Perceptions of High School Geography Teachers in Langkat Regency Towards Augmented Reality Media on Hydrosphere Content in Improving Critical Thinking Abilities

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ABSTRACT

Augmented Reality (AR) is a technology that has the opportunity to improve critical thinking skills in Geography learning. This research aims to investigate the perceptions of Geography teachers in Langkat Regency regarding using AR media in hydrosphere material to enhance critical thinking skills and explore the difficulties of geography teachers in implementing AR in Geography learning. This research uses quantitative descriptive research with survey methods. The research sample consisted of 43 geography teachers in Langkat Regency. The data analysis technique used is descriptive analysis. Based on the research results, geography teachers in Langkat Regency positively perceive the use of AR in Geography learning. Most teachers know AR's opportunities to improve students' critical thinking skills and are interested in using AR as a medium for learning hydrosphere material. The investigation results also show obstacles to integrating AR in Geography learning, namely the availability of school infrastructure and limited venues for holding activities to increase teacher competency.
1. INTRODUCTION

Geography learning today must develop students' critical thinking skills through digital learning. Critical thinking skills are essential for solving problems in everyday life (Rahmawati et al., 2020; Supena and Hariyadi 2021). In addition, integrating digital technology in geography learning is essential to prepare students to face future job and career challenges (Nadelson and Seifert, 2017; Sousa and Rocha, 2019; Tondeur et al., 2016). Future job trends emphasize critical thinking and problem-solving skills as fundamental competencies (Kirst-Ashman, 2016; Rahman, 2019; Sousa and Wilks, 2018). So, it is vital to implement integrated learning with digital technology, one of which is assisted by augmented reality (AR).

AR is a technology that can facilitate digital learning in geography learning. This technology explains abstract geographic phenomena through 2D and 3D objects on desktop or smartphone screens (Babkin et al., 2021; Dargan et al., 2023; Xu et al., 2022). Students can interact with objects in the real world, learn through experimentation, be interactive, and increase student motivation and interest in learning (Bower et al., 2014; Singhal et al., 2012). In addition, AR can be a Geography learning medium that encourages critical thinking skills (Garzón et al., 2020). One of the abstract geographic materials can be found in the hydrosphere material.

The implementation of AR in hydrosphere materials has received recommendations from several researchers. (Aristo et al., 2018) have developed AR through the Unity application. (Ducasse, 2020) stated that explanations of abstract material in the hydrosphere can use AR media. Apart from that, using AR in this material can also open up opportunities for students to search for data related to environmental issues. However, implementing AR in learning needs to pay attention to teacher readiness based on their perspective.

The challenges of applying AR in geography learning in the Sumatra region need further investigation. In the study of (Wijayanto et al., 2022) on high school geography teachers in Padang Panjang City, the teachers responded positively to AR. They have an excellent readiness to apply AR in geography learning. Additionally, (Nofrion et al., 2018) state that Sumatran teachers' technological competence, especially in Solok Regency, is sufficient to use various learning media, including AR.

Teacher perceptions in implementing AR-based geography learning need to be implemented. Teachers have a prominent role as facilitators and designers in AR-integrated learning. However, further investigation is needed regarding teachers' readiness to use AR. So, this research aims to determine the perceptions of geography teachers in Langkat Regency regarding AR as a medium for learning hydrosphere material in geography to improve critical thinking skills. Apart from that, an investigation into the difficulties of geography teachers in Langkat Regency in implementing AR must also be carried out.

2. LITERATURE REVIEW

2.1. Augmented Reality

Augmented Reality (AR) is a technology that can combine the virtual world with the natural world and then project it in real-time (Caesario and Ardiansyah, 2023; Mustaqim, 2016). As a virtual tool, AR can change information into a visual form that integrates with the natural world (Andriani and Ramadani, 2022). AR has developed rapidly in education with many applications that complement the learning process in all fields and levels of education (Garzón et al., 2019).
AR can help teachers create learning media that is easy to use, creating fun and more interactive classes (Afifah et al., 2019; Seviana, 2022). The use of AR can actively involve students in learning and make it easier to understand the material (Jannah and Oktaviani, 2022; Thahir and Kamaruddin, 2021) by depicting abstract concepts in visual form so that they become more effective (Caesario and Ardiansyah, 2023). AR can make learning more effective by various means of representation, actions, and strategies that involve students in learning activities (Mustaqim, 2016). AR also increases interest and motivation in learning because students can see situations or objects naturally and directly (Mustaqim, 2016; Setyawan and Faturul, 2019). Based on perceptions from previous research, AR is a technology that can potentially enrich students' learning experiences.

2.2. Critical Thinking Skills

Critical thinking skills require a complex process of analyzing and evaluating the information received or solving a problem (Nismaya, 2020). In geography, critical thinking skills are needed so that students can analyze occurring phenomena and formulate solutions (Islami and Hadi Soekamto, 2022). Furthermore, according to (Dwi et al., 2022), critical thinking skills are a driving factor for the success of the learning process. Critical thinking skills in Geography are essential to develop so that students can analyze and solve problems in the surrounding environment with reasonable thinking.

Critical thinking skills can be developed with a series of learning focused on practicing these skills. Through visual literacy, AR can develop students' critical thinking skills (Iqliya and Kustijono, 2019). Research has proven that AR can encourage students' critical thinking skills (Andriani and Ramadani, 2022; Caesario and Ardiansyah, 2023; Mustaqim, 2016). By integrating AR with appropriate learning models, teachers can stimulate students' thinking patterns and critical thinking.

3. METHOD

This research uses quantitative descriptive research with survey methods. Implementation of the survey using Google Forms. The population of this study were all high school geography teachers in Langkat Regency. A total of 43 respondents constituted the research sample. There are 15 statements given with four classification categories. The data analysis technique used is descriptive analysis. This analysis functions to describe numbers in sentences. Measurement of the results of respondents' perceptions via a Likert scale. The Likert scale calculation is carried out by giving a value to each statement. In this research, the assessment classification is described as follows. Strongly agree is stated with a score of four; Agree is expressed with a value of three; Disagreement is expressed with a score of two; And strongly disagree is stated with a value of one. The data processed from the questionnaire is then presented as a percentage. Next, it is described, and conclusions are drawn based on predetermined criteria.

The data processing process in this research uses Microsoft Excel software. The results from respondents will be processed and presented as graphic visualization in the form of a bar chart. The formula used to calculate the percentage of respondents who fall into a particular category determined from the research data interval class in each aspect can be seen in Figure 1.
4. RESULTS AND DISCUSSION

Langkat Regency is one of the North Sumatra districts located in the Bukit Barisan plateau. The Langkat Regency area has a topography that is partly lowland, undulating, hilly to mountainous. These diverse topographic conditions also cause diverse conditions in river watersheds (DAS), which students in the Hydrosphere material cannot cover.

Some hydrosphere sub-materials have a high level of difficulty because they are abstract. For example, in the hydrological cycle, this sub-material cannot be seen clearly but can be felt by humans (Aristo et al., 2018). This certainly makes it difficult for students to learn clearly. So, through AR, students are invited to see the structure and texture of objects on the Earth's surface in 3D (Lukman et al., 2021). Apart from that, AR also facilitates students by providing opportunities for students to understand a phenomenon process. These opportunities can increase student interest and improve critical thinking skills. According to (Buchori et al., 2017), AR influences increasing students' motivation and high-level thinking abilities.

Figure 2 shows a rMau encapsulation of respondents' responses to the four categories of statements given. Based on the interval class, there are four assessment categories: a score of 34-60 is categorized as poor; 61-85 is a sufficient category; a Score of 86-111 is a good category; and a Score of 112-136 is an excellent category. Based on the calculation results, the respondent's response to the efficiency category of technology-based learning media was the highest, with a score of 117.5 (very good). At the same time, the rest show good value categories.

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Based on the data above, geography teachers in Langkat Regency have used good learning strategies. Based on respondents’ perceptions, technology-based learning media creates very efficient learning. Besides that, geography teachers in Langkat Regency also have good AR literacy. Teachers’ perceptions about the efficiency of augmented reality in learning show good results. These data show that geography teachers in Langkat Regency are ready to apply augmented reality in geography learning.

The following discussion will be divided into four parts. First, namely, about geography learning strategies running in schools. Geography teachers in Langkat Regency are very good at implementing learning strategies. This is proven by the fact that as many as 77% of geography teachers in Langkat Regency have abandoned the lecture method in learning. Apart from that, teachers have used media in the learning process.

![Figure 3](https://example.com/figure3.png)

**Figure 3.** Results of Teacher Perception Questionnaires Regarding Learning Media

Second, namely regarding teacher perceptions of the efficiency of technology-based learning media. Based on Figure 3, the perception of Geography teachers in Langkat Regency regarding the use of learning media can be seen. Of the 34 respondents, 65% agreed that learning media can direct students to think critically, 32% strongly agreed, and the remaining 3% said they disagreed.

The data above also illustrates that most Geography teachers in Langkat Regency have used learning media that are easy to obtain and use in learning. All respondents agreed that learning media can increase students' interest in learning. This aligns with the opinion that the primary function of learning media is to motivate or increase students' interest in learning in the learning process (Nazmi, 2017). Apart from that, technology-based learning media can also help teachers in delivering learning material.
### Figure 4. Results of Teacher Perception Questionnaires Regarding The Use of AR

In general, geography teachers' perceptions of AR as a medium for learning hydrosphere material are good. This can be seen from understanding, interest, and experience using AR. As many as 63% of teachers in Langkat Regency have understood AR easily. AR can encourage students to think critically and be highly curious. This positive influence is under research by (Dilmen and Atalay, 2021), which states that using AR in learning can improve students' critical thinking skills and curiosity. Based on teachers' understanding of AR and its positive influence, they want to integrate AR as a medium for high school geography learning in Langkat Regency.

<table>
<thead>
<tr>
<th>Persepsi Guru terhadap Penggunaan Augmented Reality</th>
</tr>
</thead>
<tbody>
<tr>
<td>Media AR dapat mengarahkan siswa untuk berpikir kritis</td>
</tr>
<tr>
<td>Mudah dalam mengimplementasikan penggunaan AR</td>
</tr>
<tr>
<td>Memiliki ketertarikan menggunakan AR pada materi hidroser</td>
</tr>
<tr>
<td>Pernah menggunakan AR pada materi hidroser</td>
</tr>
<tr>
<td>Mengerti dan paham dalam menggunakan AR</td>
</tr>
<tr>
<td>Pernah menggunakan AR dalam proses pembelajaran</td>
</tr>
</tbody>
</table>

0% 10% 20% 30% 40% 50% 60% 70% 80%

- Sangat Baik
- Baik
- Cukup
- Kurang

### Figure 5. AR Examples for Learning on Assemblr Edu

From the various reviews regarding teacher perceptions above, there is a problem that not all teachers can use and utilize AR in hydrosphere material to improve students' critical thinking skills. The most influencing factor is that not all Langkat Regency high schools have
adequate internet facilities and networks. Meanwhile, infrastructure is one factor that influences the quality of learning (Dwiputri et al., 2022). Apart from that, the conditions above also illustrate the need for provision for teachers to contextualize hydrosphere material with technological rocks. According to (Nursyam, 2019), technology-based learning media is conceptually face-to-face learning with the support of information technology.

Examples of AR media with public access can be found on the AssemblrEdu web platform. AssemblrEdu allows teachers to access AR based on the desired material, making learning activities more interactive and collaborative. AR can be integrated as a learning medium through games, simulators, electronic books, and mobile applications. (Carbonell-Carrera et al., 2021) have used AR. This is following several studies that apply AR in geography learning.

Apart from that, to improve teacher competence in pedagogy, content, and technology, good coordination is needed from the Subject Teachers' Consultation Team (MGMP). However, the Geography MGMP in Langkat Regency has yet to intensify activities that can support increasing teacher competency. Meanwhile, according to (Maure et al., 2021), the quality of teachers will increase if the MGMP forum is carried out intensively. Therefore, there needs to be good cooperation from the MGPM Geography team in Langkat Regency to hold activities such as outreach and discussions that can increase the competency of geography teachers.

5. CONCLUSION

Geography teachers in Langkat Regency positively perceive using AR media in geography learning. Most geography teachers in Langkat Regency know the opportunities for using AR and are interested in using AR in geography learning. Based on their experience in utilizing AR media in the Hydrosphere material, AR can encourage students' critical thinking skills and curiosity. However, the availability of facilities and internet networks that are not evenly distributed in Langkat Regency Senior High Schools is the main factor hampering the integration of AR in geography learning. Apart from that, the geography MGMP in Langkat Regency has yet to intensify activities that can support increasing teacher competency. This condition illustrates the need for equal distribution of school facilities and infrastructure and assistance for geography teachers to contextualize geography material with the help of technology.

6. REFERENCES


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