using the Canva collaboration application with PowerPoint integrated with the ISpriing suite. Results of developing interactive multimedia products on the importance of clean air for breathing in the context of climate change for class V elementary schools.

Figure 3. Interactive multimedia title

Figure 4. Interactive multimedia menu

Figure 5. Interactive multimedia materials materials

Figure 6. Interactive multimedia

Figure 7. Interactive multimedia videos

Figure 8. Interactive multimedia quizz

After the learning multimedia has been created, the next stage is testing the multimedia, material and language. This stage has the aim of producing interactive learning multimedia products using the Canva collaboration application with valid ISpriing integrated power points. The following are the results of the recapitulation of validation sheet calculations by multimedia experts, material experts and language experts

Table 7. Validation Recapitulation Results Expert Review

Aspect	Validator (Expert)	Score	Category
Multimedia	S	98 %	Very Valid
Material	RS	87 %	Very Valid
Language	SO	93 %	Very Valid
Average		93 %	Very Valid

Based on the table above, it can be concluded that the interactive multimedia material on the importance of clean air for breathing in the context of climate change that was developed is declared very valid and suitable for use.Next is the practicality test which was carried out on class V students at SDN 146 Palembang considering that there was only 1 group of class V students at SDN 10 Palembang. The practicality test was carried out in 2 stages, namely One to One and Small Group. Following are the results of the One to One practicality test.

Table 8. Recapitulation of One to One Practicality Test Results

Assessment Aspects	Number of Statements	Max Score	Score Gain	Percentage (%)	Category
Appearance	6	6	6	100	Very good
Learning objectives	2	2	2	100	Very good
Media Interest	2	2	2	100	Very good
Material Contents	4	4	4	100	Very good
Sound	1	1	1	100	Very good
Voice	15	15	15	100	Very good

After the one to one test, it was continued with the small group test which was given a questionnaire to 8 students. The following are the recapitulation results of the small group practicality test.

Table 9. Recapitulation of small group practicality test results

Assessment Aspects	Number of Score	Statements Max	Score Gain	Percentage (%)	Category
Clarity	2	10	10	100	Very Practical
Presentation technique	3	12	15	80	Practical
Image accuracy	3	14	15	93	Very Practical
Text accuracy	2	6	10	60	Quite Practical
Video suitability	2	10	10	100	Very Practical
Navigation effectiveness	2	6	10	60	Quite Practical
Sound Compatibility	3	11	15	73	Practical
Communicative	2	10	10	100	Very Practical
Amount	19	79	95	83	Very Practical

From the table above, the recap data of the results of the small group questionnaire assessment is obtained, namely aspects of Learning Clarity 100%, Presentation Techniques 80%, Image Accuracy 93%, Text Accuracy 60%, Video Suitability 100%, Navigation Effectiveness 60%, Voice Appropriateness 73% and Communicative 100% with a total practicality of 83% in the very practical category, so it can be concluded that the interactive multimedia product on the importance of clean air for breathing in the cotext of climate change for class V Elementary School is stated to be very practical. In this final stage, what is carried out is a field test activity, namely by giving a pretest and posttest in the form of twenty multiple choice questions to students that are in accordance with the competency material. The results of the recapitulation of students' pretest and posttest can be seen in table below:

Table 10. Recapitulation of Student Learning Results

Value Interval	Number of Students		Percentage (%)		Information
	Pretest	*Posttest*	*Pretest*	*Postest*	
90-100	0	13	0	57%	Very good
80-89	0	9	0	39%	Good
70-79	6	1	26%	4%	Enough
60-69	7	0	30%	0	Not good
0-59	10	0	44%	0	Very Not Good

Based on the recapitulation table of student learning outcomes during the pretest and posttest, the differences are clearly visible. Data from 23 students during the pretest showed that 6 students got a score between 70-79 and 7 students got a score between 60-69 and 10 students got a score between 0-59. After students learned using interactive multimedia learning, it showed changes in the assessment, namely between the 90-100 score range, there were 13 students and 9 students got scores between 80-89, then there was 1 student in the score range between 70-79. No students were found in the assessment. between the score range of 60-69 and the score range of 0-59 after learning using interactive learning multimedia,

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so here you can see the difference in student learning outcomes before and after using interactive learning multimedia. The following is a comparison diagram of pretest and posttest result

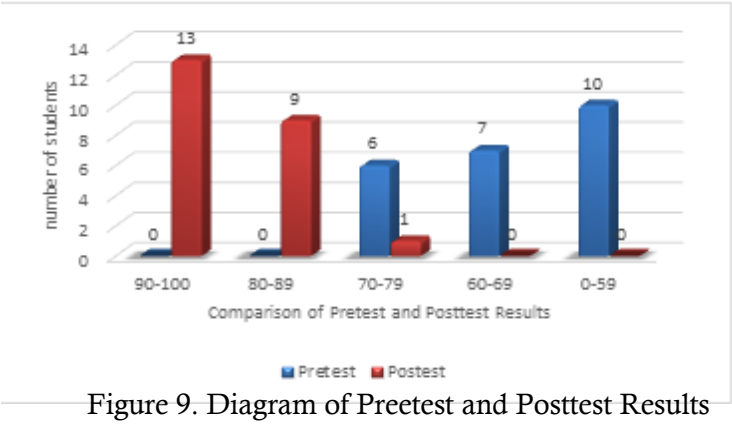

Figure 9. Diagram of Preetest and Posttest Results

Based on the diagram in the image above, it shows that there are differences in student learning outcomes in science content, especially material on the importance of clean air for breathing, before and after implementing interactive learning multimedia in learning activities.

Table 11. Recapitulation of Pretest, Posttest, N-gain Result

Mean *Pretest*	Mean *posttest*	*N-gain*
60.65	91.74	0.74
Categori		High Category

Based on the table above, it shows that the N-Gain obtained is based on the average of the initial and final tests, namely 0.74 in the high category. The results obtained illustrate that there is indeed effectiveness of the use of interactive learning multimedia on student learning outcomes in science content on the importance of clean air for breathing in class V elementary school. This is in line with the opinion of Hake (1999) which states that if $0.7 > g \geq 0.3$, then what is produced is included in the medium category. which has been used as a reference in determining the category of each learning outcome, that if the N-gain obtained is less than 0.3 then it is categorized as low and if the result obtained is greater than 0.7 then it can be categorized as high, based on the results that have been accumulated by the students' learning outcomes after implementing interactive learning multimedia is included in the high category, namely getting an N-Gain of 0.74. This is in line with the opinion of Hake (1999) which states that if N-gain ≥ 0.7, then the resulting N-gain is included in the high category, which means that interactive learning multimedia is very suitable to be used to help the learning process.

Conclusion

Based on the results of research conducted at SDN 10 Palembang, the results showed that the development of interactive multimedia learning was proven to be valid, practical and also effective for student learning outcomes. From the validation results of multimedia, material and language experts, 98% were obtained by multimedia experts, 87% by material experts and 93% by language experts, so the average was 93% and was included in the very valid category. For the practicality test, the one to one test reached 100% and The small group

reached 83%, including the very practical category. For the effectiveness test, the pretest was 60.65 and the posttest was 91.74, which shows an increase from before using interactive multimedia and after being used in learning activities so that student learning outcomes can also be categorized as high with an N-gain value of 0.74 and included in the effective category, so that The development of interactive multimedia learning on the importance of clean air for breathing in the context of climate change for class V elementary schools has indeed been tested for its validity, practicality and also the effectiveness of student learning outcomes. From the results of research that has been carried out, students like varied and interactive learning, both visual and audiovisual, so that later there will be a need to develop other interactive media.

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