International Journal of Multicultural and Multireligious Understanding

http://ijmmu.com
editor@ijmmu.com
ISSN 2364-5369
Volume 8, Issue 11
November, 2021
Pages: 359-369

Development of QR Code-Based Learning Multimedia to Improve Literature of Elementary School Students

Yetty Auliaty; Vina Iasha; Yulia Elfrida Yanty Siregar

Department of Primary Education, Universitas Negeri Jakarta, Indonesia

http://dx.doi.org/10.18415/ijmmu.v8i11.3160

Abstract

The purpose of this research is to develop learning multimedia in improving the literacy of elementary school students in DKI Jakarta based on QR codes. This study uses the ADDIE Research and Development Model. The ADDIE model is an abbreviation for the five stages of the development process, namely Analysis, Design, Develop, Implement, and Evaluate. Data collection techniques using questionnaires, interviews, and documentation. Based on the results of the development of this multimedia that this multimedia can facilitate students in understanding the material. It is evident from the assessments of appropriate experts (75% material experts, 78% media experts, and 86% linguists), the responses of students and teachers are interesting (75.4% small group trials, 76.6% field trials, and 77% teacher trial). This shows that the multimedia developed by researchers can be utilized in the learning process in schools.

Keywords: *Multimedia; ADDIE; Elementary School*

Introduction

We have entered the 21st century which is marked by the development of an increasingly fast and complex world. Various changes occur in the field of knowledge, technology, and information globally, and these changes are aimed at improving the quality of life of modern society, such as its benefits in the fields of medicine, communication, and nanotechnology. However, along with the benefits felt by the community, negative impacts also appear, such as global warming, energy crisis, or environmental damage (Untari, 2020). Therefore, it is inevitable that society needs an understanding of scientific facts and the relationship between science, technology, and society. People who have this knowledge and can apply their knowledge to solve real-life problems are called scientifically literate people (Bond, 1989). Therefore, achieving a scientifically literate society has become a demand of the times.

Scientific literacy is one of the skills/capabilities needed in the 21st century among the 16 skills identified by the World Economic Forum (Wefusa, 2015). Given the importance of scientific literacy, educating people to have scientific literacy is the main goal in any science education reform (DeBoer, 2000). Many educational organizations today accept and issue standards and guidelines (benchmarks) related to the content, pedagogy, and assessments related to scientific literacy (AAAS, 1993; Millar and

Osborne, 1998; NRC, 1996). In addition, several attempts have been made to theoretically define biological literacy (BSCS, 1993) and chemical literacy (Holman, 2002; Atkins, 2005; Shwartz, Ben-Zvi, and Hofstein, 2005).

In Indonesia, it is generally known that the scientific literacy level of Indonesian students as measured by PISA to date shows an alarming condition. However, there have been efforts to improve this situation such as efforts to reform the curriculum such as the new 2013 curriculum (Nurjanah et al., 2021). An important question for educators is how do we help students to achieve scientific/chemical literacy? According to Glynn and Muth (1994), efforts to improve students' scientific literacy are not enough just to add a lot of scientific facts in learning and increase the number of laboratory activities, but students need to be equipped with activities that emphasize minds-on in addition to hands-on activities (Kusniati, 2020). Because the affective aspect is an important factor in scientific literacy, it is necessary to include hearts-on in learning. For educators' efforts to optimally facilitate students in achieving these goals through science learning in elementary schools during the COVID-19 pandemic, they need to understand in advance what scientific literacy is and how to optimize science learning so that students have good literacy (Mujiati, 2020).

Scientific literacy is a must for everyone. Scientific literacy is very important for someone because the progress of a nation is determined by the quality of human resources who are literate in science and technology (UNESCO, 2019). Research on students' scientific literacy skills on an international scale is organized by the Organization for Economic Co-operation and Development (OECD) through the Program for International Student Assessment (PISA). Based on the results of the PISA and TIMSS (Trends In International Mathematics and Science Study) assessments, it shows that the literacy of Indonesian students is still low and tends to decline from year to year. Students' low scientific literacy can be used as an illustration that science learning in Indonesia still needs improvement. Facts in the field show that students are very good at memorizing but less skilled in applying their knowledge in problem-solving (Wahyudiana et al., 2021).

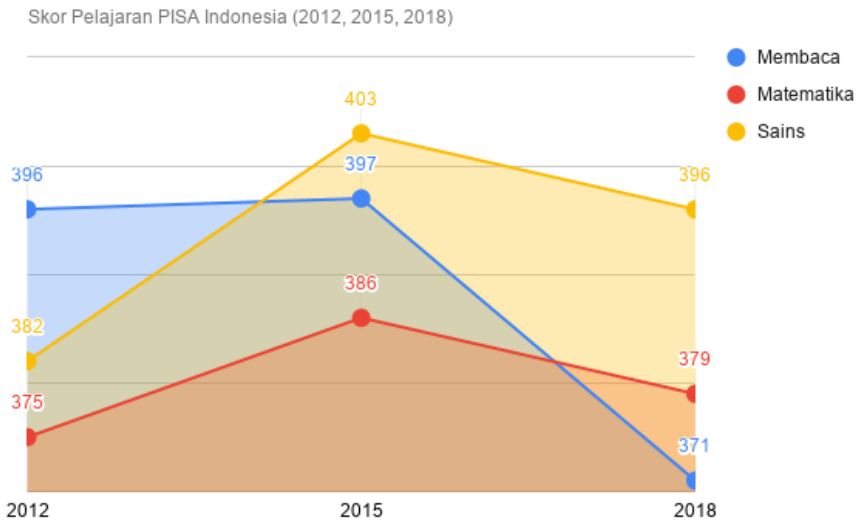

Figure 1. Indonesia PISA results from 2012, 2015 and 2018

Respectively, the scores for Reading, Mathematics, and Science from the test results in 2018 were 371, 379, and 396. This value has decreased compared to the 2015 test, where our Reading, Mathematics, and Science scores were 397 respectively. , 386, 403. Of all those scores, Reading has the lowest decline in scores, and even below the score in 2012 at 396.

The decline in the PISA score is indeed a cause for concern. When compared to the international average, Indonesia has a considerable distance. Reading, Mathematics, and Science on the international

average are 487, 489, and 489. Indonesia did not even manage to break above 400 scores for all three. This decline in quality is certainly an indication that there is some homework to be done if PISA is still the standard for our government for education development (Irawan & Iasha, 2021).

In line with the results of PISA Indonesia in 2018, the analysis of needs in elementary schools throughout DKI Jakarta for scientific literacy still needs improvement, especially in the aspect of identifying scientific issues and using scientific evidence. These two aspects not only focus on knowledge but also on science process skills. The 2013 curriculum seeks to bridge so that students' scientific literacy develops. Curriculum 2013 learning not only emphasizes conceptual knowledge but also science process skills listed in the 4th KD.

Figure 2. Graber Science Literacy Model

If explored in more detail, there are two large groups of people who have views on scientific literacy (Holbrook & Rannikmae, 2009). The first group, namely the "science literacy" group, views that the main component of scientific literacy is understanding science material, namely the basic concepts of science. This understanding of the first group is widely understood by science teachers both in Indonesia and abroad. The second group, namely scientific literacy, views that scientific literacy is in line with the development of life skills (Rychen & Salganik, 2003). That is a view that recognizes the need for reasoning skills in social contexts and emphasizes that scientific literacy is intended for everyone, not just people who choose a career in science or specialize in science. Gräber et al (2001) bridged these two groups with a scientific literacy model such as Figure 1, which shows that scientific literacy is competency/ability based and is the result of the intersection between “what do people know” (consisting of the ability to understand scientific material and the epistemological ability of science (nature of science), "what do people value" (consisting of ethical or moral abilities), and "what can people do" (consisting of learning skills, social skills, ability to carry out procedures, communication skills).

This scientific literacy model emphasizes the need for balance between various abilities and requires skills in making decisions on socioscientific issues (Holbrook & Rannikmae, 2007). Holbrook & Rannikmae (2009) developed a new definition of scientific literacy that is the target of science education. They suggest the need for an appreciation of the nature of science (NOS) and its relevance to the science being studied learn so that developing scientific literacy through science education is an effort to develop the ability to use scientific knowledge and skills creatively based on sufficient evidence, especially those relevant to careers and everyday life in solving important problems, and submitting personal arguments in making socioscientific decisions responsibly. In addition, scientific literacy also requires the ability to

develop collective interaction skills, self-development with a communicative approach, and the need to demonstrate understandable and persuasive reasoning when presenting arguments on socioscientific issues.

Learning multimedia can be used as a tool to train students' scientific literacy if the learning multimedia allows students to find their knowledge. The results of the research by Eijck and Roth (2019) show that authentic science experiences can be used as a way to improve students' scientific literacy. One learning model that provides opportunities for students to actively develop conceptual understanding by combining their knowledge with reasoning and thinking skills is learning with QR code-based learning multimedia. Learning with QR code-based learning multimedia is also in line with the scientific approach which is the essence of the 2013 Curriculum. Scientific literacy is not only related to understanding facts but also understanding the nature of science and having inquiry abilities. science. According to Piaget's theory of cognitive development, children from the age of 11 to adulthood have reached formal operational development. Students should be able to think abstractly and reason so that they can make hypotheses, be able to solve problems and find a concept through teacher guidance. Students need guidance and intermediaries for abstract thinking and reasoning. Students can concentrate on building new knowledge and learning about strategies that are useful at every stage of the inquiry process with guidance (Khulthau, 2016).

Therefore, teachers need to be wise in choosing the right media to use in the learning process. The selected media must be able to increase students' interest in learning and learning independence so that the learning process is meaningful and student learning outcomes can be achieved optimally. In fact, according to Permendikbud No. 65 of 2013 (2013: 3) states that the learning process in each primary and secondary education unit is interactive, inspirational, fun, challenging, and motivates students to participate actively, and provides sufficient space for the initiative, creativity, and independence under talents, interests, and physical and psychological development of students. Based on the explanation of the Minister of Education and Culture, it can be seen that in the learning process, students have a very important role, so teachers must be able to design learning that is not only oriented to student learning outcomes but also student learning independence and student learning processes.

The role of the teacher according to Daryanto & Rahardjo (2012: 1), namely as a manager of the teaching and learning process, acts as a facilitator who tries to create teaching and learning conditions, develops lesson materials well and improves the ability of students to listen to lessons and master the educational goals set out by them. they have to achieve. Although in reality, currently there are still many learning processes that run in one direction, namely teacher-centered so that the activity of students in the learning process is still very lacking. Therefore, learning media is needed that can overcome the difficulties that are often experienced by students.

Research Method

The method used in this research is the research and development method or Research and Development. Research and development or Research and Development is a research method used to produce a particular product and test the effectiveness of the product (Sugiyono, 2011). To produce certain products, research that is needs analysis is used, and to test the effectiveness of these products so that they can function in the wider community, research is needed to test their effectiveness. The development model used by the researcher is the ADDIE Model. In this research data collection technique, the researcher used interview, document, and questionnaire techniques. This research was conducted in elementary schools in DKI Jakarta.

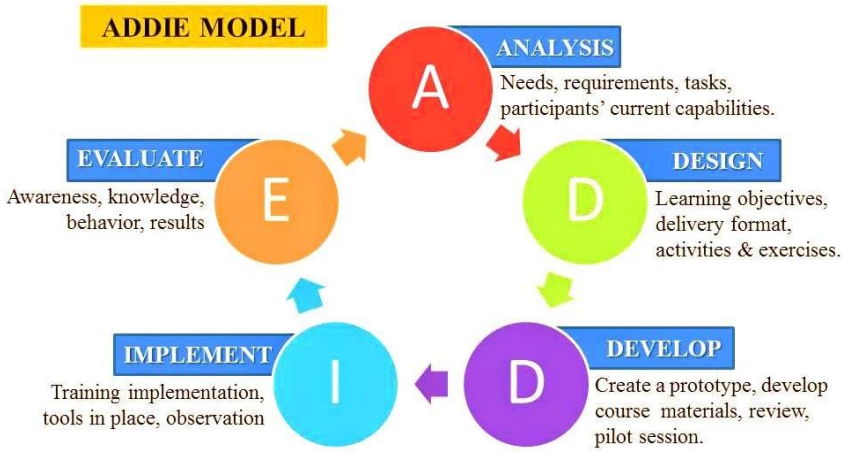

Figure 3. Research Design

Result and Discussion

Development is the result of needs analysis during the preliminary research process and the development process to the field test. The second part is a discussion which is an analysis of research and development findings. In the following, these two sections will be described in detail.

Results of Needs Analysis Identification

Before conducting a needs analysis, it begins with identifying the expected needs of educators in Duren Sawit District. In a preliminary study, several respondents, namely fifth-grade teachers in several schools in the Duren Sawit sub-district, East Jakarta, were conducted. The information sought in the identification process includes 1) the use of learning media, 2) the use of multimedia in learning, 3) the development of digital teaching materials based on QR Code 4) the Motivation of students in learning science. The analysis results show that 80% of teachers strongly agree that learning media plays an important role in improving children's knowledge, attitudes, and skills, 83% of teachers strongly agree that learning multimedia can increase positive attitudes, motivation, reading, and student learning outcomes and 84% teachers strongly agree with the development of multimedia learning in elementary schools. In addition, the results of observations provided that there were sufficient learning media devices, such as the availability of five computers/laptops, projectors, and other teaching aids. However, the problem that arises is that teachers have not maximized the use of media effectively in the learning process, especially with the use of powerpoint-based media in the learning process. When learning activities take place in class, some students show their disinterest. When the teacher explained the subject matter, it was seen that some students were less interested and less motivated to learn so that students did other activities. When students were asked about the use of media in the learning process they answered that the teacher was based on image media but it continued to make it less interesting.

Conducting Instructional Analysis and Initial Characteristics of Students

Based on the results of the questionnaire to the teacher as the respondent, it can be analyzed the appropriate instructional needs to be developed according to the characteristics of the fifth-grade elementary school students. Identification and analysis of the objectives and characteristics of the learning materials are adjusted to the results of the questionnaire obtained in the preliminary research and literature study. Learning activities based on innovative and creative active learning processes that are under the times are needed by students, especially elementary school students for grade V. For this reason, it is

necessary to develop digital teaching materials based on QR Code that can help students and educators in the success of teaching and learning activities. they.

Based on the development of the 2013 curriculum, the learning paradigm shifts from teacher center to student center to achieve the goals that have been formulated in the National Education System Law Number 20 of 2003 article 3 concerning the development of student potential to become human beings who believe and fear God Almighty, noble, healthy, knowledgeable, capable, creative, independent, and become a democratic and responsible citizen (Hermawan, 2016). Steps that can be taken to place students as learning centers (student centers) so that students are more active are using multimedia-assisted learning (Rahmad, 2015). The use of multimedia is an implementation of ICT development. This multimedia development is under the characteristics of 21st-century learning, namely the integration of technology as a learning medium to develop learning skills. Learning with the help of Information and Communication Technology (ICT) as a physical and non-physical tool used as an intermediary between teachers and students in understanding subject matter more effectively and efficiently (Yusuf, I & Subaer, 2013). Hiong & Osman (2013) stated that the integration of ICT in learning is a component of 21st-century learning that can improve the ability to think inventively, communicate effectively, high productivity, and spiritually. Quick Response Code is a two-dimensional barcode introduced by the Japanese company Denso Wave in 1994. QR Code was developed as a code that allows its content to be translated at high speed (Rouillard, 2008). Initially, the development of this barcode was aimed at tracking inventory in the vehicle manufacturing section and is now used in various trade and service industries. Currently, the use of QR Codes has been widely implemented in the form of QR Code Readers and QR Code Generator applications so that someone will find it very easy to generate information in the form of QR Codes and get the information they want to know. This convenience is because someone only scans and scans data through media from a camera phone (Anastasia, Istiadi, and Hidayat, 2010) or from the QR Code Generator application which can be downloaded for free on the Google Play Store. One of the pioneers of using QR Codes in Indonesia is Kompas daily. Readers can access online news by scanning and scanning QR Code data via mobile phones. The scan results will direct readers to the news URL that has been resolved correctly and quickly (Taufik, 2009).

Development Design Stage

In the design stage of developing QR Code-based digital teaching materials to improve scientific literacy in science learning, the author takes several steps in the development stage, starting with the analysis stage of core competency standards and basic competencies based on the Syllabus.

Product Development Stage

At this stage, researchers started QR Code-based digital teaching materials to improve scientific literacy in science learning to be shown to fifth-graders at State Elementary Schools in Duren Sawit District, East Jakarta. The product development steps are: Make sure the ISpring application and website to APK are installed on your PC or laptop.

1. Make a PowerPoint slide with the hyperlink feature as your application material
2. Open the slide properties to set the slide you created
3. So that the slide does not go to the next slide when clicked, the branching setting is set to none, so that our hyperlinks can be used by selecting on click on advanced, and to add songs, select playlists.
4. After finishing the settings select publish.
5. After the product is made, the next step is the process of converting the website to the product “apk”

Product Evaluation and Revision Stage

The data obtained in this study include data from the validation results of material experts, media, data from teacher facilitators, and data from student trials. The data will be described as follows: a). Validation to material and media experts Validation of material experts is carried out to determine the quality of learning materials that have been developed in terms of learning aspects, content aspects. The instrument used is in the form of a questionnaire, then the material expert conducts a review by putting a checkmark (√) on the score that is under his assessment. Validation from media experts is carried out to determine the quality of the media that has been developed in terms of appearance and language use. The instrument used is a questionnaire, which media experts assess by putting a mark (√) on the score that is under their assessment. Validation and revision of media drafts/scripts are carried out based on comments and suggestions from media experts and then consulted again until validation is declared valid to be tested. Likewise, the material is refined based on comments and suggestions from material experts, the results of the revisions that have been made, are consulted again until they get validation or are declared valid and feasible to be tested.

Draft Feasibility Test by Experts

Experts were asked to evaluate the learning product to see the weaknesses in the learning product. The experts who evaluate this product consist of three experts. The three people are lecturers who have expertise in the fields of media, elementary school, and language.

1. Media Expert

The expert is a lecturer as well as the Head of the Education Technology Study Program at UNTIRTA. The expert has a history of education in the field of educational technology (TP), providing advice and assessment. The advice he gave was to pay attention to gender equality, namely the use of various cartoon characters ranging from women, men, children, to adults in multimedia development. The expert's assessment of multimedia-based thematic learning materials is based on the following aspects: 1) Display and 2) Programming/Navigation. The results of the media evaluator's assessment can be seen in the table below.

Table 1. Media Expert Assessment Results

No.	Aspect	Value (Scale 4)
1.	Appearance	3,9
2.	Quality	3,8
3.	Cohesiveness	4
4.	Programming	3,8

Description of the assessment with a scale, namely: 1) 4.0 – 3.6 = Very Good (Excellent), 2) 3.5 - 2.6 = Good (Good), 3) 2.5 – 2.0 = Enough (Sufficient), 4) 1.9 – 1.0 = Less (Insufficient), 5) 0.9 – 0 = Fail. The results of the media assessment show that the aspect of the display and quality of multimedia learning, the integration between content, visuals, audio, images, and videos as well as the programming aspect is stated to be very good in the assessment of media experts.

2. Elementary School Experts

The expert is a postgraduate basic education lecturer and also the education of children with special needs at the Faculty of Education (UNJ). He provides constructive assessments and suggestions on the development of this multimedia-based thematic learning material. He gave input

that in the development of media besides being able to be used by normal students, multimedia is also expected to be used by students with special needs such as children who have problems with concentration, vision, hearing, and so on. Suggestions for improvement from him regarding the developed multimedia are: 1) Paying attention to the sound quality of the developed multimedia, 2) The use of basic colors that do not cause a distraction to students' attention during teaching and learning activities and 3) paying attention to the use of letters in the developed media.

Table 2. Assessment of Elementary School Experts on Multimedia

No.	Aspect	Value (Scale 4)
1.	Suitability	4
2.	Novelty	3,5
3.	Accuracy	3,2
4.	Completeness	3,8
5.	Learning	4

From the results of the assessment by the SD material expert and by the expert, it shows that the suitability of the material with instructional objectives and student characteristics is considered very good, while the novelty of the material in learning multimedia, the accuracy of the material with instructional objectives, characteristics and concepts, the completeness of the presentation of the material with visual and audio, the aspect of learning between educators, multimedia and students is considered good. Overall, multimedia-based thematic learning materials are good and feasible to be applied in elementary schools with some improvements.

3. Language Expert

The expert is the coordinator of Postgraduate Language Education at the State University of Jakarta. He advised on the linguistic aspect. Constructive suggestions include: 1) paying close attention to the spelling of every word in the developed multimedia, 2) Adapting to the improved spelling, 3) Reviewing the politeness of personal pronouns in the multimedia used.

Table 3. Results of the Revision of Linguists

Before Revision	After Revision
Some words are not standard and the possibility of typing errors.	Has been replaced and changed some less standard words and errors in the typing process
There are several sentences that have meanings and spellings that are not understood by students	It has been replaced and changed several sentences and spellings that are not quite right.

The linguistic assessment carried out by the linguist evaluators includes two aspects, namely the suitability of language with the development of elementary school children and linguistics including the use of words, sentences, and paragraphs. The results of the assessment can be seen in the table below.

Table 4. Assessment of Linguists on Multimedia

No.	Aspect	Value (Scale 4)
1.	Suitability	3,75
2.	language	3,67

The results of the above assessment indicate that the suitability of language with the development of elementary school-aged children and linguistic aspects including the use of words, sentences, and paragraphs are considered very good in developing QR Code-based multimedia.

In several learning media developed, scientific literacy is used as the basis for developing the media, including multimedia learning based on scientific literacy (Latip, A and Permanasari, A, 2015; Rubini, Permanasari, and Yuningsih, 2018). In both media, the domain of scientific literacy becomes a reference in determining the media objects that are displayed in the design of the learning media. Other media that use scientific literacy as the basis for development are animated videos (Wulandari, 2019). The animated video display design consists of the domains of scientific literacy, namely scientific knowledge, scientific competence, and scientific attitudes that are framed by context. In general, the characteristics of the media developed to improve scientific literacy have an interactive nature which is accommodated by animation. This interactive nature is expected to be able to facilitate scientific knowledge, especially procedural knowledge, and facilitate scientific competence, especially the competence to explain scientific phenomena and interpret data. In addition, the general characteristics found in each of the media that have been developed include the phenomena or contextuality of the material presented in the design of the media display. The appearance of the design is part of the stimulus so that students are interested in learning the material contained in the media. In addition, phenomena are also used as part of the development of the context domain in scientific literacy which becomes the frame for other literacy domains.

The use of computer-based media in science learning as an effort to improve students' scientific literacy has various impacts on the research carried out. In general, the use of computer-based media has a positive impact on increasing students' scientific literacy. Research by Latip and Permanasari (2015) found that the effectiveness of multimedia learning based on science literacy on students' scientific literacy was in the medium category with a scientific literacy ability score between 60%-70%. Other research results also found that learning multimedia increased scientific literacy in the moderate category (Winasti, Soetisna, and Hindriana, 2018; Rubini, Permanasari, and Yuningsih, 2018). These results indicate that the quality of the multimedia developed needs to be improved so that the effectiveness of the use of multimedia can be maximized.

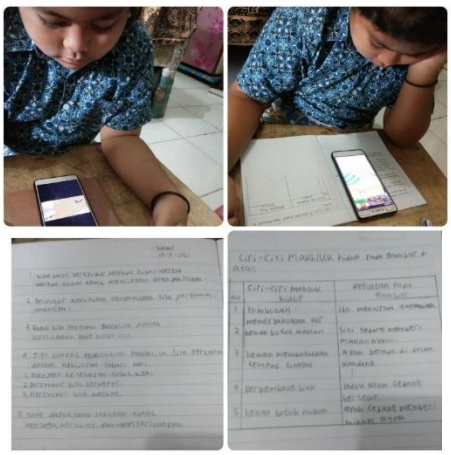

Figure 4. During Product Trial to Students

In another study, it was found that the use of learning multimedia has a positive impact on increasing scientific literacy in classes that use multimedia compared to classes that do not use learning multimedia (Nurhayati, Yasir, and Ernawalis, 2019; Juniati, Jufri, and Yamin, 2020). In other forms of computer-based media, the use of computer-based media, in general, has a positive impact on increasing students' scientific literacy. The use of PBL-based E-modules has succeeded in increasing students' scientific literacy and reducing misconceptions that occur in students (Imaningtyas, et al, 2016).

Likewise, the use of interactive e-books can improve students' scientific literacy with an increase in scores of 40-55% (Firdausy and Setiawan, 2017). In other forms of media, namely animated videos, it has an impact on differences in scientific literacy skills between classes that learn with animated videos and classes that do not use animated videos (Wulandari, 2019). Furthermore, the research of Ismail, Permanasari, and Setiawan (2016) found that STEM-based virtual labs have an impact on students' scientific literacy skills in terms of gender. Based on the results of studies in several studies, it can be concluded that computer-based media has a positive impact on students' scientific literacy skills, in general, students' scientific literacy skills increase after learning to use computer-based media. However, it is necessary to improve the quality of content, media objects, and computer-based media design so that the impact on increasing students' scientific literacy can be more effective and maximal.

Conclusion

Based on the results of this multimedia development, it can be concluded that this multimedia can facilitate students in understanding the material. It is evident from the assessments of appropriate experts (75% material experts, 78% media experts, and 86% linguists), the responses of students and teachers are interesting (75.4% small group trials, 76.6% field trials, and 77% teacher trial). This shows that the multimedia developed by researchers can be utilized in the learning process in schools.

References

Daryanto. & Rahardjo, M. 2012. Model Pembelajaran Inovatif. Yogyakarta: Gava Media. Permendikbud. 2013.

Eijck, Micheil van and Roth, Wolf-Michael. (2019). "Authentic Science Experiences as A Vehicle to Change Students' Orientations Toward Science and Scientific Career choices: LearrningFrom The Paths Followed by Brad". Cultural Studies of Science Education. Vol. 4, pp. 611-638.

Fiidami, I. N. (2019, March). PEMBELAJARAN BERBASIS LITERASI SAINS KEMAMPUAN BERPIKIR KRITIS SISWA. In *SEMINAR NASIONAL PENDIDIKAN DASAR* (Vol. 1, No.01).

Fittel, David. (2010). Inquiry-Based Science in A Primary Classroom: Proffesional Development Impacting Practice. (Thesis Master of Education), Queensland University of Technolog

Hanson, David M. (2006). Instructor's Guide to Process-Oriented Guided-Inquiry Learning. Lisle: Pasicif Crest.

Irawan, S., & Iasha, V. (2021). Core Learning Model and Mathematical Disposition, Against Mathematics Problem Solving Ability of Elementary School Students. *Buana Pendidikan: Jurnal Fakultas Keguruan Dan Ilmu Pendidikan*, *17*(2), 122–129.

Kristyowati, R., & Purwanto,A. (2019). Pembelajaran Literasi Sains Melalui PemanfaatanLingkungan. *Scholaria: Jurnal Pendidikan dan Kebudayaan*, *9*(2), 183-191.

Kuhlthau, Carol C., Maniotes, Leslie and Capari, ann K. (2018). Guided Inquiry: Learning in The 21st Century. London: Libraries Unlimeted.

Kusniati, T. (2020). Meningkatkan Hasil Belajar Operasi Hitung Bilangan Pecahan Dengan Kartu Bilangan Siswa Kelas VI SDN 3 Mangliawan Kecamatan Pakis Kabupaten Malang. *Buana Pendidikan: Jurnal Fakultas Keguruan Dan Ilmu Pendidikan*, *16*(29), 52–64.

Kusumaningtyas, H. N., & Hakim, L. (2020). Pengembangan Buku Scientific Approach Berbasis QR CodeBerintegrasi Kahoot. *Jurnal Pendidikan Ekonomi*, *13*(2), 84-93.

Mujiati, S. (2020). UPAYA MENJAGA KEBERSIHAN SEKOLAH PADA SAAT COVID 19 DENGAN MEMBERDAYAKAN TENAGA GURU DI SDN PEKAYON 03 KEC. PASAR REBO JAKARTA TIMUR. *Buana Pendidikan: Jurnal Fakultas Keguruan Dan Ilmu Pendidikan*, *16*(30), 194–202.

Nurafandi, A. *Pengembangan Modul Interaktif Berbasis QR Code pada Konsep Virus* (Bachelor's thesis).

Nurjanah, N., Cahyana, U., & Nurjanah, N. (2021). Pengaruh Penerapan Online Project Based Learning Dan Berpikir Kreatif Terhadap Keterampilan Proses Sains Siswa Kelas IV Pada Pelajaran IPA Di SD Nasional 1 Kota Bekasi . *Buana Pendidikan: Jurnal Fakultas Keguruan Dan Ilmu Pendidikan*, *17*(1 SE-), 51–58. https://doi.org/10.36456/bp.vol17.no1.a3161

OECD. (2013a). PISA 2019 Assesment and Analitycal Framework Mathematics, Reading, Science, Problem Solving and Financial Literacy. s.l. :

OECD Publishing. OECD. (2019). PISA 2019 Result: What Students Know and Can Do-Student Perfomance in Mathematics, Reading and Science (Valume I). s.l. : OECD Publishing.

Peraturan Menteri Pendidikan dan Kebudayaanrepublik Indonesia Nomor 65 Tahun 2013 Tentang Standar Proses Pendidikan Dasar Dan Menengah. Jakarta: Permendikbud.

Pertiwi, U. D., Atanti, R. D., & Ismawati, R. (2018). Pentingnya Literasi Sains Pada Pembelajaran IPA SMP abad 21. *Indonesian Journal of Natural Science Education (IJNSE)*, *1*(1), 24-29.

Sugiyono. 2011. Metode Penelitian Pendidikan. Bandung: Alfabeta.

Thomson, Sue and Bortoli, Lisa De. (2008). Exploring ScientificLiteracy: How Australia Measure Up. Camberwell, Vic: ACER.

Thomson, Sue., Hillman, Kylie., and Bortoli, Lisa De. (2013). A Teacher's Guide to PISA Scientific Literacy. Melbourne: ACER

Tim TIMSS Indonesia. (2019). Survei Internasional TIMMS [Online] http://litbang.kemdikbud.go.id/index.php/surveiinternasional-timss. (diakses: 20 Februari,2020)

Untari, S. K. (2020). Kreatifitas Guru Dalam Menyongsong Pembelajaran Masa Pandemi Covid-19. *Buana Pendidikan: Jurnal Fakultas Keguruan Dan Ilmu Pendidikan*, *16*(30s), 49–53.

UNESCO. (2019). Sceince Eduction Policy-Making Eleven Emerging issues. s.l. : UNESCO.

Wahyudiana, E., Sagita, J., Iasha, V., Setiantini, A., & Setiarini, A. (2021). PROBLEM-BASED LEARNING-BASED IPA PRACTICUM MODULE TO IMPROVE PROBLEM-SOLVING ABILITY. *Buana Pendidikan: Jurnal Fakultas Keguruan Dan Ilmu Pendidikan*, *17*(2), 161–167.

Wulandari, Heni. 2014. Pengaruh Metode Pembelajaran Flipped Classroom dan Diskusi terhadap Prestasi Belajar Akuntansi Ditinjau dari Kemandirian Belajar Siswa Kelas X Akuntansi SMK Negeri Di Kabupaten Klaten. Tesis.

Copyrights