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Engineering for Ecosystem Science: Literature Review Utilization of AR Assemblr Edu Media in Elementary Schools

Syafaa Diviella Alayya Violinzky[1], Ellianawati Ellianawati[2], Decky Avrilianda[3]
[1]Program Studi Pendidikan Dasar, Sekolah Pascasarjana, Universitas Negeri Semarang, Semarang, Indonesia, syafaadiviella@students.unnes.ac.id
[2]Program Pendidikan Fisika, Universitas Negeri Semarang, Semarang, Indonesia, ellianawati@mail.unnes.ac.id
[3]Program Pendidikan Non Formal, Universitas Negeri Semarang, Semarang, Indonesia, decky.avrillianda@mail.unnes.ac.id

Corresponding Author: syafaadiviella@students.unnes.ac.id [1]

Abstract: Education is a lifelong learning experience. Education comes to new challenges to face the era of digitalization. In its development, it requires the latest media, namely Assemblr Edu AR Media. Assemblr Edu is a platform for augmented reality in the form of real 3D in real time that can be downloaded on iOS and Playstore, and its advantages can be used anytime and anywhere. This is one of the IPAS materials related to the reciprocal relationship between biotic and abiotic. The review for this article aims to find out the research trends of Assemblr Edu AR Media on Harmony in Ecosystems. The method used is a systematic literature review with the help of publish or perish related to Assemblr Edu AR Media on Harmony in Ecosystems analyzed from 9 articles indexed by Google Scholar. The results of this study show the results of the AR Assemblr Edu Media research trend on Harmony in Ecosystems which increases significantly every year, the university that conducts a research on AR Assemblr Edu Media on Harmony in Ecosystems the most is the University of Education Indonesia, the learning model used in relevant research is problem-based learning (PBL), The learning model used in relevant research is problem-based learning (PBL), discovery learning model, project-based learning model (PjBL), direct instruction learning model and interactive visualization or called PBL with interactive media, the subject matter is harmony in ecosystems which is dominated by relevant research which is the reciprocal relationship between biotic and abiotic, finally the research on AR Assemblr Edu Media on Harmony in Ecosystems uses a variety of platforms.

Keyword: Augmented Reality, Assemblr Edu, Ecosystem

INTRODUCTION

Education is a lifelong learning process, occurring in a variety of contexts and conditions, that contributes favorably to everyone's development (Pristiwanti et al., 2022). Education not only influences development, but also serves as the main basis in shaping individuals and communities, which plays an important role in shaping the way of thinking, skills and values that are needed to face challenges at the global level. According to Ellianawati et al., (2021)

education continues to change over time. The rapid development of the times has made education experience a significant digital shift, from conventional methods to easier, interactive, and tailored to individual needs. According to Farias-Gaytan et al. (2023) technological innovations that never stop creating new goods and services, provide various opportunities for the complex education ecosystem. As a result, continuous change produces new challenges and gaps in education, including among students.

One of the skills that students need to have in this digitalization era is literacy. According to Putri et al.,. (2025) said that currently, literacy, especially in science, is one of the skills that is very important to improve. This is very relevant in facing the challenges of globalization, because with good literacy skills, students can not only master science concepts but also have the ability to implement them in daily routines. According to Lee and Park (2024), science literacy can be defined in a variety of ways, ranging from how individuals digest scientific facts and principles to how a community collectively interacts with scientific knowledge and processes. Science literacy highlights the importance of the ability to think and act, which includes mastering how to think and apply scientific methods in understanding and facing social challenges (Pratiwi et al., 2019). Supported by previous studies which revealed that the results of the analysis of the PISA assessment showed that the level of literacy in Indonesia between 2000 and 2018 had not reached the average score. In seven participations, Indonesia was in the bottom ten in 2018, and decreased when compared to 2015 (Yusmar & Fadilah, 2023).

Science literacy can be defined as a person's capacity to master scientific ideas, convey scientific data, and apply scientific knowledge to solve various problems (Irsan, 2021). Based on the results of observations that have been carried out at SDN Karangtengah 4 on students, especially high grade students, namely grade 5, only 21% of students have difficulty in learning or literacy towards IPAS learning. Meanwhile, 55% of students indicate that IPAS learning is still conventional and 62% of students feel that there is a lack of active involvement with technological media to attract deep interest in science literacy. Based on classroom observations, the results show that 34% of students face challenges in understanding abstract concepts and terms in IPAS learning, especially the components of the ecosystem to the impact of changes that occur in it. The class teacher also revealed that the school infrastructure is adequate, but the application of interactive technology-based media still has its limitations so that the material presented is less interesting and not optimal in fostering students' science literacy interest. This can cause challenges in learning and reduce student motivation to continue their studies (Risaad et al., 2025).

There is a need for new innovations to improve science literacy based on Augmented Reality (AR). Based on several studies, AR technology can integrate virtual objects into reality in 2D or 3D format and displayed directly (Aditama et al., 2019; Nugroho & Pramono, 2017). That AR presents its learning content in a more precise and real form (Tohir et al., 2024). This can increase students' desire to learn in expanding their perspective on abstract concepts that are difficult to understand in depth. Based on previous studies, it is necessary to develop AR media in one of the applications, namely Assemblr Edu.

The Assemblr Edu platform is defined as an application that can be downloaded on Android and iOS devices through the Google Play Store or App Store and can be operated easily on mobile phones (Muslimah et al., 2023). Assemblr Edu can be accessed using devices by scanning images using a QR Code and there are various other learning activities to learn the topics discussed which are based on AR (Safitri et al., 2023). Assemblr Edu media is an educational platform that is utilized by teachers and students in providing AR technology to present material interactively, thanks to attractive 3D animations to enable students' interest in learning (Nugrohadi & Anwar, 2022). Assemblr Edu has its own advantages because the animation is available from free to paid.

Based on previous research by Syarif et al. (2022), Assemblr Edu AR media for food chain materials (ecosystems) only emphasizes testing its feasibility in Pekanbaru elementary

schools. Another study conducted by Dewi et al., (2022) explained that the Assemblr Edu platform has proven effective in improving student learning outcomes. However, this research was conducted at SMK Negeri 4 Denpasar in the context of math learning. There is another study by Handayani and Asih (2024) which revealed that they had utilized Assemblr Edu AR media to improve academic performance in the IPAS sector in class IV of SDN 3 Sugihan Wonogiri, but this study did not refer to harmony material in the ecosystem.

The results of the data analysis that have been described show that science literacy in the school environment faces problems related to Assemblr Edu AR media. This shows the need for product adjustments in the 3D AR Assemblr Edu media in order to produce better innovations to improve science literacy in accordance with student characteristics and guidelines from the IPAS grade V package book. Therefore, researchers need to explore research trends regarding AR Assemblr Edu media related to harmony in ecosystems in the 2015 to 2025 time span in Indonesia. This research aims to provide readers with an understanding of the current trends in Assemblr Edu AR media research related to harmony in ecosystems.

METHOD

This research adopts the Systematic Literature Review (SLR) method. This research examines various relevant findings related to the theme raised, consisting of articles in journals and theories contained in books. The purpose of this approach is to present information with an emphasis on the material under study, so that it is expected to produce the latest findings (Paré et al., 2015; Snyder, 2019). In the research process using this method, literature reviews relevant to the research theme are collected from various references, including academic journals, books, articles, and theses (Rozianita et al., 2024).

Identifying in searching for articles using Publish or Perish (PoP) software by using the keywords “Augmented Reality, Assemblr Edu, Ecosystem”. Through the article search process, it is limited to 500 articles in Indonesian and English published from 2015 to 2025. The results of the search obtained a total of 259 articles indexed by Google Scholar. The excluded articles related to the keywords totaled 179 articles. After that, filtering based on the title and abstract obtained 80 articles. After that, 54 articles were found that did not fall under the criteria of part of the thesis/thesis and were considered less efficient to analyze. The set of articles that were assessed to be worth analyzing was 26 articles, after the data was rechecked and 17 articles were found that focused on research not learning ecosystems. The results of the articles that will be analyzed are 9 articles in accordance with Assemblr Edu AR Media research. The stages in finding journal articles and proceedings are as shown in the following figure. Figure 1.

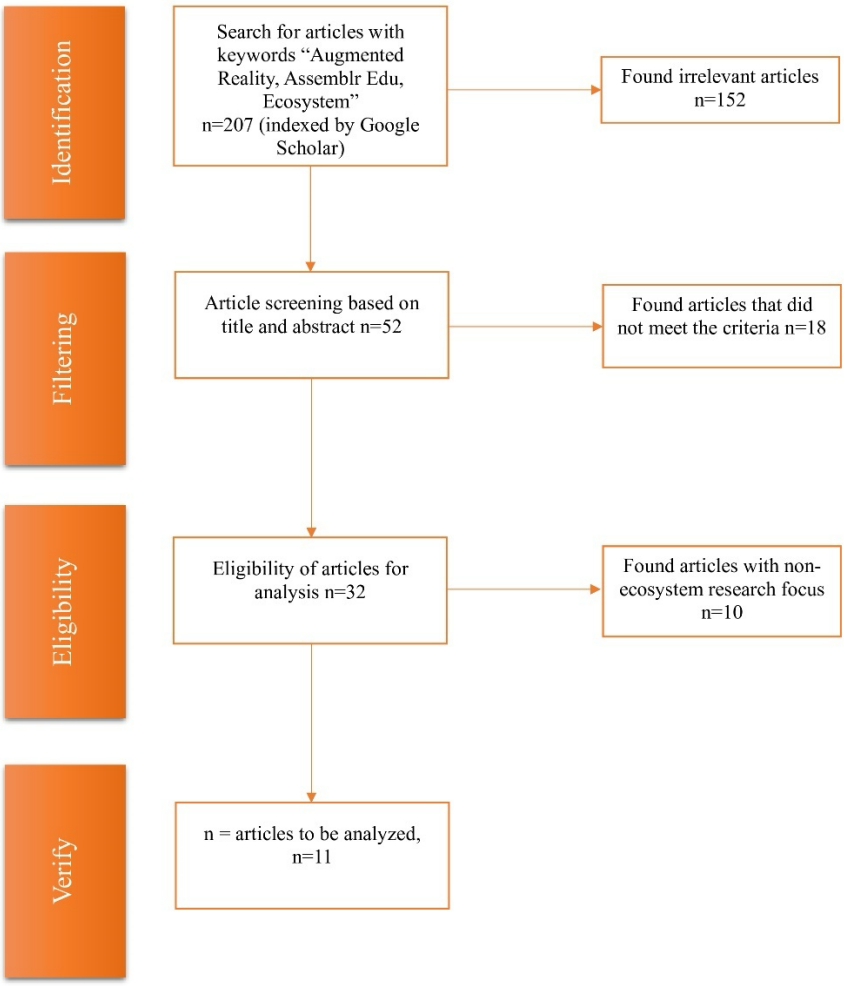

Figure 1. Illustrative Scheme of Article Search

Based on the results of the article data and proceedings or national seminars produced, it can be seen from the Assemblr Edu AR media research publications on ecosystem subjects from 2015-2025 in Figure 2.

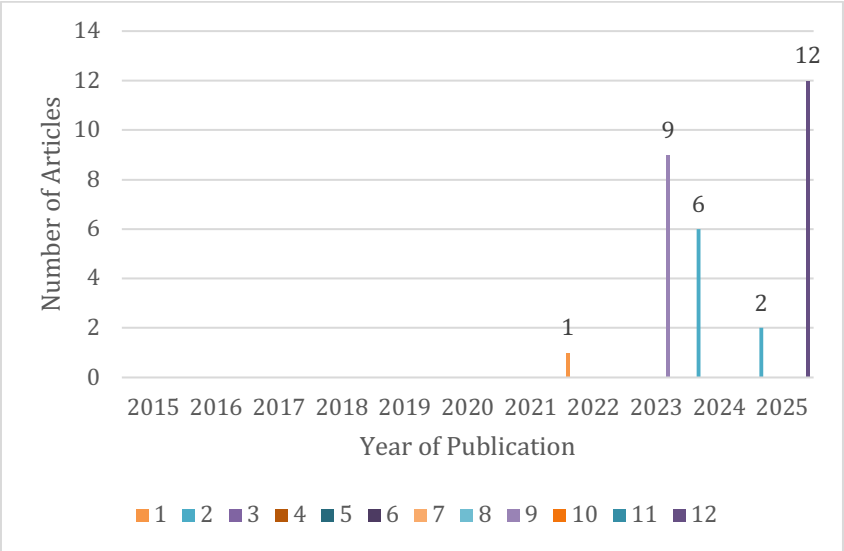

Figure 2. Research Publication Chart of AR Assemblr Edu Harmony in Ecosystem Media

The results of the articles obtained data, many universities, polytechnics, and high schools participated in conducting research on AR Assemblr Edu harmony media in the ecosystem, the data can be seen in Figure 3.

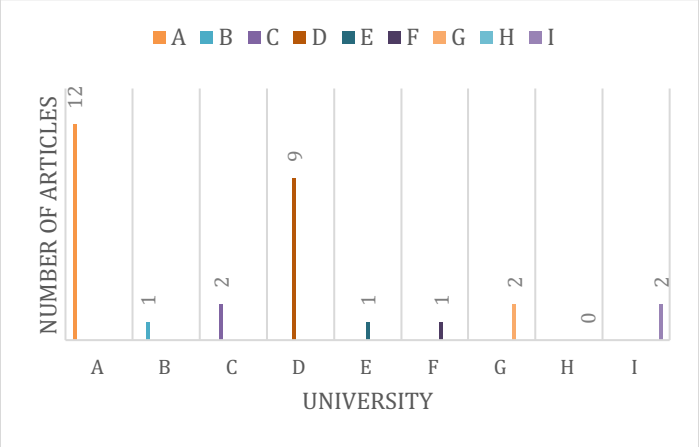

Figure 3. Graph of Universities, Polytechnics, and Colleges of Origin of Articles and Proceedings Assemblr Edu AR Media Research

The information of each university, polytechnic, and high school from which the articles were taken is presented in Table 1.

Table 1. Chart Information of University/Polytechnics

University/Polytechnic	Code
Indonesia Education University	A
Yogyakarta State University	B
Semarang State University	C
Muhammadiyah University of Pontianak	D
State University of Malang	E
TEDC Polytechnic	F
Nahdlatul Ulama Islamic University	G
Mahmud Yunus Batusangkar State Islamic University	H
Jakarta State University	I

Based on the results of 10 AR Assemblr Edu Harmony in Ecosystem research articles, there are five articles with the highest citations, the data can be seen in Table 2.

Table 2. Graph of subjects in Assemblr Edu AR Media

Nu	Article Title	Author	Total Citations
1	Analisis Kebutuhan Media Augmented Reality Berbasis Literasi Sains pada Materi Ekosistem di Sekolah Dasar	Agustin dkk.,(2025)	12
2	Development of Augmented Reality Learning Media based on Assemblr Studio Web in Ecosystem Material	Nengsih dkk., (2023)	9
3	Development of Augmented Reality Based Flipbook Media on Natural Science Subject Matter of Ecosystems	Cahya dan Bektiningsih (2024)	2
4	Pengembangan Media Pembelajaran Kartu Ajaib Berbasis Augmented Reality pada Materi Ekosistem Kelas 5 Sekolah Dasar	Maziyah dan Zumrotun (2025)	2
5	Pengembangan Media Pembelajaran Berbasis Augmented Reality pada Pembelajaran IPAS Materi Harmoni dalam Ekosistem Kelas V Sekolah Dasar	Zahrah dkk., (2024)	2

RESULTS AND DISCUSSION

Publication of AR Assemblr Edu Media Articles on Learning Harmony in Ecosystems

Based on the results of tracing Assemblr Edu AR media research articles on learning harmony in ecosystems from 2015-2025, 8 journal articles were found. These articles are published by indexed google scholar. In the figure 2 section, it can be seen and analyzed that the development of the Assemblr Edu AR Media research trend fluctuates for each year. However, what happened in the range of 2015 to 2021 article searches through the Publish or Perish software did not find any articles indexed by google scholar related to Assemblr Edu AR Media research on learning harmony in the ecosystem.

The results of analyzing article data, in Figure 3, show that Universitas Pendidikan Indonesia is the institution that produces the most research on Assemblr Edu AR Media on learning harmony in ecosystems, namely 12 articles. The distribution of Assemblr Edu AR media research on learning harmony in ecosystems has not been evenly distributed throughout Indonesia. This study was mainly conducted in two large regions in Indonesia, namely Java and Kalimantan. Therefore, this literature review is expected to clarify understanding for readers and those interested in the study so that it can be applied in teaching and learning activities. Referring to table 2, it is revealed that the research conducted by Agustin et al. (2025) has the highest number of article citations. The article compiled by Agustin et al. (2025) examines the needs analysis of science literacy-based Augmented Reality media on ecosystem material in elementary schools.

Orientation on Assemblr Edu AR Media Development

Based on a review of 9 articles reviewed, 5 Assemblr Edu AR Media articles on learning harmony in ecosystems were found to have been developed with a focus on various learning models, including problem-based learning models (PBL), discovery learning models, project-based learning models (PjBL), direct instruction learning models and interactive visualization or called PBL with interactive media. The implementation of some of these learning models aims to increase interest, motivation in learning, creativity, and effectiveness, as well as contribute to the development of students' attitudes during the learning process. Furthermore, table 3 presents the various orientations of learning models identified in the articles that have been analyzed, as well as the name of the author.

Table 3. Learning Model in Assemblr Edu AR Media on Harmony in Ecosystem Learning

Learning Model	Author
Discovery Learning	Agustin dkk., (2025)
Project Based Learning (PjBL)	Nengsih dkk., (2023)
Direct Instruction + Visualisasi Interaktif (merujuk PBL)	Cahya dan Bektiningsih (2024)
Discovery Learning atau Game Based Learning	Maziyah dan Zumrotun (2025)
Probelm Based Learning (PBL)	Zahrah dkk., (2024)

The development of AR Assemblr Edu media based on problem-based learning methods with practical Assemblr Edu allows teachers to only need to provide barcodes or QR codes so that students can use the application through devices or tablets owned by students or loaned from the school (Oktaviona & Jasril, 2023).

The application of Assemblr Edu AR media with the discovery learning model makes students eager to learn, allowing students to explore objects (animals, plants, and interactions in the food chain). That discovery learning allows students to interact with the tools used in the classroom, as well as involve themselves in interactions between fellow students and teachers through discussions that support understanding of the concepts learned (Rizal, 2019). This shows that the application of Assemblr Edu AR media in discovery learning not only increases

visual appeal, but also provides support in a participatory and meaningful learning process. Students do not just passively receive data, but also have direct involvement in the process of searching, observing, and discovering concepts through learning experiences that are full of fun and quite relevant. Thus, students' understanding of the material on harmony in ecosystems becomes deeply due to acquisition through explorative and collaborative experiences.

Analysis of AR Media Development on Learning Harmony in Ecosystems

Based on the review of 9 articles on Assemblr Edu AR media research on learning harmony in the ecosystem is carried out to improve students' abilities leading to the realm of science literacy. The distribution of student abilities leads to the cognitive domain so it is presented in a pie chart which can be seen in Figure 4.

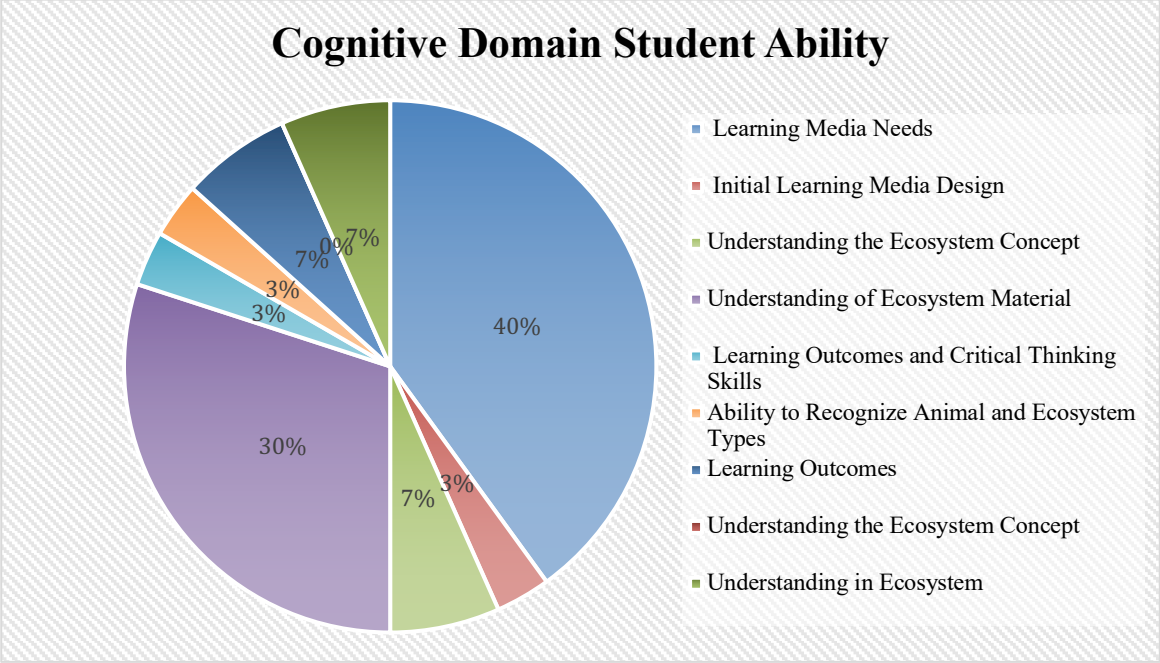

Figure 4. Students' Ability in Science Literacy

Research conducted by Agustin et al. (2025) for learning media needs. Research by Handayani et al. (2023) for the initial design of learning media. Research conducted by Cahya and Bektiningsih (2024) for the ability to understand the concept of ecosystem. Research by Nengsih et al. (2023) to improve the understanding of ecosystem concepts. Research by Satriya and Sari (2024) for learning outcomes and critical thinking skills. Research by Trenawati et al. (2024) for the ability to recognize animal species and ecosystems. Research by Maziyah and Zumrotun (2025) for learning outcomes. Research by Anastasha and Hesti (2024) for understanding the concept of ecosystem. Research by Zahrah et al. (2024) for understanding ecosystem material.

Improving skills in science literacy is most often done through Assemblr Edu AR media research that focuses on harmony in the ecosystem. This is due to the high low rate in science literacy and the inefficiency of existing learning media.

The Subject Matter of Harmony in Ecosystems used in Assemblr Edu AR Media Development

Based on the presentation of a review of 9 Assemblr Edu AR media articles on IPAS learning that have been analyzed, using various topics of subject matter based on the content of harmony in ecosystems in IPAS subjects. Details regarding the topic of harmony in the ecosystem are discussed in Table 4.

Table 4. Harmony in Ecosystem Material in Assemblr Edu AR Media

Author	Material
Agustin dkk., (2025)	Ecosystem
Handayani dkk., (2023)	Food Chain
Cahya dan Bektiningsih (2024)	Ecosystem
Nengsih dkk., (2023)	Ecosystem
Satriya dan Sari (2024)	Ecosystem
Tresnawati dkk., (2024)	Food Types and Ecosystems
Maziyah dan Zumrotun (2025)	Ecosystem
Anastasha dan Hesti (2024)	Ecosystem
Zahrah dkk., (2024)	Harmony in Ecosystems

Learning about harmony in ecosystems is not only implemented based on student activities, but the learning is designed to improve science literacy. An individual who has the ability in science literacy is an individual who applies scientific ideas, has skills in the process of science to evaluate when making daily choices that involve interactions with other people, communities, and the surrounding environment, including social and economic aspects (Arohman & Priyandoko, 2016)

The subject of harmony in ecosystems is more often applied in AR media based on Assemblr Edu, because students experience various situations in everyday life related to harmony in ecosystems. This contributes to improving students' science literacy skills. There are 9 articles that integrate harmony in ecosystems in their research, with the main focus on ecosystem or food chain material.

Application or Platform used in the Development of AR Assemblr Edu Media on Harmony in Ecosystems

Based on a review of the Assemblr Edu AR media research articles on harmony in ecosystems using varied platforms. These data can be seen in Table 5.

Table 5. Platforms Used in Assemblr Edu AR Media Development Harmony in Ecosystem

Author	Platform
Handayani dkk., (2023)	Assemblr Edu
Cahya dan Bektiningsih (2024)	Flipbook
Nengsih dkk., (2023)	Assemblr Studio
Satriya dan Sari (2024)	Unity 3D
Tresnawati dkk., (2024)	Unity 3D
Maziyah dan Zumrotun (2025)	Assemblr Edu
Anastasha dan Hesti (2024)	Assemblr Edu
Zahrah dkk., (2024)	Assemblr Edu

The results of table 5 show that 9 articles analyzed, there is 1 harmony research in the ecosystem that does not mention and explain in detail the platform used.

The use of platforms in Assemblr Edu AR media research is indeed less practical and requires quite a long time and skills, but the platform can produce good quality AR media.

AR media products supported by Assemblr Edu that have been developed allow students to easily access AR media anywhere and anytime. For example, AR media designed in barcode or QR format has the advantage of no storage, only capitalizing on quotas to be able to access with the QR that has been provided. This media can be accessed without using the device's internal storage at all.

The use of Assemblr Edu-based AR media shows a positive effect in the learning process in the classroom. This AR media motivates students to be more actively involved, think critically, and be able to explore through planned activities. The Assemblr Edu platform provides opportunities for students to build characters who are able to understand and grasp the

concepts of the knowledge learned, and apply this understanding with the skills that students have.

Learning with Aseemblr Edu AR Media offers students a unique and interesting worksheet, filled with various real 3D illustrations that are certainly relevant to students. The presentation of this material is done in a way that is communicative and easy to understand, because it uses computer technology and can be accessed through devices or tablets.

CONCLUSION

The results of this study concluded that there is an increase every year in the trend of Assemblr Edu AR research media. The most active university in studying AR Assemblr Edu media is the Indonesian Education University. The learning models applied in AR Assemblr Edu media include problem-based learning (PBL), discovery learning model, project-based learning model (PjBL), direct instruction learning model and interactive visualization or called PBL with interactive media. Science literacy skills, critical thinking, and exploration are the main themes related to Assemblr Edu AR media in harmony in the ecosystem. The most researched harmony material in ecosystems is related to biotic and abiotic mutual relationships. Research conducted using various platforms. Suggestions or input for further research are that Assemblr Edu AR media should be combined with other learning models such as Contextual Teaching and Learning (CTL) so that its application is wider at various grade levels and for further research for researchers should provide training in advance for users or teachers to make this media and also how to use it, so that utilization is more optimal.

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