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Wetlands: 3D Mapstory Application to Improve Students' Learning Outcomes: Effective or Ineffective?

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Abstract: Wetlands: 3D Mapstory Application to Improve Students' Learning Outcomes: Effective or Ineffective?. Objectives: The development of learning media in the era of Education 4.0 can be measured by technological innovation. However, limited time and funds have hindered lecturers and students from various higher education institutions in Indonesia from experiencing direct field practice, especially in the wetlands in South Kalimantan, hailed as one of Indonesia's natural laboratories for wetlands. The development of the Wetlands: 3D Mapstory answers students' conditions to become more familiar with the wetland environment without coming directly to South Kalimantan. The aim is to effectively use the Wetlands: 3D Mapstory to concretize the abstract concept of wetlands to improve students' learning outcomes. **Methods:** The research development using the Luther model is limited to the testing stage. It is designed using 3D maps from satellite imagery using ArcGIS and combined with photos and learning materials on wetlands. The validation uses expert judgment on material and media aspects. Effectiveness test using paired sample t-test to analyze effective or ineffective Wetlands: 3D Mapstory Application to improve learning outcomes. **Findings:** The results show that the Wetlands: 3D Mapstory was developed as an Android-based application. This application was declared feasible and effective for improving student learning outcomes related to developing wetland areas in the Geography Education Study Program at Lambung Mangkurat University. So, the development of Wetlands: 3D Mapstory can fill the gap in learning media geography to improve the quality of lectures. **Conclusion:** Wetlands: 3D Mapstory Applications are feasible and practical for exploring wetlands in South Kalimantan and enhancing students' learning outcomes. The implications of the results of this research strengthen and increase the variety of learning media to support learning activities and outcomes in universities.

Keywords: wetlands, learning outcomes, 3d mapstory, application, effective.

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INTRODUCTION

The Education 4.0 era has had a significant impact on the world of education, one of which is the change in the education paradigm, namely the shift from the classical paradigm to virtual education. Virtual education can be seen in most online learning education (Crawford et al., 2020; Toquero, 2020). Online learning supports education 4.0 today, mainly using technology (Almeida & Simoes, 2019; Hariharasudan & Kot, 2018). Therefore, the development of technology encourages the world to continue to change rapidly so that it impacts all aspects of life, including education.

Technology-based media in education assists learners in better understanding the material that is being studied (Marini et al., 2022). Media also helps to optimize thinking, communication skills, attention, learning outcomes, and motivation (Aristin et al., 2023; Arsyad, 2015; Diana & Mansur, 2018; Gaol et al., 2019; Tafonao, 2018). Learning media grows and develops along with the development of learning technology. Learning geography in college requires a good understanding of the environment around where they live (Day et al., 2021). Through this media, students can reduce material misconceptions and integrate with real experience to make the material contents more detailed (Rahmatsyah & Dwiningsih, 2021) and recognize the characteristics of the surrounding environment. Most importantly, the media is used to communicate effectively and efficiently with students and lecturers, which can increase student activity during the learning process (Astuti et al., 2019; Insani et al., 2023; Rohmah & Russanti, 2021; Schwan et al., 2018; Suri et al., 2023) and improve the quality of learning (Lazo-Amado & Andrade-Arenas, 2023).

Since wetlands are the main components of geography, most notably in physical geography, South Kalimantan's wetlands possess unique regional characteristics. In South Borneo, these wetlands provide habitats for numerous aquatic organisms, birds, and small mammals, contributing to regional biodiversity. The wetlands in South Borneo are also unique in their ability to support vegetation typically adapted to life in saturated soil conditions. For instance, peatlands, a type of wetland ecosystem, are particularly notable for their slow peat formation process, which results in deep deposits of organic soil material (Du Preez & Brown, 2011). These peatlands are ancient ecosystems, with some having peat deposits exceeding two meters in depth. These peatlands' unique species composition and age make them vital to South Borneo's wetland ecosystems. For this reason, this wetland in South Kalimantan is used as a learning resource for lecturers and students and as a natural laboratory in Indonesia. Lecturers and students from various universities in Indonesia can study the wetlands in South Kalimantan directly.

Based on the results of observations and interviews with several lecturers and students from universities in Indonesia, it was found that they have experienced problems in the learning process of field lecturers and practicums. One of them is that they could not conduct field lectures and physical geography practicums directly in South Kalimantan's wetlands. Thus, they must adapt to this situation. However, the students and the lecturers are still required to experience field lectures and practicum first-hand, especially those who still need help learning, such as understanding the wetlands concept.

Although technology-based learning media are increasingly developing, few are specifically designed to visualize and explore the unique characteristics of wetlands in South Kalimantan. Wetlands: 3D Mapstory answers the conditions students face to become more familiar with the wetland environment without coming directly to South Kalimantan. This media was developed into an innovative application-based media (.apk) to support wetland practicum learning. Wetlands: 3D Mapstory can display a three-dimensional map of the wetlands in South Kalimantan, accompanied by concept material for each type of wetlands. The map of each type of wetland can be seen from various angles so that students understand the shape of the wetlands concretely.

Wetlands: 3D Mapstory media design is flexible and can be run on smartphones, tablets, laptops, or computers. Learning using smartphones is an essential element in improving learning technology. Wetlands: 3D Mapstory can later be accessed by students from various universities with a technology readiness level via

laptops or gadgets. This media is created and adjusted as realistically as possible to concretize the existing wetland environment so that lecturers and students get real experience learning about wetlands. This is supported by Dale's theory, which states that the more concretely students learn the material through direct or imitation expertise, the more learning experiences they will get so that learning will be more meaningful. This is also supported by three-dimensional media using computerized technology relevant to various scientific fields to improve memory skills by up to 60%, improve 21st-century skills, and make the learning process more practical efficient in the era of education 4.0, and improve students' learning outcomes (Al Hashimi et al., 2019; Catalano et al., 2011; Kupriianova & Lapshina, 2024; Rodríguez-Pérez & Blázquez, 2023; Utami et al., 2019; Wahyuningtyas et al., 2021).

Therefore, research on three-dimensional media design based on mobile applications is essential to fill the void in interactive media development research in education. Wetlands: 3D Mapstory can be an interactive media that provides a direct picture of wetland types in the classroom. Previous research has shown that there are few variants of 3D media for wetlands (Al-Ansi et al., 2023; Aristin et al., 2020; Halawa & Kholida, 2022; Mezquita et al., 2021; Shi et al., 2021; Steidle et al., 2023), and the resulting media fills the learning needs of digital learners. Their learning character combines independent learning through collaboration (Seibert, 2021) and searching for information quickly (Shorey et al., 2021).

Earlier studies have developed 3D media in various disciplines, including 3D maps of dry land (Aristin et al., 2020), a virtual reality application (Al-Ansi et al., 2023; Mezquita et al., 2021; Shi et al., 2021), a cultural heritage (Halawa & Kholida, 2022), a landscape environment (Steidle et al., 2023), health care education (Alhonkoski et al., 2021), and many more uses of 3D in other fields, they have not explicitly addressed wetlands 3D Map as interactive learning media. The novelty of this research is that it focuses on developing three-dimensional media based on mobile applications related to wetlands in the form of 3D maps and photos to improve students' learning outcomes. This application will assist lecturers and students in concretizing various types of wetlands in South Kalimantan, which is one of the natural laboratories for wetlands in Indonesia. Using mobile technologies enhances flexibility and accessibility in education, including lectures. Hence, using smartphones and other gadgets as innovations in learning processes would assist lecturers in optimizing the teaching and learning process, ultimately improving students' learning outcomes (Andriyanova et al., 2024; Asmianto et al., 2022; Haji Mohamad Yusuf et al., 2024; McCulloch et al., 2018). Although technology-based learning media are increasingly developing, few are specifically designed to visualize and explore the unique characteristics of wetlands in South Kalimantan to improve student learning outcomes. This research aims to establish Wetlands: 3D Mapstory as an innovative solution to overcome these challenges.

METHOD

This research method uses research and development to produce new products through the development process. This method has certain new products and tests the effectiveness of these products. It's more focused on making and developing products that are suitable for use so that they can support the learning process. Development research has three main components: development models, procedures, and product trials (Daryanes et al., 2023).

This development research produced a product of learning media in Wetlands: 3D Mapstory based on a 3D map of wetlands in South Kalimantan. Developing Wetlands: 3D Mapstory that can be used on smartphones, laptops, tablets, and computers-based Android.

The development model used in this study adopts the Luther development model (figure 1), which consists of six stages: concept, design, material collecting, assembly, testing, and distribution (Wilechansky et al., 2016). Empirically, Luther's development design is more flexible for developing learning products compared to ADDIE (Donald, 1959; Robert K. et al., 1975), Gegne (Robert M. et al., 1992), Bloom (Peter W. et al., 2001), and SAM (Michael, 2012). Luther's design offers a flexible flow in the cycle so developers can produce products effectively and efficiently (Komang Sudarma et al., 2021).

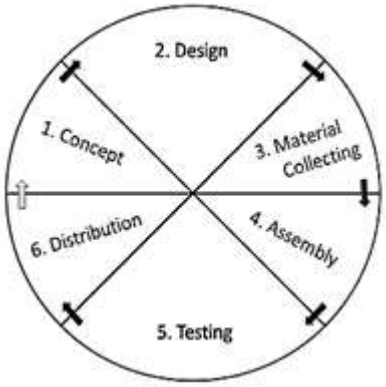

Figure 1. Development of luther model

Participants

This research was conducted at the Geography Education study program at Lambung Mangkurat University, Banjarmasin. The students in this research are actively taking Regional Development Geography courses in the even semester of the 2023/2024 academic year. The research sample consisted of 2 experts in media and wetland materials (physical geography) determined by purposive sampling. Media development is done through a validation test using an expert judgment method. This means that Wetlands: 3D Mapstory involves media and material experts to validate and provide assessments, suggestions, and criticisms for improving the product being developed. Consideration for selecting experts refers to the learning product development design prepared by McAlpine & Weston (1994) and refined by Uwes Anis (2015). They are lecturers at Universitas Negeri Malang, Indonesia. The selection of these two validators was based on research expertise and practice in learning media development and expertise in physical geography.

Instrument

The validation test instrument uses a validation sheet with a Likert scale with four alternative answers of 4 points: 1: strongly disagree, 2: disagree, 3: agree, 4: strongly agree (Rawashdeh et al., 2021). This media validation sheet measures the quality of interactive media through the developed media features. Aspects assessed by media validators include factors of display design, animation, and ease of use of media (Table 1).

Table 1. Media expert validation indicators

No	Indicators
Display Design	
1	Display design according to the characteristics of interactive learning media users
2	The image on the media is clear
3	Videos on media are easy to understand
4	The menu display on the media can make it easier for users
5	Fonts the letters on the media can be read by the users
6	Buttons have consistent color and icons
7	The background on the media does not interface with the display
8	The colors used are consistent
Animations	
1	The animation used is not excessive

2	The animation used is in accordance with the characteristics of the user
3	Media is interactive
User Easy	
1	Easy to use media
2	Media can be used on various devices
3	The media has navigation buttons at play
4	The media are effective and efficient

Table 2. Material expert validation indicators

No	Indicator
Language	
1	Grammatical accurancy according to EYD
2	The language used in in accordance with the level of cognitive development of student
3	The accurancy of the use of terms in the media
4	The compatibility between the colors, images, shapes, and sizes of the font's cover
5	Politeness in the use of languages
6	Easy to understand language
Display and Presentation	
1	The accurancy of the font
2	Use of font size and text
3	Use of spacing and text spacing
4	Readability of text
5	Placement of images and text
6	The attractiveness of the appearance, colors, and layout of the images
7	The attractiveness of all media display to increase student motivation
Concept of the Material	
1	Compatibility of the image with the concept of the material
2	Visual elements support the material
3	The content created can help use 3D Media
4	Easy use of media
5	Compatibility of the images with the concept of the material

The material validation sheet measures the completeness and clarity of the material presented in the developed media. The aspects assessed include material and grammar (table 2).

The instrument used is an essay test to encourage students' learning outcomes through the wetlands: 3D Mapstory application. The essay's 5 questions were taken from wetland material in South Kalimantan. The aim is to measure the effectiveness of the wetlands: 3D Mapstory application to improve students' learning outcomes at Geography Educational Program Study, Universitas Lambung Mangkurat.

Research Design and Procedures

The flowchart for designing Wetlands:3D Mapstory using the Luther model (Fig. 2)

Analyze

To measure the effectiveness of wetlands: application of 3D map stories through essay questions. The analysis includes normality tests using the Shapiro-Wilk test and paired sample t-test. The results of the paired sample t-test were used as hypothesis testing, namely the use of wetlands: 3D Mapstory Application that effectively improved students' learning outcomes at the Geography Education Study Program, Universitas Lambung Mangkurat.

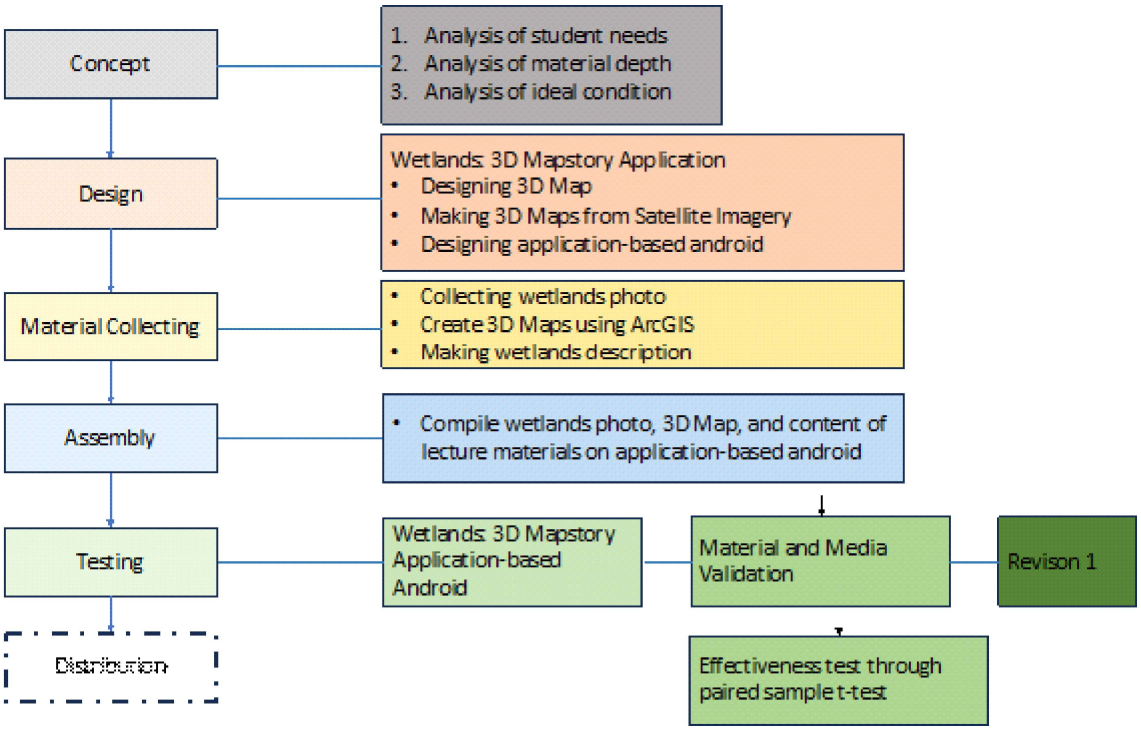

Figure 2. Flowchart of wetlands: 3D mapstory application as learning media

■ RESULT AND DISCUSSION

Concept Stage

In this concept stage, an analysis of student needs, the depth of the material, and the media used in learning in several geography education programs is carried out. Based on the depth analysis of wetland management material, it was found that the shape and type of wetlands were still complex for students to understand, especially students from study programs outside South Kalimantan. This is supported by an interview with a lecturer at Widya Dharma University, who stated that the shape and type of wetlands are difficult to understand because they are still abstract. This is related to the results of the analysis regarding the needs of the students, and the researchers found that students still need interactive media to concretize wetlands taught in the abstract to support learning models.

Design Stage

This stage explains how to design wetlands: a 3D Mapstory application as learning media. The development of this media is based on the results of an analysis of student needs and the depth of the material. The method of this learning media consists of several steps that must be followed.

1. Designing 3D Maps
2. Make 3D maps of Banjar Regency, Banjarmasin City, and 3D maps of wetlands from satellite imagery.
3. Designing application-based Android (via . APK file)
4. The slide contains menus in interactive media, such as the wetland-type menu, the information menu for each wetland, and the image menu for each wetland.

Material-collecting Stage

This data collection stage designs Wetlands: 3D Mapstory media products. The data collected includes photos of types of wetlands in Banjarmasin City and Banjar Regency, South Kalimantan, maps of Banjarmasin City and Banjar Regency from aerial photographs, and

learning materials related to types of wetlands to describe the contents of the material. The data collection stage for the Wetlands: 3D Mapstory media is as follows.

1. Photos of wetlands scattered in Banjarmasin City and Banjar Regency were collected by taking pictures of the kinds of wetlands directly in the field. The images include the Barito and Martapur rivers, former excavations, estuaries, peat, mangroves, rice fields, and reservoirs.
2. This 3D wetland map was created using satellite imagery specifically for Banjarmasin and Banjar Regency. Figure 3 presents the steps for making a 3D map of wetlands.
3. The material concept of wetlands was obtained by studying the literature that describes each wetland. This will later help students strengthen the definition of wetland types.

Material validation of wetlands media: This 3D map story has three aspects: language, appearance and presentation, and the material's content. Figure 3 presents the scoring results from the material validation and validation categories.

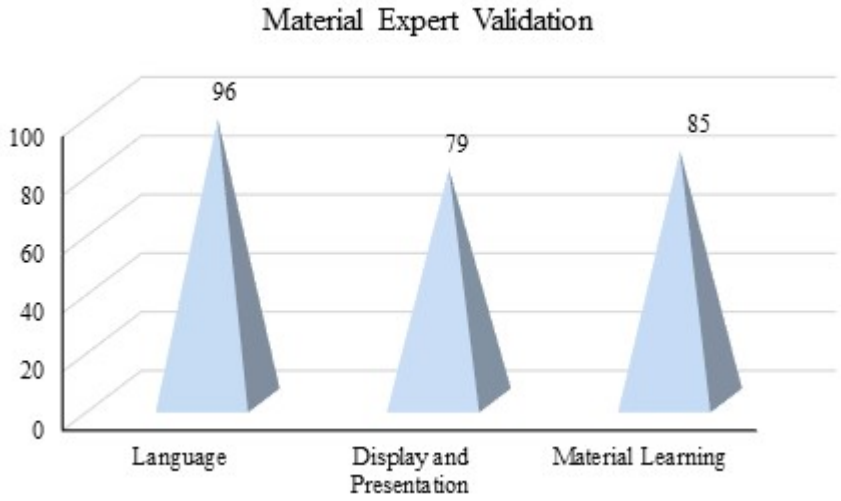

Figure 3. Scoring of material validation

Based on the results of the material validation (Table 3), it was found that the material on the Wetlands: 3D Mapstory was declared valid with the language and content aspect values of 96 and 85, while the display and presentation aspects were 79. The mean of material validation is 86.7, which means that the material on the application is very valid. The results of the validation of three-dimensional media in various research studies show that validation in material, discussion, and appearance is declared valid and can be tested at the next stage (C. A. Sari et al., 2024; R. M. Sari et al., 2023; Setiawan, 2024; Zakaria & Iksan, 2007). These results are similar to validation tests in wetlands: 3D Mapstory Application.

There are revision notes in this aspect of display and presentation to improve the material presented in this media even better by learning. Notes from media experts for media display in font size and spacing between words need to be considered and adjusted so that users are more comfortable reading the existing text. In addition, material experts advise choosing the map's color to be adapted to the actual conditions of the wetland type and not to contrast with the font's color in the wetland's material. The material collected from the field forms the basis for compiling learning content about wetlands in 3D Mapstory media. The compilation of content must have a truth level above 60% so as not to bias students who use media as a learning resource.

Content review references refer to the truth of the content, aspects of the novelty of the material, and its adequacy as a learning resource.

Assembly Stage

This assembly stage is an advanced stage of designing Wetlands: 3D Mapstory as interactive media related to wetlands. The procedure for creating the Wetlands: 3D Mapstory application is explained as follows (Figure 3).

SRTM Image is an image that functions in analyzing elevation models where the height values are obtained from the 1984 WGS datum. The

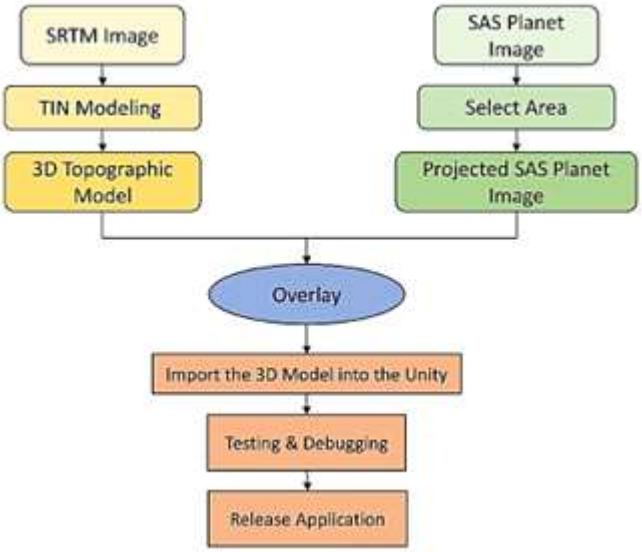

Figure 3. Stages of making a wetlands: 3D mapstory

Digital Elevation Model (DEM) thematic map of Banjarmasin City and Banjar Regency was obtained using the Shuttle Radar Topography Mission (SRTM) Image. The results of this image are processed using the Triangulated Irregular Network (TIN) Model. The TIN is a topological data model based on vector data representing surface morphology in interconnected triangles (Lim & Pilesjö, 2022). TIN represents a surface with no overlap of the original data points and a series of adjacent triangles, so rendering the triangular aspects makes it easy to create 3D visualizations (Al-Abadi, 2017; Liu & Wu, 2019). The TIN model has been used to solve problems related to object buffers, building topographic maps, and multiplayer information. So, using the TIN Model, the surface of the wetland environmental area can be represented at the level of the earth's surface using three-dimensional (3D) visuals. This process produces a 3D topographic map with a predetermined height range. So, 3D visualization is easily constructed.

Additionally, satellite image data collection for the Banjarmasin City and Banjar Regency areas also uses SAS Planet Image. The results of the SAS Planet Image are overlaid with a 3D topographic model to produce a three-dimensional map of Banjarmasin City and Banjar Regency. The following process is to import the 3D Model into the Unity software. The results of the model integration in Unity Software are then implemented on Android-based devices.

This assembly activity is intended as a product development that starts with preparing Android-based software, creating menus and icons for navigation buttons, and downloading several field photos of wetlands presented in the learning media. Wetlands: 3D Mapstory media production stage results from integrating media design by inserting images (pictures) of wetlands,

three-dimensional maps, and learning materials. The integration results are made using an Android-based application (Figure 4).

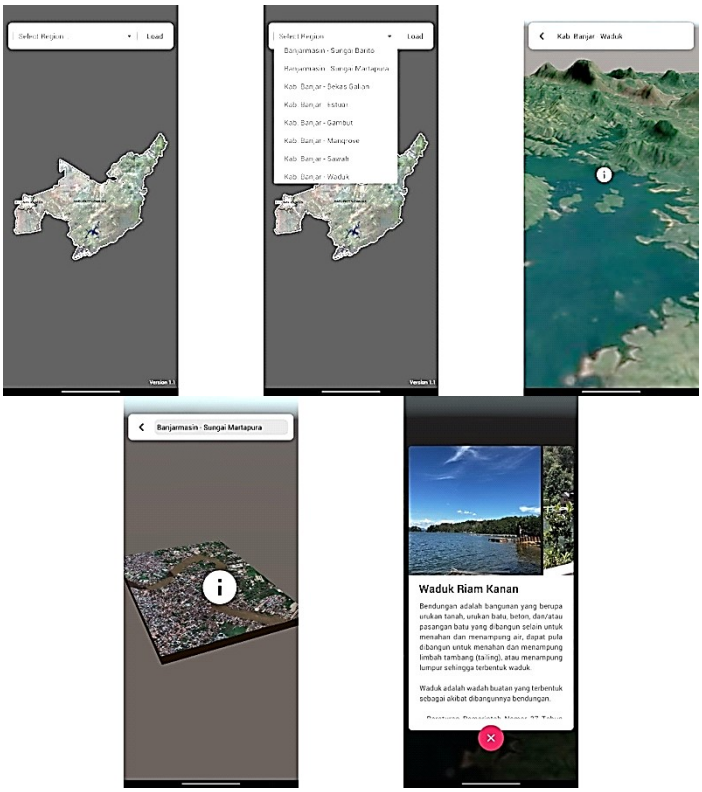

Figure 4. Wetlands: 3D mapstory application

Wetlands: A 3D MapStory-based Android has been made. It is necessary to check beforehand that all the navigation buttons function correctly. Apart from that, checks were also made on the quality of photos of the wetlands, three-dimensional maps of the wetlands, and the completeness of the materials. After checking, it is followed by publishing interactive learning media products in Android-based applications. Wetlands: 3D Mapstory is an interactive learning media that can be used anywhere and anytime (flexible) to meet the information needs of students in class. This aligns with the statement that electronic media has advantages, including easily accessible media and more flexible use (Ahmed et al., 2020) for experience and learning (García-Martínez et al., 2019). This form of learning allows students to move freely and access learning materials from any learning source. So, for the Wetlands: 3D Mapstory media to be used, the next step that needs to be done is the media testing stage.

Testing Stage

Two experts need to validate the media product Wetlands: a 3D MapStory-based Android. The experts on media are the lecturers whose expertise is in geography learning media. Meanwhile, the lecturers who are experts in the material aspects of this study are in physical geography.

The two validators assess the Wetlands: 3D Mapstory media according to each element based on their scientific fields. Figure 5 presents the media expert's scoring of the three media aspects: display design, animation, and user ease.

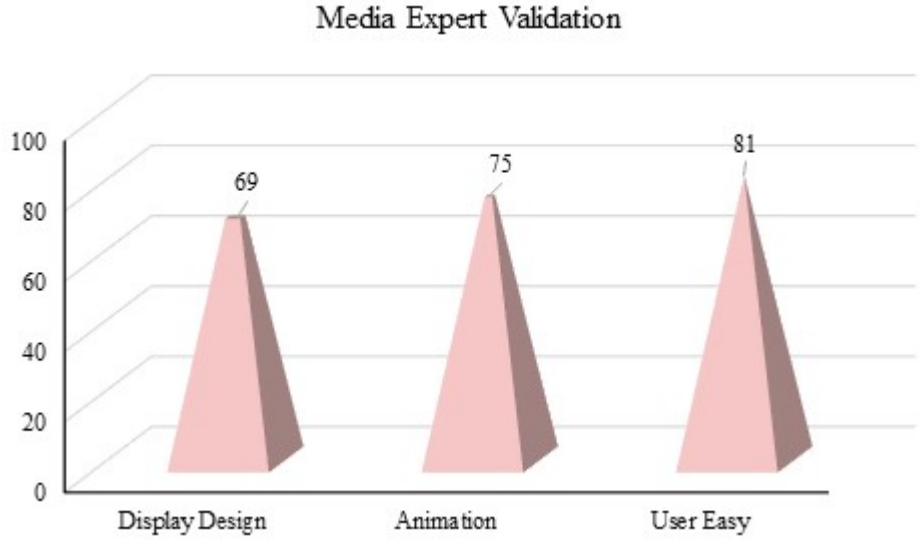

Figure 5. The score of media validation

Based on the results, it was found that the display design and animation aspects were declared valid at 69 and 75 (Table 5). This means that these two aspects still have notes that need to be revised so that the media becomes better. Notices given by media experts include a) it is necessary to add consistent colors to buttons and icons, b) it is better if the background color on the media is adjusted to the display so that the display is not too contrasty, and c) it is necessary to add a video of wetlands even though the media has presented photos. The user's easy aspect is stated to be very valid, with a value of 81. This means that media experts should refrain from revising this aspect. So, it can be concluded that the Wetlands: 3D Mapstory media has been declared valid from the media aspects.

The next stage is testing the effectiveness of wetlands media: 3D Mapstory application to improve student learning outcomes. Testing the effectiveness of this media uses a paired sample t-test with normality test prerequisites. The Shapiro-Wilk test determines the distribution of normally distributed data with a significance level above 0.05 (table 3).

Table 3. Test of normality (shapiro-wilk)

			W	p
ID Test	-	Skor Test	0.418	< .001

Note. Significant results suggest a deviation from normality.

A paired sample t-test was used to differentiate between the two data sets. The results show differences in learning outcomes based on pret-est and post-test scores (table 4). So, the increase in student learning outcomes in regional development geography courses is supported by the effectiveness of using the Wetlands: 3D Mapstory Application.

Digital technology plays a vital role in the era of education 4.0, including three-dimensional technology (3D technology). This 3D technology has been used in various scientific fields, such as education (Faizal et al., 2020; Putra & Mufit, 2022; Salsabila et al., 2022; Su et al., 2019), astronomy (Chien, 2017), geography (Aristin et al., 2020; Carrera et al., 2017), and technique

Table 4. Paired samples T-Test

Measure 1		Measure 2	T	df	p
ID Test	-	Skor Test	-55.166	85	< .001

Note. Student's t-test.

(Hackett & Proctor, 2016). 3D technology is closely related to images and visualization (Hamm et al., 2019). This can be seen from the 3D images, which give a more detailed and exciting effect. This 3D technology display provides an authentic experience with digital information and is used with the help of mobile devices to support the learning process (Boada et al., 2015; Sung et al., 2018). This means that media should be able to help students record and remember in the learning process (S. A. Sari & Husna, 2016).

3D technology in this field of learning has a positive impact on learning outcomes, learning motivation (Chang & Lai, 2018; Rossler et al., 2019; Sugiyono, 2018), and improving skills (Arikunto, 2014) and knowledge (Sung et al., 2018). In the scientific field of geography, 3D technology is used for 3D images. These 3D images are used as animations and images in mobile applications. This can later form student thinking patterns and help concrete student interactions to understand a material concept. Wetlands are a type of land that dominates the southern Kalimantan region, especially the city of Banjarmasin (Nur Saputra & Efendi, 2018; Tirtosudarmo, 2022). Wetlands are a type of land that has excess water content in its soil. This extra water content causes the land area to constantly flood seasonally or permanently (Balwan & Kour, 2021; Hammer & Bastian, 2020). The distinctive characteristics of wetlands make this land unique compared to other types of land. Another uniqueness of wetlands is the potential and problems that accompany them. The potential of wetlands is related to the function of wetlands as the primary support for human life (Hu et al., 2017). The role of wetlands is to store carbon on the earth's surface and land with abundant biodiversity (Barua et al., 2021).

In contrast, wetland problems are related to mistakes in wetland management. Wrong wetland management can lead to disasters that affect humans (Endter-Wada et al., 2020). Disaster mitigation in wetlands can be done by introducing wetland characteristics to every stakeholder, especially students (Finlayson et al., 2013). So, the use of 3D technology in each scientific field has differences but has in common that the use of 3D technology is used to support teaching (Potkonjak et al., 2016; Schelly et al., 2015). Map-based 3D technology is a means for students to introduce wetlands. The variety of learning media helps students understand abstract material concepts (Inayah & Zubaidah, 2020). In addition, 3D technology that is conceptualized in a structured manner can be used to evaluate learning methods and media used during the learning process. This study explored and focused on creating 3D models, Wetlands: 3D Mapstory, based on three-dimensional maps and field photos showing wetland types on Android-based gadgets to enhance learning outcomes about wetlands in regional development. Each image will describe the definition of the land type. So, the user can select a wetland type, the system will display a three-dimensional map of the wetland, and the user can interact with the 3D model to view information related to the object. This aligns with students using smartphones in tertiary institutions to communicate by exchanging notes, information, discussions, and productive academic assignments (Hasan et al., 2019). However, further and in-depth studies may need to be developed to be accessed on the IOS platform.

The study suggests that Wetlands: 3D Mapstory can help students understand wetlands concretely, support the learning process in class

and increase students' learning outcomes and motivation in learning activities. This aligns with several studies that state that the developed Android-based media products can improve student learning motivation, student involvement in the learning process, and learning outcomes because the material is conveyed well through easy-to-use media (Foronda et al., 2016; Hanson et al., 2019; Shields & Riley, 2019; Smith et al., 2018). Apart from that, the Wetlands: 3D Mapstory media has advantages compared to other media, one of which is that it provides hands-on experience. This media allows students to form abstract concepts into concrete ones. Students studying wetland material through this media can integrate theory and practice in an integrated manner. Student interactions concretely do something in a 3D environment (Smith et al., 2018) that can support the learning process, which can stimulate ways of thinking, shape skills, knowledge, and understanding of concepts, so it can improve students' learning outcomes (Foronda et al., 2016; Hanson et al., 2019; Muhson, 2010; Mustaqim, 2017; Nurrita, 2018; Tafonao, 2018; Zakaria & Zanaton, 2007). Therefore, the characteristics of the Wetlands: 3D Mapstory can stimulate our five senses according to the level of the learning hierarchy.

CONCLUSION

Recent observations suggest that students outside the wetland environment need learning media to understand wetland habitats in South Kalimantan. The findings prove that the Wetlands: 3D Mapstory Application was declared feasible and effective for use in improving student learning outcomes related to the development of wetland areas. This supports lecturers' convenience in providing a concrete understanding of concepts without going directly to the wetland field.

The study demonstrates that Wetlands: 3D Mapstory can fill the gap in developing technology-based interactive media to improve the quality of lectures, such as regional development geography in geography education study programs. This media also contributes to developing media to enhance students' learning outcomes and keep the quality of lectures. The implications of the results of this research strengthen and increase the variety of learning media to support learning activities and learning outcomes in universities.

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