Development of Unity 3D Learning Media to Increase Students' Learning Outcomes and ICT Literacy

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Article Info	Abstract
	This research is based on the students' learning achievement in science subject of water cycle topic, which was quite difficult for the students. One of the obstacles facing the teacher was learning media that were lacking updates in relevance to current development. The objectives of this research are to develop, to test the validity, to analyze the effectiveness and the practicality of Unity 3D learning media. Research and Development design based on Borg and Gall is used in this research. The product validity test was carried out by experts through data analysis technique in the form of percentages. The product effectiveness test was carried out with a wide-scale trial using a quasi-experimental design through data analysis technique of students' learning outcomes improvement by using the n-gain test and students' ICT literacy with percentages, as well as differences in learning outcomes through t-tests. The product practicality test was done by distributing questionnaires for students' responses by using a data analysis technique in the form of percentages. The results of this research showed that the validation assessment conducted by media experts was 93.1% and by material experts was 87.5%, with very valid criteria. The effectiveness of the product with the n-gain test was 43% (moderate), and the increase in students' ICT literacy was 12%. There was a significant difference in the post-test result of the experimental and control class through the t-test of 4.3%. The practicality of media was 89% (very practical), based on students' responses. From those results, it can be concluded that the Unity 3D learning media is effective and practical for improving learning outcomes and ICT literacy for fifth-grade elementary school students.

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INTRODUCTION

The rapid development of information and communication technology affects all aspects of life, including education. The development of science and technology encourages the use of said developments in the learning process. Teachers are required to develop tools that can support the learning process to suit current development, in addition to being able to use the tools provided by the school.

One of the roles of information and communication technology in the world of education is in the use of instructional media. Arsyad (2013) argues that learning media is an inseparable part of the teaching and learning process for the achievement of educational goals in general and learning objectives in schools in particular. Learning media is a tool that can be used to facilitate teaching and learning process and can facilitate effective communication between teachers and students, especially for elementary students who fall into the concrete operational stage. Thus they need tangible objects to facilitate understanding of a concept. Therefore, learning media is an urgent need.

The real facts show that the use of instructional media by teachers in the learning process was not optimal. Based on conducted preliminary observations and interviews conducted, 4 out of 6 teachers from elementary schools were delivering learning material by using lecturing method. These teachers were more concerned with cognitive aspects and paid less attention to students' interests and motivation in learning. So, it could affect the level of students' understanding.

A teacher is required to be able to create appropriate learning media to make the teaching more interesting, active, and ensure that the material received by students is not just a collection of concepts (Khairoh, Rusilowati, and Nurhayati, 2014). The active involvement of students in learning can contribute to psychological readiness and attitude of respect for students so that it affects their abilities to receive the material, remember, and solve problems related to the subject under discussion (cognitive intelligence) (Wilke, 2003).

Following current development, learning media should be based on information and communication technology (ICT). It is because that the technological developments bring an impact to learning activities in the classroom (Kuncahyo, 2017). This can be proven by the fact that many schools apply technology in learning. The purpose of using said technology is to make learning a positive and interesting activity.

Based on the above reasons, the development of ICT-based learning media is needed so that learning media can be used by students not only during the learning process at school. Learning media that will be developed is using Unity 3D software. Thus it can support almost every version of Windows, Blackberry, Android, and iOS (Jagadish, Anand, Prakash, Patil, and Sathiya, 2018). Students can access the software via smartphone, laptop, or computer by downloading it through the play store or AppStore beforehand. In using the media, students do not always have to be connected to the internet. Internet is only needed when students download the learning media, making it more affordable for them.

The objectives of this research are to develop, to test the validity, to analyze the effectiveness and the practicality of Unity 3D software learning media.

METHODS

This research is development research using the Borg and Gall development design, which includes: needs analysis, planning, developing preliminary product form, preliminary field trial, revision of preliminary field trial result, main field trial, operational product revision, operational field trial, and final product improvement. In this research, a product in the form of learning media was developed using Unity 3D software on water cycle topic, followed by testing on the effectiveness and practicality of the instructional media. The test subjects in this research were fifth-grade students of Public Elementary School 02 Salatiga in

2018/2019 academic year totaling 28 students (experimental class), and fifth grade of Public Elementary School 09 Salatiga in 2018/2019 academic year totaling 28 students (control class).

The variables measured or observed in this research were the validity of instructional media, the effectiveness of instructional media, and the practicality of instructional media. The validity of instructional media applied assessments from validators of media experts and material experts, with data analysis techniques in the form of percentages. Furthermore, the effectiveness of the product was carried out by a large-scale trial using a quasi-experimental design with a form of non-equivalent control group design, which has a control group but it cannot function fully in controlling external variables that affect experimental treatments. The data analysis technique used to measure the improvement in learning outcomes was an n-gain test, and students' ICT literacy was percentages. Meanwhile, to analyze the differences in post-test learning outcomes between experimental class and control class, pre-test and post-test learning outcomes in the experimental class, as well as a pre-test and post-test learning outcomes in the control class, t-test was used. The product practicality test was done through the distribution of questionnaires for students' responses by using a data analysis technique in the form of percentages.

RESULTS AND DISCUSSION

This research on the development of Unity 3D learning media was carried out in May of the 2018/2019 academic year, taking subjects of fifth-grade students of Public Elementary School 02 Salatiga totaling 28 students and fifth grade of Public Elementary School 09 Salatiga in totaling 28 students. The results of the research include the development of Unity 3D learning media on the water cycle topic for fifth grade elementary school, the effectiveness of Unity 3D learning media on the water cycle topic for fifth grade elementary school, and the practicality of Unity 3D learning media on the water cycle topic for fifth grade elementary school.

Unity 3D learning media on water cycle topic is a learning media that is packaged in the form of an application called "Catch Me." The characteristics of Unity 3D learning media are adjusted to characteristics proposed by Gerlach and Ely (Arsyad, 2015) which are (1) fixative, containing several images and animations about events or examples of activities related to water cycle topic, (2) manipulative, containing various explanations relating to the material of the water cycle with various examples relating to the students' daily lives which are presented in a relatively short time but still complete and clear for the students to construct understanding and find solutions to problems (Hamzah, 2009), meaning that those examples are not presented in full as they are in real life, (3) distributive, the media can be transformed to several places at the same time as it can be accessed through play store, making it easier for students to get Unity 3D learning media on water cycle topic and to use it wherever and whenever they are.

Unity 3D learning media contains two menus; the material menu, and the playing menu. In the material menu, students can explore information related to the water cycle topic presented in the form of animations and explanations accompanied by interactive audio Hendrawan (2017). The material menu of the Unity 3D learning media is presented in figure 1.

Figure 1. Display of Material Menu of the Unity 3D Learning Media

On the other hand, in the playing menu, students can measure their level of understanding related to the water cycle topic by answering various questions in the form of multiple-choice and fill-in-the-blanks that are packaged in a game of catching fish. Husain (2014) the use of media

involving the use of senses to the maximum can improve students' learning outcomes as the media contain combinations of elements such as texts, images, animations, and games related to learning material, to prevent students from boredom. Also, Saputri, Rukayah, and Indriayu (2018) explains that the development of ICT-based media with games helps students to understand and master the material in the learning process. The playing menu of the Unity 3D learning media is presented in figure 2.

Figure 2. Display of The Playing Menu of The Unity 3D Learning Media

The research was divided into 3 main stages: (1) needs analysis stage, namely by conducting a basic literature review on media development, preliminary observation, analysis of the learning media requirement, planning the product to be developed, designing the product, (2) development stage, including preliminary field trial to test the validity of the product through the validators of media experts and material experts presented in table 1, revision of the preliminary field trial, the main field trial is to conduct trial in small group on 33 respondents, product revision, operational field trial namely a large group trial in 2 classes, each of which amounted to 28 respondents, as well as the improvement of the final product, (3) evaluation phase, at this stage tests for the effectiveness and the practicality of the product was done.

Table 1. Recapitulation of The Unity 3D Learning Media Validation Score

On the water cycle topic aspect	Validator		Average	Maximum score	Percentage (%)
	I	II			
Unity 3D learning media					
Quality of the opening menu	12	10	11	12	92
Slide quality	11	11	11	12	92
Quality of text or sentence	20	20	20	20	100
Background quality	8	8	8	8	100
Color quality	8	8	8	8	100
Image and animation quality	6	7	6.5	8	81
Interaction with the media	11	9	10	12	83
Total percentage					93.1
The material in unity 3D learning media					
Content	-	17	17	20	85
Presentation eligibility	-	6	6	8	75
Language assessment	-	12	12	12	100
Total percentage					87.5

Table 1 shows a recapitulation of the validation assessment from media experts and material experts on Unity 3D learning media. Unity 3D learning media are designed to be interesting and most importantly are easy to operate by elementary students (Mustaqim, 2017). Color quality is one thing that needs to be considered in learning media. The colors in this learning media are chosen by paying attention to the combination, composition, and color resolution to develop the imagination and thinking of students (Obaydullah, and Rahim,

2019). Unity 3D learning media not only contains the concept of material but also provides examples related to students' daily lives. This is because science learning is not enough just by providing information, but it needs to be linked to students' lives (Priyono, 2016).

The effectiveness of Unity 3D learning media on water cycle material can be seen from the increase in students' learning outcomes and increased students' ICT literacy. Learning outcomes become one of the aspects of students' success in understanding the material that has

been obtained from learning activities (Fityan, and Wahyudin, 2018). Improved students' learning outcomes by learning to use Unity 3D learning media was shown through the n-gain test of 0.43 or 43% (moderate), while the increase in student learning outcomes in the control class (using images media) by 0.13 or 13% (low). The result of t-test increased the experimental class and control class by 0.039. This is consistent with the opinion of Maria, Rusilowati, and Hardyanto (2019) that ICT-based learning media effectively improve the learning process in the classroom.

Based on the results t-test of differences in post-test results between experimental, and control class was t_{value} =2.072 was obtained, which is significant at the level of 4.3% as it is below the 5% significance level, therefore it can be concluded that there are significant differences in the post-test results of the experimental class and the control class. The differences in learning outcomes between the experimental class and the control class can be seen through the paired t-test. The difference test in the experimental class with pre-test and post-test result was 0.000 < 0.05, and the different test in the pre-test and post-test control class result was 0.003 < 0.05.

In addition to an increase in student learning outcomes in learning to use Unity 3D learning media on water cycle material, the students' ICT literacy abilities also increase along with the innovation of learning media that utilizes this ICT (Febrianti, and Susilowati, 2018). The effectiveness of Unity 3D learning media was also shown by the improvement of students' ICT literacy abilities. The data of students' ICT literacy abilities were obtained through observation during learning with Unity 3D learning media, by two observers. The students' ICT literacy abilities increased each meeting. The average was 70.8% with an increase from meeting 1 to meeting three by 12%. Improvement of students' ICT literacy abilities is presented in figure 3.

The practicality of learning media can be seen from the responses given by students and teachers to Unity 3D learning media on the water cycle material for fifth-grade elementary school. Students' responses to learning media are

classified as very good. Following García-Valcárcel, Gómez-Pablos, and García statement (2016) that learning by using ICT-based media can increase students' motivation in learning. This is evident from the percentage of student responses of 89%, hence the Unity 3D learning media on the water cycle material is included in the very practical criteria. Students' responses can be seen from the aspects of media use, usage reactions, and supporting facilities.
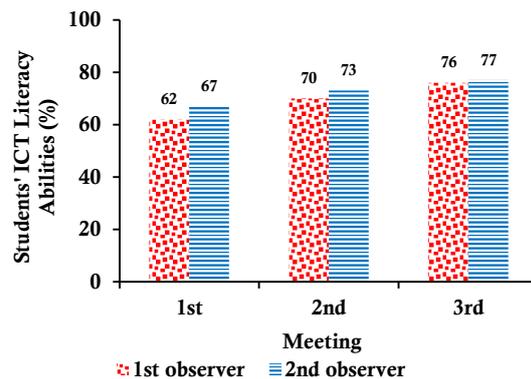

Figure 3. Improvement of Students' ICT Literacy Skill

The teacher's responses to the Unity 3D learning media show that material is considered to have a good influence on students because, with the learning media, students can learn water cycle material wherever and whenever they are. Also, the Unity 3D learning media are developed following the level of elementary students, which is by using attractive designs and relevant to current development. According to the teachers, Unity 3D learning media are quite effective in helping students to learn. Also, the selection of material on the Unity 3D learning media developed is considered appropriate. Although the material is about the water cycle, it is packaged well by providing introductory material, such as the use of water for living things and providing ending material about human activities that affect the water cycle. Students will feel attracted to learn new things through learning media that are different from the learning media they are used to. This learning media can be used in the classroom because it is following Curriculum 2013, stating that students are required to seek and find their concepts actively.

But the thing to pay attention to is Unity 3D learning media requires a device in the form of a laptop or computer that not all schools provide. It pokes the weakness or constraint of using Unity 3D learning media, which is the use of Unity 3D learning media is limited if it is used in schools that do not have adequate computers facility. Unity 3D learning media is one of the learning media that has not been obtained by the teacher before.

Unity 3D learning media can be used as one of the learning media and source of students' learning, especially in the water cycle material. This learning media is developed following the level of elementary school children, which according to Piaget to be at a concrete operational stage, which requires tangible objects so that they can understand concepts and solve problems related to them well. This learning media is recommended to students as a reference for learning. With this learning media, students can learn the water cycle material simply by paying attention and listening to the available audio, as it minimizes the students' boredom when studying. Students can also measure their abilities through the playing menu available on the media, which is packaged in the form of a game to catch fish. Students can use this learning media wherever and whenever they are.

As has been explained, Unity 3D learning media is not only effective in improving students' learning outcomes, but also effective in improving students' ICT literacy abilities. This learning media is designed concerning ICT literacy indicators according to the Indonesian Ministry of Communication and Information (2006), which are information literacy, computer literacy, digital literacy, and internet literacy.

CONCLUSION

Unity 3D learning media on water cycle material of fifth-grade elementary school is an ICT-based learning media that uses Unity 3D software. This learning media is developed following the needs of students and aims to facilitate students in understanding the concept of the water cycle material. This is proven by the level of validity of Unity 3D learning media through an evaluation by validators of media experts of 93.1% (very valid) and material experts of 87.5% (very valid). The effectiveness of learning media can be seen from the increase in learning outcomes in the experimental class (using Unity 3D learning media) through the n-gain test of 43% (moderate), and there is a significant difference in the post-test results of the experimental and control classes by 4.3%. The effectiveness of learning media is also seen from the increase in students' ICT literacy abilities from meeting 1 to meeting three by 12%. The practicality of learning media is seen from the very positive responses given by teachers and students. The percentage of students' responses to learning media was 89%, so Unity 3D learning media is included in the very practical criteria.

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