Feasibility Analysis of Interactive Multimedia on Intercation of Living Things Topic to Promote Scientific Literacy Skills

Dhita Ayu Permata Sari[1]*,Wahono Widodo[2], Muhamad Arif Mahdiannur[3], Ernita Vika Aulia[4], Hasan Subekti[5], Siti Nurul Hidayati[6]

[1,2,3,4,5,6] Science Education Department, State University of Surabaya, Surabaya, 60231, Indonesia

Abstract. This study aims to determine the feasibility of interactive multimedia storyboard of Smart Apps Creator (SAC) based on scientific literacy on transfer energy material. Feasibility is described in terms of content, construction, understanding, and multimedia aspects. This research is research and development (R&D) based on understanding by design framework to design learning media. This design is a backward design focused on learning goals as a result of instruction before plan for learning activities and teaching method. The research instrument is a validation sheet that is used to assess the feasibility of the storyboard. Validation sheets were given to 3 experts in science education, multimedia, and have doctoral degrees. The results showed that the SAC interactive multimedia storyboard developed was categorized as valid and very valid because the results of the validator's assessment reached a value of more than 3. It can be concluded that the developed storyboard is suitable for making the interactive multimedia by using SAC application on the topic of interaction of living things.

Keywords: Storyboard, scientific literacy, interaction of living things

1 Introduction

It is known that literacy and character are the foundation for the development of student skills to meet their future in the 21st century [1]. One of these literacies is scientific literacy, which is very important in the life of modern society that faces various problems related to science and technology [2], and has become the main goal of science education throughout the world today [3]. However, from 2006 to 2018, the scientific literacy ability of Indonesian students still fluctuated from time to time and was below the international average [4]. This shows that the scientific literacy of Indonesian students' needs to be improved with various efforts.

Scientific literacy is defined as the capacity to use scientific knowledge, identify questions and draw conclusions based on facts and data to understand the universe and make decisions about changes that occur due to human activities [5]. Scientific literacy means an appreciation of science by increasing the components of self-learning in order to contribute to the social environment [6].

The National Research Council (1996) states that scientific literacy is the ability to use scientific knowledge in an effort to solve problems. Scientific literacy is also the ability to think scientifically [16]. Based on the PISA objectives, scientific literacy refers to an individual's ability to possess the following: (1) scientific knowledge and use that knowledge to identify questions, acquire new knowledge, explain scientific phenomena, and draw evidence-based conclusions about related issues. science; (2) understanding of the characteristics of science as a form of human knowledge and inquiry; (3) awareness of how science and technology shape the life, intellectual, and cultural environment; and (4) willingness to engage in science-related issues and scientific ideas as a reflective person [7].

The National Research Council (2001) suggests that someone who has scientific literacy skills is a person who uses scientific concepts, has scientific process skills to make decisions in everyday life related to other people, the environment, and understands the interactions between science, technology and society. A person who is scientifically literate must understand the relationship between science and society, understand the methods and processes of science, have knowledge of science concepts or basic conceptual schemes, and understand the relationship between science and life or view science as part of life [6]. This is supported by the 2015 PISA report which reveals that someone who is scientifically literate must have the competence to explain phenomena, evaluate and design investigations, and interpret data and evidence scientifically in order to solve problems in everyday life [9].

National Science Education Standards (1996) states that scientific literacy is a knowledge and understanding of scientific concepts and processes that enable a person

* Corresponding author: dhitasari@unesa.ac.id

to decide based on the knowledge possessed. Scientific literacy is the ability to use scientific knowledge, identify questions, and draw conclusions based on facts in order to understand and make decisions regarding nature and its changes through human activities [10]. It can be concluded that scientific literacy skills are the ability to solve problems in everyday life by using scientific concepts obtained in education. The development of scientific literacy is very important because it can contribute to social life and improve decision making at the community and personal levels [11].

The Covid-19 pandemic situation is still happening, although with the tendency for the escalation to get smaller [12]. Various educational policies during the pandemic, namely Distance Learning [13], have brought wisdom to the increasing use of online learning. In order to facilitate the development of scientific literacy, research on the use of interactive multimedia has been carried out to facilitate it, although it still uses a face-to-face pattern [14]. Meanwhile, online learning research using a flipped classroom approach to facilitate the development of critical thinking skills has been carried out [15]. This is also in line with the government's policy to use this approach in distance learning [13].

At this time, students are known as Generation Z (Gen-Z), who have a tendency to be inseparable from gadgets. Almost every student has a device and operates it for daily activities. The results of a survey conducted by the Internet Indonesia Service Provider Association showed that 91% of people aged 15-19 years used gadgets and the internet. In addition, in 2018 the average time they spend using the internet every day through any device is 8 hours 36 minutes [16]. Perhaps, in the situation of the Covid-19 pandemic, this number will be even greater. Therefore, it is necessary to research the use of interactive multimedia based on devices, by applying the flipped classroom approach to improve scientific literacy in students. The development of research results [14] by involving the Industrial World Business World to become a product that can be accepted by a wider audience seems worthy of research.

Technology-based learning is one of the government's efforts to adapt learning methods to suit the times [17]. According to Ilham Habibie, the learning trend in the future is that technology is used as a tool to encourage students so that motivation and enthusiasm for learning emerges [17]. Thus, the development of technology in education becomes important for the development of national education in the future.

Various kinds of research have been conducted to find various kinds of technology-based creative media. The use of gadgets is one of the right ways to stimulate student learning [18]. Students also become more enthusiastic when doing assignments and accessing the internet by using gadgets [19]. The use of android-based applications by giving the right assignments can also improve student learning outcomes including scientific literacy skills, thinking skills and analogy abilities [14, 20].

In line with various kinds of good learning practices in online classes during the Covid-19 pandemic, the cost of internet access to run several smartphone applications is a student obstacle. In addition, unstable signals often interfere with smooth learning. Previous research has produced device-based learning media that require internet access only when downloading software. The use of this application is considered positive by users, both teachers and students [14]. However, the availability of this application still does not have much variety in other topics.

Learners also want more videos that make them more interested and understand what they are reading. Visualization of this material is considered to be able to assist students in understanding learning [14]. In this study, the development of device-based learning media that will be developed using the Smart App Creator 3.0 software will provide a complete learning package that can be accessed by students during one semester of learning. This application is also equipped with a student activity guide to improve students' scientific literacy.

This study aims to determine the feasibility of interactive multimedia storyboard of Smart Apps Creator (SAC) based on scientific literacy on interaction of living things material that can be used to facilitate flipped classroom learning by paying attention to the development of the Covid-19 pandemic condition to improve students' scientific literacy. Feasibility is described in terms of content, construction, understanding, and multimedia aspects. The urgency of this research is to meet the needs of increasing students' scientific literacy.

2 Research Methods

This research is research and development (R&D) based on understanding by design framework to design learning media [21,22]. This design is a backward design focused on learning goals as a result of instruction before plan for learning activities and teaching method. There are three stages of this framework. First stage is identifying desire results. This stage, the content standard is examined to be taught and developed instructional objectives. This stage also reviewed the scope and sequence of what is to be taught. Some important questions that should be reconsider are “what should learners be able to do, know, and understand at the end of instruction?”, “what content should be taught?”, “in what order should be taught content?”, and “what long-term understandings are desired at the end of instruction?”. Stage 2 determine acceptable evidence of student learning and proficiency before deciding how the knowledge and skills are taught. For example, the evidence can be collected by quizzes, tests, projects, etc. The assessment should align with the desire learning results. Some important question should be considered for this stage are “How will teachers know if learners achieved the desired results?” and “What is acceptable evidence for students’ achievement?”. The last stage is planning learning experiences and instruction. These activities should help to make clear instructional goals while redirecting back to the assessments made in Stage 2. Some questions should be reconsider are “What knowledge and skill will

learners need to effectively perform and achieve the desire results?", "How can the learning activities that being selected help students gain knowledge and skills?", "How should the skills and knowledge being assessed be coached", and "What materials and resources are needed to meet my instructional goals?".

Interactive multimedia on the topic of interaction of living things is made using Smart Apps Creator 3. The design begins with designing a storyboard which is then continued by using Smart Apps Creator 3. In designing the storyboard, the researcher refers to the Understanding by Design Framework stages.

After the storyboard is prepared, the next step is to validate the storyboard to three experts of natural science and learning media. The validation results are material for revising the storyboard. The storyboard that has been made is a reference in making interactive multimedia with predetermined software (Smart Apps Creator 3). Each validation aspect is evaluated based on the validity rating scale in Table 1.

Table 1. Validity Rating Scale

Rating	Score
Very good	5
Good	4
Enough	3
Less	2
Not good	1

Furthermore, the data from the validity results were analysed using quantitative descriptive analysis. The data is calculated by averaging the score given by the validators. Values are described qualitatively according to the assessment criteria of the device presented in Table 2.

Table 2. Criteria for Storyboard Assessment Category

Score interval	Category	Description
$4{,}2 \leq S \leq 5{,}0$	Very valid	Can be used with little revision
$3{,}4 \leq S \leq 4{,}1$	Valid	Can be used with some revision
$2{,}6 \leq S \leq 3{,}3$	Enough	Can be used with multiple revision
$1{,}8 \leq S \leq 2{,}5$	Less valid	Can be used with so many revision
$1{,}0 \leq S \leq 1{,}7$	Not valid	Can't be used

3 Results and Discussion

The results of the feasibility of the storyboard are presented in Table 3. The feasibility assessed content aspect, construction aspect, understanding aspect, and multimedia aspect. Validity is determined by validation result of three validators (lecturers of Science Education of Universitas Negeri Surabaya, who are experts in the field of Science Education and Multimedia). The storyboard developed contains guidelines for students, finding concepts activity, and discussion activities related to interaction of living things topic.

Table 3. Storyboard Validation Results

No.	Assessed Aspect	Average	Category	Reliability (%)
I.	Content			
1.	Scenario/storyboard of interactive multimedia contains socio-scientific issues aspect.	5	Very valid	100.00
2.	Scenario/storyboard of interactive multimedia contains aspects of investigation activities.	5	Very valid	100
3.	The equipment and materials needed in the investigation activities are realistic to be applied in Indonesia schools that have utilized the use of gadgets.	4.67	Very valid	93.33
4.	Scenario/storyboard of interactive multimedia contains reading activity related to phenomena in real life.	4.67	Very valid	93.33
5.	Scenario/storyboard of interactive multimedia contains decision-making or problem-solving activities.	4.67	Very valid	93.33
6.	Scenario/storyboard of interactive multimedia contains problems that help students improve scientific literacy skills.	4.67	Very valid	93.33
7.	Problem solving activities in the Scenario/storyboard of interactive multimedia are the application of concepts of science studies.	5	Very valid	100.00
8.	Scenario/storyboard of interactive multimedia contains scientific literacy practice questions.	5	Very valid	100.00
9.	Scenario/storyboard of interactive multimedia can trigger students' curiosity.	4.67	Very valid	93.33
10.	Scenario/storyboard of interactive multimedia can promote collaborative skills.	4.67	Very valid	93.33
11.	Scenario/storyboard interactive multimedia can promote communication skills.	4.33	Very valid	86.67
12.	Scenario/storyboard interactive multimedia can promote critical thinking skills.	5	Very valid	100.00
II.	Construction			
1.	Scenario/storyboard of interactive multimedia applies a scientific literacy mindset.	4.67	Very valid	93.33
2.	Scenario/storyboard interactive multimedia has a menu that can be applied.	5	Very valid	100.00
3.	Instructions in the scenario/storyboard of interactive multimedia can help user to learn and explore the media.	4.67	Very valid	93.33
III.	Understanding			
1.	The information in the scenario/storyboard of interactive multimedia is easy to understand by media developers.	4.33	Very valid	86.67
2.	The information in the scenario/storyboard of interactive multimedia is easily understood by users.	4.33	Very valid	86.67
3.	Scenario/storyboard of interactive multimedia in accordance with General Guidelines for Indonesian Spelling (PUEBI).	5	Very valid	100.00
IV.	Multimedia			
1.	Scenario/storyboard of interactive multimedia leads to the use of various mutually supportive media.	5	Very valid	100.00

No.	Assessed Aspect	Average	Category	Reliability (%)
2.	Scenario/storyboard interactive multimedia can be produced into learning media.	5	Very valid	100.00

Table 3 shows that the results of scenario/storyboard validation in each aspect are in the range of 4 to 5 or in very valid category. The range of reliability between validators reaches 85-100% which means the assessment between the three validators has a good match. However, validators also suggest some minor revisions for the storyboard.

In terms of content, the storyboards made show the existence of socio-scientific issues, the existence of investigation activities with tools and materials that are realistic with the conditions of schools in Indonesia, and the use of gadgets, the existence of readings containing phenomena in real life.

The selected teaching materials are also in accordance with the learning objectives, the characteristics of the students, and the appropriate time allocation. The selected learning resources are also in accordance with the learning materials and scientific approaches and integrated science learning. The validator suggests to add more reading sources to provide more information. These sources also can be accessed on the internet. The utilization of the internet facilitates independence, feedback, acceleration, affordability, affectivity, and productivity in the learning process [23]. Thus, more resources are added in 'Let's Explore' section.

In addition, storyboards contain activities to make decisions or solve problems by showing activities and practice questions that can improve students' literacy skills. In the storyboard, there is "Let's Explore' section that contains investigation activities to solve a problem. The purpose of this activity is to promote students' literacy skills by explaining phenomena, evaluating and designing investigation, interpreting data and evidence scientifically in order to solve a real live problem.

Nowadays, scientific literacy skills are important for students [9]. Scientific literacy skills can help student to promote their problem-solving skills [24]. Student can apply their knowledge to deal with real situation if they have scientific literacy skills [24]. These skills can be improved in the learning process with supporting facilities and learning media that give activities that carry out investigation to find solutions based on real life problems [25].

'Let's Explore' section is also supports communication skills and critical thinking skills. This section is designed for group activities during learning process. Students must discuss how to solve the problem with their find within their group. Students' communication skills and critical thinking can be promoted by discussion [26,27]. It is reported that discussions teach more learning related to higher level items compared to lectures [Garside]. It is also showed that students achieve higher score on exams and course grade by participating in discussion group that those who did not attend discussion sessions [28]. Group discussion can improve students' confidence, communication skills, and stimulate students' learning because students become more active and engage with the material [29].

The results of the understanding aspect assessment in Table 3 show that the storyboard created can be understood by users and is in accordance with General Guidelines for Indonesian Spelling (PUEBI). It is important to clarify the material presented in the media because it can help students to understand the material and mastering the learning objective easily [30].

Table 3 also shows that storyboards have menus that can be applied and serve as help for users. Storyboards also direct students to the use of various media, such as text, image, and video, in learning with scenarios that can be produced. Learning materials that is presented on interactive multimedia through text, image, video, sounds, and animation, not only should provide interactivity to its users, but also can attract students to learn more about the subject [31]. An interesting learning media can promote students' interest and attractiveness to learn a subject [32]. Based on the results of this validation that categorized as very valid category, the storyboard created can be continued to the stage of the application development process.

According to Piaget [33], active student involvement in learning can increase students' interest and understanding. This has been done during the learning process so that students' interest and understanding also increases. The teacher has linked the cognitive structure that students already have with new knowledge, so this helps students to understand learning better. In addition, through active learning by discovering concept and principles independently, students can get more experiences and conduct experiments to find their own understanding about the concept and principles [34]. It can be concluded that the storyboard created can be used for making an interactive multimedia on the topic of Interaction of living things to promote scientific literacy skills.

4 Conclusion

Based on validation results on the storyboard that have been developed, it can be concluded that the storyboard of Interaction of living things topic is very feasible. Thus, it can be used to make interactive multimedia to promote students' scientific literacy skills. The interactive multimedia will be developed by using the Smart Apps Creator 3 application

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