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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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A B S T R A C T

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.

A R T I C L E   I N F O

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 Fatirul, 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.

$$p = \frac{f}{n} \times 100\%$$

Keterangan:
p = presentase yang sedang dicari
f = frekurensi
n = jumlah total frekuensi

Figure 1. Respondent Categorization Formula

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.
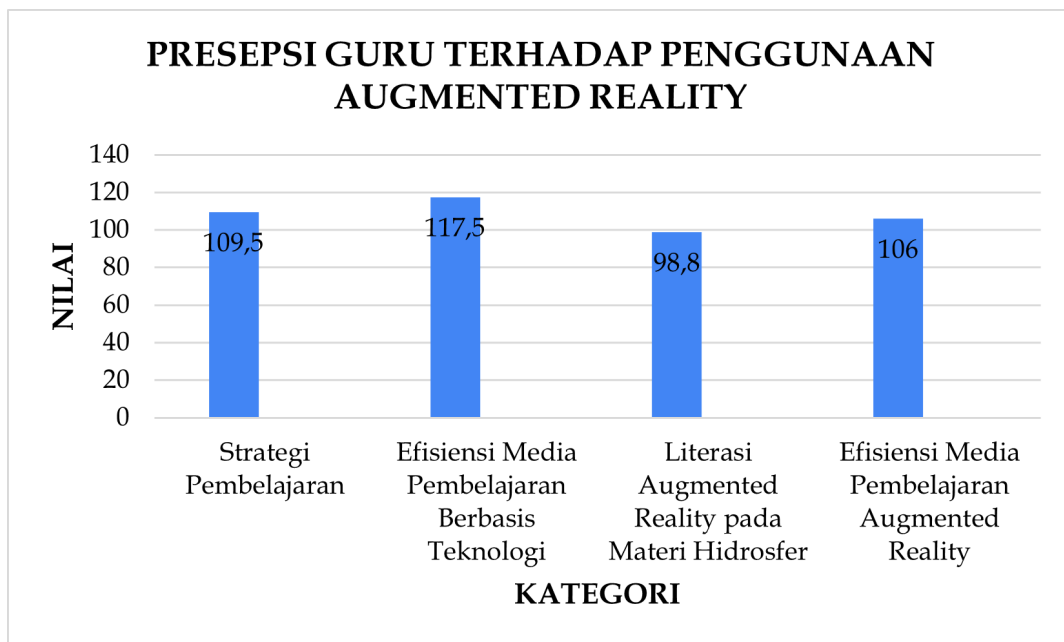

Figure 2. Teacher Perceptions of the Use of AR

Figure 2 shows a rMau ecapitulation 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.

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. 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.
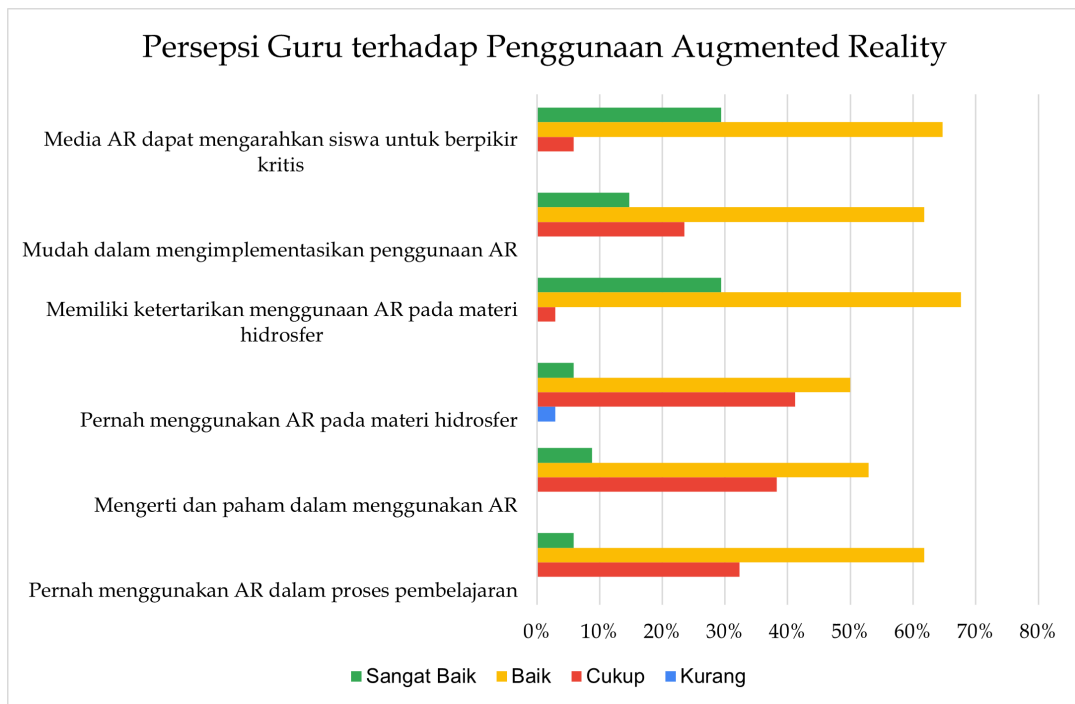
Figure 4. Results of Teacher Perception Questionnaires Regarding The Use of AR

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.

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

Afifah, B., Widiyaningtyas, T., and Pujianto, U. (2019). Pengembangan bahan ajar perakitan komputer bermuatan augmented reality untuk menumbuhkan keaktifan belajar siswa. *Tekno*, *29*(2), 97. https://doi.org/10.17977/um034v29i2p97-115

Andriani, M. W., and Ramadani, A. (2022). Pengaruh Penggunaan Media Augmented Reality Berbasis Android Terhadap Kemampuan Berpikir Kritis Siswa Kelas Sekolah Dasar. *JUPE : Jurnal Pendidikan Mandala*, *7*(2), 567–576. https://doi.org/10.58258/jupe.v7i2.3849

Aristo, R., Afirianto, T., and Akbar, M. A. (2018). Desain dan Implementasi Mobile Augmented Reality Untuk Media Pembelajaran 3D Hidrosfer. *Jurnal Pengembangan Teknologi Informasi Dan Ilmu Komputer*, *2*(12), 7545–7550.

Babkin, V. V, Sharavara, V. V, Sharavara, V. V, Bilous, V. V, Voznyak, A. V, and Kharchenko, S. Y. (2021). *Using augmented reality in university education for future IT specialists: educational process and student research work.*

Bower, M., Howe, C., Mccredie, N., and Robinson, A. (2014). *Augmented Reality in education – cases , places and potentials*. *September 2014*, 37–41. https://doi.org/10.1080/09523987.2014.889400

Buchori, A., Setyosari, P., Dasna, I. W., Ulfa, S., Degeng, I. N. S., and Sa'dijah, C. (2017). Effectiveness of Direct Instruction Learning Strategy Assisted by Mobile Augmented Reality and Achievement Motivation on Students Cognitive Learning Results. *Asian Social Science*, *13*(9), 137. https://doi.org/10.5539/ass.v13n9p137

Caesario, N., and Ardiansyah, A. S. (2023). Telaah Challenge Based Learning berbantuan Augmented Reality terhadap Kemampuan Berpikir Kritis Peserta Didik. *Prosiding Seminar Nasional Matematika*, *6*, 92–99.

Carbonell-Carrera, C., Jaeger, A. J., Saorín, J. L., Melián, D., and De la Torre-Cantero, J. (2021). Minecraft as a block building approach for developing spatial skills. *Entertainment Computing*, *38*, 100427.

Dargan, S., Bansal, S., Kumar, M., Mittal, A., and Kumar, K. (2023). Augmented Reality: A Comprehensive Review. *Archives of Computational Methods in Engineering*, *30*(2), 1057–1080.

Dilmen, I., and Atalay, N. (2021). The Effect of the Augmented Reality Applications in Science Class on Students' 21st Century Skills and Basic Skills. *Journal of Science Learning*, *4*(4), 337–346. https://doi.org/10.17509/jsl.v4i4.32900

Ducasse, J. (2020). Augmented reality for outdoor environmental education. *Augmented Reality in Education: A New Technology for Teaching and Learning*, 329–352.

Dwi, Y., Kurniawan, A., Utomo, D. H., and Insani, N. (2022). Pengaruh model pembelajaran inkuiri terbimbing (guided inquiry) terhadap kemampuan berpikir kritis pada mata pelajaran Geografi siswa kelas X IPS SMAN 1 Genteng. *Integrasi Dan Harmoni Inovatif Ilmu-Ilmu Sosial*, *2*(1), 81–88. https://doi.org/10.17977/um063v2i12022p81-88

Dwiputri, F. A., Kurniawati, F. N. A., and Febriyanti, N. (2022). Pengelolaan Sarana dan Prasarana di Sekolah Dasar dalam Meningkatkan Kualitas Pembelajaran Daring di Masa Pandemi. *Aulad: Journal on Early Childhood*, *4*(3), 198–205. https://doi.org/10.31004/aulad.v4i3.178

Garzón, J., Baldiris, S., Gutiérrez, J., and Pavón, J. (2020). How do pedagogical approaches affect the impact of augmented reality on education? A meta-analysis and research synthesis. *Educational Research Review*, *31*, 100334.

Garzón, J., Pavón, J., and Baldiris, S. (2019). Systematic review and meta-analysis of augmented reality in educational settings. *Virtual Reality*, *23*(4), 447–459. https://doi.org/10.1007/s10055-019-00379-9

Iqliya, J. ., and Kustijono, R. (2019). Keefektifan media augmented reality untuk melatihkan keterampilan berpikir kritis siswa. *Seminar Nasional Fisika (SNF) 2019*, 19–25.

Islami, M., and Hadi Soekamto. (2022). Efektivitas Model Pembelajaran Inquiry Menggunakan Quizizz Multimedia Berbasis Gamification terhadap Kemampuan Berpikir Kritis Siswa. *Jurnal Ilmiah Pendidikan Profesi Guru*, *5*(2), 383–392. https://doi.org/10.23887/jippg.v5i2.48338

Jannah, R., and Oktaviani, R. N. (2022). Pengaruh Penggunaan Media Augmented Reality terhadap Kemampuan Literasi Numerasi Digital pada Pembelajaran Matematika Materi Penyajian Data Kelas V MI At-Taufiq. *Jurnal Ibriez : Jurnal Kependidikan Dasar Islam Berbasis Sains*, *7*(2), 123–138.

Kirst-Ashman, K. K. (2016). *Empowerment Series: Introduction to Social Work and Social Welfare: Critical Thinking Perspectives*. Cengage Learning.

Lukman, M. I., Handoyo, B., and Utomo, D. H. (2021). Pengembangan Sumber Belajar Geografi Berbasis Spasial dengan Augmented Reality untuk Meningkatkan Kemampuan Berpikir Tingkat Tinggi. *Jurnal Pendidikan: Teori, Penelitian, Dan Pengembangan*, *6*(12), 1869. https://doi.org/10.17977/jptpp.v6i12.15161

Maure, F. S., Arifin, A., and Datuk, A. (2021). Peran Musyawarah Guru Mata Pelajaran (MGMP) dalam Meningkatkan Profesionalisme Guru Sosiologi di Kota Kupang. *Jurnal Ilmu Pendidikan (JIP) STKIP Kusuma Negara*, *12*(2), 111–118. https://doi.org/10.37640/jip.v12i2.534

Mustaqim, I. (2016). Pemanfaataan Augmented Reality sebagai Media Pembelajaran. *Jurnal Pendidikan Teknologi Dan Kejuruan*, *13*(2), 174–183. https://doi.org/10.1109/SIBIRCON.2010.5555154

Nadelson, L. S., and Seifert, A. L. (2017). Integrated STEM defined: Contexts, challenges, and the future. In *The Journal of Educational Research* (Vol. 110, Issue 3, pp. 221–223). Taylor and Francis.

Nazmi, M. (2017). Penerapan Media Animasi untuk Meningkatkan Minat Belajar Peserta Didik pada Mata Pelajaran Geografi di SMA PGII 2 Bandung. *Jurnal Pendidikan Geografi*, *17*(1), 48–57.

Nismaya. (2020). Meningkatkan Kemampuan Berpikir Kritis melalui Model Pembelajaran Problem Based Learning. *Simki.Unpkediri.Ac.Id*, *6*(2), 102–107.

Nofrion, N., Wijayanto, B., Wilis, R., and Novio, R. (2018). Analisis technological pedagogical and content knowledge (TPACK) guru geografi di Kabupaten Solok, Sumatera Barat. *Jurnal Geografi*, *10*(2), 105–116.

Nursyam, A. (2019). Peningkatan Minat Belajar Siswa Melalui Media Pembelajaran Berbasis Teknologi Informasi. *Ekspose: Jurnal Penelitian Hukum Dan Pendidikan*, *18*(1), 811–819. https://doi.org/10.30863/ekspose.v18i1.371

Rahman, M. M. (2019). 21st century skill'problem solving': Defining the concept. *Rahman, MM (2019). 21st Century Skill "Problem Solving": Defining the Concept. Asian Journal of Interdisciplinary Research*, *2*(1), 64–74.

Rahmawati, D., Jannah, N., Ragil, I., and Atmojo, W. (2022). Media Digital dalam Memberdayakan Kemampuan Berpikir Kritis Abad 21 pada Pembelajaran IPA di Sekolah Dasar. *Albasicedu*, *6*(1), 1064–1074.

Setyawan, B., and Fatirul, A. N. (2019). Augmented reality dalam pembelajaran IPA bagi siswa SD. *Kwangsan*, *7*(1), 286912.

Seviana, R. (2022). Pengembangan Media Pembelajaran Augmented Reality pada Pembelajaran Geografi Materi Planet di Tata Surya. *Geodika: Jurnal Kajian Ilmu Dan*

Pendidikan Geografi, *6*(2), 198–208. https://doi.org/10.29408/geodika.v6i2.6122

Singhal, S., Bagga, S., Goyal, P., and Saxena, D. V. (2012). Augmented Chemistry : Interactive Education System. *International Journal of Computer Applications*, *49*(15), 1–5.

Sousa, M. J., and Rocha, Á. (2019). Digital learning: Developing skills for digital transformation of organizations. *Future Generation Computer Systems*, *91*, 327–334.

Sousa, M. J., and Wilks, D. (2018). Sustainable skills for the world of work in the digital age. *Systems Research and Behavioral Science*, *35*(4), 399–405.

Supena, I., and Hariyadi, A. (2021). The Influence of 4C (Constructive , Critical , Creativity , Collaborative) Learning Model on Students ' Learning Outcomes. *International Journal of Instruction*, *14*(3), 873–892.

Thahir, R., and Kamaruddin, R. (2021). Pengaruh Media Pembelajaran Berbasis Augmented Reality (Ar) Terhadap Hasil Belajar Biologi Siswa Sma. *Jurnal Riset Dan Inovasi Pembelajaran*, *1*(2), 24–35. https://doi.org/10.51574/jrip.v1i2.26

Tondeur, J., Forkosh-Baruch, A., Prestridge, S., Albion, P., and Edirisinghe, S. (2016). Responding to challenges in teacher professional development for ICT integration in education. *Educational Technology and Society*, *19*(3), 110–120.

Wijayanto, B., Susetyo, B. B., Rahmadani, S. F., Pernando, J., and Operma, S. (2022). GEO-AR ENHANCEMENT: Inovasi Pembelajaran Berbasis Augmented Reality pada Guru Geografi di SMA/MA Kota Padang Panjang. *Abdi: Jurnal Pengabdian Dan Pemberdayaan Masyarakat*, *4*(1), 16–23.

Xu, W.-W., Su, C.-Y., Hu, Y., and Chen, C.-H. (2022). Exploring the effectiveness and moderators of augmented reality on science learning: A meta-analysis. *Journal of Science Education and Technology*, *31*(5), 621–637.