

Development of Construct 2-based Educative Game in The Topic of Environmental Pollution

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Abstract

This study aims to determine student responses and feasibility of construct 2-based educative game in the topic of environmental pollution. This study is included in the research and development using Waterfall development model. This model consists of five stages, namely analysis, design, implementation (coding), testing and maintenance. The test subjects in this study were 30 students of class VII B, MTs Sumenep. The results of the feasibility test of the construct 2-based educative game obtained an average validity value of 82.5% with a very valid category and an expert reliability value of 95.5% with a very reliable category. The results obtained from the student response questionnaire were 87.16% with very good criteria. Therefore, it can be concluded that construct 2-based educative game in environmental pollution topic can be used in the learning process.

Key words: Construct2, Educative Games, Environmental pollution.

INTRODUCTION

Education is very important in determining the progress or lagging of a nation. The progress of a country can be seen from the quality of human resources (Khotimah et al., 2020). The current era has entered the 21st century. The challenges in the field of education in the 21st century are getting tougher. One of them is that educational institutions must be able to produce prospective educators who have learning skills, innovate and master in terms of media and information to solve the challenges that exist in this life. (Yuliati, 2017). Students' skills and competences at school can be trained through science learning.

Natural science is a scientific discipline

that has a close relationship with everyday life. Natural science studies the relationship between nature and mathematical concepts or a discovery of concepts or facts that exist in nature (Utami et al., 2017). Science learning at the junior high school level should be integrated, so that in one theme there are several materials consisting of physics, biology and chemistry (Husna et al., 2017). In addition, the goals of science education are as a knowledge, understanding, exploration, discovery, imagination, creativity, scientific attitudes and the application of the attitudes or theories that have been obtained (Pamungkas et al., 2017). Based on the explanation above, it is very important for students to learn

science because every student will interact directly with nature, so students can know theories related to nature and know phenomena that occur in nature.

Learning media is important to be used in the science learning process. Learning media is a tool for teachers in the process of delivering information to students (Masykhur & Risnani, 2020). Learning media is used to present material so that it is easily understood by students, so that the material is not abstract (Ganda, et al., 2020). Learning media can make the learning process effective and efficient, so that it can achieve the learning objectives to be achieved. Teachers really need creativity in choosing and making learning media, in order to improve the quality of student learning (Tofanao, 2018).

Along with the times, smartphones have become a necessity for students and are widely used as a means of playing and learning. Seeing these conditions, smartphones can be one of the learning media that can be applied in the Android-based learning process (Kuswanto & Radiansah, 2018). The use of Android-based learning media has many advantages, namely being able to motivate students to learn, improve student learning outcomes, give chances for students to study anytime and anywhere, and give students a sense of fun in learning (Hidayatulloh, Praherdhiono, & Wedi, 2020). Based on the condition of students who use smartphones as their daily needs, it is very important for teachers to improve their ability to make or use Android-based media, such as games. In fact, there are

still many teachers who use conventional learning methods (Tofanao, 2018). Apart from using conventional methods, teachers still do not use innovative Android-based learning media (Tofanao, 2018).

Many types of Android-based media can be used by teachers in the learning process, one of which is educative games. Educative games can be used as an alternative media in the learning process in accordance with the 21st era, which requires everyone to be able to master technology. Educative game is a learning media that combines games and learning. Educative game contains of learning, developing concepts and knowledge that aim to educate students, hone students' abilities, and can motivate students to learn and play (Greggi & Novrianti, 2020). With this motivation, students will have an interest in learning.

Making games requires an application that is often called a game engine. Many applications can be used to make educative games, one of which is Construct 2. Construct 2 is a software with HTML5 features that can be used to make games with 2D designs (Agung Saputro, Kriswandani, & Ratu, 2018). Construct 2 is perfect for making educational games because Construct 2 has features that support game development, so you can make games with 2D designs. This software is very easy to understand and use because this software does not require special programming or what is called coding (Hardiyanti et al., 2020). The ease of Construct 2 applications without using the coding process will make it easier for

people who are not experts in technology to be able to make games.

Environmental pollution is a material that is very directly related to everyday life (Husna et al., 2017). The content in this material is about problems that occur in everyday life. This material is very important for students to master because it is related to environmental preservation. Thus, educative games can be used as an alternative learning media in this material, because the use of textbooks (text books) makes students feel bored and students feel less interested in learning (Damayanti et al., 2020). Based on the explanation described above, it is very important to do this to support effective and efficient learning by using educational games on environmental pollution in the learning process.

From the explanation above, the purpose of this study was to describe student responses and determine the feasibility of construct 2-based educative game in the topic of environmental pollution.

METHODE

This research is included in the research and development, which is the type of research used to produce a product. This research was conducted in February 2022 at MTs Istikmalunnajah, Sumenep Regency. The sample used in this study was VII B class with 30 students. The development model used is the waterfall model. This model consists of 5 stages, namely analysis, design, implementation, testing, and maintenance.

The research instruments used in this study were expert and material expert validation sheets. The validation sheet is used to determine the level of eligibility assessed by media experts, material experts and teachers, as well as a student response questionnaire used to determine student responses to this educational game. Data collection techniques using questionnaires, observation, and documentation. Data analysis.

The research follows the steps of the waterfall development model. The analysis phase is the first stage carried out to analyze what needs are needed to develop the product. At this stage, an analysis of student characteristics and curriculum analysis was carried out using the observation method.

The second stage, namely design, is the stage for designing a design that will be realized in the form of a product. The steps taken at this stage are determining the software and hardware requirements that will be used to develop an educative game, determining the material, designing the game, and designing the appearance of the game. This stage refers to the results of the analysis phase.

The third stage is implementation. The implementation view is a real stage of making software. At this stage will produce a product that has been developed. Making products at this stage refers to the results obtained at the design stage.

The fourth stage is testing. This stage is carried out to determine the feasibility of the product that has been produced. The steps taken at this stage are to validate

the experts who are analyzed using the validity formula below.

$$p = \frac{f}{n} \times 100\%$$

(Modification of Akbar, 2015)

description:

p : Average value

f : Total number of scores

n : Amount of data

In addition, the result is categorized based on the assessment criteria as follows table 1.

Table 1. Validation Criteria

Percentages	Criteria
80% < P ≤ 100%	Very valid
60% < P ≤ 80%	Valid
40% < P ≤ 60%	Moderate
20% < P ≤ 40%	Less valid
0% < P ≤ 20%	Totally invalid

(Modification of Umam & Mandasari, 2019)

Furthermore, the reliability of the media is measured using the formula below.

$$R = \left[1 - \frac{A - B}{A + B} \right] \times 100\%$$

description:

R : Instrument reliability

A : The highest frequency given by the validator

B : The lowest frequency given by the validator

with criteria of reliable if the reliability value is > 0.75 or > 75% (Borich in Wakhidah et al., 2020).

After the product is declared feasible, the product will be applied to determine student responses to the product produced. Student response questionnaires were analyzed using formula below.

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

(Modification of Akbar, 2015)

description:

X : Average score

S : Total score obtained

N : Total maximum score

assessment of students responses criteria based on table 2.

Table 2. Student Response Criteria

Percentages	Criteria
75% < X ≤ 100%	Very high
50% < X ≤ 75%	High
25% < X ≤ 50%	Low
0% < X ≤ 25%	Very low

(Modification of Rodiawati & Komaruddin, 2018)

The fifth stage is maintenance. This stage is the longest stage in the waterfall model. The step taken at this stage is correction errors that were not discovered in the early stages of the cycle.

RESULTS AND DISCUSSION

The results of this research are educational games in the topic of environmental pollution for seventh grade students. The data generated from each stage in the waterfall model are as follows:

A. Analysis Stage

The results of the analysis of student characteristics, namely students when carrying out the learning process pay less attention when the teacher explains learning, are less active during the learning process, and many of the students are more happy when learning with a game system, this is in accordance with the opinion (Husna et al., 2017) which states that characteristics of students at the junior high school level still like to play. The results of the curriculum analysis are describing the curriculum used in schools, namely the 2013 curriculum. The material

used in the development of educative games is environmental pollution.

B. Design Stage

Results of the requirements determination is related to hardware and software namely in the process of developing educative games that requires a software in the form of corel draw X7, youtube, construct 2, netlify, Website 2 APK Builder Pro. The hardware is in the form of Windows laptops and smartphones based on Android version 6. The results of this step are used to prepare hardware and software devices to make educative games. The results of the steps for determining hardware and software requirements are used in making educative games, for preparing hardware and software devices for making educative games.

The result of the process of determining the material, namely the material used is environmental pollution. The following is a material chart of environmental pollution in Figure 1.

The environmental pollution material is chosen because this material is closely related to the environment, most of this material is theoretical in nature so that it requires a process of memorizing in the learning process. The memorization process will make students feel bored in carrying out the learning process. When students feel bored in the learning process, it can make students less interested in participating in the learning process (Hafidzulloh & Erman, 2021).

The results of the design of educative games are known in making educative games on environmental pollution materials that require quite a long time and learning (3 months). The obstacles encountered when making this educative games were placing the video into construct 2, setting the educative games backsound, setting the score in the educative games, and converting the results of the educative games design into an application form. The procedure for operating an educative

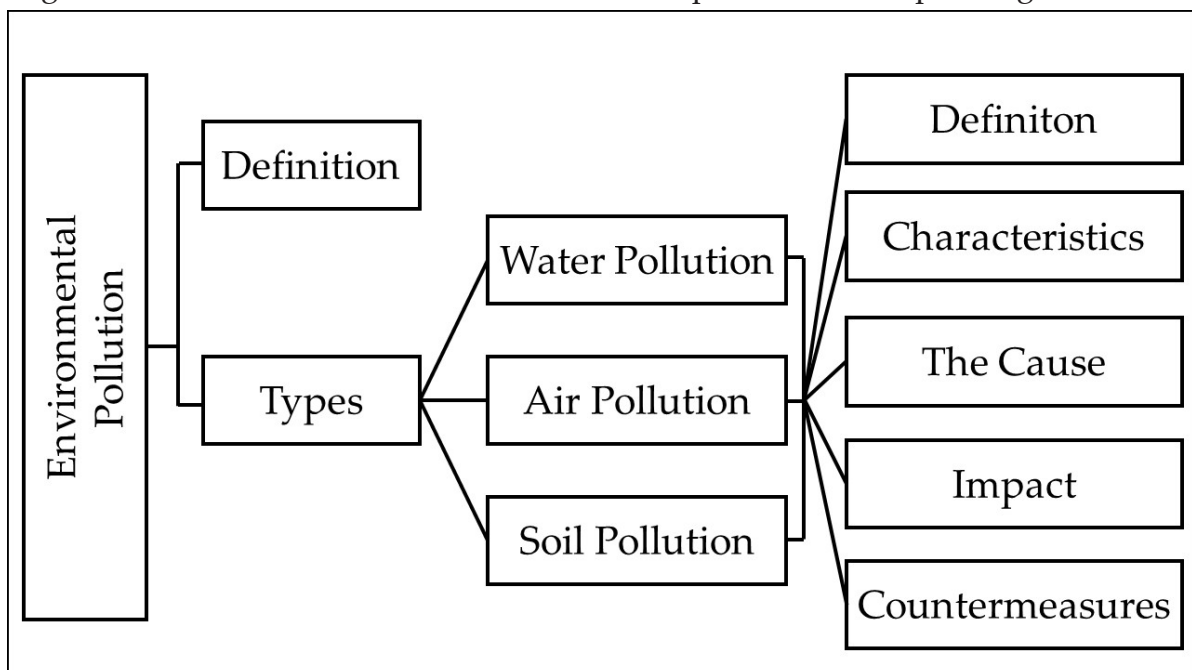


Figure 1. Environmental Pollution Material Chart

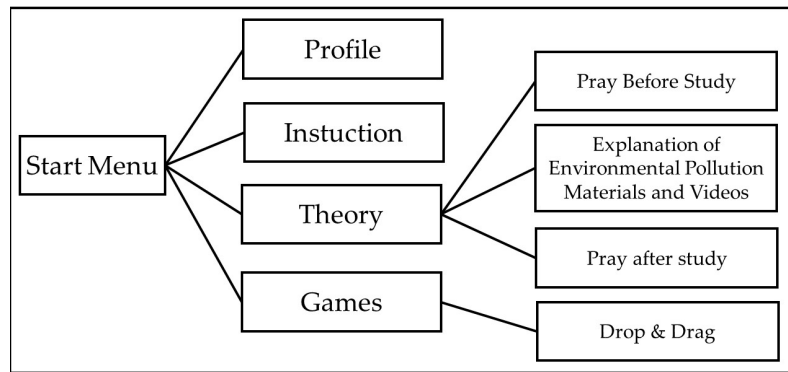


Figure 2. Chart of The Educative Game

games is to install an educational game application for environmental pollution material on the user's smartphone. In addition, in the development of this educative games does not require costs.

The results of the design show that Game display consists of backgrounds, buttons, music, pictures, prayers before and after learning, videos, materials and games. The display chart of the educative game to be developed is in Figure 2

3. Implementation Stage

This stage is the product manufacturing stage which involves several Corel Draw X7 applications for display design. Youtube search for videos and music, construct 2 incorporates components from games. Netlify to turn educational games into web form. Meanwhile, the website of 2 APK builder pro is used to convert educative games into APK form. The end result of this implementation stage is an educative game media on environmental pollution material. This stage is the most difficult stage because making educative games takes a long time and requires learning to make educative games. The resulting educative game is as follows figure 3 and figure 4.



Figure 3. Initial Display (Start Menu) of Educational Game

4. Testing Stage

At this stage, the product feasibility test process and product application in the learning process are carried out to determine student responses. The product feasibility test consists of media and material feasibility tests. The media feasibility test consists of 3 aspects that are assessed, namely aspects of suitability, convenience, and appearance. This sheet was validated by media experts and science teachers. The results of the media feasibility test can be seen in the following table 3.

Table 3. Media feasibility test results

Aspect	Validity	Reliability
suitability	80%	100%
convenience	83%	96%
Appearance	82%	95%
Average	82%	97%



Figure 4. Game Display

The average score of the validity of the media expert test is 82% with a very valid category. The media expert test reliability average score is 97% with the reliable category. From these results, it can be seen that educative game as an Android-based learning media can be used in the learning process. This happens because this media is in accordance with the conditions of students who have made Android their daily needs. By using educational game media on environmental pollution material, students can learn while playing. Because basically the characteristics of students at the junior high school level are still happy to play (Husna et al., 2017).

Assessment on the feasibility of the material is carried out by material experts and science teachers. The aspects assessed in the material feasibility assessment are suitability, convenience, completeness and

clarity. It shown in table 4.

Table 4. Material feasibility test results

Aspect	Validity	Reliability
suitability	80%	100%
convenience	85%	95%
Completeness	90%	89%
Clarity	75%	93%
Average	83%	94%

The average score of the validity of the material expert test is 83% with a very valid category. The average reliability score of the material expert test is 94% with the reliable category. Based on the results of the material feasibility test in educative games, it can be seen that this educative game is suitable for use in the learning process. The material in this educative game is environmental pollution. Environmental pollution material is material that is closely related to the environment because it discusses the problems that exist in the environment.

Seeing the importance of students to understand environmental pollution material, so that learning carried out by students must be meaningful. Meaningful learning is a learning process that connects new information with existing knowledge (Wahyuni & Ariyani, 2020).

From the results of the media and material feasibility tests, it can be seen that educative games on environmental pollution based on Android are suitable for use in the learning process. This is in accordance with the opinion of Damayanti et al., (2020) that states that an Android-based educative game to introduce endangered animals using construct 2 is appropriate for use in the learning process.

After the educative game is declared feasible, this educative game is applied to the learning process to find out how students respond by using a student response questionnaire. The questionnaire was filled by students in class VII B of MTs Istikmalunnajah, Sumenep with a total of 30 students. The results of filling in the student response questionnaire can be seen in the following table. The aspects assessed are media, material, and interest aspects. The results shown in table 5.

Table 5. Recapitulation of Student Response Questionnaire Results

Aspect	Average	Criteria
Media	86.67%	Very good
Theory	86.67%	Very good
Interest	88.13%	Very good
Average	87.16%	Very Good

Based on the table 5, it can be seen that each indicator in the student questionnaire is in the very good category. The overall average score of the student response

questionnaire was 87.16%. The average value of all aspects in the student response questionnaire is included in the very good category. Based on these results, students gave a very good response to the use of educative games in the learning process to increase student interest in learning, because students can learn with a new and fun system. So that, students can learn with pleasure and not feel bored. This is in line with opinion of Damayanti et al, (2020) which states that educative games are interesting and unique learning media, so they can increase student interest in learning.

CONCLUSION

According to the validation test, the average value of validity is 82.5% with a very valid category and the reliability value is 95.5% with a reliable category. While the results of student responses are 87.16% with very good criteria. So that, construct 2-based educative game on environmental pollution material are appropriate for use in the learning process and can be well received by students. It is suggested that the components of game level in educative games should be added. Furthermore, the appearance of educative games should be made even more attractive, and it should be available on the play store.

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