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Learning using real science mask with qr code to increase students' digital literacy

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Abstract. The Industrial Revolution 4.0 demands the use of technology in every aspect, including in education. One of the efforts to prepare human resources in the field of education is the government policy regarding "Independent Learning: Independent Campus". Higher education graduates will be required to master various fields of science and be flexible in developing independence when seeking and finding knowledge. This requires good digital literacy skills. Real Science Mask with QR Code is a learning media which connected to Google classroom and make a concrete science concept. The research method was carried out by developing a product in Real Science Mask with a QR Code which will be tested for its validity and the effectiveness of the product in learning. The final data analysis was carried out by analyzing the students' digital literacy scores. Students' digital literacy skills using Real Science Mask with QR Code were in the high category of 71.43% and the medium category of 28.57%. The results of the study were also supported by a good response from students of 57.14%. It concluded that learning using the Real Science Mask with the QR Code model is effective in improving the students' digital literacy skills.

1. Introduction

The Industrial Revolution 4.0 demands the use of technology in all aspects, including in education. The Industrial Revolution 4.0 can change the way people live and will ultimately have an impact on the educational, social, economic, and political systems. Efforts to increase readiness to face the Industrial Revolution 4.0 in terms of Human Resources (HR) and infrastructure also need to be prepared to be able to compete with other countries. One of the efforts to prepare human resources in the field of education is the government policy on "Independent Learning: Independent Campus". This policy encourages an increasingly autonomous and flexible learning process in higher education. This aims to create a learning culture that is innovative, non-restrictive, and can be done anywhere and anytime. Therefore, higher education graduates are required to master various fields of science and be flexible in developing independence in seeking and finding knowledge. To be able to seek and find knowledge in the current era of the Industrial Revolution 4.0, well digital literacy skills are needed. Digital literacy involves more than the mere ability to use software or operate a digital device; it includes a large variety of complex cognitive, motor, sociological, and emotional skills, which users need in order to function effectively in digital environments. Digital literacy is the interest, attitude, and ability of individuals to use digital technology and communication tools to access, manage, integrate, analyze and evaluate information, build new knowledge, create and communicate with others in order to participate effectively in society [1].

Science education provides a variety of learning experiences to understand scientific concepts and processes that are developed through the ability to think analytically, inductively, and deductively to solve problems related to events that occur in the natural surroundings. The concept of natural science is based on observing phenomena that occur in living things and their environment, while some things that are observed cannot be seen by the naked eye at the time of learning. Real Science Mask with QR Code is a learning media in the form of a mask containing illustrations of science material connected to Google classroom. The use of the Real Science Mask with QR Code is expected to facilitate learning activities to concretize a science concept that is still abstract and cannot be observed directly. In addition, its use that is connected to Google classroom can provide unlimited access in the learning process so that learning can be done anywhere and anytime. Therefore applied research is needed for the development of Real Science Mask with QR Code which is expected to be a solution to build a concrete learning experience and be able to improve the digital literacy of the students. The applied research proposed is following the 2016-2020 UNNES Research Strategic Plan, namely increasing the use of science and technology for the surrounding community through *Tridharma* activities. In addition, this applied research is also in line with one of the pillars of UNNES conservation, namely the pillars of value and character, because the research carried out has innovative value in learning.

The purpose of this research was to produce learning media in the form of Real Science Mask with QR Code that was tested valid by experts and was feasible in terms of readability and graphics and to obtain learning media that had been tested for its effective use in improving the digital literacy of the students.

This research has specificities and virtues, including 1) through this research, a Real Science Mask with QR Code learning media will be presented, science learning is not limited by space and time and can minimize costs; 2) The Real Science Mask with QR Code learning media has been designed in such a way that it can build a concrete learning experience that is interesting and easy to understand; 3) the results of this study are expected to help the students to improve digital literacy.

Researches that lead to the development of both ICT-based and conventional-based learning media have been done before. Fatimah & Mufti [2] have developed Science-Physics learning media with an android-based smartphone. Permana et al. [3] have developed multimedia-based science learning media. Mulyadi et al. [4] have created a flash media flipbook. Rahman et al. [5] have created an android-based augmented reality. These studies still only focus on learning outcomes. In its development, researchers pointed out the importance of digital literacy to face the Industrial Revolution 4.0 in the education field. Research results with a digital literacy theme have been carried out by several researchers, including research on increasing digital literacy that can be done using the Technology-Embedded Scientific Inquiry (TESI) Learning Model [6]. Besides, some studies use the Science and Technology learning model of society to determine its effect on science learning outcomes in terms of digital literacy [7]. Scientific literacy can be trained using Schoology-based e-learning [8]. The use of website-based learning media can also improve students' digital literacy skills in physics learning [9]. The applied research that will be carried out also utilizes IT-based learning media (technology). The learning media used is the Real Science Mask with QR Code, in the form of a mask containing illustrations of science material connected to Google classroom. Real Science Mask with QR Code as a learning media that is specifically designed to improve the digital literacy of the students. Research on the use of scientific masks linked to QR codes has never been conducted.

Digital literacy is about knowledge and skills to use digital media, communication tools, or networks in finding, evaluating, using, making information and utilizing it in a healthy, wise, intelligent, accurate, precise and obey the law to foster communication and interaction in everyday life [10]. In Indonesia, there have not been many studies examining digital literacy. Previous research has studied more about information literacy, media literacy, and ICT literacy in a particular group of people in several regions in Indonesia. Digital literacy competencies are useful in dealing with information from various digital sources that continue to evolve along with the development of information and communication technology as a result of the phenomenon of media convergence [11].

2. Methods

This research belongs to the Research and Development (RnD) investigation. The development procedure uses Borg and Gall's theory [2], namely (a) analysis of the product to be developed; (b) developing the initial product; (c) expert validation and revision; (d) legibility testing and revision; (e) limited usage/field trials test. Experts/validators selected in this stage are experts in the field of material and media. Material experts are needed to obtain input regarding the content of the material presented in the learning media, while media experts are needed so that the learning media used can facilitate students in learning. Moreover, the input of the validators is used for revising the media.

The population in this study were all students of the Natural Science Education Study Program of the Integrated Natural Science Department, FMIPA UNNES, in the even semester of the 2019/2020 school year, while the sample used was students of the Natural Science Education Study Program of the Integrated Natural Science Department in the 4th semester. Final data analysis was carried out by analyzing the students' digital literacy scores that will be grouped into 3 categories, namely high, medium, and low categories. The data that has been grouped are then described in the graphs and analyzed descriptively.

Researches that lead to the development of both ICT-based and conventional-based learning media have been done before. Fatimah & Mufti [3] have developed Science-Physics learning media with an android-based smartphone. Permana et al. [4] have developed multimedia-based science learning media. Mulyadi et al. [5] have created a flash media flipbook. Rahman et al. [6] have created an android-based augmented reality. These studies still only focus on learning outcomes. In its development, researchers pointed out the importance of digital literacy in facing the Industrial Revolution 4.0 in the education field. The research results that have a digital literacy theme have been carried out by several researchers, including research on increasing digital literacy that can be done using the Technology-Embedded Scientific Inquiry (TESI) learning model [7]. Also, some studies use the Science and Technology learning model of society to determine its effect on science learning outcomes in terms of digital literacy [8]. Scientific literacy can be practiced using Schoology-based e-learning [9]. The use of website-based learning media can also improve students' digital literacy skills in physics learning [10]. The applied research that will be carried out also utilizes IT-based learning media (technology). The learning media used is the Real Science Mask with QR Code, in the form of a mask containing illustrations of science material connected to Google classroom. Real Science Mask with QR Code as a learning media that is specifically designed to improve the digital literacy of the students. Research on the use of scientific masks linked to QR codes has never been conducted. The research activity is divided into 2 stages, namely: 1) the making of Real Science Mask with QR Code validated by experts and learning tools that have been tested for legibility, 2) testing the use of Real Science Mask with QR Code in learning to see the effectiveness in improving students' digital literacy accompanied by a description of device development.

3. Results and Discussion

The final data analysis of the research was carried out by analyzing the students' digital literacy scores. Digital literacy is about knowledge and skills to use digital media, communication tools, or networks in finding, evaluating, using, making information, and utilizing it in a healthy, wise, intelligent, accurate, precise, and obey the law to foster communication and interaction in everyday life [11]. The results of the students' digital literacy assessment were grouped into 4 categories, namely high, medium, low, and very low categories (Figure 1). The research data showed that the students' digital literacy skills in using Real Science Mask with QR Code were in the high category of 71.43% and the medium category of 28.57%. Based on the digital literacy skills assessment data, it can be concluded that the use of the Real Science Mask with QR Code has largely contributed to improving student skills in the use of IT-based learning media. Real Science Mask with QR Code media, which involves the integration of several digital media platforms, such as Google Classroom, Google Drive, Website, and QR code scanning, has proven to be able to require students to always play an active role in the use of several digital platforms that are integrated into learning.
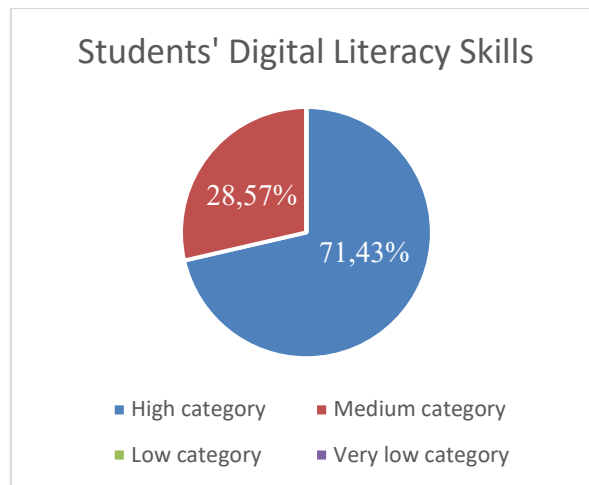
Figure 1. Students' Digital Literacy Skills Result Diagram
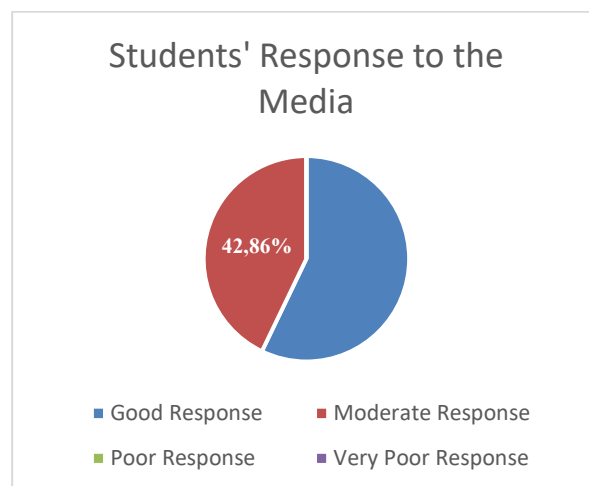
Figure 2. Students' Media Response Result Diagram

The increased complexity of contemporary digital contexts has caused several researchers to call for new frameworks through which to study and develop these new literacies [13][14]. Further tensions arise when faced with the task of defining what it means to engage critically with digital media. For example, it could be considered a set of 'skills and practices' form of curatorship [15] or empowering consumers to shape content [16]. Indeed, the multiple forms of critical digital literacy reflect the array of academic disciplines involved with this area of research and their different theoretical underpinnings and goals. Against this backdrop there is clearly a need for continuing to challenge and test what we mean by critical digital literacy in the complex, contemporary digital landscape.

Through the questionnaire, the students' feedback after carrying out learning activities with Real Science Mask with QR Code was obtained (Figure 2). The results of the student response questionnaire analysis showed that 57.14% were in a good category. There were still 42.86% who showed less response due to some technical problems, including the slow speed of internet access in students' areas, thus limiting their space to access digital platforms that have been determined, and the gadgets performance limitations used. It can be concluded that learning using the Real Science Mask with the QR Code model is proven to be effective in improving students' digital science literacy skills. Digital literacy is more than just the technical ability to operate digital device properly; it comprises a variety

of skills that are utilized in executing task in digital environments, such as constructing knowledge during surfing the web, dechipering user interfaces, playing digital games, searching in databases, creating and sharing content and communicating in social network [17]. Students can also use the integrated science instructional materials as one of the learning sources to construct knowledge and digital literacy in a science subject [18]. Therefore, this research product was an alternative solution in applying integrated science learning and promoting the school literacy program.

4. Conclusion
Based on the research data, it was found that students' digital literacy skills using Real Science Mask with QR Code were in the high category of 71.43% and the medium category of 28.57%. The results of the study were also supported by a good response from students of 57.14%. So it can be concluded that learning using the Real Science Mask with the QR Code model is effective in improving the students' digital literacy skills.

5. Acknowledgement

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