

## Research article

# Geography Virtual Reality for Learning About Ecotourism and Rural Sustainability

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## Abstract.

Tourism has an essential role in economic development through improving people's welfare. However, tourism activities are vulnerable to global issues, one of which is the COVID-19 pandemic. Social restrictions on economic activity have implications for the sustainability of tourism. One effective strategy to maintain tourism sustainability in regional development can be achieved through education channels by packaging the concept of tourism into virtual reality (VR) 360<sup>0</sup>-assisted learning materials. This study aimed to develop VR 360<sup>0</sup> media in supporting geography learning on sustainable ecotourism. This was development research using the PLOMP model, which consisted of 3 stages: (1) preliminary research; (2) prototype design and development; and (3) evaluation. The results showed that the VR 360<sup>0</sup> media helped the student's learning process actively and independently through interaction with 360<sup>0</sup> panoramic projections and multimedia. Immersive learning experiences involving complex thinking and contextual reflection were formed through the VR 360<sup>0</sup>-assisted learning activities with learning outcomes of a) information literacy, b) exploration, and c) reflection on the content of sustainable ecotourism. Learning activities engaged through the virtual environment are expected to foster a good understanding in the student environment of the importance of managing and developing ecotourism in supporting rural sustainability.

**Keywords:** mobile immersive, geography, virtual reality 360<sup>0</sup>, ecotourism, rural sustainability

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## 1. Introduction

Tourism has an essential role as a driver of Indonesia's national economy. Tourism helps the development of a country by improving the socio-economic welfare of the community [1,2]. The development of tourism in local communities through the management of natural and cultural resources [3] can increase the development of a region [4]. However, the COVID-19 pandemic presents new challenges in tourism sustainability [5,6], one of which is the implementation of mobility restrictions in tourism activities [7]. One effective strategy to maintain tourism sustainability in regional development is integrated through education by packaging tourism concepts into learning materials.

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Ecotourism and Rural Sustainable materials are included in the Geography curriculum of Senior High Schools in Indonesia. Education has a vital role in tourism because it effectively supports tourism activities [8]. The scope of tourism material includes tourism, Ecotourism, and Rural Sustainable [9]. Characteristics of complex material by combining theoretical learning and practical activities in the field. The characteristics of this material help foster a contextual reflective learning process through Ecotourism materials [10] and complex thinking through Rural Sustainable materials that are multidisciplinary [11].

This material is linear with the Ministry of Tourism and Creative Economic policy, which focuses on tourism development based on local (village) potential. In Ecotourism material, students are faced with how to maintain the authenticity of nature and the environment, art and culture, customs, the way of life, maintain flora and fauna, and protect the environment [12]. Meanwhile, in the competencies that must be possessed in sustainable rural materials [13], students can analyze rural potential (socio-cultural conditions, local people's way of life, physical potential, social institutions), which can be developed into sustainable nature-based villages tourism. The limitations of actual learning during the COVID-19 pandemic forced field learning to be impossible, thus requiring media to facilitate the Geography learning process during the pandemic, one of which was virtual reality (VR) media.

The development of virtual reality-based mobile devices initiates innovation in geography learning. A mobile application based on a virtual environment helps the Geography learning process strengthen students' spatial abilities and intelligence [14]. In addition, the learning process that is integrated with virtual reality facilitates the student's learning process through the accessibility of virtual learning objects [15,16]. Learning objectives are easy to achieve because students are actively involved and interact with the virtual environment [17]. On the other hand, the promotion of tourism activities in geography learning can foster a sense of concern for students on aspects of the village economy through tourism sustainability. This study aims to develop virtual reality learning media to accommodate geography learning on ecotourism and rural sustainable materials.

Mobile VR development is oriented towards interactive activities and immersive experiences. Researchers developed VR with a visual representation of 360°. The 360° concept allows users to interact with the content of the 360° panoramic environment [18,19], so it does not require excessive computing power on user accessibility. VR representation is designed and implemented meaningful learning design with full access to 360° VR panorama to enhance student immersive experience. Meaningful learning can increase student participation and involvement in learning activities [20].

## 2. Methods

### 2.1. Object Research

The location of this research is Ecotourism Cafe Sawah (1,060 masl) Pujon Kidul Tourism Village, Pujon District, Malang Regency, Indonesia. The location is at -7.85 South Latitude and 112.45 East Longitude. Physiographically, Pujon Kidul Village is located in the highlands with a 25-40% slope [21], with an area of 8,500m<sup>2</sup> [22]. From a geological point of view, Pujon Kidul Village is dominated by volcanic landforms due to the process of volcanism of Kawi-Butak volcanic rock (Qpkb formation) with volcanic activity (volcanic breccia, lava, tuff, and lava). This can be seen in the physical characteristics of the black volcanic soil color with land use in the form of agriculture and plantations.



**Figure 1:** Photo of Aerial (Drone) Cafe Sawah.

### 2.2. Research Methodology

The development of VR as a Geography learning medium is included in research and development using the PLOMP model. The PLOMP model was chosen because it has clear and detailed development procedures and is product-oriented [23]. The development procedure should be clear and systematic [24]. The PLOMP development model has three stages; Preliminary Research, Prototype Planning, Development, and Evaluation [25].

TABLE 1: PLOMP Model Procedure on 360° VR Development.

Procedure	Activity	Activity
Preliminary Research	Observation and analysis of needs at the research site	Potential and problems at the research site.
Prototype Design and Development	Design and development of prototypes in the form of prototype and framework designs development	Prototype and results of VR product validation (formative evaluation).
Evaluation	Product trial on users	Summative evaluation of VR products.

### 2.3. Prototype Design

VR 360 serves as an accurate visual representation of the geosphere phenomenon. In this development, the visual representation in VR 360 is based on Ecotourism and Rural Sustainable content. The following is the scope of VR 360 content on Ecotourism and Rural Sustainable materials.

TABLE 2: Ecotourism and Rural Sustainable Content Scope in VR 360°.

Variabel	Indicator	Sub-Indicators
Ecotourism and Rural Sustainable	Environmental Conservation	Conservation efforts Environmental Quality. Settlement and Land Use. Population and waste management. Unsustainable resource use and risk areas.
	Cultural Preservation	Impact on socio-population Population density Population pressure during tourist visits High cost of living Influence on local communities
	Community Participations	Active participation of local communities Social relations Social interaction and communication
	Economics Benefits	Local economic conditions Accessibility of work and Employment Welfare Economic policy Education Infrastructure procurement
	Empowerment of Vulnerable Groups	Tourism Planning and Management towards empowering communities and vulnerable groups Health Education Individual Safety

Source : (Modifications Cobbinah, P. B, 2015 and Bryden, J, 2002)

### 2.4. Framework Development

The VR 360° framework design includes a web-based application with mobile (smartphone) access. The selection of the VR 360° development design is based on the accessibility of the user's complexity. Furthermore, Internet access with the hyperlink concept facilitates acquiring new knowledge and information by users to use it as a medium in learning effectively.

The development of the VR 360° is designed with an emphasis on providing users with an immersive experience. Information on material content is packaged in a visual

representation of the 360° panoramas. This content packaging helps users interact massively with the material content presented in the object hotspot of interest in the 360° panoramas. The division of dimensions in the development of VR 360° is divided into three systems (visual [infographics and poster], audio [storytelling and background], and audiovisual [video]), device, and content (user guide and learning material). Development framework for the VR 360° development;

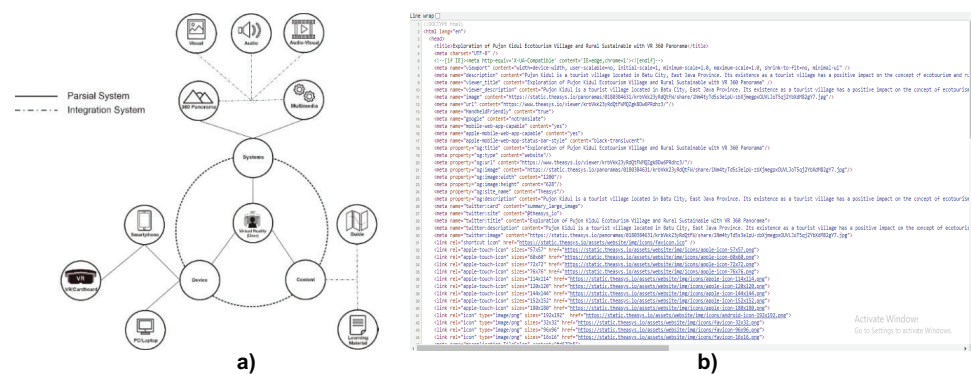


Figure 2: VR 360° framework development, (a) VR 360° system design and (b) VR 360° Source Code.

### 3. Result and Discussion

The design of the VR 360° prototype is directed at further development through the research and development process. Student accessibility to VR 360° is based on a web-based application with two main features, namely 1) a projection area in the form of a visual representation of 360° panoramas; and 2) Menu bar containing access to VR 360° (smartphone and PC/Laptop), apperception, and other features (multimedia on hotspots of interest).

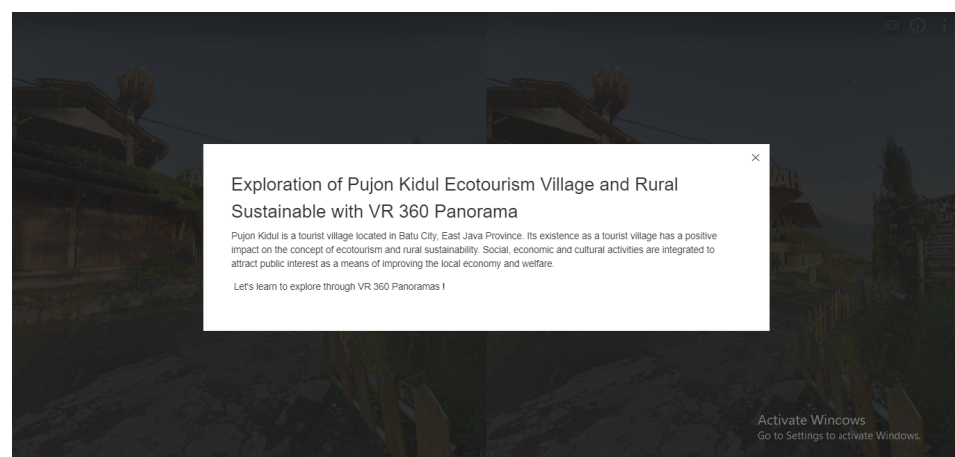
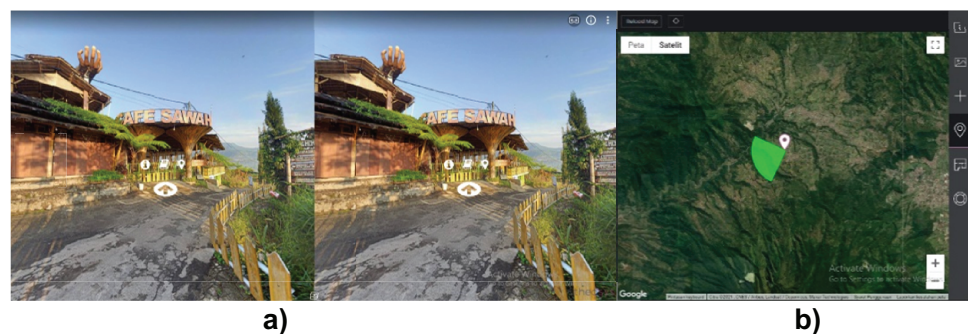


Figure 3: Introductory Information on VR 360°.

Initial access to VR 360° is done by adjusting the device used (smartphone or PC/Laptop). The use of devices in VR 360° determines users' immersive experience in accessing Ecotourism and Rural Sustainable content. Packaging of material contained within the scope of Ecotourism and Rural Sustainable is contained in various indicators such as Environmental Conservation, Cultural Preservation, Community Participation, Economic Benefit, and Empowerment of Vulnerable Groups.

Access to the material contained in the scope of Ecotourism and Rural Sustainable is presented with a hotspot of interest with visualization through various icons (photos, videos, infographics, posters). In addition, access is designed with hyperlink technology that can assist users in searching for information in an organized and in-depth manner so that students gain new knowledge and experiences in their cognitive aspects and skills and attitudes in exploring activities on VR 360°.



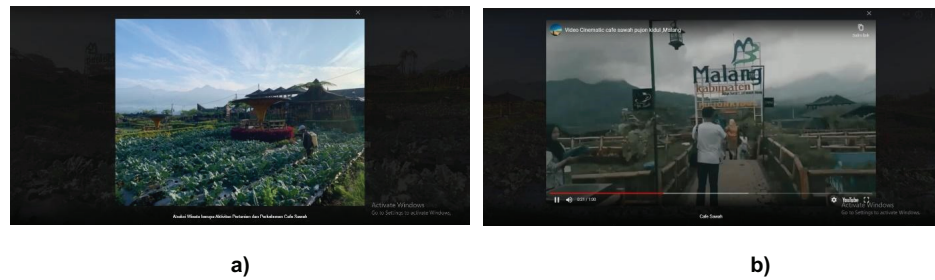
**Figure 4:** VR 360° View (a) HMD (High Mounted Display) Access by User (Student) and (b) Teacher Monitoring via Geolocation.

Figure 4a shows users (students) learning to explore using the projection area media on the VR 360°. In addition, hotspots of interest in icons help students deepen material content in agricultural activities in tourism objects, environment-based tourism, and community empowerment-based village development. Figure 4b shows the monitoring carried out by the teacher to students in exploratory learning activities. Monitoring in the form of assisted orientation with a satellite image base map makes it easier for teachers to monitor student learning activities based on the geographical characteristics of an area, mainly related to Ecotourism and Rural Sustainable materials (table 2).

The features in the VR 360° support the Geography learning process. The features in the VR 360° have functionalities that support the learning process. About Ecotourism and Rural Sustainable materials, VR 360° provides a new experience in teaching and learning activities.

Based on table 3 shows were learning activities using VR 360° regarding the packaging of Ecotourism and Rural Sustainable material content. The content of the material is adjusted to the students' thinking stages [26]. Students are directed to search and





**Figure 5:** Access information on VR 360°, (a) Information integrated with visual media (photos), and (b) Information integrated with YouTube platform video.

**TABLE 3:** Ecotourism and Rural Sustainable Content Learning Activities using VR 360°.

Dimension	Features	Activity	Material Details	Achievement Indicator
Content	Learning Material	Interactive and Engagement Information Literacy Ecotourism and Rural Sustainable	Environmental Conservation	Conservation efforts Environmental Quality Settlement and Land Use Population and waste management Unsustainable resource use and risk areas.
		Exploring and Observing the 360 panoramic projection area	Cultural Preservation	Impact on social-residential life. Population density Population pressure during tourist visits High cost of living Influence on local communities
			Community Participations	Active participation of local communities Social relations Social interaction and communication
		Explaining the Evidence of the Ecotourism and Rural Sustainable	Economics Benefits	Local economic conditions Job accessibility and Employment Prosperity Economic policy Education Infrastructure procurement
			Empowerment of Vulnerable Groups	Tourism Planning and Management towards empowering communities and vulnerable groups Health Education Individual Security

read information about Ecotourism and Rural Sustainable materials in the first activity. The concept of affordability of students as users in VR is packaged by presenting new knowledge through interactive and complex information literacy learning activities [27]. The achievement of the temporal indicator in this activity is in the form of Environmental Conservation. Environmental Conservation indicators require an in-depth concept understanding, which trains and becomes a mindset domain for students to make decisions [28]. Students must be responsible for maintaining the quality of the

environment, settlements and land use, population and waste management, and the use of unsustainable resources in ecotourism and rural sustainable in the surrounding environment.

Students can use VR 360<sup>0</sup> for observation and exploration of cultural preservation and community participation. VR serves to strengthen concepts through the organization of perceptions and understandings that have been obtained by integrating practical activities in the projection area in the form of 360 panoramas assisted by multimedia [29]. Achievements are formulated; namely, students can identify critically about the social conditions of the population, and active community participation is seen in community-based local potential management. Thus, students will know the impact of Ecotourism management in an area with real implications for Rural Sustainable.

The last activity was using VR 360<sup>0</sup> media in the form of Explaining the Evidence of the Ecotourism and Rural Sustainable. Students are actively and collaboratively [30,31] able to show actual evidence based on facts in the field regarding ecotourism and rural sustainable materials. The evidence that shows the influence of Ecotourism on Rural Sustainable is contained in the detailed material on Economic Benefits and Empowerment of Vulnerable Groups. Evidence of the success of the economic activity is found in the achievement of local community welfare in the form of employment accessibility, equitable distribution of economic policies, procurement of infrastructure in the form of Education and Health infrastructure, and ensuring individual security. This evidence in activities is shown with the help of the 360<sup>0</sup> VR projection area, emphasizing the formation of immersive experiences [32] with active and independent activities through manipulating the virtual environment as a contextual learning environment for students.

## 4. Conclusion

Ecotourism and rural sustainable materials provide added value to the learning process, mainly related to theoretical and practical studies in geography learning. The introduction channel through education about Ecotourism and Rural Sustainable can help foster students' complex and contextual reflective thinking in their role as the younger generation in supporting village sustainability. However, the COVID-19 pandemic presents new challenges in the sustainability of tourism, especially in learning Geography. This research aims to develop learning media based on VR 360<sup>0</sup> in Ecotourism and Rural Sustainable materials. The position of technology has a central role in the continuity of an effective and efficient learning process. VR 360<sup>0</sup> as a form of



technological innovation in learning has a positive impact in supporting the Geography learning process. Ecotourism and Rural Sustainable Geography material characteristics are complex and multidisciplinary, and field-based require VR 360<sup>0</sup> as an innovative and comprehensive learning medium. Through VR 360<sup>0</sup>, it can foster complex and contextual reflective thinking in studying Ecotourism and Rural Sustainable. Exploration activities in the projection area help in achieving learning in the form of information literacy, exploration, and reflection, so that tourism sustainability can be achieved in the Education channel through strengthening students' understanding and concepts as a basis for mindset and decision making in managing Ecotourism in improving Rural Sustainable in the vicinity.

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