Development of Mobile-based Learning Applications to Increase Environmental Awareness for Students

Hilda Lufita Sari[1], Chatarina Muryani[2], Singgih Prihadi[3]

[123]Geography Education, Universitas Sebelas Maret
[2]Disaster Rearch Center, Universitas Sebelas Maret

lufitasarihilda@gmail.com, chatarinamuryani@staff.uns.ac.id,
singgihprihadi@staff.uns.ac.id

Abstract. During the Covid-19 pandemic, the teaching and learning process cannot be face-to-face but must be online. It takes suitable learning media so students can understand the learning material well and not get bored because they have to study from home. This study aims to develop mobile learning media on Natural Resources Conservation material to increase students' environmental awareness. The research approach uses Research and Development with the Borg and Gall model. This study used second graders of all social studies majors at Kebakkramat high school, using the control and experimental classes. The data collection techniques in this research are observation, documentation, questionnaire, and test. The instrument used in this study contains an indicator of environmental concern known as the New Environment Paradigm (NEP) indicator. The data analysis techniques are (1) Validation and reliability of test instruments; and (2) Product Effectiveness Tests. The validity of material experts and media experts are learning media products declared very feasible. The Effectiveness test of the product with the Independent Sample T-Test at a significant level of 5% resulted in a mobile learning application that can increase students' environmental awareness with T-count = 3.573 > T-table 1.692. Thus, explain that developed mobile learning media effectively increases students' environmental awareness in Kebakkramat High School.

Keywords: Development, Effectiveness, Learning Applications, mobile, environmental awareness

1   Introduction

Coronavirus (COVID-19) is a pandemic disease that affects education systems in various countries with different income levels [1] The coronavirus pandemic was acknowledged to have affected the global education system by the United Nations Educational, Scientific, and Cultural Organization (UNESCO) [2]. In Indonesia, where there is a chance that the Covid-19 pandemic will spread, the learning process can no longer be conducted face-to-face in classrooms, and the Covid-19 pandemic also has a significant

impact on the country's educational system. As a result, the entire teaching and learning process is conducted online using the distance learning system [3].

Various distance learning media are tried and used, including e-learning, zoom application, google classroom, youtube, and WhatsApp social media. These facilities are used to carry out learning like in the classroom. Teachers are indirectly required to be able to use and access technology through employing this online medium. In addition to being bored from being unable to meet friends, students are astonished and ill-prepared for the new educational system [4].

In this kind of distance learning, learning media is needed to bridge teacher-student interaction's limitations. According to Cavanaugh [5], multimedia is 'computer-mediated information presented simultaneously on more than one medium. The phrase simply denotes the presence of written and visual content [6]. Visual content can be composed of dynamic, graphic elements that depict real-world phenomena or static elements like models and photos. Verbal content, however, can include both spoken and written words [7]. Effective multimedia designs are praised for enhancing cognitive processes and learners' ability to absorb and assimilate material [8]. A compelling and educational experience can also be created using well-designed multimedia. [7] Effective design "encourages students to pay attention to pertinent material, arrange it into a coherent thinking, and integrate it with past knowledge," according to. Research has also demonstrated that badly designed materials have a negative effect on pupils because they can become overwhelmed and confused by too much information.[9].

According to [10], explaining the importance of applying technology to the world of education as the originator of the nation's intellectual life, technology-based information literacy can bridge the interaction of teachers and students who cannot carry out face-to-face activities. Furthermore, according to [11] in addition to teachers who are required to master technology and information in delivering learning materials, students are also expected to develop a new series of digital era learning to answer the challenges of advancing technology-based education.

Environmental degradation can be decreased by students' knowledge, which correlates with their environmental awareness behavior. [12] The pupils' lack of interest in comprehending and researching environmental issues was the root reason for their low environmental awareness. Teachers should encourage children to comprehend environmental issues and take action to solve them [13]. Teachers, however, frequently pay more attention to their student's academic performance than their efforts to uphold the standards of the learning environment [14]. Consequently, environmental education must be taught in schools.

For students, environmental awareness is a critical problem. As a result, schools must employ efficient tools to educate children about environmental challenges. Students' awareness of initiatives to protect the environment and its surroundings may grow due to learning about environmental care. Long-term efforts are necessary to build a healthy ecological system [15]. That is in line with the findings of Rahardjo's study, which demonstrate that instruction should center on boosting pupils' favorable views toward the environment [16].

It is quite evident that the most popular method for analyzing students' environmental concerns is The New Environment Paradigm model. The models explain that the

relationship between the environment and student attitudes and behavior in schools is indeed quite important, especially if there are concerns that there are people who conclude that the era of global issues makes environmental issues less critical [17]. The main advantage of multimedia learning is the ability to increase student interest in exploration in developing a superior understanding of learning. [18] Currently, the research aims to develop multimedia in learning which is expected to increase students' environmental awareness.

2   Methods

This development research was conducted at Kebakkramat High School. The reason for choosing Kebakkramat High School was based on the consideration that the school does not have a geography support application for mobile-based learning applications. This research uses Research and Development (R&D) with Borg and Gall development model. This model contains 4 (four) stages data collection, planning, product development, and testing. These four stages are used to develop Mobile-Based Learning Applications to Increase Environmental Awareness. The stages of development with the Borg and Gall model can be seen in Figure 1.
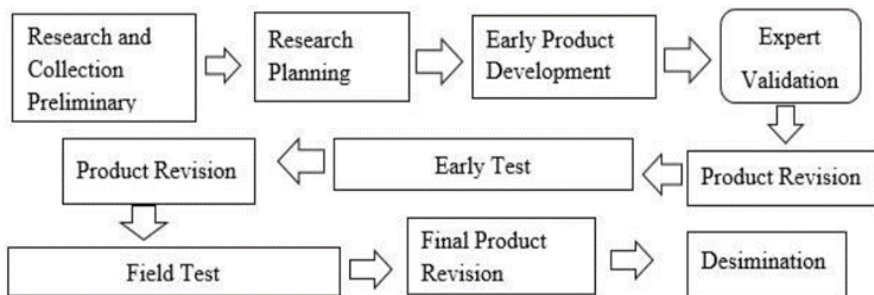
Fig. 1. Borg and Gall model [19]

Data collection is carried out as follows:

1. Data collection on the condition of schools and students was carried out by field observations and interviews with three geography teachers.
2. Collecting data on student needs for mobile learning is done by interviewing using a questionnaire to 60 students and 3 geography teachers.
3. Collection of teaching materials for mobile learning is good in the form of descriptions, pictures, maps, or carried out with various compilations.
4. Material validators and media validators carry out product validation (mobile learning).

Test the effectiveness using quasi-experimental To find out students' environmental awareness, use the NEP indicator:

Table 1. New Environmental Paradigm (NEP) indicators and their application to students

No	Dimention	Aplication to students
1	Limits to growth	Students are actively involved in various techniques to provide solutions given to reduce excessive exploitation of natural resources through various actions
2	Anti antropocentricsm	Students consistently develop solutions related to efforts to conserve flora and fauna in various actions. Students are prohibited from destroying ecosystems and habitats of living things.
3	Balance of natures	Students are expected to be able to develop, implement, and communicate new ideas to others effectively in various conditions to maintain the balance of nature. Students are prohibited from destroying the environment, damaging the balance of biotic and abiotic nature.
4	Rejection of examptionalism	Students are actively involved in efforts to create a habitable earth in various actions. Students are prohibited from damaging the environment, because the impact will create an uninhabitable earth and not friendly to living things. For example, ozone depletion will cause a greenhouse effect, which can cause global warming.
5	the possibility of an ecocrisis	Engage in various techniques to carry out the solutions given to reduce environmental abuse so that ecological disasters do not occur

Source : [19]with modification

A quasi-experiment is carried out using experimental and control classes to test mobile learning products. In a control class, the geography learning in this class does not use Android-based Mobile Learning and only focuses on WhatsApp groups. In the experimental class, geography learning in this class uses Android-based Mobile Learning and WhatsApp group.

3   Result

This research intends to develop android-based mobile learning. This research is divided into 4 (four) stages, namely: 1) research and collection preliminary, 2) research planning, 3) product development, and 4) field test and dissemination. These four stages aim to development of mobile-based learning applications to increase environmental awareness for students. The development of mobile learning products for geography learning is following the steps for developing the Borg and Gall model as follows:

3.1 Research and Collection Preliminary

The results of interviews with three Geography teachers at Kebakramat High School found that they had difficulty explaining learning materials in distance learning because they were not experienced in delivering material online. At the beginning of the learning pandemic through the WhatsApp Group, after one semester of interviews with students about difficulties in learning geography online, it was found that most students (92%) stated that they had difficulties in capturing learning materials. When given an alternative to learning with mobile learning, both teachers and students stated that they needed the learning media. This stage contains an analysis of student learning styles and media development presented in tables 2 and 3.

Table 2. . Table 2. Analysis of Student Learning Styles

Learning Style	Total	Percentage (%)
Visual	86	53,75
Audio	42	26,25
kinesthetic	32	20,00

Table 3. Media development analysis

Indicator	Percentage (%)
Students use media in learning	73,75
Development of teaching materials	73,75

From Table 2, it can be seen that 53.75% of students have a visual learning style (86 students), 26.25% of students have an audio learning style (42 students), and 20% of students have a kinesthetic learning style (32 students). Based on the data above, the Android-based Mobile Learning that will be developed will be directed to cover all the characteristics of learning styles that are dominated by the characteristics of visual learning styles.

3.2 Research Planning

At this stage, the design of learning applications is carried out to be used as a reference in product development. The first step is to prepare learning materials and determine program objectives. The selected learning material is Hydrospheric Dynamics and Its Impact on Life. The next step is to design media components which include teaching modules, pictures, maps and videos to clarify the material. To be more interesting, the mobile learning application will be equipped with educational games. In addition, the learning application must contain the New Environmental Paradigm (NEP) indicator.

3.3 Product Development

Learning materials are developed referring to needs analysis and uploaded into learning applications. The geography learning material chosen to be developed is Hydrospheric

Dynamics and Its Impact on Life. To clarify and attract the appearance in the application, the learning materials are equipped with pictures, maps and video links. To increase students' awareness of the environment, in some parts the material is related to environmental preservation and Sustainable Development. The test is displayed in the form of a quiz. The material must be made as a power point to make it easier to enter the material into the Godot Engine software. Data conversion from ppt to Adobe Illustrator (AI) is carried out at this stage. The next step is to create a moving animation using Spriter Software, this software serves to move objects so that they resemble animation. Editing process using Spriter Software. After converting to mobile resolution and creating animations, the next step is coding to be able to display materials such as running applications. The software used for coding in this application is Godot Engine.

2a (learning material in the form of power point)
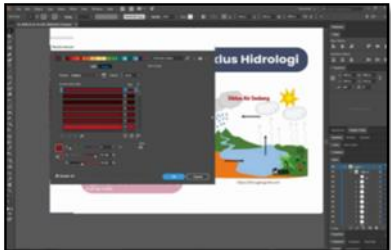
2b (Data conversion using Data conversion using)

2c (editing process using Spriter Software)

2d (Coding in this application by Godot Engine)

Fig. 2. Development stage

The complete learning media has been validated by media experts and material experts with "very feasible" assessment results.

Table 4. Indicator of Media Expert Validators and Material Expert Validators

No	Indicator	
	Media Expert Validators	Material Expert Validators
1	Design	Material Quality
2	Navigation	Benefits
3	Program Management	Environmental Awareness

3.4   Field Test and Desimination

This stage contains a quasi-experimental with environment awareness test. The test refers to the indicator of The New Environmental Paradigm (NEP) which can be used to determine students' environmental awareness. NEP has 5 indicators that are used through multiple choice questions.

Table 5. Effectiveness Test with Paired Sample T-Test

Class	Experiment	Control
Average	77,437	67,974
Varians	82,745	50,615
Total	34	34
t-test	3,573	
t- value table	1,692	

The results of the effectiveness test show the value of t test> t test table so that it can be concluded that the experimental class is more effective in increasing students' environmental awareness than the control class. Thus the mobile learning media on the hydrosphere dynamics material has succeeded in increasing environmental awareness of students in Social Science class X Kebakkramat High School.

4   Discussion

Research results show that learning media is effective in learning geography. That confirms previous research, which states that the developed learning media is effective in learning geography. The difference between this research and previous relevant research is in the development model and objectives. This study uses the Borg and Gall model, while the previous research used the Dick and Carey model. The next difference is in the purpose of media development. This research aims to increase environmental awareness, while previous research has a development goal to increase spatial ability.

However, there is a weakness in learning using Android-based mobile learning, namely that Android smartphones can only use android-based mobile learning. The development of android-based mobile learning has been adapted to the syllabus, geography lesson plan (RPP), and data analysis of the needs of second-grade students

Kebakkramat high school. Student needs analysis includes learning styles, use of media, development of teaching materials, and visualization of color and typeface.

To increase students' environmental awareness, the material presented in this android-based mobile learning contains indicators of The New Environmental Paradigm (NEP). In addition, pretest and posttest questions, quizzes, and assignments were designed using the NEP indicator. This Android-based mobile learning contains pictures, learning videos, and educational games that can be used anytime and anywhere so that students can repeat the lessons that have been delivered.

Following the calculation of the effectiveness test through the posttest scores of the control and experimental classes, this mobile learning effectively increases environmental awareness by using cognitive indicators of students. During learning using Android-based mobile learning, there are several advantages, namely:

1. Easy for students to install with an application size that is not too large.
2. The material presented is equipped with pictures and videos to make it easier for students to understand the material.
3. There are educational game features that can increase students' knowledge.
4. This Android-based mobile learning uses offline mode, so it does not use the internet.
5. This Android-based mobile learning can use anytime and anywhere.

5   Conclusion

Based on the study results, Mobile learning media is needed, especially in distance learning during the Covid-19 pandemic. The validation of material and media experts shows that the developed mobile learning media is feasible to teach Hydrospheric Dynamics material and its impact on life. The results of researchers are that Mobile learning media for Hydrosphere Dynamics material is effective for increasing environmental awareness of Kebakkramat High School students. The effectiveness test (T-Test) compares post-test scores between the control and experimental classes. Following the results of control and experimental classes, it is known that the t-count is $\pm$ 3.5729 with a t-table of 1 .6923 (a significant level of 5%). The comparison results show that android-based mobile learning is effective in learning. The implications of this research are the development of mobile-based learning applications to increase environmental awareness for students. This Android-based mobile learning can contribute to improving student learning outcomes. This learning application can be used as a fun and meaningful learning alternative, especially for geography subjects in distance learning in the COVID-19 era.

Acknowledgments

References

1. Wajdi M B N, Iwan Kuswandi, Umar Al Faruq, Zulhijra Z, Khairudin K and Khoiriyah K 2020 Education Policy Overcome Coronavirus, A Study of Indonesians *EDUTEC J. Educ. Technol.* **3** 96–106
2. UNESCO 2020 Distance Learning Solutions *en.unesco.org*
3. Rulandari N 2020 The Impact of the Covid-19 Pandemic on the World of Education in Indonesia *Ilomata Int. J. Soc. Sci.* **1** 242–50
4. Murad D F, Hassan R, Heryadi Y, Wijanarko B D and Titan 2020 The Impact of the COVID-19 Pandemic in Indonesia (Face to face versus Online Learning) *Proceeding - 2020 3rd Int. Conf. Vocat. Educ. Electr. Eng. Strength. Framew. Soc. 5.0 through Innov. Educ. Electr. Eng. Informatics Eng. ICVEE 2020* 2020–3
5. Cavanaugh C 2001 Effectiveness of K-12 DL *Int. J. Educ. Telecommun.* **7** 73–88
6. Jonassen D H, Howland J, Moore J and Marra R M 2002 *Learning to Solve Problems with Technology: A Constructivist Perspective (2nd Edition)* (New Jersey: Prentice Hall)
7. Issa N, Mayer R E, Schuller M, Wang E, Shapiro M B and Darosa D A 2013 Teaching for understanding in medical classrooms using multimedia design principles *Med. Educ.* **47** 388–96
8. DiGiacinto D 2007 Using multimedia effectively in the teaching-learning process *J Allied Heal.* **Fall;36** 176–9
9. Chandler P and Sweller J 2009 Cognitive Load Theory and the Format of Instruction Cognitive *Cogn. Instr.* **8** 293–332
10. O'Neil H F J, Perez R S and O'Neil H F 2002 *Technology Applications in Education (1st Edition)* (New Yourk: Routledge)
11. Schmid R and Petko D 2019 Does the use of educational technology in personalized learning environments correlate with self-reported digital skills and beliefs of secondary-school students? *Comput. Educ.* **136** 75–86
12. Nurwidodo N, Amin M, Ibrohim I and Sueb S 2020 The role of eco-school program (Adiwiyata) towards environmental literacy of high school students *Eur. J. Educ. Res.* **9** 1089–103
13. Narut Y F and Nardi M 2019 Analysis of Environmental Care Attitudes in Grade VI Elementary School Students in Ruteng City *Sch. J. Pendidik. dan Kebud.* **9** 259–66
14. Riskina M D 2019 Descriptive Study of Environmental Care Attitudes through the Adiwiyata School Program at SMAN 2 Pamekasan *Kaji. Moral dan Kewarganegaraan* **7** 1–15
15. Afriliani A, Muhartati E and Hindrasti 2019 *Adiwiyata Program Implementation Profile and Environmental Care Attitudes at Provincial Level Adiwiyata Junior High School in Tanjungpinang 2018* (Universitas Maritim Raja Ali Haji)
16. Rahardjo S 2017 Increasing Environmental Care Behavior and Student Responsibilities through the Ejas Model with the Science Edutainment Approach *J Pendas* **4** 1–7

17. Dunlap R and Van Liere K 2008 The "new environmental paradigm" *J. Environ. Educ.* **40** 19–28
18. Shahzad M, Nadeem M A and U-Nisa Z 2021 Developing Learning Environment Using Interactive Multimedia *Pakistan J. Distance Online Learn.* **VII** 93–106
19. Meredith D G, Joyce P G and Walter R B 2003 *Education research: An introduction, 7th Eddition* (United State of America: Pearson Education)