"Merapi Volcano Imaginary" an alternative multimedia learning geography in the south region of Merapi volcanism

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Abstract

This study aims to anticipate the loss of learning for students in the geography education field practice in the southern region of Merapi Volcano during the Covid-19 Pandemic era by developing Android-based interactive learning multimedia as a medium and teaching materials. The development uses the ADDIE method (Analysis, Design, Development, Implementation, and Evaluation). Product feasibility was assessed by six material and media expert lecturers and ten geography education students as users. The result of the development is an interactive multimedia with flipped book combined with Adobe Flash Maker on Android, with the name "Merapi Volcano Imaginary." The material contains geographic physical and socio-economic studies on ten study areas, namely: Tugu Yogyakarta, Lava Breccia, Sambisari Temple, Merapi Museum, Plawangan, Mbah Maridjan Museum, Kaliadem Bunker, Gendol River, Sisa Hartaku Museum, Upper River Section "Opak." The experts rated the media and material in the Excellent category. Users' results are the same: readability, cohesiveness, attractiveness, coloring, material understanding, material order, and metacognitive value. All respondents stated that multimedia was feasible and effective as a medium and teaching material for field practice of geography education in the southern region of Merapi Volcano.

Keywords: *interactive multimedia learning, Merapi, vulcanism, geography, android base*

INTRODUCTION

The Covid-19 pandemic that has hit Indonesia since the beginning of 2020 has left many changes in the world of education. One greatly affected is the policy regarding implementing learning at each level. Knowledge carried out face-to-face in a real class has now become virtual or online. These conditions affect the achievement of learning objectives to produce three abilities, namely, affective, cognitive, and psychomotor. Online learning limits students' physical interaction activities in optimizing the role of the senses in responding to learning stimuli. The learning outcomes for aspects of online knowledge are getting a more significant portion to be fulfilled.

The Ministry of Education and Culture (2022) said that this pandemic creates a greater risk of learning loss for children of learning age at all levels of education. The risk of loss of learning is also felt by students of geography education at Yogyakarta State University, master and undergraduate programs in field study design courses. This course is geography education field practice with a learning model that emphasizes field observation to produce a substance of learning design. Observation content includes geographic studies from physical, social, and economic reviews and technical geography.

The geography education field practice course discusses implementing geography theories and their learning, including models, approaches, methods, and techniques (Lambert & Morgan, 2010). These aspects are applied in geographic field activities to review physical conditions, social conditions, and other conditions. Field activities are developed through joint research (groups) and practical activities related to Geography Cluster Education in schools and higher education, both on and off campus. The competence of learning this course is measured in the ability to combine various geographical theories, measurement techniques, and analytical methods in a comprehensive manner.

Implementing these lectures requires a locus of study design to represent the courses' achievements. Classes emphasize knowledge of geographical facts that can be integrated with objects, scope, structure, and geographical approaches to nature. These lectures are realized through efforts to demonstrate concepts and phenomena in the field through field studies. Lecturers and students are involved in the learning process, so mastery of the competencies should be broader and more meaningful. The field study method is oriented towards the Contextual Teaching and Learning model, especially in mastering physical geography materials such as geomorphological, geological, hydrological, and climatological studies which are included in the scope of physiographic material. However, the existence of this physiographical material cannot be separated from the influence and influence of humans.

The lecture location choice significantly considers the course's learning outcomes. Practically, Nursa'ban (2013) offers three main steps in designing a field study: planning, implementation, and reporting or evaluation. These three should be able to answer the competencies that students must master, how to achieve them, and how to know their achievements.

The Merapi Volcano area is one of the areas used as a location for field practice lectures for geography education students. This area has a complete geosphere phenomenon, both physically and socially. The phenomenon of dunes on the southern side of the Merapi volcano is a unique natural phenomenon. The process of forming and the shape is exciting to study. Not only symptoms of Volcanism such as volcanic/magmatic eruptions, hot clouds, lava floods, ash showers, and others in the Merapi Volcanic Area and its surroundings there are also social, economic, and cultural phenomena such as Education, tourism management, distribution of settlements, sellers souvenirs, food vendors, and even lodging services.

The landscape of the Merapi volcanic area can present geographical phenomena in an integrative manner in explaining the interrelationships between humans, places, and the environment. In this context, it seeks to become a bridge of thought and actualization of social sciences with natural sciences, besides understanding the dynamics of culture, society, and the economy (Haggett, 2001; Bednardz, 1994). This study studies the earth's surface, namely the space on the earth's surface formed by the elements of the geosphere (lithosphere, hydrosphere, pedosphere, biosphere, and anthroposphere) in the form of areas and their contents studied using

spatial, ecological, and complex regional approaches, for optimal regional utilization. And sustainable to improve the welfare and survival of humanity.

Before the pandemic, practice or observation model lectures were implemented directly in the field with a contextual approach. Lecture activities allow students to examine their problems in the area, evaluate the usefulness of the ideas presented in class, and educate them to make naturalistic observations and investigations. Field studies allow students to carry out data collection projects, testing theory, and social interventions. Contextual learning encourages students to understand the nature, meaning, and benefits of learning through the process of involving students to find their subject matter, meaning that the learning process is oriented to the operation of direct experience functionally, and the material studied will be firmly embedded in the memory of students (Johnson, 2001).

The problem of learning loss and the delay in learning outcomes due to the Covid-19 pandemic since the beginning of 2000 has become a concern for the writer. Ideas and ideas for developing learning vehicles that can substitute the need for achievement indicators of course learning with the nature of field study or observation. Innovation in the educational process continues from time to time in line with the rapid advances in science and technology. The development trend of the world in the 21st century is more oriented toward developing human potential and no longer focuses on individual technical abilities in exploring and exploiting nature. This relates to the development of technological innovation so that every individual involved in education must be able to adapt to current products.

Mastery of technology is one of the integrative competencies in knowledge, skills, and attitudes. Educators and students must be able to adapt and master technology in learning. On the other hand, teachers must also be more innovative in developing technology to help students achieve learning goals. The development of multimedia teaching materials is expected to help overcome the problem of limited time for geography subjects. In addition, it also makes it easier for students to adjust multimedia to the material for the field practicum being carried out. Lecturers or geography teachers in Indonesia have led to interactive multimedia in multimedia development. Interactive media is needed to achieve learning goals for both educators and students.

Seeing the need for geography field practice, namely media and geography field practice guidelines, the authors aim to develop interactive multimedia based on Android, which can also be embedded in personal computers that function as media and learning materials for students. In addition, the need for teaching materials that were initially conventional to innovative teaching materials to overcome the limitations of time and place. This product is predicted to make it easier for students to apply theory to conditions in the field due to the need for more media and teaching materials specifically designed for learning purposes. The results of this development will: 1) explain the characteristics of interactive learning multimedia based on Android and Personal Computers as media as well as learning materials to support geography field practice lectures about the Merapi Volcano Area and its surroundings. 2) the effectiveness of interactive learning multimedia based on Android and Personal Computers as media and learning materials to support geography lectures in geography education study programs.

Product specifications developed in this study are in the form of product content in learning multimedia and teaching materials related to physical and social phenomena in the Merapi Volcano Area. Teaching material is made in packaging embedded in the Android platform or personal computer.

LITERATURE REVIEW

Field Study-Based Geography Learning

Learning is a series of body and soul psycho-physical activities to lead to the development of the whole human person, which means it involves elements of creativity, taste and intention, cognitive, affective, and psychomotor (Sardiman, 2007). This learning is expected to prove knowledge of new facts or be able to do something new. This conception also applies to geography learning at every level of education. The scope of

geography studies is directed at mastering the basic concepts, approaches, and principles of geography. It would be ideal if the learner could relate it to the dynamics of the elements of the geosphere, including the lithosphere, pedosphere, atmosphere, hydrosphere, biosphere, and anthroposphere, and their spatial distribution patterns. The learning domain can ideally integrate the nature, object, scope, structure, and approach of geography with nature as the center.

The material object of geography studies as a science that studies the similarities and differences of geosphere phenomena with an environmental or regional perspective in a spatial context. Haggett (2001) states that geography can create interrelationships between the natural environment and human society through physiographical approaches, namely spatial, ecological, and regional complexes with human activities in maintaining a sustainable life. The spatial course emphasizes the analysis of the variation in the distribution of symptoms on the earth's surface based on the principles of distribution, interrelation, and description (Flynn, 2018).

This ecological approach in geography is concerned with the interrelation of human life with the physical factors that form a spatial system that connects one environmental region to another that creates an ecosystem. In this regard, human interrelation with the surrounding natural environment is studied based on ecological concepts and principles or using an environmental approach. The area complex approach focuses on the area differentiation approach as a combination of spatial and ecological systems. Understanding the interaction of area differentiation, see the diversity between regions as the foundation of the development of a part. These differences present demand and supply as a manifestation of complementary interactions, intervening opportunities, and transferability. Both approaches are studied through spatial analysis and the interaction between human and environmental variables, which are then studied concerning them (ecological research).

To understand the study of these geographical phenomena, Khotimah (2022) stated that current technology, such as social media, can help understand natural phenomena such as hydrometeorology. Grzyb and Dolinski (2021) state that field study is the most appropriate way of learning to analyze them. Munandar (2020) describes university geography learning as an effort to collect data directly by observing, interviewing, taking notes, or asking questions. According to Munandar (2017), students can analyze their problems in the field, evaluate the benefits of the ideas presented in class, and make naturalistic observations and investigations. Students participate in ongoing activities. Field studies also offer students opportunities for data collection, theory-testing, and social intervention projects. Field study is part of the contextual learning model. Taylor and Keefe (2021) state that geography is a study that can provide an overview of physical and social phenomena through field studies. Geography bridging the relationship between the physical environment and humans includes geographic determinism, in which variations in human society are interpreted as the result of different biological contexts.

The description above explains that field study is a contextual geography learning method with various learning models to build 21st-century humans, such as constructivism, inquiry, questioning, learning community, modeling, reflection, and authentic assessment.

Constructivism builds or compiles new knowledge in students' cognitive structures based on this experience (Sanjaya, 2010). This theory or school is the philosophical basis (thinking) of the contextual approach (CTL). Learning characterized by constructivism emphasizes building self-understanding effectively, creatively, and productively based on previous knowledge and knowledge and from meaningful learning experiences. Fundamental knowledge is something that is constructed or discovered by oneself. Knowledge is not a set of facts, concepts, or rules that are remembered, but students must reconstruct that knowledge and then give meaning through experience. The learning process based on these considerations must be packaged (managed) into a cycle of receiving information/knowledge from the teacher. Students, in this case, will build their knowledge through active involvement in the learning process (Sardiman, 2009).

Sugiyanto (2010) describes the Inquiry approach in a field study as a learning process based on searching and discovery through a systematic thinking process. So the knowledge and skills acquired by students are expected to be not only the result of remembering a set of facts but also the results of their discoveries. Learning is asking and answering questions. Asking questions can be seen as a reflection of each individual's curiosity, while

answering questions reflects one's ability to think. The purpose of the learning community is to get students used to collaborating and utilizing learning resources from their study partners (Rusman, 2011). The concept of a learning community suggests learning outcomes from collaboration with others.

Learning outcomes are obtained from sharing between friends, groups, and those who know to those who don't know (Riyanto, 2009). Johnson (2001). added several principles of the learning community component, namely sharing, awareness that the knowledge, experience, and skills they have are beneficial to others, and the learning community can be a source of learning. Modeling is a learning process that demonstrates an example that students can imitate (Sugiyanto, 2010). It can also be interpreted that learning specific skills and knowledge is followed by a model that students can emulate (Sardiman, 2009). Reflection is a process of depositing experiences learned by sorting and re-evaluating the events or learning events that have passed (Sugiyanto, 2010). Students will realize that the knowledge they have just acquired is an enrichment or even a revision of the knowledge they have previously had by thinking about what they have just learned, analyzing, and responding to all events, activities, or experiences that occur in learning, even providing input or suggestions if needed. Accurate Assessment (Authentic Assessment) is a process of collecting various data and information that can give an overview or guidance on student learning experiences (Munandar et al., 2020). Authentic assessment is carried out in an integrated manner with the learning process. This assessment is carried out continuously during the learning activities. The emphasis is directed at the learning process, not on learning outcomes. Bosco and Ferns (2014) state that authentic assessment is carried out during and after the learning process, can be used for formative or summative, which measures skills and performance, is continuous, integrated, and uses feedback.

Based on the geographic study approaches above, Nursa'ban (2013) offers several alternative activity steps in conducting field studies. These steps are divided into three major stages: Preparation/Planning, Implementation, and Reporting. The three stages should be able to answer questions; What competencies must students master? How to achieve them?, How to find out their achievements?

The preparation/planning stage is carried out, among other things, to determine the competencies to be achieved and contains a series of activities that students must carry out sequentially to achieve competence. At this stage, it is designed to determine observation points in the field that are competent and prepare the tools and materials needed while in the area. This preparatory activity is also carried out by making observation instruments or field notes, including geographical material objects (lithosphere, atmosphere, biosphere, hydrosphere, and anthroposphere), report formats, and drafting activity programs and draft budgets.

At the implementation stage, students carry out activities to fill in the instruments given, and the instructor facilitates activities in the field related to security and data information according to the activity program plan. The students directly observe the phenomena found in the area while the instructor explains the existing phenomena. At this stage, discussions are often carried out to strengthen the conceptual description of the wonders found. Students and instructors often practice measuring certain physical phenomena, such as climatic, pedological, geological, and other conditions.

The third stage is reporting, in which students report the results of activities in the field according to the format provided. Furthermore, an assessment process of the achievement of field study activities can be carried out using several techniques, both tests and non-tests. Assessment by test uses questions and statements related to the stages of exercises, tools, and materials, objects of study at each observation point given after the activity takes place. While the assessment using non-test techniques can be in the form of an appraisal, performance, assignment (Project), and portfolio (Portfolio).

Merapi Volcano Area

In the development of geography learning, the Merapi Volcano Area and its Surroundings have a unique ecosystem and very varied natural resources. This ecosystem exists in a land zone with very characteristic volcanism. The enormous potential in the Merapi Volcano Area and its surroundings is an attraction in itself to optimally function the existing study potential while applying geographic principles and conservation.

Landforms in the Merapi Volcano Area and its surroundings are very varied and exciting, shown by

volcanic phenomena (volcanism), hills, rivers, floods, and so on. Likewise, the phenomenon of settlements and changes in land use are also attractive to study materials related to geographic studies.

The choice of location for implementing the Geography Education Field Practice (PLPG) is in the imaginary axis of Yogyakarta Merapi to Parangtritis. It takes place at 20 points, which are divided into three categories, namely the Merapi Region and Surrounding categories, including the Upper Opak River, the "Sisa Hartaku" Museum, the Gendol River, Kaliadem Bunker, Mbah Maridjan Museum, Plawangan, Mount Merapi Museum, Sambisari Temple, Lava Pillow - Watu Adeg, then the Tugu Area category includes the Yogyakarta Palace, the Krapyak Stage, and the Yogyakarta Palace Monument on the Krapyak Stage. Next last is the type of the Parangtritis Area and its surroundings, including the Piyungan Landfill - Puncak Angka, Rock Outcrops in Karanggayam, Embung Imogiri, Sriharjo, Muara Opak - Burra - Parangkusumo Sand Dune Lagoon, Parangtritis, and Parangendog.

The location selection takes the basis of applying the nature of geography, physical geography, social geography, and technical geography. The completeness of the material covered in the 20 locations was the reason why these locations were chosen and used in Geography Education Field Practical lessons. In developing this multimedia, only ten sites were taken because they already represented the substance of the material covering 20 locations. Picture of the 10 locations of the Merapi volcano area, namely:

1. Yogyakarta Monument

   Tugu Yogyakarta is located in the center of Yogyakarta city, precisely located at the intersection of Jalan Jenderal Sudirman and Jalan Margo Utomo. Initially, this monument had the name "Golong Gilig" Monument. However, now it is better known as the white pal monument because the color of paint used since ancient times was white. The location of the white pal monument itself is said to have symbolic value because it is in a straight line connecting the South Sea, the Ngayogyakarta Hadiningrat Palace, and Mount Merapi. Initially, the monument was in the form of a cylindrical pillar conical upwards. At the same time, the base is a circular fence with a round top. Initially, the height of the Golong Gilig monument building also reached 25 meters. According to public belief, the monument's shape means unity between the Ngayogyakarto Hadiningrat Palace and its people.

2. Lava Pillow

   Geographically, the Lava Pillow is located in the east of the Special Region of Yogyakarta Province, to be precise, on the mouth of the Opak River with coordinates 7⎵42⎵5⎵ South Latitude 110⎵26⎵35⎵ East Longitude. Pillow lava is located west of Watuadeg Hamlet, Jogotirto Village, Berbah District, Sleman Regency, Special Region of Yogyakarta Province. Right under the bridge to the east of Sumber Kidul Hamlet, Kalitirto Village, there is an igneous rock outcrop resulting from magma freezing with a cushion structure. The pillow lava rock was originally a high-temperature molten lava resulting from a volcanic eruption which froze quickly when exposed to seawater to form lumps resembling pillows. The formation of pillow lava or pillow structures is a function of cooling rate with flow rate, meaning that it freezes very quickly and flows very slowly.

3. Sambisari Temple

   Sambisari Temple is located in Sambisari Hamlet, Purwomartani Village, Kalasan District, Sleman Regency. Sambisari Temple is located approximately 12 km east of the City of Yogyakarta towards the City of Solo or about 4 km before Prambanan Temple and in a position of about 6.5 m below ground level. This temple was only discovered around 1966. It is adjacent to Prambanan Temple, Kalasan Temple, and Sari Temple. Based on geological research on the temple's rocks and the soil around the temple, it is indicated that this temple was buried with material from Mount Merapi during its violent eruption in 1906. Sambisari Temple is a Hindu temple that was thought to have been built by a King from the Sanjaya dynasty, with a statue of Shiva as the Mahaguru occupying the main chamber.

4. Museum of Mount Merapi

   Mount Merapi Museum is a historical museum located in Yogyakarta on Jl. Boyong, Banteng Hamlet, Hargobinangun Village, Pakem District, Sleman Regency, Special Region of Yogyakarta. Mount Merapi

Museum is situated on the slopes of Merapi; if the weather is clear, you can see Mount Merapi directly from the courtyard of the Museum of Mount Merapi. Mount Merapi Museum stands on an area of 3.5 hectares with an area of about 4,470 m2. On October 1, 2009, the Mount Merapi Museum was inaugurated by Minister Purnomo Yusgiantoro, who served as Minister of Energy and Mineral Resources (ESDM) then. The shape of the building is unique, namely in the form of a cone that resembles a volcano.

5. Plawangan Hill

Plawangan is located in Turgo, Hargobinangun Village, Pakem District, Sleman Regency, Special Region of Yogyakarta. Plawangan Hill is included in the Mount Merapi National Park area. Plawangan Hill and Turgo Hill are the results of the extrusion of basaltic lava that appeared in the early phase of the formation of the old Mount Merapi 60,000 to 80,000 years ago. Plawangan and Turgo Hills are remnants of the early Merapi cone called Proto Merapi. Turgo hill is estimated at 138,000 years, and Plawangan hill is estimated at 135,000 years. On Plawangan hill, one of the natural attractions is part of Mount Merapi National Park.

6. Museum "Mbah Maridjan"

The Mbah Maridjan Museum, or Petilasan, is a housing complex once the home of Mbah Maridjan. The museum, located in Kinahrejo Hamlet, Umbulharjo Village, Cangkringan District, Sleman Regency, is located at 07°34.970' South Latitude and 110°26.929' East Longitude. Geographically, the location of the Mbah Maridjan Petilasan Museum is not far from Mount Merapi, which means it is still in the highlands. Based on field data, it was recorded that the location of the museum is at an altitude of 3702 feet above sea level. At that altitude, the air pressure is higher. Fog often falls, causing the relative humidity measurement to become very saturated, touching nearly 100% at 15°C. The Mbah Maridjan Museum is a tourist attraction that shows the awesomeness of the eruption of Mount Merapi, which hit the village where Mbah Maridjan lived, who was the caretaker of Mount Merapi at that time.

7. Kaliadem Bunker

Kaliadem Bunker is one of the underground bunkers or protection holes that used to function as a means of disaster mitigation for the eruption of Mount Merapi before finally being terminated after the explosion in 2006. Now, Bunker Kaliadem has become one of the tourist destinations on Mount Merapi. The Kaliadem Bunker is located in Kaliadem Hamlet, Kepuharjo Village, Cangkringan District, Sleman Regency. Astronomically, the Kaliadem Bunker is located at 07°34.970' South Latitude and 110°859° East Longitude. Kaliadem Bunker has been around since the Dutch colonial period occupied Indonesian territory. Bunkers are underground, a room for defense and protection from enemy attacks. The Kaliadem bunker was rebuilt in 2001 by the Sleman district government. It was inaugurated four years later, namely in 2005, located in Kinahrejo Village, Hargobinangun, Pakem District, Sleman Regency, Yogyakarta. Kaliadem Bunker is approximately 4 km from Mount Merapi, and you can see the view of Mount Merapi very clearly when the weather is clear. This bunker was established as a place of mitigation to take shelter, hide, and save themselves for the people from the Merapi eruption, which could happen anytime.

8. Gendol River

Gendol River is a river that originates directly from Mount Merapi. Very often, every incandescent lava avalanche and hot cloud from Mount Merapi leads now to the headwaters of this river, more precisely, the Gendol river is located in Kayen, Sindumartani, Ngemplak District, Sleman Regency, Yogyakarta Special Region. Astronomically, the Gendol River is situated at 07°34.970 South Latitude and 110°26.929'East. During the phreatic eruption of Mount Merapi in March 2019, incandescent lava and hot clouds headed toward this river. Even during the big explosion of Mount Merapi in 2010, hot clouds slid past this river up to a distance of 9.5 kilometers. Because Mount Merapi material is often crossed, the Gendol River is a sand mining location.

9. Sisa Hartaku Museum

The Mini Museum "Sisa Hartaku" (My Leftovers) is located in Petung Hamlet, Kepuharjo Village, Sleman Regency, Special Region of Yogyakarta. Astronomically, this museum is located at 07°36.032' South Latitude

and 110°26.949' East Longitude. The Mini Sisa Hartaku Museum building was formerly the house of a resident named Kimin, who was one of the victims of the ferocious eruption of Merapi in 2010. After the outbreak of Merapi, the victims were relocated to a safer place. However, the sense of belonging and memories of the site has resulted in the homeowner wanting to be able to continue to see his house even though the building is no longer intact. Therefore the local community agreed to use the house as a museum with a collection of personal items that were damaged due to the "wedhus gembel" sweep, and other residents also donated items. This museum building still presents its original form, such as terraces, living rooms, bedrooms, family rooms, kitchens, back rooms, and other spaces. The existence of the Sisa Hartaku Museum is enough to help improve the local community's economy, which has been relocated to another area. The "Sisa Hartaku" Museum is a tourist attraction that must be visited by tourists visiting this area.

10. Upper Opak River

The Upper Opak River is a significant river crossing the Sleman and Bantul Regencies. The upstream of the Opak River is in the area of Mount Merapi. The upper reaches of the Opak River are located at 07°36.114' South Latitude and 110°26.766' East Longitude. The condition of the upstream Opak River is dominated by pyroclastic materials originating from the eruption of Mount Merapi. Pyroclastic material in this location includes sand, gravel, and large and small rocks. The upstream part of the Opak River can be said to be a young river, with the characteristics of the river body, which is still steep, the depth of the river is deep, and the river bed is in the shape of the letter "V." The source of water from the Opak River comes from Mount Merapi's springs (spring), located around the peak. As we also know, the Opak Hulu river area is one of the rain catchment areas on Mount Merapi.

Learning Multimedia

Multimedia includes various media that are integrated into one. In multimedia, components such as images, sound, video, text, and animation are combined into a unified whole. Each media element can stimulate one or more of the human senses. Kuehnert's theory says that the more senses are involved in the learning process, the more influential the learning process will be. This theory expressly states the use of more than one human sense. Therefore, using media in learning can be expected to improve learning outcomes. The above statement is based on Dale's (1979) message, which states that the acquisition of learning outcomes through the senses of sight is around 75%, through the minds of hearing is about 13% and through other reasons is about 12% (Arsyad, 2010: 10).

Based on some of the opinions above, multimedia is essential in the learning process, seeing from the many senses involved when using multimedia. After that, multimedia is also flexible in adjusting to one's learning speed. A student with a higher learning speed can adapt his learning activities more quickly, while a student with a slow learning speed can complete his learning activities according to their rate. This is very different from learning in conventional classes, where each student is forced to study at a pace determined by the teacher. Students with a high learning speed can feel bored, whereas those with a low learning speed think that learning is too fast to follow.

The use of multimedia in the learning process makes learning more interesting, more fun, more interactive, and can be done more flexibly concerning time and place. Learning is not required to be present at a particular place and time to participate in learning activities because they can study subject matter through multimedia anytime and anywhere as long as there are multimedia so that the quality of student learning can be further improved.

Hamalik (1989) states that learning by using multimedia provides benefits, including helping students learn broad lessons that contain various concepts, principles, facts, and variations that require multiple media to convey. Idris (2008) confirms that the advantages of multimedia include making the learner an "owner" so that he can determine what he wants to learn. Furthermore, Sigit et al. (2008: 9) state that multimedia has many advantages, including reducing the "image" of very large or broad objects that can be presented to schools. Sutopo (2003: 21) states that multimedia can reduce the time and space used to store and display documents in

electronic form rather than in paper form.

Multimedia is divided into five elements, namely: text, image, audio, video, and animation (Sofyan, 2008: 2). While the multimedia presentation format, according to Arsyad (2010:) there are four forms, namely: tutorials, drills, and practice, simulations, and games.

METHODS

Research design

This study uses the Research and Development (R&D) method with the ADDIE model developed by Branch (2009), which includes: Analysis, Design, Development, Implementation, and Evaluation. In the early stages of the analysis, the researcher conducted a work analysis; its function was to discover and clarify various problems faced by teachers and students during learning. This activity is carried out to determine solutions in solving the learning problem. Based on the performance analysis conducted, it was found: "Limited field practice materials for students and students in conducting field practice" and "difficulties in developing media and materials for geography field practice"

In the design stage, the steps are: designing learning multimedia as teaching materials for developing geography field practice guides. The next stage is to formulate what material will be included in the learning multimedia as well as the flowcharts and storyboards of the multimedia. At the development stage, the flowchart and storyboard that have been made are developed into a multimedia prototype which is divided into several steps, including:

1. Interface Design

   At this stage, the researcher/developer makes the appearance as attractive as possible so that students are interested in the multimedia. They are creating an interface design tailored to the needs at the analysis stage. The interface design process uses several graphic software, namely: Adobe Photoshop and Adobe Illustrator.

2. Coding

   Coding is translating commands in an algorithm into a programming language so that the program runs as desired. At this stage, the designs made are converted into Macromedia Flash (.swf) format. Coding is done using Macromedia flash with action script format so that the program becomes more interactive.

3. Compiling

   The compiling process is done so that all computers can read the program. This is because not all computers can read programs created by flash (in this case, the .swf and .fla formats).

4. Package software; Software packaging is done to make the application easier to use on any computer.

The development stage in the implementation of multimedia is tested on students by adjusting it to the learning model that is applied. Evaluation is carried out in research activities at each stage of development if needed.

Time and Location of Research

The field studied in this study is the development of multimedia learning geography with material from the Merapi Volcano area to support field practice of geography education. The research was conducted on March 15 – September 30, 2022.

Object of research

The object of this development research is in the form of physical and socio-economic geographical phenomena in the Merapi Volcano Area and its surroundings.

Product Trial Design

a. Trial Design

Product trials were carried out at the program validation stage aimed at students and educators, especially in the FIS-UNY Geography Education Study Program. The purpose of product trials is to find out the reactions and responses of users when using the developed multimedia.

b. Data Collection Techniques and Instruments

The technique used for data collection in this development research was obtained from the product validation and evaluation stages. The instrument used is first validated by a product expert (expert judgment).

c. Data analysis technique

The data obtained in this study includes qualitative and quantitative data. Qualitative analysis is used to consider product revisions and measure the quality of learning teaching materials developed to determine student learning outcomes. Qualitative data, namely in the form of comments, suggestions, and input put forward by media experts, geography teacher subject matter experts, peer reviewers, and students. Analysis for quantitative data used validation sheets and product quality assessment sheets, empirical tests of cognitive learning outcomes tests, cognitive learning outcomes tests, normality tests, and homogeneity tests.

RESULTS AND DISCUSSION

Characteristics of interactive learning multimedia

Learning media Merapi Volcano Imaginary is a learning media developed digitally and can be accessed via the Android platform. The Merapi Volcano Imaginary learning media was constructed for students and contained material on physical geography and socio-economic geography at ten points related to the Merapi volcano (Tugu Yogyakarta, Lava Pillow, Sambisari Temple, Mount Merapi Museum, Plawangan Hill, Mbah Maridjan Museum, Kaliadem Bunker, Gendol River, My Treasure Remaining Museum, Upstream Opak River). The following are instructions for use as well as the parts that users need to know in using the Merapi Volcano Imaginary learning media:

a. Initial Display

After entering the application, the user will see three menus, namely 1) material, 2) gallery and 3) quiz, each of which can be accessed by clicking on the available options. On the lower left, the user can see the competency achievement menu; on the lower right, the user can find information on the compiler and developer.

Figure 1. Initial View

In the competence achievement section on the bottom left, it can be accessed by clicking; then a display will appear as shown in figure 2

Figure 2. Display of Competency Achievement Page

In this section, users can find out the formulation of abilities that users can implement when they have finished using learning media. Users can click the back button to start viewing the content.

b. About the Compiler

Before entering into the material, in the initial menu of the Merapi Volcan Imaginary media, there is a menu about the compiler, which contains profiles of the compilers and developers of learning media. To view the profiles of the compiler and developer, you can swipe the screen. The following is what appears on the about builder page:
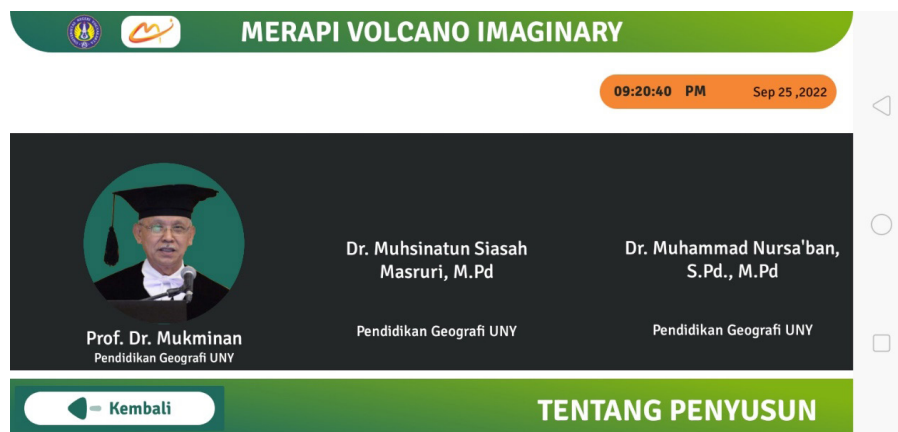
Figure 3. Compiler View Page

c. Display Material

The material display is a page that displays material from each point related to the Merapi volcano and sub-materials. In this section, users can scroll and select the fact they want to study by clicking on the topic they want.

Figure 4. Display of the Material Menu Page

Material containing a video and an explanation of each point's physical and socio-economic conditions will appear when clicked on the list of topics on the previous page6,35 mm. The following is the page that will appear when the user selects one of the dot menus:
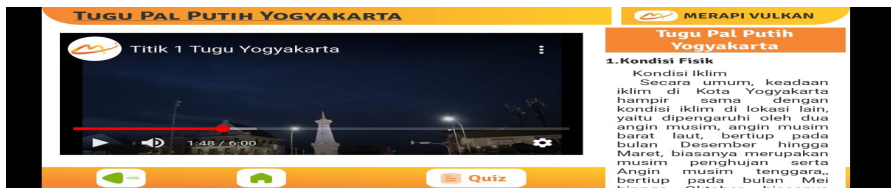

Figure 5. Material Display

The existing video is the main focus of the material; the text beside the video contains explanations of the material conveyed in the video. Videos are informative for students to deepen the material being studied.

d. Quiz

At the bottom of the material are three buttons: to return, go to the main page, and access the quiz. If the quiz button clicks, the user can fill in the available quizzes. There are three quizzes with content that adjusts to the material being studied.
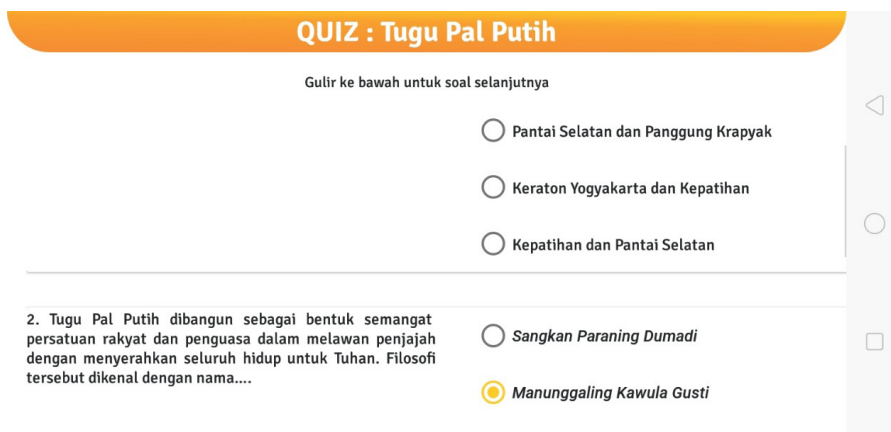

Figure 6. Quiz Page Display

e. Gallery

The gallery page will appear when the user clicks the "gallery" button on the main menu. The display that will appear contains photographs as an explanation of the physical and socio-economic conditions of each point. The following show appears on the gallery menu page:

Figure 7. Display of the Gallery Menu Page

The effectivenes of interactive learning mulitmedia "Merapi Volcano Imaginary"

a. Initial feasibility of product development

Borg & Gall (2007) stated that one of the activities in the develop a preliminary form of a product or developing the initial setup of the product to be produced is to evaluate the feasibility of the product draft to be developed. The product's initial feasibility process was carried out by six expert lecturers (expert judgment), media experts, and material experts. The feasibility assessment process uses a panel method with a scale of five. The validity of an item is determined based on the recommendation of the panelists using the validity index formula from Aiken (V); the value of V lies between 0 and 1.

The feasibility of interactive multimedia learning based on Android and Personal Computers in the material aspect is assessed based on three indicators of concept correctness, material sequence, and metacognitive value. Assessment of the media aspect uses six criteria as indicators: Readability, Cohesiveness, Interesting shapes, Coloring, and Understanding of the material.

The results of the validator's assessment of the above criteria are presented in the following diagram.
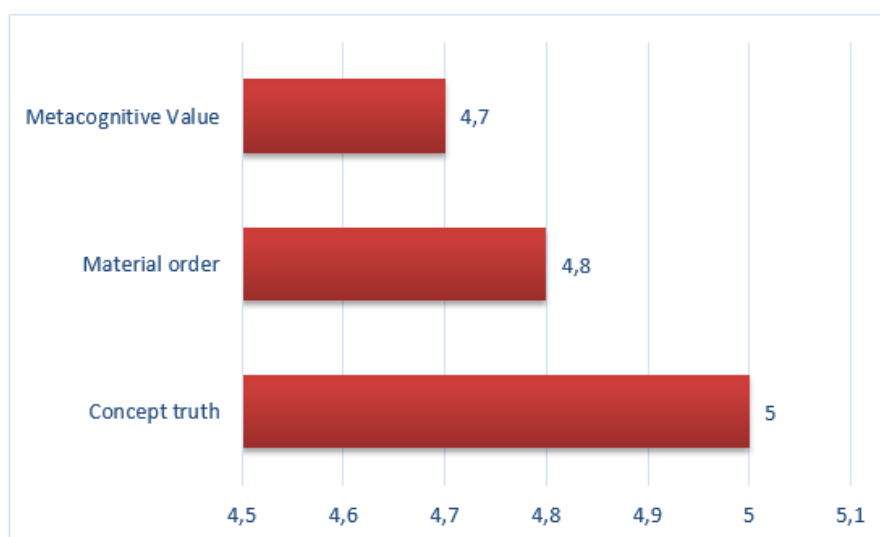

Figure 8. The results of the material expert's assessment of interactive learning multimedia based on Android and Personal Computers

Figure 8. shows that based on a scale of 5, the average rating of material experts is 4.83, with the lowest rating being given by content experts 2 for cognitive value and material experts 3 for material order. All material experts judged the correctness of the concept to provide the maximum rating.

The media expert's assessment of how the presentation of interactive learning multimedia based on Android and Personal Computers is presented in the following figure.
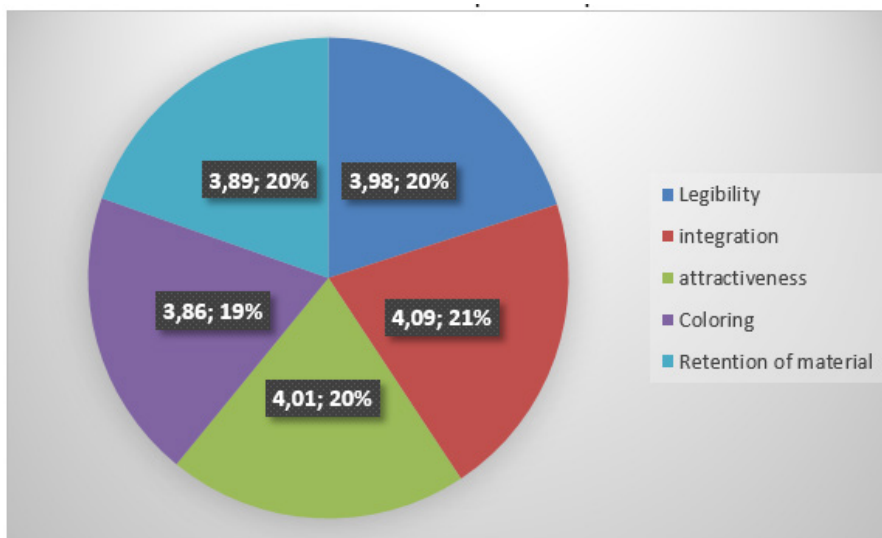
Figure 9. The results of the media expert's assessment of interactive learning multimedia based on Android and Personal Computers

The e-module assessment by media experts includes six indicators in the picture showing that the average score is 3.96. The assessment results of the material and media presented in the two images converted into the Aiken formula show an average of 0.77, which means it is in the correct category. These results indicate that based on the assessment of six experts, interactive learning multimedia based on Android and Personal Computer that was developed is effectively used as a media and geography learning material.

b.   Trial Results

This testing stage was carried out on a limited number of users of 10 undergraduate geography education study program students (semesters 5 and 7) and masters (semesters 2 and 3). The results of student assessments of the implementation of interactive learning multimedia based on Android and Personal Computers are presented in the diagram below.
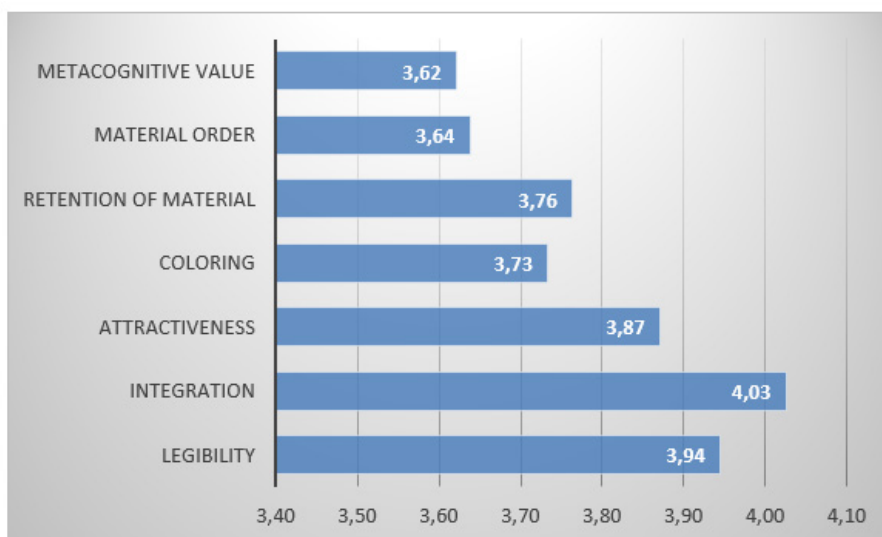

Figure 10. Results of student assessments regarding the implementation of interactive learning multimedia based on Android and Personal Computers

The picture above shows that students score the lowest average on material order, while the highest achievement is the aspect of cohesiveness. The mean scores of the test subjects included: Readability (3.95),

Media integration (4.02), Interesting (3.87), Coloring (3.73), Material comprehension (3.76), Material sequence (3.63), and Metacognitive value (3.63).

CONCLUSION

1. The developed interactive learning multimedia products have the following characteristics:

    a. Combination of Android-based Flipped Book applications combined with Adobe Flash Maker and other supporting applications embedded on Android smartphones and Personal Computers.

    b. The multimedia is named: Merapi Volcano Imaginary in substance providing descriptions and activities for students related to geographical material (physical geography and socio-economic geography) in ten study areas on the Merapi volcano and its surroundings, including Tugu Yogyakarta, Lava Pillow, Sambisari Temple, Mount Museum Merapi, Plawangan Hill, Mbah Maridjan Museum, Kaliadem Bunker, Gendol River, Sisa Hartaku Museum, Upstream Opak River.

2. The results of the initial feasibility assessment from experts and limited trials to students, the multimedia products developed are feasible and effective to use as media and student teaching materials.

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