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Development Instructional Media Based on Virtual Reality Assisted by The MilleaLab Application on Tourism Resources Material

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ABSTRACT

VR technology is changing the world of education by providing immersive and interactive learning experiences. This study develops LaViGeo, a VRbased learning media designed using the MilleaLab application to enhance learning in tourism resource materials. This study follows the ADDIE development model, consisting of five stages: analysis, design, development, implementation, and evaluation. This study involved 21 students in the Geography of Transportation and Tourism course, selected randomly. Data were collected using a validation questionnaire for material and media experts, as well as a student response survey. The results is LaViGeo was very feasible and effective to use from expert assessments and through trials with students. The integration of multimedia elements, learning videos, 360-degree images and interactive features can be accepted by students for concept materials related to tourism geography. There are challenges in the form of direct integration of 360-degree YouTube videos and limited trials so that further research is needed regarding wider implementation and optimization.

Keywords:

Virtual Reality; ADDIE Model; Millealab; Instructional Media; Geography of Tourism.

ABSTRAK

373

Teknologi VR mengubah dunia Pendidikan dengan menyediakan pengalaman belajar yang imersif dan interaktif. Studi ini mengembangkan LaViGeo,

Submitted: 2024-11-06; Accepted: 2025-04-10; Published: 2025-04-28 *Corresponding author: mega.prani@unsil.ac.id media pembelajaran berbasis VR yang dirancang menggunakan aplikasi MilleaLab untuk meningkatkan pembelajaran dalam materi sumber daya pariwisata. Penelitian ini mengikuti model pengembangan ADDIE, terdiri dari lima tahap: analisis, desain, pengembangan, implementasi, dan evaluasi. Studi ini melibatkan 21 mahasiswa pada mata kuliah Geografi Transportasi dan Pariwisata, dipilih secara acak. Data dikumpulkan menggunakan kuesioner validasi untuk ahli materi dan media, serta survei respons mahasiswa. Hasilnya, LaViGeo sangat layak dan efektif digunakan dari penilaian para ahli dan melalui uji coba kepada mahasiswa. Integrasi elemen multimedia, video pembelajaran, gambar 360 derajat dan fitur interaktif, dapat diterima oleh mahasiswa untuk materi konsep terkait geografi pariwisata. Terdapat tantangan berupa integrasi langsung video youtube 360 derajat dan masih terbatasnya uji coba sehingga perlu dilakukan penelitian lebih lanjut terkait implementasi dan optimasi yang lebih luas.

Kata kunci:

Model Pembelajaran; Nilai-Nilai Budaya Local; Teknologi Pendidikan; Augmented Reality; Ilmu Pengetahuan Sosial.

1. Introduction

The swift advancement of technology in the 21st century has spurred the development of virtual reality across various sectors. One notable area is higher education, where students must acquire proficiency in this emerging technology. This progress is closely linked to the adequacy of computer laboratory facilities available at universities. Consequently, the integration of virtual reality technology can offer significant advantages for both students and instructors in the learning process within higher education. (Rachmadian, 2023).

The use of virtual reality technology by lecturers in learning can be in the form of learning media. Instructional mediathrough virtual reality technology offers an immersive learning experience (Hendri, Darmansyah, & Yeni, 2020). This allows students to interact directly with learning content in a real simulation environment. According to Chen et al., (2020) instructional mediawith virtual reality technology can encourage students to become better at understanding abstract concepts to be more real. This is because virtual reality technology has the ability to display multimedia. Multimedia presentation in virtual reality can provide students with an experience to interact more closely with teaching materials (Parong & Mayer, 2018). This activity will increase student motivation in learning. The same thing was conveyed by Sampaio & Peralta (2009) that multimedia capabilities in virtual reality technology can motivate users to focus more on the material being studied.

Multimedia allows lecturers to present learning materials in various forms of media such as text, images, learning videos and 360-degree video (Chen, 2021). The use of multimedia presentations in virtual reality technology is increasingly relevant for effectively delivering teaching materials on Tourism Resources. These materials encompass various aspects, including tourism sources and potentials, as well as tourist objects and attractions, along with their corresponding systems. It is

essential for these teaching resources to provide a comprehensive understanding that reflects the real conditions encountered in the field.

Based on observations and interviews with the course lecturers, it was found that they have been utilizing various learning video media, particularly from YouTube, to deliver course materials. However, results from the learning evaluations conducted by the lecturers revealed that students still struggle to grasp the concepts related to Tourism Resources. This is evident in their assignment performance, specifically in the tourism resource video projects, which have largely been limited to mere descriptions of tourist locations rather than a comprehensive examination of the subject matter.

In the same study in tourism, virtual reality technology has been utilized in learning. According to Saneinia et al., (2024), the use of digital virtual reality technology in tourism can help students find virtual tourism locations, interact with cultural heritage in new and interesting ways and gain practical skills through real-world simulations in virtual reality. Research conducted by Liu & Dong (2024) which discusses art resources as tourism resources is in line with the topic of this research. Virtual reality technology has the potential to showcase tourism art resources within a virtual environment, allowing users to experience the allure of these resources more directly. The findings from two studies indicate that virtual reality can significantly aid users, particularly students, in their exploration of tourism materials. By effectively simulating the real world, virtual reality enables students to access tourist locations and engage with tourism resources in a more efficient and impactful manner.

Lecturers should utilize virtual technology to enhance students' understanding of the teaching material. Furthermore, the subject of Tourism Resources is particularly well-suited for presentation through virtual reality learning media. Therefore, it is essential for lecturers to develop virtual reality instructional materials tailored to align with the unique characteristics of their students.

Research on the development of instructional media base on virtual reality has become a trend in recent years with many themes. Research conducted by Purnama (2016) used a form of virtual reality in the form of 360-degree video in geography subjects with material on patterns and shapes of geographic objects according to physical landscapes. Although this media is said to be effective to implement, there still needs to be additional interaction in the virtual space that has been created because his media just passive interaction so that students can understand the material presented. Therefore, further research needs to consider the interaction aspect in virtual reality media.

There are various instructional media base on virtual realitydevelopment applications that can realize the interaction aspect in them. Agusty & Anggaryani (2021) said that one of aplication is MilleaLab application which is designed with various more specific features. Harnisa (2023) added that this application aims to create good reality visualizations in supporting the learning process. MilleaLab is a virtual reality platform that supports users to create and access 3D and virtual reality-based educational content easily, quickly, and affordably (MileaLab, 2023).

Research that utilizes MilleaLab as a virtual reality instructional mediadeveloper application is research from Agusty & Anggaryani (2021) about the development instructional media"GoWarm with Millealab". The research indicates that the media has been rated very positively, receiving favorable responses from 20 high school students. In summary, "GoWarm with Millealab" has been effectively developed to raise awareness about the issue of global warming. Nonetheless, further research is required to enhance the VR-based physics instructional media, particularly regarding

content and evaluation improvements. While the teaching materials share similarities with those in geography subjects, the scope of discussion varies in perspective. Therefore, additional content development is necessary for its application in geography classes.

The next reserch by Ashari et al., (2021) showed that the development of virtual reality media was different from previous researchers, namely in the form of virtual fieldwork for learning aspects of physical geography after the pandemic. The findings from his study indicate that virtual fieldwork can be effectively conducted through indirect synchronous learning or by creating instructional videos tailored to provide a comprehensive visualization of field conditions within online learning environments. To enhance this approach, further development is necessary, including adjustments to the video presentation and the breadth of the material to better meet these requirements.

Finally, Research by Rachmadian (2023) found several advantages of developing virtual reality media that are said to be suitable for use in digital Geography learning in schools and can increase students' motivation, curiosity and immersive experience in learning about the process of rock formation and lithosphere dynamics at the Parangireng Complex Geosite. However, this media still needs to improve the quality of the design to make it more attractive to students and visual descriptions of the material because in this study, the main feature used in virtual reality only uses the 360-degree image feature. This is certainly still not optimal in providing a deep virtual interaction experience to users.

Based on the findings of previous studies, it is evident that the features of instructional media utilizing virtual reality are still limited in providing optimal virtual interactions. This limitation arises from the multimedia elements employed, which predominantly consist of 360-degree images, 360-degree videos, or instructional videos related to teaching materials. Furthermore, the application of virtual reality media in geography education, in particular, has not been extensively implemented in universities, especially through the Millealab Application.

In response to the identified research gap, this study seeks to develop instructional media based on virtual reality that will enable students to interact with multimedia and diverse teaching resources. This research aims to address shortcomings in previous studies by enhancing user interaction within the virtual environment, particularly for the Tourism Resources subject, utilizing the MilleaLab application designed for university-level education. Consequently, the researchers intend to enrich this virtual instructional media by incorporating a variety of multimedia interaction features, including images, 360-degree videos, and explanatory videos, all integrated into a single virtual reality-based platform via the MilleaLab application. This approach will accommodate the diverse characteristics and learning needs of students.

2. Methods

2.1. Development Model

This research is a product-based research which is better known as development research. The development model used is the ADDIE procedural model (Rayanto & Sugianti, 2020). Setyosari (2020) said that the procedural model is a descriptive model that has steps that must be followed to produce a particular product. According to Branch (2010) the stages of the ADDIE development

model consist of 5 stages, namely Analyze, Design, Develop, Implement, and Evaluate. The stages or procedures of research and development can be seen in Figure 1 below:



Figure 1. Research and Development Stage of the ADDIE Model

Source: (Robert Maribe Branch, 2010)

2.2 Research Subject

The subjects in this study were randomly selected from students of the 2023 intake who were contracting the Geography of Transportation and Tourism course in 2024 Class C in the Department of Geography Education, Siliwangi University, totaling 21 students. Students who were the subjects of the study had the characteristic of preferring multimedia instructional mediathrough practical and individual learning forms.

2.3 Data Collection and Analysis

The data collection instrument used in this study was through a questionnaire. The questionnaire used was a media validation questionnaire (product design), a material validation questionnaire (product content) and a student response questionnaire to instructional media base on virtual reality that had been modified from Putri (in Marom, 2023) and Maryu (in Arif, Hartono, & Arinta, 2023) whose instruments have passed validity and reliability tests. The assessment of the expert validation questionnaire and student responses used a Likert scale of 1-5 consisting of: Very Good (VG) with a value of 5, Good (G) with a value of 4, Enough (E) with a value of 3, Less (L) with a value of 2 and Very Less (VL) with a value of 1. Furthermore, from the instrument, research data was obtained in the form of numerical data in the form of validation scores and questionnaire results. Then, the data obtained was analyzed quantitatively using the formula shown in Figure 2 below.

$$X_{i=\frac{\Sigma S}{S_{max}}x\ 100\%}$$

Figure 2. Quantitative Data Processing Formula

Description:

Xi = Validity Percentage

 ΣS = Assessment score in all item

Smax = Ideal assessment score in one item

100 = Constan

The percentage score results obtained from the research are interpreted in the table criteria which show in Table 1 bellow.

Percentage	Criteria	Category Description
81%-100%	Veri Feasible	without any revision
61%-80%	Feasible	with partial revision
41%-60%	Quite Feasible	with partial revision and re-readability test
21%-40%	Not feasible	with the total revision and re-readability test
0%-20%	Very Not feasible	may not be used.

Table 1. Media Instructional Feasibility Scale	e
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Source: Arikunto (In Fira, 2023).

3. Results and Discussion

This research and development initiative produces virtual reality (VR) products that can be accessed through smartphones and designed as virtual boxes. The Virtual Reality (VR) experience is created using the MilleaLab application, incorporating elements such as perception, a learning environment that mimics the real world, educational materials, instructional videos, 360-degree videos, teaching resources from online portals, and quizzes. The content of this research and development is centered around tourism resource learning materials tailored for students in Class C of 2023. The information is sourced from a variety of instructional media, making it easier for students to grasp. This product is designed to be utilized exclusively within the Millea Lab Viewer application on smartphones, following exportation by the researcher to the Android version, also facilitated through the MilleaLab application. The researcher has named this developed virtual reality instructional media product "LaViGeo," which stands for "Geography Virtual Laboratory."

3.1 The Stages of Developing Instructional Media Based on Virtual Reality Assisted by The Millea Lab Application on Tourism Resources Material

Research and Development of Instructional Media Based On Virtual Reality uses the ADDIE development model. This development model consists of 5 stages consisting of Analyze, Design, Develop, Implement, and Evaluate.

3.1.1 Analyze Stage3.1.1.1 Analysis of Learning Materials

The analysis of learning materials focuses on evaluating the content outlined in the Semester Learning Plan (RPS) to be presented to students. The selection of topics related to Transportation and Tourism Geography is tailored to the needs of lecturers, the characteristics of the students, the Sub-CPMK, and the assessment indicators to be achieved. This study specifically examines the material on Tourism Resources, with the detailed results of the analysis presented in Table 2 below.

 Table 2. Mateial VR Media-Geography of Transportation and Tourism Media Materials

Sub-CPMK	terial	Learning Outcomes				
Able to understand	Tourism	Resource	1.	Understand the concept of tourism		
tourism and tourism	Concept			resources.		
as well as tourism			2.	Determine resource indicators in tourism.		
resources.			3.	3. Determine the type of tourism resource.		
			4.	Identify the symptoms of the geosphere as		
				a tourism resource.		
	Tourist	Attractions	1.	Understand the definition of tourist objects		
	and Attra	ictions		and attractions.		
			2.	Determine the factors that affect tourist		
				attractions.		
	Tourist	Attraction	1.	Determine the parts of the tourist		
	Object S	ystem		attraction system.		
		-	2.	Understand the object of tourist attraction.		
			3.	Determine the type of tourist attraction		
				object.		

(Source: RPS Geography of Transportation and Tourism)

The data presented in Table 2 indicates that the majority of learning outcomes necessitate a deep understanding and skillset. Beyond comprehension, students must also be capable of analyzing and identifying various materials relevant to the context of tourism resources. This highlights the need for a diverse range of instructional materials to effectively achieve these learning outcomes.

3.1.1.2 Analysis of Student Characteristics

The results of the analysis of student characteristics through the results of the questionnaire show that the characteristics of students in the 2023 intake have various learning methods during lectures. However, the most dominant is learning through listening at 70.4% and demonstration/practice at 65.7%.



Figure 3. Characteristics of Student Learning Styles

During lectures, students expressed that practical learning activities through demonstration have never been implemented to enhance their educational experience. Learning through demonstration, particularly through field practice activities, is crucial for comprehension. However, students indicated that the field practice activities conducted so far have been a combination of several courses, which they feel has not optimally supported their understanding of the material, especially regarding a thorough grasp of Tourism Resources.

The insights gathered from the interview with Mr. Elgar Balasa Singkawijaya, M.Pd., the lecturer for the Geography of Transportation and Tourism course, reveal that students in the 2023 class show a stronger preference for learning materials presented directly by lecturers. This preference has led instructors to favor a direct lecture approach, utilizing PowerPoint presentations during class. Furthermore, students appear to be less prepared for independent group learning, resulting in assignments that are more frequently structured as individual tasks. This aligns with the findings from the student questionnaire, which indicated a significant inclination towards independent learning, with 62% of respondents favoring individual study and 59.3% preferring study in groups.



Figure 4. How Students Learn

3.1.1.1. Analysis of Instructional Media Needs

The results of the questionnaire revealed that lecturers in the Geography of Transportation and Tourism course employ a variety of instructional media in their teaching. The most frequently used resources include learning videos, utilized by 67.6% of respondents, images at 60.2%, and textbooks at 53.7%. This data indicates that while multimedia is being utilized, it has not been fully maximized to facilitate direct learning experiences. Consequently, for the Tourism Resources material, additional media are necessary to enhance students' understanding in a deeper and more realistic way.



Figure 5. Variations of Instructional mediaUsed by Lecturers in Class

Research indicates that students recommend utilizing instructional media to enhance their understanding of course material, with preferences including 81.5% for learning videos, 60.2% for PowerPoint presentations, and 55.6% for virtual reality. Analysis of instructional media needs reveals that virtual reality, although previously underutilized, is favored by students. This medium aligns well with the topic of Tourism Resources as it allows students to virtually explore a variety of resources and tourist attractions. Through virtual reality technology, including 360-degree video content, students can access destinations that may be distant from their location. This approach offers an enriching learning experience, particularly for independent exploration through the virtual box tool. All educational materials can be organized and integrated by instructors into a cohesive unit using the Millea Lab application.



Figure 6. Instructional mediaThat Are Students' Choice

3.1.2 Design Stage 3.1.2.1 Designing Materials

The process of designing the materials is informed by the results of prior material analysis. The newly developed materials are aligned with the achievements outlined in the assessment indicators. Given the dense nature of the Tourism Resources content, researchers have decided to divide the material into three distinct sub-sections, which will then be organized into three virtual reality scenes: 1) Scene 1 focusing on Tourism Resources, 2) Scene 2 concentrating on Tourism Objects and Attractions, and 3) Scene 3 covering Tourism Object Systems and Attractions. Additionally, the development of the material content is aimed at providing contextual displays, utilizing multimedia formats such as images, educational videos, 360-degree videos, and YouTube videos.

3.1.2.2 Designing a Story Board

The process of designing a storyboard involves crafting a storyline that serves as a bridge to effectively communicate the Tourism Resources material within LaViGeo's virtual reality (VR) content. This storyboard is created in an Excel format and includes the concept of the material to be presented, the virtual environment design to be

developed, and the multimedia features to be incorporated into the VR content, such as images, text, 360-degree videos, YouTube videos, website links, and more. This activity aligns with the storyboard format example provided during VR training by the application developer, MilleaLab.

3.1.2.3 Designing Research Instruments

The activity of designing research instruments was carried out by compiling validation instruments for material and media experts by adapting the modified research questionnaire from Putri (in Marom, 2023) and Maryu (in Arif, Hartono, & Arinta, 2023) whose instruments have passed validity and reliability tests Develop Stage.

3.1.3 Develop Stage

3.1.3.1 Product Manufacturing with Millealab

The development of virtual reality products at Millealab encompasses three main activities. First, the researcher prepares various assets, including environmental features, structures, static and animated objects, as well as pop-up information such as text, audio, and quizzes, along with interactions like custom images, 360-degree YouTube videos, standard YouTube videos, uploaded videos, uploaded 360-degree videos, and portals, all in accordance with the storyboard designed earlier.

Second, the researcher organizes these assets and interactions based on the planned scene flow outlined in the storyboard to create a virtual reality display that meets research requirements. In this study, three virtual reality scenes have been developed focusing on tourism resources, each comprising sub-materials, which include concepts of tourism resources, tourist objects and attractions, and the systems surrounding these attractions. Lastly, the researcher integrates the created virtual reality content with the MilleaLab Creator application, linking it to the Millea Lab Viewer. This allows users to access the virtual reality scenes via the Millea Lab Viewer's interface, for which the creator shares a link and class code to facilitate access.



Figure 7. The Process of Setting Up Assets, Pop Up Info and Interactions







Figure 9. Virtual Reality Content Scene Display in MilleaLab Viewer

The development of LaViGeo, a virtual reality-based media project by Millealab, aims to deliver an immersive learning experience focused on specific aspects of tourism resources. By utilizing multimedia displays, the project aspires to enhance students' understanding of theoretical concepts, enabling them to apply this knowledge contextually in real-world environments.

3.1.3.2 Validation

At this stage, two validators have evaluated the virtual reality instructional media: Mr. Elgar Balasa Singkawijaya, a material expert, and Mr. Hilmwan Wibawanto, a media expert. Both experts assessed each component of the LaViGeo virtual reality instructional media using a validation instrument that adheres to established rules and standards for media assessment. The feasibility of the LaViGeo virtual reality instructional media, as evaluated by the two experts, is presented in Table 3 below.

 Table 3. Recapitulation of The Results Feasibility Assessment of Instructional Media Base on Virtual Reality by Experts

Matrial Aspect	Score	Media Aspect	Score
Relevance of Material		Functions and Benefits	
Learning materials in instructional media base on Virtual Reality through Millea Lab are delivered in relation to the Geography, Transportation and Tourism course.	5	Instructional Media base on Virtual Reality through Millea Lab can clarify and facilitate the delivery of messages in learning to students.	5

Learning materials in instructional media base on Virtual Reality through Millea Lab are in accordance with the objectives that must be mastered by students.

Learning materials in instructional media base on virtual reality through Millea Lab are in accordance with the learning indicators to be achieved by students.

Learning materials in instructional media base on virtual reality through Millea Lab include Tourism Resources material.

Accuracy/Quality of Material

Delivery of material through in instructional media base on virtual reality through Millea Lab in accordance with the context of everyday life.

The material has been presented correctly.

The systematic presentation of Tourism Resources material is presented in a coherent manner.

The images presented are appropriate to explain the Tourism Resources material.

The videos presented are appropriate for explaining the Tourism Resources material.

The benefits of the material can increase students' knowledge regarding Tourism Resources material.

The delivery of Tourism Resources material throughinstructional media base on Virtual Reality through Millea Lab is easy for students to understand.

Language and Typography Aspects

Language is easy to understand by students.

The writing is easy to read by students.

The use of language in instructional media base on Virtual Reality through Millea Lab is considered effective.

5	Instructional Media base on Virtual Reality through Millea Lab can arouse students' interest and motivation to learn.	5
5	Instructional Media base on Virtual Reality through Millea Lab is easy to use.	5

5

Visual Aspects of Media

5	The selection of colors, backgrounds, texts, images and animations is interesting.	5
5	The image size is appropriate for students.	4
5	The image lighting is right.	5
4	The speed of the Virtual Reality movement of the image is running well.	5
4	The video size is appropriate for students.	4
5	The speed of the Virtual Reality video movement is running well.	5

4

Audio Media Aspects The rhythm of the voice presented by the narrator is 5 according to the needs of the students. The narrator's voice is heard 4 clearly and informatively. The sound of music is in accordance with the 5 atmosphere and appearance of the images **Typographic Aspects** Easy to read text type Text size is appropriate (not

too small and not too big)

Language Aspects

5

4

5

4

4

		The language is easy for students to understand.	5
		Programming Aspects	
		Duration settings are suitable for students.	5
Total Score	66	Total Score	75
Validity Percentage	94,29	Validity Percentage	93,75
	Veri		Veri
Criteria	Feasible		Feasible

Table 3 shows that material experts and media experts provide the criteria of "very feasible" so that instructional media base on virtual reality LaViGeo is relevant to be used as a instructional media that provides multimedia and virtual interaction.

3.1.3.3 Revision

However, this instructional media received feedback concerning the placement of its virtual features, which need improvement. Suggestions regarding the text display on the image feature were not implemented, as both the developer and researcher believe this feature is already prominent and cannot be resized due to file limitations within the Millea Lab Creator application. Additionally, no revisions were made to the globe asset feature, which appears to be floating, because its current appearance aligns with the original design in Millea Lab Creator; altering its position might detract from its overall impact. The revisions that have been made are detailed in Table 4 below.

Table 4. Revision of VR Media Tourism Resources from Expert





Revisions were made in response to the results of the effectiveness test conducted with students. Feedback from the students primarily focused on visual aspects, such as the need to enlarge the text within images for better readability. Furthermore, they suggested enhancing the quality of video content, including both image and audio quality, to facilitate clearer comprehension of the material presented. Additionally, students were informed that the MilleaLab Viewer application is compatible with all smartphone specifications, ensuring easy access for everyone.

3.1.4 Implement

At this stage, the researcher conducted a direct trial of the LaViGeo virtual reality product prototype using the MilleaLab application. The participants in this trial were students enrolled in the Geography, Transportation, and Tourism course during the odd semester of 2023, specifically from class C. Two product trials were carried out: one with small groups and another with larger groups. As part of the media trial with the students, the researcher distributed a questionnaire to gather their

Development Instructional Media Based on Virtual Reality Assisted by The MilleaLab Application on Tourism Resources Material

responses regarding the use of virtual reality media. The findings from the student response questionnaire, which assessed the application of virtual reality instructional media assisted by MilleaLab on the Tourism Resources material, are clearly presented in Table 5 below, highlighting the results from both the small and large group trials.

Table 5. Recapitulation of The Results of Student Response (Small and Large Group) on The Effectiveness of Using Instractional Media Base on Virtual Reality

Small Group					
No.	Aspect	Score	Percentage	Category	
1	Functions and Benefits	137	76,11	Effective	
2	Audio Visual Aspects	59	65,56	Effective	
3	Language and Typography Aspects	45	75,00	Effective	
	Average		72,22	Effective	
Large Group					
No.	Aspect	Score	Percentage	Category	
1	Functions and Benefits	360	75,00	Effective	
2	Audio Visual Aspects	240	72,08	Effective	
3	Language and Typography Aspects	160	72,50	Effective	
	Average		73,19	Effective	

Table 5 shows that material experts and media experts provide the criteria of "effective" so that instructional media base on virtual reality LaViGeo is effective to be used as a instructional media that provides multimedia and virtual interaction.

3.1.5 Evaluate

In the ADDIE method, evaluation activities are carried out at each stage. The final evaluation is carried out during implementation to students through a questionnaire. Regarding the results of the overall evaluation in this research process, it is explained in the following description.

- During the needs analysis stage, the researcher conducted classroom observations and interviewed lecturers teaching the Transportation and Tourism Geography course. This approach aimed to gather insights into how Transportation Geography and Tourism are taught and to understand the instructional media utilized by lecturers during lessons. To enhance the credibility of the findings from the observations and interviews, the researcher also distributed a preresearch questionnaire to assess student needs.
- 2) During the design phase of virtual reality media, researchers are conducting studies using various references related to instructional media and virtual reality, drawing from MilleaLab. The product planning process incorporates feedback from lecturers in the Transportation and Tourism

Geography course to ensure that the virtual reality content offered aligns with the specific learning needs.

- 3) In the developed stage of virtual reality media, the researcher developed with a team, namely students who have limitations in running the Millea Lab application. This is because the Millea Lab creator application is new for students and has never used it before. However, with guidance from lecturers who have participated in Millea Lab training, this can be overcome well. After the product has been developed, the next part is to ask for assessment or validation from media and material experts. In the media and material validation activities, the researcher received a lot of input from media and material experts for the improvement of the content of instructional media base on virtual reality.
- 4) During the implementation phase, the researcher conducted a limited trial involving both small and large groups of 3rd semester students enrolled in the Transportation and Tourism Geography course. A total of 21 students participated, which included 5 individuals in the small group trial and 16 in the large group trial. At this stage, students exhibited considerable enthusiasm for experimenting with virtual reality media, despite having access to a limited number of VR box devices. As a result, the trial process was divided into several sessions, allowing students to take turns using the VR box and engaging with the virtual reality content in the Millea Lab Viewer application. Throughout this process, valuable feedback was gathered from students via questionnaires, which served as a foundation for the research team to make enhancements to the developing virtual reality media.
- 5) The final results of the expert validation show that the virtual reality media in the Tourism Resources material developed through MilleaLab is "feasible" to be applied in the classroom. In addition, from a limited trial, students stated that the developed virtual reality media was "effective" to be applied in learning.

3.2 Discussion

Based on the research results, this research and development was carried out using the ADDIE development model by Brach which consists of 5 stages, including: analysis stage, design stage, development stage, implementation stage and evaluation stage (Branch, 2019). The result of the analysis student characteristics and media needs, data obtained showed that 65.7% of students prefer learning by practicing or demonstrating in understanding the teaching materials of Tourism Resources. According to Dale (in Lee & Reeves, 2018) conveyed that learning by doing directly can provide a more optimal learning experience. This is because students utilize all their senses and maximize them in studying the teaching materials. Students are able to interact with the environment and other learning resources directly. Thus, this learning method provides a meaningful learning experience and can be remembered longer.

To create an immersive learning experience, instructional media based on virtual reality is highly effective for delivering content on tourism resources. Virtual reality enables the integration of various multimedia elements, including images, educational videos, 360-degree videos, 360-degree images, and YouTube clips. This approach aligns with Dale's perspective, which emphasizes the importance of examining the impact of media combinations within the context they are used, rather

than solely evaluating a single type of media in a laboratory setting. (Lee & Reeves, 2018). Virtual reality-based learning media can motivate and engage students in learning practices and improve visual literacy skills so that they can improve their abilities.

Using of virtual reality can provide a learning environment that provides various multimedia and designs it to be used for independent learning. A similar opinion was expressed by Rosadi, Qomaruzzaman, & Zaqiah (2023) that learning media, especially virtual reality can facilitate students in personal and independent learning. In line with the results of this study, it shows that 62% of students stated that they were more focused if they studied independently with individual learning. It is aligning with findings from Hughey (2020) which emphasize the importance of personalized digital learning environments. The incorporation of VR allows students to engage with content at their own pace while still benefiting from a structured and instructor-led curriculum. (Azmi, Hamsi, & Utama, 2024) adding that VR offers a unique immersive experience, allowing students to feel as if they are inside a virtual environment, which can increase their engagement and deeper understanding of the subject matter.

Instructional media based on virtual reality products developed by Millealab in this study offers access to various forms of interaction through an array of media included in the application. These interaction features comprise learning videos tailored to the needs of tourism resource materials, 360-degree videos relevant to the tourism content presented, images designed in alignment with the tourism resource themes, and virtual environmental assets created to resemble real-life environments, such as virtual laboratories. These features aim to provide students with a sense of immersion and hands-on experience while interacting within a virtual setting that closely mimics real-world environments. (Mulders, Buchner, & Kerres, 2020). The development of this product aims for students to gain direct experience and gain meaningful experience because all senses allow them to participate in interactions that are designed in virtual space so that they can support the learning process (Harnisa, 2023).

The research and development of the Geography Virtual Laboratory (LaViGeo), which employs Virtual Reality (VR) technology, represents a substantial advancement in the realm of instructional media, particularly in the exploration of Tourism Resources. This study's uniqueness lies in its innovative integration of VR via the MilleaLab application, offering a more immersive and interactive learning experience than traditional methods. While prior research has shown the effectiveness of multimedia in enhancing students' educational experiences, this approach takes it a step further. (Mayer, 2020), the application of VR in geography education remains underexplored, particularly in the context of tourism resource learning.

This research and development initiative seeks to create instructional media utilizing virtual reality tailored to meet the needs and characteristics of students. The instructional media, named LaViGeo, stands out by offering a comprehensive VR-based learning experience that incorporates 360-degree videos, interactive quizzes, and digital teaching materials, all integrated within the MilleaLab developer application. This method allows students to explore and analyze tourism resources without the limitations of physical field visits, as identified in previous studies. (Guttentag, 2010).

Prior studies have emphasized the importance of multimedia in enhancing learning outcomes. According to (Mayer, 2020), multimedia learning principles suggest that integrating text, images, and videos can improve comprehension and retention. However, most studies focus on static or two dimensional multimedia, whereas this research extends the concept to immersive VR, which allows learners to interact dynamically with the content. Unlike previous research that primarily explores video-based or interactive simulations (Merchant et al, 2014), LaViGeo structures its instructional content into three distinct VR scenes about Tourism Resources, Tourism Objects and Attractions, and Tourism Object Systems providing a scaffolded and immersive learning environment.

The storyboard design approach used in this study aligns with the findings of (Srilakshmi et al. (2024), who argue that well-structured digital learning environments significantly improve spatial awareness and cognitive engagement. By leveraging the structured format provided by MilleaLab, this research ensures a coherent and pedagogically sound VR learning experience, a gap identified in prior studies that often lacked systematic instructional design in VR content development (Huang et al., 2023). The results from this design phase underscore the importance of structured instructional design in VR-based learning environments. Future research should investigate the effects of VR storytelling techniques on student engagement and knowledge retention. Moreover, the scalability of these VR applications should be evaluated to assess their feasibility in broader educational contexts.

The next phase of this research involves the development of LaViGeo, a virtual reality (VR)based learning media, utilizing MilleaLab. This stage focuses on the organization of assets, interactions, and multimedia components to create an immersive learning environment aimed at enhancing student engagement in Tourism Resources education. Key elements that are being developed include environmental features, both static and animated objects, pop-up information (text, sound, and quizzes), and interactive media such as 360-degree videos and YouTube integration. A systematic arrangement of these components, guided by the storyboard, ensures that the learning experience aligns with the established learning objectives.

The results of the media validation show that the LaViGeo virtual reality learning media is declared feasible by both material experts and media experts. The purpose of media expert validation is to determine the feasibility of the media to be used in learning (Marom, 2023). The findings from the assessment conducted by material and media experts indicate that this media is suitable for use in educational contexts. Furthermore, feedback from students during the media trial phase demonstrates that this learning media is effective in practice. This effectiveness can be attributed to various enhancements made in response to inputs from validators, media experts, and material specialists. This research is in line with the research of Saparuddin et al., (2024) who showed that the results of material and media validation on Millea Lab-based virtual reality media on disaster mitigation materials for high school students are in the category of very feasible to be implemented.

The development of LaViGeo introduces a structured methodology for creating VR-based educational content, setting it apart from previous research in multimedia learning. While existing studies emphasize the benefits of multimedia learning (Mayer, 2020), few have explored fully immersive VR experiences designed specifically for tourism education. Unlike prior VR applications that focus on passive learning experiences (Merchant et al., 2014), LaViGeo enables active engagement through interactive quizzes, real-world simulations, and scenario-based learning.

Moreover, the study builds upon spatial learning theories Li et al., (2023) emphasizing the role of VR in improving spatial cognition and contextual learning. The integration of immersive elements aligns with experiential learning theories (Kolb, 2015), reinforcing the significance of interactive, real-world applications in geography education. While previous research (Huang et al., 2023) highlights the motivational impact of VR in education, LaViGeo advances this by offering structured, topic-specific VR scenes tailored to students' curriculum needs.

The implementation stage of this research involved a direct trial of the LaViGeo virtual reality (VR) instructional media using the MilleaLab application. Trials were conducted with students enrolled in the Geography, Transportation, and Tourism course, organized into both small and large group formats. The effectiveness of the instructional media was evaluated through student response questionnaires, which focused on three key aspects: functionality and benefits, audiovisual quality, and language and typography. The findings reveal that LaViGeo was rated as "effective" in both small and large group trials, with average effectiveness scores of 72.22% and 73.19%, respectively. The highest-rated aspect was functionality and benefits, with scores of 76.11% in small groups and 75.00% in large groups, indicating that students regarded the VR-based instructional media as valuable for learning about Tourism Resources. The consistent effectiveness across all three aspects suggests that integrating VR into education enhances both engagement and comprehension.

This study contributes to the growing field of VR-based education by providing empirical evidence of its effectiveness in Tourism Resources learning. While previous studies have explored VR in general education (Huang et al., 2023; Merchant et al., 2014), few have specifically examined its structured implementation in geography and tourism-related subjects. Unlike traditional multimedia learning tools, LaViGeo combines interactive VR experiences with structured instructional design, aligning with multimedia learning principles Mayer, 2020).

Moreover, while prior studies on VR learning highlight its potential for improving spatial awareness and engagement, this research advances the field by integrating VR with detailed language and typography considerations, ensuring accessibility and readability in immersive environments (C.-C. Chen & Chen, 2022). This focus on instructional design within VR-based learning environments differentiates LaViGeo from existing VR applications, which often lack a systematic evaluation of multimedia elements (Guo, Kim, & Rubin, 2014).

The findings underscore the potential of VR-based instructional media to improve engagement and learning outcomes in tourism education. Future research should investigate the long-term effects of VR learning on student knowledge retention and academic performance. Additionally, further exploration of cross-platform compatibility and enhancements in accessibility is crucial to promote the broader adoption of VR-based learning tools.

The final stage of this research centered on evaluating the feasibility and effectiveness of the virtual reality (VR)-based instructional media, LaViGeo, which was developed using MilleaLab. Evaluation activities were conducted throughout the ADDIE process, culminating in a final assessment through expert validation and student feedback. The findings suggest that LaViGeo is not only "feasible" for classroom use but also "effective" in enhancing student engagement and improving learning outcomes in the Transportation and Tourism Geography course.

During the needs analysis phase, the research identified a significant lack of interactive instructional media within current classroom practices. To address this gap, the design and development phases incorporated VR-based learning experiences that aligned with the course objectives. Student trials demonstrated a high level of enthusiasm for VR learning, even though challenges related to access to VR equipment were encountered. These challenges were effectively managed through a structured trial process. The final validation conducted by material and media experts confirmed the quality of the instructional media, ultimately resulting in its successful implementation.

This study provides a structured approach to evaluating VR-based instructional media, differentiating it from prior research that primarily focuses on the development or implementation of VR without a comprehensive assessment process (Merchant et al., 2014). While previous studies have demonstrated VR's ability to improve engagement and spatial understanding (Chen & Chen, 2022), this research adds a new dimension by systematically validating VR instructional content through expert review and student feedback.

Unlike conventional multimedia learning tools, LaViGeo emphasizes interactive and immersive experiences tailored to tourism geography education. The study builds upon Mayer's (2020) multimedia learning theory by ensuring that cognitive load is managed effectively through well-structured VR content. Additionally, the evaluation of student enthusiasm and learning effectiveness supports experiential learning theories (Kolb, 2015), reinforcing the value of VR in real-world educational applications.

Moreover, the distinctive aspect of this research is its focus on addressing the technical challenges related to VR implementation. Previous studies have highlighted that the use of VR in education is frequently impeded by technical issues and a lack of familiarity among users. This study tackles these obstacles by involving lecturers trained in MilleaLab to assist students, thereby ensuring a smoother integration and enhancing the overall learning experience.

This research aims to develop virtual reality products that allow students to learn about tourism resources through unique and innovative experiences. To enhance this virtual learning medium, the researchers are maximizing the use of multimedia elements, including images, instructional videos, 360-degree footage, and visual features that create the impression of an immersive environment. (Zakharov, Eremeev, Bavykina, & Makarova, 2020). Thus, students can more easily understand the material presented through the multimedia sources prepared in it.

4. Conclusion

The findings from the research and discussions reveal the following: 1) The development of LaViGeo, a virtual reality (VR) instructional medium utilizing the MilleaLab application, has been confirmed as an effective and viable tool for enhancing students' learning experiences related to tourism resources. By applying the ADDIE model, the study has successfully designed, developed, and validated an immersive and interactive learning resource; 2) Validation from experts indicates that LaViGeo meets the necessary educational standards and is deemed "very feasible" for classroom implementation. Trials conducted with students in both small and large groups have demonstrated that the VR-based instructional media is "effective" in fostering engagement, comprehension, and

independent study. The integration of multimedia components—such as educational videos, 360degree images, and interactive features—has further enriched students' understanding and contextual application of geographical and tourism-related concepts; 3) This study is consistent with earlier research highlighting the advantages of VR in enhancing student motivation, engagement, and comprehension. LaViGeo allows students to virtually explore tourism resources, thereby overcoming geographical limitations and providing a learning experience that traditional methods fail to offer. However, recommendations for future development include improvements in visual quality and broader device compatibility; 4) All feedback from material and media validation, as well as suggestions from prospective users, has been addressed. Nonetheless, certain enhancements were constrained by access limitations within the MilleaLab application, such as restrictions on the direct integration of 360-degree YouTube videos. Additionally, the research was confined to small- and large-group trials, indicating a need for further studies to broaden its scope and effectiveness.

5. References

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