Development of hydrological cycle learning media based on android application for fifth grade elementary school students

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Abstract: *Based on Efendi's research (2020), it is found that many teachers only focus on using books so that students feel bored and bored in learning which results in learning not being maximally received. educational media is used as a tool in learning activities to assist teachers and students in achieving learning goals, where technology has become an integral part of all activities. This study aims to develop multimedia learning applications for hydrology subjects for grade v elementary school students. The methodology used is R&D, focusing on the development process. the application is made through the analysis, design, and development stages. validation from two validators of the media gave 94% results and stated the validity of the media without revision to be used in learning the hydrological cycle in the school curriculum. recommendations from this study are to improve user identity features and quiz features in the surrounding environment.*

Keywords*: R&D; aplikasi; siklus hidrologi; media pembelajaran; multimedia;*

Introduction

Literally, the word "science" means knowledge, which is based on the scientific method and is rational and objective (Kumala, 2016). In the book "Learning Science for Early Childhood" Abrucasto (1993) says that science or IPA is a knowledge obtained through a series of coherent processes to reveal everything related to the universe. This can be taken to mean that science is a science that is systematically organized, objective, and also realistic not only about the universe but also about how to obtain facts about the universe. Science, or Natural Sciences (IPA) in Indonesian, is defined as the effort to observe natural phenomena around us and explain them logically so that conclusions can be drawn. One of the subjects taught at the elementary school level in Indonesia is IPA (Kusniawati & Subayani, 2023). In elementary schools, science education plays a crucial role in continuing science education at higher levels because the initial knowledge that students possess greatly influences their interest and tendency in learning science (Widiana, 2016). Yulianti (2017) also said that natural science or science in elementary school is very important because it is a provision for students to face various global problems that arise today (Yulianti, 2017). Science itself originates from experiments on observed natural phenomena, not from human thought. Science is also categorized into various fields such as astronomy, chemistry, meteorology, mineralogy, physiology, and biology (Kumala, 2016). Learning is the essence of the educational activity. Education is defined as the interaction process between students and learning resources (Firmadani, 2020). Educational activities are techniques to achieve learning outcomes (Kumala, 2016). The absorption rate in receiving diverse learning varies among students. This includes the learning system for each child, especially for elementary school children who are still in stages of sensory and motor development. The National Education Standards Agency

[53]

(BSNP, 2013) states that scientific inquiry is an ideal method to be applied in science education because it is capable of enhancing the ability to think, work, behave scientifically, and communicate, which are important components in life skills (Kumala, 2016).

The science material for 5th-grade elementary school on the hydrological cycle explains how water on Earth is constantly renewed and never runs out, as well as the system of rain formation, according to research conducted by Wijariyah (2020) at SD N Teras 1, Kab. Serang, especially in the 5th grade, one of the problems in the learning process of the hydrological cycle is the lack of understanding of the water cycle or hydrological cycle. Additionally, the learning materials still focus on the book and lack the use of tools and the surrounding environment that could be utilized as learning media (Wijariyah, 2020). As part of the learning process, teachers must encourage students to think scientifically about natural processes and the environment (Kusniawati & Subayani, 2023). Considering the role of teachers and also efforts in helping students understand the material well and maximally, there is a need for learning media that support the learning of the hydrological cycle for grade 5.

According to data obtained from a study in 2022 by Kusniawati and Subayani, the collected data showed that 60% of students still have difficulty mentioning the stages of the hydrological cycle, 50% assume that water evaporation only occurs at the sea surface, and 70% are confused when seeing pictures of rain events occurring in the mountains, while students only understand that rain occurs over the ocean (Kusniawati & Subayani, 2023). According to a statement by Joko Purnomo, there is a need for a learning media that can support the learning and teaching process (Pribowo, 2018). From this, it can be said that there is a need for learning media to help understand the concept of the hydrological cycle for students.

To date, the outcome of education is key to the survival of a nation (Kharismatika, Cahyadi, & Subekti, 2023). Considering the rapid development of technology, it is essential to keep up with technological advances, including in the field of education. With the significant development of technology and information, this is felt in the field of education and is considered beneficial for the educational world (Amin Akbar, 2019). The percentage of gadget users is quite high at 79.5%, including children and teenagers in Indonesia (Oktafia, Triana, & Suryani, 2021). In a study conducted by Wulandari (2016) from 2014 data, about 47 million people in Indonesia or about 14% of the total active smartphone users use their smartphones. This makes Indonesia rank in the top five countries using electronic devices, especially smartphones (Heni & Mujahid, 2018).

From the above data, it is known that many children are proficient in operating gadgets. Technological developments can be utilized in the field of education. In line with the official curriculum, namely, the independent curriculum. The independent curriculum aims to create a pleasant learning atmosphere (Rahmadayanti & Hartoyo, 2022). In the independent curriculum, there is also the Pancasila student project, which includes several themes, one of which is by using innovation and technology applications, students can solve various problems in their society by synergizing technological and social aspects. Thus, they will have the ability to build a smart community culture (Rahmadayanti & Hartoyo, 2022). In line with the independent curriculum, advanced technology development can accelerate and smooth the

learning process (Wal Ilham, 2022). Based on research conducted by Efendi (2020) It is found that the development of learning media that is attractive to students is needed. This, as in Efendi's research (2020) that a motion graphics animation video has been developed which is considered capable of explaining phenomena that are abstract or difficult to visualize. In his research, he also wrote that videos can make students feel more interested in learning. In line with Mayer's statement in (Kurniawan, Kuswandi, & Husna, 2018) in previous research that multimedia media development is considered capable of attracting students' attention. In this case, a multimedia-based android application was developed in which there is a learning video, animation, audio images, and other interesting things for students.

The developed application is an Android-based software. Observations show that students enjoy learning using media with images and attractive colors. Especially in science learning, students are more interested in materials that present clear images (Luh Putu Ari Laksmi & Wayan Suniasih, 2021). Thus, the developed application features elements such as Basic Competencies and Core Competencies of the material, quizzes, instructional videos, and is equipped with visual and audio content that makes it more attractive. The purpose of this research is to develop more varied and innovative learning media for future educators, and it is hoped that educators can create learning media that are more suitable and effective for students, taking into account the aspects of technological development in the surrounding environment.

Method

The research method used in this study falls into the Research and Development (R&D) category. R&D is one of the research methods used in the validation and development process of products (Sugiono, 2019:28). In her research, Sri Sumarni, Sugiyono also states that development research is a way to create a product and test the performance of the product (Sumarni, 2019). Currently, the development model used is ADDIE, which involves stages of analysis, design, development, implementation, and evaluation. However, due to the time constraints of the author, this research is only limited to the design stage due to the limited time available to the researcher.

This R&D method has been widely applied in the fields of engineering and natural sciences (Sugiyono, 2022). According to Sri Sumarni in her research, research and development were initially only applied in the industrial world and less than 1% were applied in education and social sciences (Sumarni, 2019).

From the literature review conducted, results were obtained that were used as a source of ideas or inspiration for the development of media from the selected material. Therefore, the development carried out took the form of a software application for the hydrological cycle for a 5th-grade elementary school. The subjects are the 5th-grade students. This is because it aligns with the chosen material to be developed, which is the hydrological cycle material that is included in the 5th-grade elementary school curriculum. Data collection in this case uses a literacy study. Sugiyono (2012) mentioned that a literacy study is a type of research that studies theoretical and other references relevant to the research problem (Wulandari, Salsabila, Cahyani, Nurazizah, & Ulfiah, 2023). There are many advantages to using this

observation method in data collection, including being able to understand the context of the data, gain direct experience, and also discover things not revealed by other methods due to direct fieldwork, thus obtaining more realistic data. In line with Sugiyono, Adini (2022) also states that literacy study (library research) is a data collection method by studying theories from various literature relevant to the ongoing research (Adlini et al., 2022).

In this study, there are several research instruments included that consist of divisions of media and material validation sheets. This questionnaire method collects data by giving respondents several written questions (Mufidah et al., n.d.). This questionnaire is used to assess whether the product produced can be applied well to students. The validation sheets shown to experts in media and materials are used to determine the quality of the media created and the suitability of the material within the media.

In data analysis, validity data indicates whether the media created are valid or not. The data collected is then analyzed and processed both quantitatively and qualitatively. Analysis of the data obtained from experts on resources and also educational media is shown as a form of recommendation and evaluation for the development of learning media in the future. As a form of renewal and future development, there is a need for qualitative descriptive data analysis. Meanwhile, data collected using a Likert scale, is analyzed using quantitative descriptive analysis. The data calculation to obtain the percentage number uses the formula of the number of scores obtained divided by the maximum score which is then multiplied by 100%. According to Prasetyo (2015), in his research, the score for media feasibility is shown in Table 1 (Prasetyo, 2015)

Table 1. Media Feasibility

Media Feasibility Categories		
No.	Media Feasibility Score (%)	Category
1	85 – 100	Very Feasible
2	69 – 84	Feasible
3	53 – 68	Moderately Feasible
4	37 – 52	Less Feasible
5	20 – 36	Not Feasible

Results and Discussion

The results of validation to the two media expert validators showed a score of 47 with validator I getting a score of 47 with a percentage of 94%. With this, the application made for learning media for the hydrological cycle in grade 5 elementary schools can be said to be valid and suitable for use in learning. The score obtained from validator II is also at 47 with a percentage of 94%. From the two distributions of media validation questionnaires to the two teachers, the media validation results were obtained at 94%, which means that this application can be used and applied in learning the hydrological cycle of grade 5 elementary school. From the distribution of validation questionnaires to the two teachers, an input was obtained regarding the application developed, namely if the application can make updates such as for example the teacher is able to update the material in it which is adapted to the

surrounding environment so that learning is expected to be better understood by children in the classroom.

The development of media is made according to their respective uses and purposes. Behind the development of learning media, which has become very varied, there are advantages and disadvantages, in the development of media in the field of education. Multimedia development in the field of education can be an innovation. Arsyad (2014) in his book states that the use of multimedia in learning can increase desire, interest, motivation, and stimulation in learning. It also can have an impact on the psychology of students

1. *Analysis*

Therefore, the media development conducted is in the form of an application targeted at the material of the hydrological cycle in natural sciences for fifth-grade elementary students. The stages in the development of this media are carried out using the ADDIE model, which consists of the stages of analysis, design, development, implementation, and evaluation. However, due to the time constraints of the author, the research is only limited to the design stage. The following are the stages that use

The analysis stage is conducted on the hydrological cycle material, characteristics of the students, and availability of resources and infrastructure at the school. This is done by conducting a literary study of several articles and books. From the research conducted by Ernawati and Rachmawati (2018), the results of observations and interviews with teachers and students showed that the use of learning media is considered inefficient because it is only limited to textbooks and blackboards, which causes students to be less interested (Ernawati & Rachmawati, 2020). In addition, observations conducted in 2017 at SDN Penanggungan stated that 13 out of 30 students in each class were able to understand the concepts and facts of natural sciences, and less than half of them could master the concepts (Muh Zulqutbi Azhari & Yuliati, 2017). Another study mentioned that the results of observations and interviews conducted at the elementary school Cluster Yudistira in Negara sub-district showed that teachers only utilized books in learning (Putu, Wirantini, Astawan, & Gede Margunayasa, 2022).

At the beginning of 2022, there were 370.1 million mobile device connections in Indonesia, according to data from the research company data reported. This supports the fact that many millennials still find it difficult to balance between learning and the use of technology, especially gadgets, although learning is their main responsibility as students (Rostiani, Sujana, & Jayadinata, 2023). Combining technological developments and learning can be a breakthrough in the world of education. Multimedia development in learning is an innovative thing in the world of education. According to Hoftetter in Binanto (2010), multimedia not only utilizes computers to create and compile visuals or audiovisuals but also functions as a combination of links and tools that allow users to interact, react, and communicate with one another (Ilmiani, Ahmadi, Rahman, & Rahmah, 2020). From several studies, it is concluded that there is a need for the development of updated learning media

so that students can understand the material well and make the process of learning and teaching more enjoyable

2. Design

Based on the results of the analysis, the next step is the process of designing the media to be created. In this study, there are several applications used in the media creation process, namely Articulate Storyline 3, Canva, and Website2ApkBuilder. The first step in developing this application is the creation of a storyline that has been arranged according to the prototype design, followed by the collection of assets that will be used in the media creation.

Asset collection is taken from several sources. Some are from Google, Canva, and YouTube. These assets are collected and then used for media creation. In the integration of these assets, the help of another application is required, namely Canva. Here, Canva plays a role in designing the application in the background as shown in Figures 1 and 2.
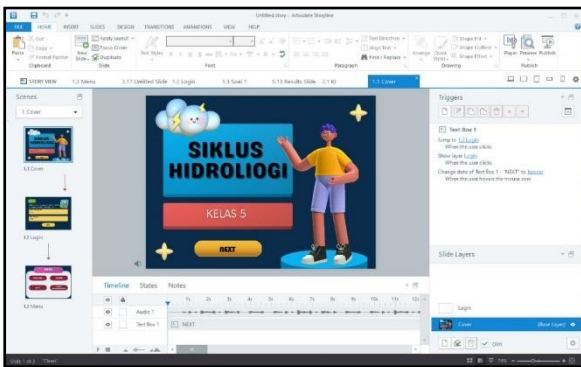

**Picture 2.** Initial design of the application
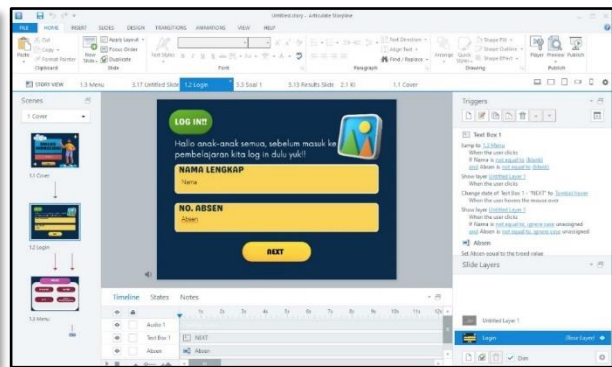
Picture 1. Application interface after pressing the "Next"

The initial display is accompanied by additional background music, so it is hoped that students will be more comfortable following the lessons within the application. The initial display of the application will show Image 1, which if the "Next" button is pressed, will respond to the next part as shown in Image 2. According to Image 2, there is a trigger in that section that will provide a response if the user accidentally presses the "Next" button before completing the "Full Name" and "No. Absent" sections, there will be a warning response to complete those sections as shown in Images 3 and 4
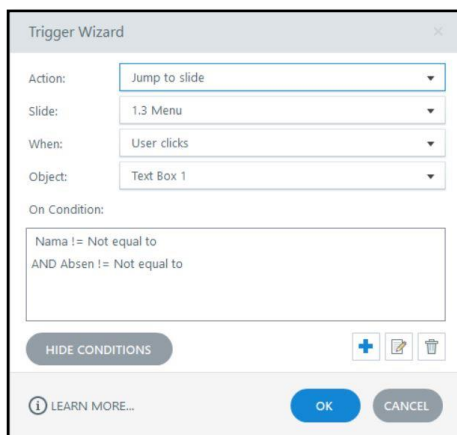
Picture 3. Trigger implementation
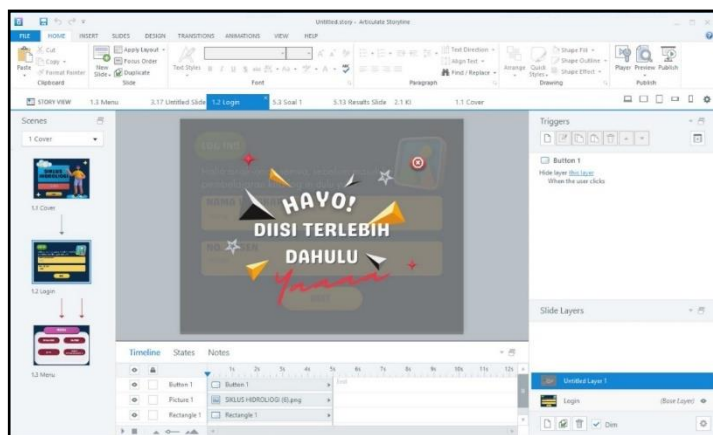
Picture 4. Warning display to complete the fields

If you press the cross button complete the two columns and then press the "Next" button, it will display the main menu which is divided into four parts, consisting of Basic Competencies and Core Competencies (KI and KD), material, quizzes, and instructional videos.

3. *Development*

This section discusses the process of creation/development from the previous stage, which is designing, and the final outcome of the application. Next, functional testing and media feasibility testing are conducted. Below are the stages of media development that were carried out:

### a. **Creating Learning Media Using Articulate Storyline 3**

After the design was created in the Canva application, the next step was the integration of the designed media to operate as planned, using Articulate Storyline 3. First, create a new project in the Articulate Storyline 3 application. Then, create each section you want to make according to the initial design starting from the main page of the media. Image 6 shows the creation of buttons on the main menu. In the creation of tools, the design made on Canva is used, then adding text for Basic Competencies and Core Competencies (KI and KD), Material, Instructional Videos, and Quizzes by clicking the "insert" menu on Articulate Storyline 3 and then selecting "Text Box".

After all sections are created, the process of implementing animations on the media is then carried out. Some of the tools used in creating animations: the timeline tools are used to set the duration of the animation displayed, and the state tools are used for editing when an arrow or when text is pressed to display the desired animation effect, and the triggers tools are used as commands that will run the effects and animations that have been applied and are also used to display the next slide when the text is clicked.

In this application development, on the main menu there is a Quiz section which contains 10 multiple-choice questions as a measure to assess whether one can understand the lesson well. The maximum score is 100 and the minimum passing score is 70. Scores below 70 are considered failing, as shown in images 9 and 10.
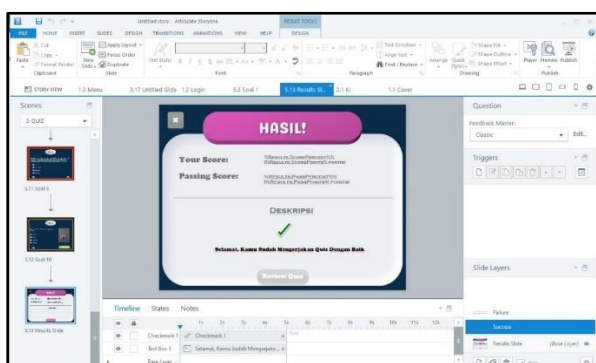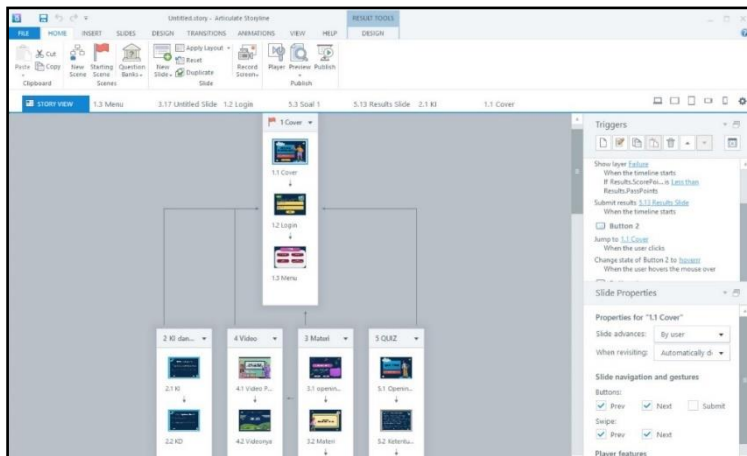

Picture 6. Pass quiz display
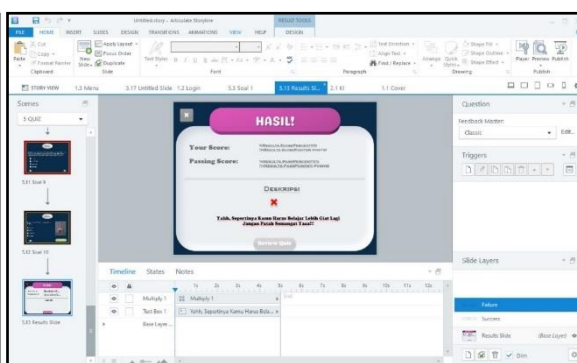
Picture 5. Fail quiz display

After being set up to show the scores obtained, whether it is declared pass or fail, the application is programmed to be able to review the results of the answers so that the students can understand which questions they got right and wrong.

Picture 7. Story view display

The creation of the media is completed according to the initial design that has been made. This includes adding images, instructional videos, materials, and the necessary audio for the media being created. Image 11 shows the view after all the media has been completely created in Articulate Storyline 3, including the arrangement and programming of the media.

The process of installing the application is done by converting the media that has been developed by Articulate Storyline 3. The media that has been created and published in Articulate Storyline 3 will result in an .apk file extension. To convert from an Articulate Storyline 3 extract file into a mobile application, the assistance of a third-party application, Website2APKBuilder, is required.

The application that has been installed on the Android device was then tested on the Android system, and operating the application could be done smoothly and correctly according to the design from the initial display, main menu section, and core section, to the quiz part and the results are shown.

Based on the development of the hydrological cycle application, the next step is the need for validation by two experienced validators. The validation itself is done by providing a media feasibility test questionnaire to these two validators, and then the average of their scores is calculated. The recapitulation results from both validators can be seen in Table 2

Table 2. Media validation score

Media Feasibility Assessment		
Validator I	**Validator II**	**Average**
47	47	94%
94%	94%	

Based on the results obtained, it is evident that rapid technological advancement necessitates continuous updates to keep pace with the times. Children aged 5 to 12 years are the majority of users of current information and technology media (Megahantara, 2017). Primary school children, typically aged 6 to 12 years, often utilize technological advancements, especially mobile phones. Observing this phenomenon, schools have adopted

an independent curriculum in education. In line with the current curriculum, which uses the independent curriculum, it also emphasizes the development of student competencies and important materials so that students gain more meaningful and enjoyable knowledge without haste (Rahmadayanti & Hartoyo, 2022). From this, it can be concluded that there is a need for the development of enjoyable learning media for children in educational activities with proper guidance from both teachers and parents.

The development of media is made according to their respective uses and purposes. Behind the development of learning media, which has become very varied, there are advantages and disadvantages, in the development of media in the field of education. Multimedia development in the field of education can be an innovation. Arsyad (2014) in his book states that the use of multimedia in learning can increase desire, interest, motivation, and stimulation in learning. It also can have an impact on the psychology of students (Arsyad, 2014:19).

This android application media was chosen because it was considered to have various advantages in it which made the author finally think of developing this application. As for some of the advantages of developing this android application, namely because every learning media made must be able to help all student learning styles, so that students are able to learn happily and easily (Rostiani, Sujana, & Jayadinata, 2023). In this case, the application created contains several interactive components in it such as images, animations, audio, audio visual, and also text. This is in accordance with the principle of multimedia itself and in line with the journal (Ilmiani, Ahmadi, Rahman, & Rahmah, 2020) that the combination of images, audio, text, graphics, and video is able to increase the enthusiasm of students to learn. This makes multimedia development a new innovation in science learning.

This is in line with research conducted by Efendi (2020) assessing that learning using animation-based videos is considered effective and suitable to be developed and applied in science teaching. In the research conducted by Efendi (2020), which also applied to the hydrological cycle material, assessed that the development of videos for hydrological cycle material was a good learning media development because it was able to visualize the material well.

However, the development of motion graphs videos is the impetus for the development of multimedia-based android applications in which there are images, audio, animation, and also learning videos so that there are more features in it and it is also easy to use because it is not only video but also written material. Application development was chosen because it is considered capable of attracting student interest because it is easy to access, easy to use, and also contains things that are interesting for students in learning, especially for elementary school children. this is evidenced by the value of 80% of the 26 respondents who agreed regarding this matter (Wijaya &Devianto, 2019). This is in line with research conducted by Ilmiani (2020) that is able to make students more interested in learning, efficient and easy to use anytime and anywhere. In this case, the advantage of developing this application compared to previous research is that there is an interactive relationship between students and the learning media created because there are also quiz features so that it can make interactive learning media for students.

One form of realization is the development of technology-based learning media. From this, technology is not only seen from its negative side but also has a positive aspect that can be applied in learning, for example, its development applied to the hydrological cycle material for fifth-grade students. Research results show that the hydrological cycle material involves processes and is abstract, so the oral explanation given by teachers is still felt to be lacking (Putri, Kuswandi, & Susilaningsih, 2020). This is the basis for creating an Android-based hydrological cycle learning media application. Thus, students are expected to learn in a more enjoyable way and also understand the lessons more optimally. This application includes several features including educational videos, learning materials, and quizzes that can be used as evaluation materials for teachers. The development of this application has also been validated by two validators, taken from two different school teachers, namely at SD N 01 Meteseh and SD N Dresi Wetan. The scores obtained from these two teachers were 47 with a percentage of 94%, meaning that this application is valid for use in teaching.

Conclusion

Given the continuous advancement of technology, so too must educational media develop. The development of learning media that keeps up with the times is essential. Children today are adept at using technology, including gadgets. From this, a tool has been developed within the learning process that is updated and enjoyable, namely the development of multimedia in Android-based application learning.

Based on the study results, it can be concluded that the development of a learning resource on the hydrological cycle for fifth-grade elementary students based on an Android application is validated as a learning source that can be applied in science education on hydrological cycle material, with a media validation result of 94% by two teacher validators from SD N Dresi Wetan and SD N 1 Meteseh. With the development of this media, it is hoped that it will help students understand the hydrological cycle, which includes materials, educational videos, and quizzes that can be used to assess student understanding of the hydrological cycle material. Further research needed includes the creation of a feature based on identity storage for its users to record user tracks such as the development of their understanding over time. And it could also be enhanced with the provision of questions more tailored to conditions in the environment.

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