



Needs analysis for the development of ARVR-based teaching materials to support biodiversity literacy in Sebangau National Park

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Article Information	Abstract
Keyword: Augmented reality; Virtual reality; Biodiversity literacy; Central Kalimantan; Ecotourism Kata Kunci: Augmented reality; Virtual reality; Literasi biodiversitas; Kalimantan Tengah; Potensi lokal; Ekowisata History: Received : 22/07/2024 Revised : 14/05/2025 Accepted : 03/06/2025 Published : 13/06/2025	Central Kalimantan is one of the regions in Indonesia that has high biodiversity, but unfortunately, this biodiversity is now threatened by various human activities and forest fires, which still frequently affect forests in Indonesia. In this study, we focus on analyzing teacher and student perceptions about the development of ARVR-based teaching materials, especially to support biodiversity literacy. The research method used was a qualitative descriptive design. Data collection was carried out by distributing questionnaires to two junior high school teachers and twenty junior high school students in Palangkaraya City, Central Kalimantan. The collected data were analyzed using descriptive analysis. The results of this research show that teachers have never developed their own teaching materials, especially ARVR-based materials that discuss rare plants and animals in Sebangau National Park, while students believe that the use of ARVR-based teaching materials will make learning activities more interesting. This research concludes that the development of ARVR-based teaching materials is a very important effort based on teacher and student perceptions, and it is important to continue in future research to develop the materials and test their effectiveness. <i>Abstrak. Kalimantan Tengah merupakan salah satu daerah di Indonesia yang memiliki keanekaragaman hayati yang tinggi, namun sayangnya keanekaragaman hayati tersebut kini mulai terancam oleh berbagai aktivitas manusia dan kebakaran hutan yang masih sering melanda hutan-hutan di Indonesia. Dalam penelitian ini kami fokus untuk menganalisis persepsi guru dan siswa tentang pengembangan bahan ajar berbasis ARVR, khususnya untuk mendukung literasi keanekaragaman hayati. Metode penelitian yang digunakan adalah metode penelitian kualitatif deskriptif. Pengumpulan data dilakukan dengan menyebarkan kuesioner kepada 2 orang guru SMP dan kepada 20 siswa SMP di kota Palangkaraya Kalimantan Tengah. Data yang terkumpul dianalisis dengan menggunakan analisis deskriptif. Hasil penelitian menunjukkan bahwa guru belum pernah mengembangkan sendiri bahan ajar khususnya bahan ajar berbasis ARVR yang membahas tentang tumbuhan dan satwa langka di taman nasional sebangau, sedangkan siswa berpendapat bahwa penggunaan bahan ajar berbasis ARVR akan membuat kegiatan belajar menjadi lebih menarik. Penelitian ini menyimpulkan bahwa pengembangan bahan ajar berbasis ARVR sangat penting dilakukan berdasarkan persepsi guru dan siswa dan penting untuk dilanjutkan pada penelitian selanjutnya untuk mengembangkan bahan ajar tersebut dan menguji efektivitasnya pada penelitian selanjutnya.</i>

A. Introduction

Central Kalimantan is one of the regions in Indonesia that has high biodiversity, but unfortunately this biodiversity is now threatened by various human activities and forest fires which still frequently hit forests in Indonesia (Abram et al., 2021; Astuti & Fatimah, 2024; Baging, 2023; Kadir et al., 2022). The case of forest fires is an environmental problem which indicates that there is still a lack of environmental awareness so it's necessary to make an effort to increase awareness to carry out conservation efforts, one of which is through education or what is also called biodiversity literacy.

Biodiversity literacy includes the fundamental process of biodiversity awareness (Moss et al., 2014). Biodiversity literacy is defined as the ability to understand the concept of biodiversity and the ability to have knowledge about specific actions that lead to biodiversity conservation (Hooykaas et al., 2019; Schneiderhan-Opel & Bogner, 2020). By mastering the concept of biodiversity literacy, a person will have a sense of concern for conditions in the surrounding environment, especially regarding the preservation of resources. its natural power. These efforts are important to ensure sustainable biodiversity (Widiyatmoko & Daeni, 2021).

One effort that can be made to support increasing biodiversity literacy is by integrating science learning with problems in the surrounding environment, one of which is the problem of excessive use of natural resources (Dwianto et al., 2017). This is also in line with the characteristics of science learning where science essentially consists of processes, products and scientific attitudes (Mbari et al., 2018; Utami et al., 2016), so that it can help students' understanding of science concepts as a whole, not only in theory but also in practice.

One of the applications of science learning at the junior high school level to support biodiversity literacy can be optimized by using digital-based teaching materials, which are in line with developments in science and technology. The development of science and technology will create new trends and become the main pillars for the development of the world of education, as the forerunner to the development of the era of society 5.0 (Risdianto et al., 2020). So, in practice, teachers as the spearhead of education are also required to be able to integrate the use of digital technology in their learning activities (Widyawati et al., 2024). One of the digitalization of learning activities can be the use of digital-based teaching materials which have many positive impacts on improving the quality of learning.

Several studies state that there is a positive impact from the use of digital-based teaching materials on learning activities at the elementary (17) (Fatchurahman et al., 2022), middle school (Yager & Akcay, 2010), and high school (Roswati et al., 2019) levels. This is in line with the results of previous

research by the research team where the use of digital-based teaching materials is still rarely used in learning activities, even though students and teachers feel the need for innovation through the use of these teaching materials. Even now, the development of new technology in the world of education is designed to increase user involvement, such as the use of augmented reality (AR) and virtual reality (VR) which have proven effective in increasing student understanding. Based on these references, through the use of AR and VR-based teaching materials in science learning in junior high schools, it is hoped that it can help students' understanding and provide a more concrete learning experience, especially to support increasing biodiversity literacy.

Biodiversity literacy is a very important competency for students to master; this is in order to maintain the preservation of biodiversity in Central Kalimantan in particular. In our previous research, we succeeded in uncovering various potential unique biodiversity in Central Kalimantan, including the endemic karamunting plant which has the potential to be developed as a food fortification ingredient (Zannah et al., 2022a), the galam plant which can be developed as an anti-bacterial soap (Azhari & Zannah, 2022), the bajei plant which used by the Dayak tribe as an anti-acne medication and to increase breast milk production (Zannah et al., 2022b; Zannah et al., 2017), as well as various other endemic plants in Central Kalimantan which are used by the Dayak tribe to fulfill their health and food needs. The results of our research certainly prove that Central Kalimantan in particular has abundant biodiversity which needs to be preserved, so it is necessary to carry out further research regarding proof of its implementation as a learning resource in science learning activities, one of which is in junior high schools.

In Central Kalimantan there is a protected forest area designated by the government based on the Decree of the Minister of Forestry No. 529/Menhut-II/2012 with an area of 542,141 hectares, namely the Sebangau National Park Area. The natural wealth in Sebangau National Park includes 808 types of flora, 35 types of mammals, 182 types of birds and 54 species of snakes. This diversity is certainly a local potential in the Central Kalimantan region which can be a potential learning source in science subjects for junior high school students, one of which is the material "interaction of living things with their environment".

The use of biodiversity in the Sebangau National Park area as a natural science learning resource with material on "interaction of living things with their environment" in the form of local potential-based teaching materials with digital use in the form of ARVR is of course expected to be a form of innovation in science learning to support increasing biodiversity literacy. Considering that access to

Sebangau National Park is not easy, the use of ARVR-based teaching materials can certainly make learning activities more concrete. Based on this, research and development are urgently needed to produce ARVR-based science teaching materials that are valid, effective and efficient to support increasing biodiversity literacy for junior high school students in Palangkaraya City in particular, where previously it is necessary to carry out a needs test analysis first regarding the research and development activities. So, the aim of this research is to analyze the need for the development of ARVR-based teaching materials to support biodiversity literacy, especially that discuss about rare plants and animals in sebangau national park.

B. Material and method

The method of this research is a descriptive qualitative by used surveys to collect data. Research design can be seen in Figure 1. The research was conducted at Imam Nawawi junior high school in Central Kalimantan, Palangkaraya city. The research respondents were 2 teachers and 20 junior high school students in 7th grade, Imam Nawawi junior high school.

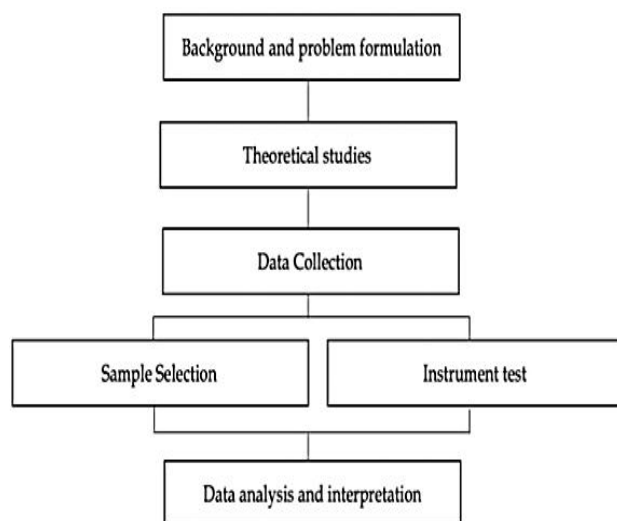


Figure 1 Research design

The research starts with quantitative research and continues with qualitative research following an explanatory strategy. In this research, the instrument that used is questionnaire to analyze the student and teacher perceptions about ARVR based-teaching materials that could improve student biodiversity literacy.

Data analysis techniques that used in this study are data collection, data reduction, data display and

verification (Mohajan, 2017, 2018). Data collection began with researchers distributing questionnaires to 2 teacher respondents and 25 elementary school students determined purposefully.

Then, the data obtained from student and teacher's questionnaire were analyzed by grouping the answers from the teacher and student respondents based on the questionnaire questions, then give a score to each answer according to the scoring criteria and then calculate the total score of the answer.

The questionnaire used the Guttman scale with answer choices "Yes" or "No". Answers "Yes" get a score of "1" and answers "No" not get a score or "0". All answers are then calculated based on percentage (Rosaria et al., 2023).

C. Results and discussion

The results of this research found several facts regarding the perception of teachers and junior high school students regarding the ARVR-based teaching materials which has the potential to improve student learning outcomes, after distributing questionnaires to 20 student 7th grade junior high school students. The results shown in Table 1. Based on the question number 1, the result show that the most students stated that teacher never use the learning media, even though the use of learning media in class is very useful (Diah et al., 2022). Furthermore, based on the question number 2, 80% of students agree that teacher need to used technology-based learning media, where its use can increase student motivation (Mirosunaily & Pramudiani, 2021). Unfortunately, based on question number 3, 70% of students stated that teachers never used technology-based learning media. Even learning media made by the teacher himself that stated in question number 4 where 80% of students stated that teachers had never done it.

The use of learning media can help teachers to deliver material more easily, one of which is in science learning. Based on the question number 5, students stated that when teacher explained the science learning about interaction of living things with their environment, teachers never integrated the material with rare plants and animals in central Kalimantan (100%), whereas the students stated that they need to know about that material based on the answer on the question number 6 (100%), especially in material with the theme "interaction of the living things with their environment" on the question number 7 that made by own teacher based on the question number 8 because students stated that the material is very interesting to study based on the question number 9 (100%).

Table 2 The results of interpretation of student's perception

Question	Percentage (%)	
	Yes	No
1. When learning activities in class, has your teacher ever using learning media especially when explains the interaction of living things with their environment?	0	100
2. In your opinion, is it necessary for teachers to carry out learning media-based technology?	20	80
3. When studying in class, has your teacher ever used a learning media- based technology?	30	70
4. As far as you know, has the teacher ever used learning media-based technology in the form of teaching material written by your own teacher during learning activities in class?	20	80
5. Has your teacher ever explained about something that is unique from Central Kalimantan in the form of rare animals and plants when studying in class especially when explains the interaction of living things with their environment?	0	100
6. In your opinion, do you need to know about the rare animal and plant that exist in Central Kalimantan in its natural habitat?	100	0
7. When studying material with the theme "interaction of the living things with their environment", do you think the teacher needs to convey typical plants in Central Kalimantan as an example?	100	0
8. In your opinion, when the teacher is teaching material with the theme "interaction of the living things with their environment", is it necessary for the teacher to compose his own teaching materials/modules by presenting examples in the form of plants that are typical in Central Kalimantan?	100	0
9. In your opinion, are the rare animal and plants in Central Kalimantan interesting to study? Especially in material with the theme "interaction of the living things with their environment".	100	0
10. In your opinion, when the teacher explains the material with the theme "interaction of the living things with their environment" using rare animal and plants from Central Kalimantan, it will make you more enthusiastic to participate in learning activities? Especially teaching material-based technology like ARVR?	100	0
11. Has your teacher ever using teaching material-based ARVR when explain the materials about "interaction of the living things with their environment"?	0	100
12. Has your teacher ever using teaching material-based ARVR when explain the materials about "interaction of the living things with their environment" especially those that simulate the native habitats of rare animals and plants in Sebangau National Park?	0	100

Table 2 The results of interpretation of teacher's perception

Question	Percentage (%)	
	Yes	No
1. When learning activities in class, do you ever use learning media especially when explains the interaction of living things with their environment?	100	0
2. In your opinion, is it necessary for you as a teacher to carry out learning media-based technology?	100	0
3. When studying in class, do you ever used a learning media- based technology?	100	0
4. Do you ever used learning media-based technology in the form of teaching material written by your self during learning activities in class?	50	50
5. Do you ever explained about something that is unique from Central Kalimantan in the form of rare animals and plants when studying in class especially when explains the interaction of living things with their environment?	0	100
6. In your opinion as a teacher, do you need to explain to your student about the rare animal and plant that exist in Central Kalimantan in its natural habitat?	100	0
7. When studying material with the theme "interaction of the living things with their environment", do you think as a teacher needs to convey typical plants in Central Kalimantan as an example?	100	0
8. In your opinion, when you explain about "interaction of the living things with their environment", is it necessary for you to compose your own teaching materials/modules by presenting examples in the form of plants that are typical in Central Kalimantan?	100	0
9. In your opinion, are the rare animal and plants in Central Kalimantan interesting to explain to your students? Especially in material with the theme "interaction of the living things with their environment".	100	0
10. In your opinion, when you explain the material with the theme "interaction of the living things with their environment" using rare animal and plants from Central Kalimantan, it will make your students more enthusiastic to participate in learning activities? Especially teaching material-based technology like ARVR?	100	0
11. Do you ever using teaching material-based ARVR when explain the materials about "interaction of the living things with their environment"?	0	100
12. Do you ever using teaching material-based ARVR when explain the materials about "interaction of the living things with their environment" especially those that simulate the native habitats of rare animals and plants in Sebangau National Park?	0	100

One of the obstacles may be in terms of accommodation, to accommodate material about typical plants and animals in Central Kalimantan, one of which is in the Sebangau National Park area. In fact, with the development of technology, we can create learning media that can overcome these problems so that we can still present real conditions in the Sebangau National Park environment without presenting students directly, namely by using virtual-based learning media. This is in line with the opinions of students who agree based on the question number 10. Where so far it turns out that teachers have never developed virtual-based learning media (question number 11), especially those that describe conditions in the Sebangau National Park area (question number 12). These results are certainly very unfortunate, considering the potential for utilization of ARVR-based teaching materials especially in science learning. Based on previous research stated that the use of AR and VR has a positive impact on increasing student competence (Buchori et al., 2017; Jamrus & Razali, 2021; Nowlan et al., 2023; Pombo & Marques, 2020; Reeves et al., 2021; Wittayakhom & Piriyasurawong, 2020).

By using ARVR, teacher can make the material more concrete because AR allows superimposition of digital content like the real-world environment via the use of smartphone, tablet or virtual reality (VR) (Reeves et al., 2021). Where this is very important, especially in science and biology learning.

ARVR called mixed or extended reality that enable enhancing reality with digital resources (in the case of AR) or the creation of entirely digital environments (in the case of VR), in which users interact with information and other users. Apps on smartphones that can display information about nearby buildings or trigger location-sensitive media are common examples of AR in use, while immersive 3D virtual worlds that encompass a user's entire field of vision using a dedicated headset are the most common type of VR experience. This has led to a wider adoption in a range of settings, all the way from hospitality training to remote support of workers in dangerous environments such as in nuclear reactors and on the battlefield (Bonner & Reinders, 2018). Of course, this technology can also be adapted to be used in locations that are vulnerable to exploration by junior high school students, one of which is the Sebangau National Park.

Based on Table 2, based on the question number 1, the result show that the teacher never uses the learning media, even though that the teacher agree that the use of learning media is very necessary, especially technology-based learning media (question number 2). In fact, the use of learning media, especially technology-based media, can improve student competence (Pakpahan, 2014). Unfortunately, based on question number 3, teacher stated that he never used technology-based learning media. Even

learning media made by the teacher himself that stated in question number 4.

In the discussion of learning materials in science, it was also discovered that teachers had not integrated the unique animals and plants in Central Kalimantan as learning resources, based on question number 5. Whereas on the other hand the teacher also feels the need to integrate it into learning activities based on question number 6. The use of materials related to specific matters in a region is also known as local wisdom-based learning. The application of local wisdom-based learning has great potential to be applied in the classroom to improve the quality of learning (Ningrum et al., 2018)., so that it can be applied to learning activities in the classroom.

And based on the question number 7, teacher think that teacher needs to convey typical plants in central Kalimantan as an example. And teacher also need to compose their own modules by presenting examples in the form of plants that are typical in central Kalimantan based on question number 8 and number 9.

Then, based on the question number 10, the teacher also agree that the student will be more enthusiastic especially teaching material-based technology and unfortunately the teacher never that used that teaching material-based ARVR. Most of the teacher agree that the use of the learning media important in learning activities. In biology education, the use of learning media is very important because education is a process of two-way communication which teaching is done by teachers as educators while learning is done by learners (Fatmawati, 2016).

In the current era of globalization, the use of learning media, especially technology-based ones, is very important. This is because the massive developing of technology on every life aspect, include in education aspect (Adeliyanti et al., 2021). Because the development of technology in education greatly influences learning strategies (Safitri et al., 2021).

Based on the research result, the teachers stated that they had never used ARVR-based teaching materials (see table 2). Even though the use of ARVR based on the results of previous research, it showed positive impacts, including enrich student experience (Reeves et al., 2021), motivation and students cognitive learning results (Buchori et al., 2017) (Fatma et al., 2021).

Central Kalimantan has very high biodiversity, this is also in accordance with the results of a survey of teachers who agreed that biodiversity in Central Kalimantan in particular has the potential to be used as a learning material. But unfortunately, this biodiversity is located in areas that are difficult to reach, one of which is in Sebangau National Park, so it requires the help of technology, one of them teaching material-based ARVR. Based on the results of previous research, ARVR can be used as a tool to give information about an area with difficult reach, for

example mountains destinations of Western Macedonia (Kleftodimos et al., 2023). These results show that ARVR can also be used to provide a virtual depiction of the location of Sebangau National Park that can developed as teaching materials in science learning.

D. Conclusion

This research concluded that the development of ARVR-teaching material very important thing to do based on teacher and student perception, based on several questions asked. As technology develops, the use of technology-based teaching materials has become a necessity. One of them is using ARVR technology. This research is the reason for the next research to develop the ARVR-based teaching materials especially to enhance biodiversity literacy and to facilitate student to explore biodiversity in Sebangau National Park as Ecotourism Destination which provides economic and environmental benefits.

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