



Development of Interactive Media Scratch-Based Educational Games on Environmental Conservation Materials in Elementary Schools

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Abstract: This study aims to develop interactive media Scratch-based educational games on grade V environmental conservation material in elementary schools and measure the feasibility of the media. This research used the D&D (Design and Development) method with the ADDIE model research design, which consists of 5 stages (Analysis, Design, Development, Implementation, and Evaluation). Data feasibility collection was done through the validation of material experts and media experts, as well as response questionnaires given to teachers and students. The data analysis technique used descriptive analysis techniques, which include qualitative and quantitative data. The results of the feasibility test from the material validator got a percentage score of 91.67%, which belongs to very feasible category; the media validator got a result of 92.5%, which belongs to very feasible category. The teacher response questionnaire obtained a result of 97.5%, with a very feasible category, and the student response questionnaire obtained a result of 95.75%, which belongs to very feasible category. Based on the resulting research, the interactive media developed, namely Scratch media, was very feasible to be used as a digital technology-based learning media innovation in elementary schools.

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Introduction

Education is an asset in the development of quality human resources according to the guidance of the times that need to be lived and pursued for each generation. It can guide each individual to have the strength to grow into a person with personality or character (AbdRahman, 2019). Based on the globalization that continues to spread and the rapid development of technological advances, education as a fundamental thing must also play an active role in improving human resources in the current era. Education can prepare and create the golden generation of the nation's successors (Hasnawati, 2017). The educational process can occur between two people who interact with each other, namely educators and students (Putra et al., 2020). It can be observed that the role of the teacher is the main thing in transferring knowledge to students.

The role of teachers as educators is not only teaching, but also educating, training, and guiding students so that they can be motivated to continue learning (Sopian, 2016). As such, students will not only understand but can also interpret the material that has been delivered. Therefore, the role of the teacher is very important, namely as the spearhead of the entire educational process (Monita & Faizah, 2020). With the current globalization, the ability of teachers is demanded and challenged to be able to provide creative and innovative learning materials, with the skills and presentation of teachers when teaching being the main points



(Davidi, 2018). Teacher professionalism is a benchmark in developing learning innovations that will be given to students. However, it cannot be denied that in accomplishing this, there are still many problems in the classroom, especially at the elementary school level (Trianingsih, 2016).

There are still teachers who only deliver material by dominating the class (teacher-centered) using the lecture method, while students only sit quietly listening without interpreting what material has been taught. It is stated that this lecture method has also become a habit that teachers always apply in teaching because it is considered practical and easy (Mahmudah, 2016). Whereas when the teacher dominates the class, the learning will be considered monotonous and undeveloped. That is because it makes students bored, sleepy, and less active, so the learning atmosphere becomes less effective (Suryani, 2020). Meanwhile, in the 21st century as it is today, students are required to be more active in every learning process, so teachers must be able to provide learning for students so that they can interact with each other and not get bored in class in the sense that students dominate the class (Warif, 2019). An effective learning process must be supported by learning media that can be interesting and not monotonous for students, which is in accordance with the learning material to be taught (Rosdiana et al., 2018). Learning media is also said to be a bridge or intermediary to become a tool for teachers when transferring knowledge to students (Risma et al., 2019). In line with this, there is a need for innovations provided by teachers in developing learning media in order to increase student enthusiasm in the learning process when it takes place (Damayanti, 2019), especially learning media innovations that are included in the field of technology.

The research is based on observations of current conditions and situations, namely the 21st century. It cannot be denied that the flow of globalization continues to spread widely, especially in the field of technological development. This technological development has entered almost all aspects of life, one of which includes education (Ellitan, 2020). The 21st century requires educational institutions to be able to produce generations who think critically and creatively and can solve problems by utilizing technology in them. By technology, the learning process that is carried out can have a good impact on the development of students in the future and can improve the quality of learning because it is in accordance with the existing times (Eliyasnı et al., 2019). The thing that teachers can do as educators is to prepare learning media that can support and be in line with utilizing technological developments. Teachers must be able to develop all their abilities to be able to design and create an interesting learning process through the use of technology (Khalil & Wardana, 2022). Technology-based learning media or digital learning media is an alternative for teachers as a first step to present and harmonize education with technology so that it can make it easier for students to understand the lesson, especially for elementary school students, as a foothold for developing future abilities. The application of appropriate learning media can facilitate teachers in teaching and learning activities, and students will be more interested in following it (Nurrita, 2018). Elementary school students need to be provided with contextual or real learning by teachers through the visualization of digital technology-based learning media. It can also be obtained from a learning process that can improve reasoning skills and hone the cognitive abilities of elementary school students.

One of the lessons that can train students' cognitive abilities is science learning. In addition, this science is also very important to learn because it can hone students to think critically in interpreting the relationship between humans and their environment and natural phenomena based on human observation and research, such as in the material on environmental conservation efforts (Ardhani et al., 2021). This material is closely related to



students' lives, so students are expected to not only understand the material but also apply it in their daily lives in an effort to minimize the environmental damage that occurs (P. Lestari, 2015). From there, teachers as educators must be able to integrate science learning materials that are quite complex so that they become meaningful through the selection of media that can support learning. The science learning objectives can be achieved by selecting media that can make students feel excited and fun and inviting students directly during the learning process so that they can actively participate to gain a deeper understanding, which is aligned with technological developments (Sulviana et al., 2018).

The development of appropriate digital technology-based learning media can be achieved through the Scratch application. This application is the first program in the delivery of interactive learning media through the involvement of digital technology that can include the creation of videos, games, stories, and simulations so that it can be in accordance with 21st-century skills (Resnick et al., 2009). Scratch is run through a programming language that is based on drag-and-drop codes, such as simple jigsaw puzzles that are arranged one by one to form blocks of code (Yulhendri, 2022). Therefore, this Scratch program has creative and interactive content that teachers can use as learning media to hone students' critical thinking skills. The learning media that has been created in the Scratch application can be reaccessed by students anywhere and anytime, so students can use and relearn the material previously explained by the teacher.

This is in line with research conducted by (Wardani et al., 2022) that the use of learning media through the Scratch application is very suitable and effective to be given to elementary school students in learning science learning material on animal respiratory organs because students feel interested when learning takes place with media designed with interesting animations and quizzes. In addition, this media has the advantage of using digital technology but can be used offline so that students can access it anytime and anywhere. In a research conducted by Sembring et al. (2022), the development of Scratch learning media based on local value on set material is very feasible and practical to use; students feel interested and easier to understand the material taught by the teacher. The effectiveness of game media based on the application of Scratch in science learning in grade IV elementary schools is considered effective to be given in improving student learning outcomes because of the difference in the value of the results of learning with conventional methods (Kusumawati, 2022).

Based on the above problems, this study aims to develop Interactive Media Scratch-Based Educational Games on Environmental Conservation Material for Grade Five in Elementary Schools. One of the main reasons for conducting this research is that previous studies have only developed Scratch in the form of games or learning media. Therefore, researchers want to make innovations that are expected to help students to better understand the subject matter of environmental preservation according to the times by combining media and games in one form of digital-based teaching materials, namely Scratch.

Research Method

This research was conducted using the D&D (Design and Development) method with a development research design from the ADDIE model (Analysis, Design, Development, Implementation, Evaluation). The following is a chart of the steps in the research:

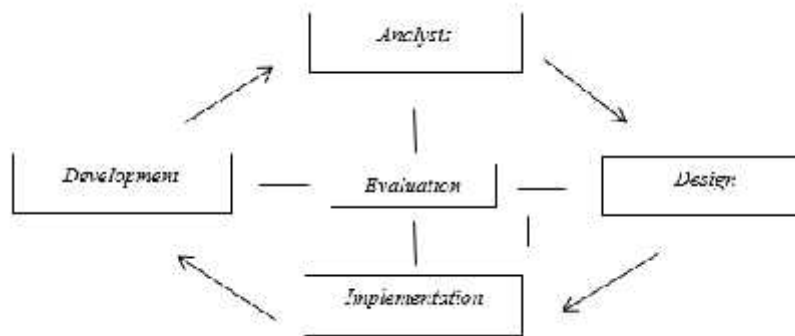


Figure 1. Stages of the ADDIE model (Anglada, 2007)

The first stage is Analysis. The object of the problem was identified, and the actions to be taken were analyzed. This initial stage included the Analysis of the existing problems and the search for a solution that is tailored to the material to be taught and the characteristics of students at school.

The second stage is Design. The learning media framework to be developed was designed after analyzing the problem, followed by designing a solution by conceptually developing the media.

The third stage is Development. The product design was realized before it was implemented and tested on students by making a validation instrument that was going to be tested by experts in terms of material and media. Therefore, at this stage, the product of the learning media has been completed. After testing, there were revisions in the form of suggestions, input, and direction from experts to create learning media that is ready for Implementation.

The fourth stage is Implementation. After the learning media had been tested for validation by experts, then the media was implemented on the students. Students were given a questionnaire containing their assessment and response to the learning media that has been tested in teaching and learning activities in the classroom. The educator also filled out the questionnaire.

The fifth stage is Evaluation. At this evaluation stage, the researcher understood what needed to be improved and improved overall to create a better learning media than before. The subjects involved in this research were material experts, media experts, teachers, and fifth-grade students of the UPI Cibiru Laboratory Elementary School. The instruments used were interviews and questionnaires. The interviews to gather qualitative data were conducted at the beginning of the research implementation. On the other hand, the questionnaire to gather quantitative data was obtained from the results of the response assessment filled by material experts, media experts, teachers, and fifth-grade students of UPI Cibiru Laboratory Elementary School. Therefore, the data analysis technique used descriptive analysis techniques, which include qualitative and quantitative data. The scores obtained from each questionnaire question were summed up and then converted into percentage form by dividing by the ideal score, with the following formula:

$$Ps = \frac{S}{N} \times 100\%$$

Ps = Percentage

S = Number of scores obtained

N = Total ideal score

The data that has been collected was then analyzed using the Likert scale measurement formula.

Table 1. Likert Scale

Scale	Level of Achievement	Interpretation
5	80% - 100%	Very Feasible
4	60% - 79,99%	Feasible
3	40% - 59,99%	Fair
2	20% - 39,99%	Less Feasible
1	0% - 19,99%	Not Feasible

Source: Adapted from (Sugiyono, 2011)

Results and Discussion

The results obtained in this study were in the form of Scratch-based digital teaching materials consisting of learning media and games to be used as a bridge or intermediary for teachers to teach environmental conservation learning material in grade V science learning. The Scratch learning media was in the form of environmental conservation material contained in interactive slides consisting of moving images and animations.



Figure 2. Scratch-based Interactive Learning Media

The interactive games obtained from drag and drop codes in Scratch, in accordance with environmental conservation material, consist of 2 games, namely save water, and keep clean, both of which have game instructions so that it is easier for students to use them.



Figure 3. Scratch-based Educational Games

Before being implemented in class V students for teaching and learning, Scratch media packaged in learning media and games were previously validated by experts, through material expert validation tests and media expert validation tests. The results were calculated and analyzed according to the Likert scale measurement formula to determine the feasibility

of the Scratch media. According to the results of the material validation test, the following assessment was obtained.

Table 2: Material validation test results

No	Assessment Aspect	Total Score
1.	Appropriateness of Content and Objectives	40
2.	Learning Quality	15
Total		55
Percentage		91,67%
Category		Very Feasible

From the material expert validation test, the results of the 91.67% assessment were obtained, which belonged to very feasible category. In the media expert validation test, a result of 92.5% means that it also belonged in the very feasible category. The following is a table of the results of the media expert validation test assessment.

Table 3. Media validation test results

No	Assessment Aspect	Total Score
1.	Clarity of Appearance	14
2.	Suitability of Programming	15
3.	Media Quality	8
Total		37
Percentage		92,5%
Category		Very Feasible

From both experts, this Scratch media was very feasible to be taught or implemented in grade V elementary school students with environmental conservation material. To find out the response of teachers and students to this Scratch media, there was a questionnaire that was distributed during the research. The research was conducted at UPI Cibiru Laboratory Elementary School class VF (Sakura) consisting of 11 students and 1 homeroom teacher. From the results of this teacher questionnaire, the results obtained were 97.5%. It belonged to the very feasible category. Furthermore, there was a questionnaire given to 11 students to find out the students' responses after using Scratch media. The results obtained were 95.75%, which means that this Scratch media was very feasible to be taught to fifth-grade elementary school students in the science subject of environmental conservation.

From the results of the research that has been done, Scratch media was very feasible to be used as teaching material in the teaching and learning process in science subjects on environmental preservation material for class VF students of UPI Cibiru Laboratory Elementary School. In developing this Scratch media using the D&D (Design and Development) method with a development research design from the ADDIE model, which was carried out through 5 stages as stated by Brunch (2009) as follows:

The initial stage carried out was Analysis; at this stage, when making observations in the classroom, the learning carried out was still less varied; learning media is a bridge or intermediary in delivering the material, and the teacher still provides it through textbooks and PowerPoint displays. Learning media is an essential aspect of the teaching and learning process; from this, students are less excited and feel bored. Currently, we have entered the era of digitalization; teachers must be able to innovate to combine technology and learning media that will be given to students who can be directly involved, not just sitting quietly listening. From these problems, learning media must be modified so that it can be more varied. Researchers want to develop Scratch media in which learning media and games are combined



so that it is expected to be interesting for students and in accordance with the applicable curriculum at school so that later it can be applied by teachers. From the curriculum aspect, the material in science learning requires critical thinking aspects and hones students' cognitive abilities, so Scratch media can be in accordance with the material taught by providing learning media and fun games. According to (Mutia, 2021) the characteristics of elementary school students are more likely to like playing, moving, and working in groups. Based on these things, it is hoped that Scratch media will be an alternative to solving these problems.

Furthermore, at the design stage, design was carried out by making Scratch media by dragging and dropping the codes in it. The media was designed in such a way that it has an attractive appearance and content for students. The media would be given learning media in the form of science learning material on environmental conservation, which was packaged through interactive slides, namely, there are moving images and animations. They were then, continued with the provision of games that are tailored to the material so that they can hone students' critical and cognitive thinking skills by remembering to provide instructions in the game. Students could access and operate the media; when clicking play games, games will appear in which 2 games are contained; namely Save Water and Keep Clean. Likewise, when the instructions are clicked, there will be instructions for using the game. When the material was clicked, there would be an interactive learning media display that can be seen and considered by students. This Scratch media was obtained by going through the codes contained in Scratch, namely motion, looks, sound, events, control, sensing, operators, variables, and my blocks. These codes were adjusted and put together according to the desired appearance. In addition, to make the media more attractive, we can choose sprites and backdrops according to our wishes and the material to be taught.

The next stage was development. At this stage, before the Scratch media was implemented in students at school, the media was first validated by experts, namely there were material experts and media experts, with a range of 1-4 ratings. For the material validation test, a percentage score of 91.67% was obtained, which, according to the Likert scale measurement formula, was a very feasible category. From this material validation test, the material validator provides suggestions for the addition of sound or audio when the delivery of material in the learning media in Scratch takes place so that students like being explained directly by the teacher. Then, for the media expert validation test, the validation results were 92.5%, so it got a very feasible category. This media validator also gave suggestions for the animation in the Scratch media to be more dynamic. Suggestions from experts are accommodated and applied to the development of media that will be implemented in students at school.

Next was the implementation stage. Scratch media that has been developed and tested for validation by material experts and media experts can then be tested on students of class VF UPI Cibiru Laboratory Elementary School. Giving Scratch media, students are divided into several groups. Because there were 11 people in the class, it was divided into 4 groups consisting of 2-3 students. For the initial learning process, students listen to the provision of material through interactive learning media in Scratch. Then, students came forward to the front of the class with their groups to operate and run games on Scratch media. The groups came forward alternately and orderly. The group that gets the highest points from each of these games gets a reward in the form of a prize. Therefore, students must work together to collect as many scores as possible because each game has a time that needs to be considered as well. During the implementation, students were enthusiastic and eager to run the media and operate games according to the material that had been taught.



The last stage was evaluation. After students carried out the teaching and learning process through the Scratch media, there was a questionnaire that needed to be filled in as a student response when using the media. In addition, homeroom teachers who monitor and observe were also given a questionnaire in the form of teacher responses. The questionnaire was to get suggestions, input, and improvements for the future. In the teacher response questionnaire filled out by the homeroom teacher, the results were 97.5%, which can be categorized as this Scratch media was very feasible to be taught to students. Furthermore, in the student response questionnaire distributed to 11 students in the class, the overall percentage of results obtained was 95.75%, so the category was also obtained very feasible. Students gave a happy response to the existence of this Scratch media. The teacher's response provides suggestions for the future to be able to use a mouse to make it easier for students when operating games on Scratch media.

Scratch media can be categorized as very feasible because it can also provide positive responses from students and teachers. In line with research conducted by (Setiawan et al., 2021) that Scratch media packaged as learning media turned out to be effective for use and received a positive response from users. Moreover, in the Scratch media there are games and animations that can attract the attention of students, especially elementary school children (A. Lestari & Sudihartinih, 2022). That is because the Scratch application display has characters, as well as codes that can be dragged and dropped to bring up educational games that can help the teaching and learning process. However, Scratch applications are still rarely used in education, in research (Satriana et al., 2019) the use of Scratch is only 8% of 100% distribution. This can occur because of its use via the internet and is considered still difficult to use by some teachers and students. Whereas through this Scratch application can be a learning media that hones the critical and systematic thinking skills of students and collaborates with each other (Hansun, 2014). Therefore, the Scratch application should be introduced and studied as a fun interactive learning media in accordance with technological developments as it is today with different materials or learning. In addition to being accessible anywhere and anytime because it is in the form of digital technology, Scratch applications also have the advantage that users do not need to install applications through computers or devices that require high specifications, even just through smartphones or cell phones can easily enter and access them (Irawan et al., 2023). That way, it can make it easier for users from all walks of life, both children, adults, and parents. In line with the research proposed by (Solihah et al., 2022) that the Scratch application can be used as a learning media operated to students by teachers who previously went through training first.

Scratch media also has the benefit of being able to foster student enthusiasm and improve students' critical thinking abilities and creative skills in accordance with 21st-century skills. Students can develop their imagination because there is a visualization of images with an attractive animation display. In addition, scratch media can be saved and shared with its users to be viewed and accessed repeatedly anywhere and anytime, making it easier, especially for students in schools, to understand the material. The development of this media can also increase students' interest in learning activities in the classroom because it contains interactive learning media development and fun educational games.

Conclusion

The conclusion obtained from the results of this study for the material expert validation test was 91.67%, and for the media expert validation test obtained 92.5%. Then, from the teacher response questionnaire, 97.5% and student response questionnaire, 95.75%. Therefore, the provision of scratch media development is very feasible to be used as a learning tool, namely



as a medium for delivering learning materials. This scratch media can also be saved and accessed repeatedly by teachers and students. Adding interactive media and educational games to scratch makes the learning process more enjoyable so that students can easily understand the material.

Recommendation

Based on what has been done, some recommendations can be given for the development of scratch media in the future, these recommendations are shown for user from teachers and others, namely as follows:

- 1) Scratch media can be developed to present other materials besides environmental conservation material.
- 2) In order for Scratch media to be delivered more effectively, more supportive rooms or facilities with adequate internet conditions should be provided. As a result, if we want to access it offline, you can download the Scratch application first.
- 3) The difficulty in developing Scratch media is when looking for sprites or animated characters that do not exist on the Scratch page, so it is necessary to search first on the internet. Therefore, it is better that if we want to make media in Scratch, we must first make sure that the character we want to use is in Scratch or not.

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