

Virtual Reality Development for Ecotourism Learning Media

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Abstract. Adaptation to technological advancements plays a pivotal role in enhancing the quality of education. One endeavour to achieve high-quality learning is utilising virtual reality as a medium. This research aims to develop virtual reality-based learning media as a creative approach to ecotourism education. The study was designed using the 4D research and development model, consisting of four stages: define, design, develop, and disseminate. The research results indicate that the developed virtual reality learning media is suitable for use in education. This aligns with the validation of media and material experts, who provided favourable assessments on content, language, and presentation. Testing with a limited group also received a positive response. Students assessed that virtual reality media is an engaging and interactive medium.

Keywords: virtual reality, ecotourism, learning media.

INTRODUCTION

Ecotourism is a form of sustainable environmental management. Ecotourism is one of the strategies for preserving nature, promoting sustainability, and increasing ecological awareness [1]. As a strategy for sustainable development, implementing ecotourism aims to protect the environment and improve the community's economy [2]. Ecotourism provides dual benefits by emphasising environmental conservation and social empowerment. Communities actively manage tourism by considering ecological conservation and economic benefits [3]. In addition, implementing ecotourism also requires attention to the elements of education, protection, and active community supervision [4]. Communities play a crucial role in sustainable tourism management. Through ecotourism, communities activate their groups to engage in tourism management fully. Communities actively contribute to planning, organising, directing, and evaluating tourism development [5]. The full involvement of the community aims to achieve equity and reduce the dominance of the government and the private sector [6]. Educational institutions are essential to increase students' knowledge and comprehension of the value of environmental conservation in the context of ecotourism. Never-

theless, the discipline of ecotourism still uses a restricted number of learning methods that do not fully leverage technological improvements.

Ecotourism is one of the Geography Education Study Program courses at Samudra University. Ecotourism's course goals are to develop student's abilities to analyse the urgency of environmentally conscious development in tourism using spatial and ecological perspectives. Innovative learning media are needed to enhance students' knowledge and interest. Preliminary studies indicate that ecotourism learning in the Geography Education Study Program at Samudra University uses lecture methods, individual assignments, and group discussions. Towards the end of the course, the learning method involves team-based projects. So far, learning media have included textbooks, news, scientific journals, images, and audiovisual media. Despite the use of various media, virtual reality media has yet to be used in learning activities.

Virtual reality (VR) is an innovative medium that assists learning. According to [7], VR promises a new teaching and learning model that better meets the needs of 21st-century learners. Virtual reality media as a learning medium in the ecotourism course is unavailable. Therefore, developing virtual reality learning media is necessary

to support ecotourism learning activities. The development of VR as an innovative learning medium is expected to enhance the effectiveness of ecotourism learning and positively contribute to environmental conservation.

Implementing virtual reality (VR) learning media in education aims to enhance students' absorption of information [8]. Using VR technology in teaching media will make learning media more engaging and interactive [9]. Ariatma's study shows that virtual reality can increase student participation and critical thinking skills in online learning during the COVID-19 pandemic [10]. Virtual reality can also improve the understanding and learning interests of elementary school teacher education students at Makassar State University. The study [11] also indicates that using virtual reality to teach high school students mathematics can enhance motivation and learning outcomes. According to these study results, using Virtual reality learning media can result in quality learning. While virtual reality has been widely utilised in education, it has yet to be utilised as a learning medium in ecotourism courses. Therefore, developing virtual reality learning media is necessary to support more innovative learning activities. Consequently, developing VR as a learning medium in the ecotourism course is crucial. Through content development in VR, students can gain a profound learning experience and engage directly with the ecotourism environment virtually.

METHODS

The research method utilises research and development. New and more innovative learning aspects can be developed and applied through the research and development (R&D) approach. This study is designed as development research using the Four D Models, which consist of four stages: define, design, develop, and disseminate [12].

The first stage is determining the reference for media development based on needs analysis. The needs analysis aims to identify deficiencies in the learning process. The needs analysis includes analysing the materials, learning objectives, and assignments. Material analysis seeks to determine the parts of the material that will be studied. Specifications of learning objectives involve elaborating learning achievements into more specific indicators tailored to the material analysis re-

sults. Task analysis is developed based on ecotourism materials' essential competencies and achievement indicators. The results of the needs analysis serve as a reference in media design.

The development stage is producing the final media according to the desired specifications. At this stage, media and subject matter experts validate the designed press. Furthermore, the virtual reality media is tested on a limited basis with ten students. Validator corrections and user media assessments are used for media improvement. The product assessment questionnaire includes two assessment aspects, namely attractiveness and interactivity. The questionnaire contains four response options: strongly agree, agree, disagree, and strongly disagree. If respondents mostly choose to agree and strongly agree, this indicates a positive response, and the product is considered suitable for use in learning. The final stage is to disseminate the product to colleagues and students.

RESULTS AND DISCUSSION

Define. The define stage is the phase of determining the reference for instructional media development. The media development in this study is based on analysing deficiencies in the implemented learning process. Based on the interview results, it is known that the teaching methods used are lectures, discussions, and field observations. The most frequently used instructional media are textbooks, news, journals, images, and audiovisual media. The tasks given to the students are to review ecotourism through written and audiovisual press found in journals and social media platforms. Before the final exam, students are assigned to directly observe the ecotourism industry in groups, done on holidays, from a distance, and within a short period. These limitations result in the observation reports only achieving limited learning objectives and topics. Virtual reality instructional media can overcome the limitations of issues and learning achievements.

The developed virtual reality media refers to four topics in the ecotourism course. The first topic is the potential of natural tourism and job opportunities in ecotourism. The specific objectives of this topic are for students to analyse the potential of natural and ecotourism tourism, identify job opportunities in the ecotourism industry, and describe various ecotourism products that can be

developed and promoted. Students virtually observe through the Ujung Tamiang Ecotourism virtual reality media to achieve this goal. They are then tasked with preparing a report on the potential of natural tourism and ecotourism. The report includes a description of natural potential, job opportunities in the field of ecotourism, and an analysis of various ecotourism products that can be developed.

The second topic is ecosystems, biodiversity, and their utilisation in ecotourism. The specific objective of this topic is for students to identify ecosystems, vulnerabilities, and threats in ecotourism. Students virtually observe through the Ujung Tamiang Ecotourism virtual reality media to achieve this goal. They are tasked with creating a presentation on the potential and vulnerability of ecosystems and making recommendations for ecotourism utilisation patterns.

The third topic is the introduction to attractions and the development of ecotourism products. The specific objective of this topic is to identify and evaluate the potential development of ecotourism products. Students virtually observe through the Ujung Tamiang Ecotourism virtual reality media to achieve this goal. They are tasked with designing an ecotourism attraction development plan in the form of a project proposal.

The fourth topic is the evaluation of ecotourism products. The specific objective of this topic is to analyse the risks associated with ecotourism development and develop strategies to mitigate these risks. Students virtually observe through the Ujung Tamiang Ecotourism virtual reality media to achieve this goal. They are tasked with evaluating the strengths and weaknesses of ecotourism products and providing recommendations for enhancing visitor experience and their positive impact on the environment and local communities.

Design. The design stage is the stage of designing virtual reality media. At this stage, the researcher designs virtual reality content tailored to the needs of ecotourism learning. The design of virtual reality media uses the 3D Vista application, software that can process 360 photos and videos into virtual reality content. The virtual content presents four observation locations, namely: 1) Tuntong Laut Information House located in the residential area of Kuala Pusung Kapal Village; 2) sea transportation; 3) Ujung Tamiang Mangrove Educational Tourism; and 4) Pusung

Sium. Each displayed location also provides clickable buttons to access the provided information.

Table 1 – Virtual Reality Design

No.	Location	Appearance
1.	Information House	Tuntong Laut Information Conservation area model Educational activities
2.	Accessibility	River conditions River transportation Access to the Tuntong Laut habitat
3.	Ujung Tamiang Mangrove Educational Tourism	Tuntong Laut nests Release of Tuntong Laut Socialisation area Rest area
4	Pusung Sium Island	Sea Beach

Information House. The first location displays the Tuntong Laut information house, which consists of five areas: the front yard, the hall, the side room, the back room, and the dock. The front yard features a sand pool that serves as a place for Tuntong Laut egg incubation. The hall is the main room that displays Tuntong Laut posters, fossils, and a conservation area model. Additionally, the hall functions as a classroom or meeting room. Each object in the main room has buttons that display information in the form of posters, photos, and videos. The side room, located on the south side of the hall, functions as an incubator for young Tuntong Laut. This area provides buttons that display informational videos about tukik. Next is the back room, which serves as a storage area for conservation equipment. The next room is the dock, located behind the information house. Information and teleportation buttons are provided in each room, allowing users to obtain information and move from one room to another.

Accessibility. The visualisation of the second location presents the river conditions, the boat used, and the atmosphere while passing through the river channel. The river conditions are visualised in two river channels, the Tamiang River and the Alur Barom River. In both river channels, photo and video buttons present the journey atmosphere. Additionally, teleportation buttons are

provided that lead to the Information House, Ujung Tamiang, and Pusung Sium.

Ujung Tamiang Mangrove Educational Tourism. The third location is located at the mouth of the Ujung Tamiang River. This location is known as Ujung Tamiang Mangrove Educational Tourism. The visualisation of the third location displays the beach and a rest house. Ujung Tamiang Beach is a place for Tuntong Laut breeding and the Tuntong Laut release area. In addition to displaying beach visualisation, the beach virtual reality also provides photo album buttons and videos of Tuntong Laut egg survey activities and releases. The visualisation of the third location also shows the rest house and the socialisation area. The visualisation of the socialisation area embeds buttons that display socialisation activities.

Pusung Sium Island. Pusung Sium Island is a public tourist location and a Tuntong Laut breeding site. In this location, teleportation buttons allow users to move from one point to another, which is still in Pusung Sium.



Figure 1 – Virtual Reality Display Map

Develop. The development stage aims to produce the final media according to the desired specifications based on the assessment of media experts, subject matter experts, and student media users. Media experts and subject matter experts validate the designed media. Furthermore, virtual reality media was tested on a small group consisting of 10 students who were media users. Validator corrections and media user assessments are used for media improvement.

Table 2 – Validation from Media and Material Experts

No.	Validator	S	N	S, %	Criteria	Category
1.	Dr. Rima Meilita Sari, M. Pd.	85	90	93	Excellent	Eligible
2.	Ramdan Afrian, M. Pd.	122	130	94	Excellent	Eligible

Based on Table 3, the media expert validated the developed virtual reality product by giving a score of 93%. This score indicates that the developed media has high attractiveness and interactivity. This is based on the assessment of linguistic and display aspects. The linguistic aspect of the product is communicatively conveyed using short, concise, and clear sentences, making it easy to understand. The display assessment includes bright colour designs suitable for learning materials and easy-to-use navigation buttons. According to the media expert's assessment, the developed learning media is rated as "excellent" and considered "eligible" for use. Subject matter experts have also validated the virtual reality product. The material assessment aspects include content, language, and presentation. The subject matter expert gave an average score of 94% with an "excellent" rating and considered it "eligible". Based on this validation, the developed product is deemed suitable for use. This aligns with [13] opinion, stating that the developed media can be used if the trial reaches 81.00%-100.00%.

Furthermore, the product was tested on a limited group of 10 students. Based on the feasibility test, the students scored 96% for attractiveness and 95% for interactivity. These scores indicate that the developed media has high attractiveness and interactivity. This is based on assessing easily understandable language, bright design aspects, accurate room simulations, and components such as images and clear sensory sounds. Through virtual reality media, users can virtually see the Ujung Tamiang ecotourism location using 360-degree panoramic photos that allow users' perspectives to reach beyond one frame and encompass the entire space. This makes users feel as if they are at the location.

The learning process using virtual reality media makes the learning experience engaging and interactive. Users can obtain detailed information about the presented objects because corresponding data and information accompany each main object. For example, when users are in the hall

and want to know more details about the conservation area. Users can press the button on the conservation area model, which will display the map and video of the conservation area. Furthermore, users can choose whether to view the map or the video. This also applies to other objects. For example, if users want to see fossils or tukik, they can click on the desired object, which will display information in the form of descriptions in the form of posters, images, or videos on the screen. Interaction between students and virtual objects makes learning more engaging and interactive. Authors [14] argue that virtual reality in learning helps teachers create exciting new opportunities to support various types of interactive learning environments.

Disseminate. At this stage, virtual reality media is disseminated to colleagues and students. The developed learning media is based on the .exe application that can be installed on the Windows operating system.

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CONCLUSIONS

Virtual reality is a learning medium capable of providing a digital learning experience that aligns with the development of information technology. Research findings indicate that the developed virtual reality learning media is suitable for use in education. This is achieved through validation from media experts and content experts and testing with a limited group, who responded positively and evaluated that the developed virtual reality is an engaging and interactive medium based on assessments of content, language, and presentation aspects.

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