

Bringing Ecosystems to The 3d World: Students' Characteristics, Assessments, and Perceptions of Edu Assemblr Media

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Abstract

The development of educational technology requires innovative learning media that are interactive and aligned with the characteristics of 21st-century students. However, many existing media have not fully leveraged augmented reality technology to enhance learning engagement. This research aims to develop Assembler Edu-based learning media as a means of interactive material visualization. The method used is based on Sugiyono's research and development (R&D) model, which includes potentials and problems, data collection, product design, design validation, and limited perception tests. The product produced by Assembler Edu Media displays 3D objects and supporting information by the Ecosystem teaching materials. The results of the limited perception test showed a positive response from students, with an average assessment of the "excellent" category in terms of appearance, ease of use, and learning attractiveness. It was concluded that this medium is suitable for use in the early stages of implementation. Assemblr edu has the potential to be an effective alternative interactive learning media to support the ecosystem learning process. This development aligns with SDG 4 (Quality Education) by utilizing digital technology to enhance the quality of learning.

Keywords: Assembler edu, ecosystem, students' perception, education, 3D

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Introduction

Education is an effort to develop a person's or group's knowledge, skills, individual potential, and attitude to form a whole human being. As a never-ending process, education aims to form future generations who adhere to the nation's cultural values and Pancasila principles (Sujana, 2019). The development of 21st-century learning, especially in the digital era, encourages education to adapt through the use of technology that provides creative and innovative learning opportunities. However, one of the current educational challenges is the use of learning media that still tends to be textbook-oriented or limited to conventional methods and media. The low use of learning technology, combined with teachers' difficulty in choosing and creating appropriate interactive media, results in a less engaging learning process that has the potential to reduce student motivation.

Based on an interview with a Biology teacher at Ignatius Slamet Riyadi High School, it is known that Biology learning, especially ecosystem materials, utilizes whiteboards, PPTs, learning videos, and package books. Teachers have made innovations in the form of simple mockups, but have not used interactive media based on 3D animation due to limited time, energy, and the cost of manufacturing materials. In addition, teachers feel that PPTs and learning videos are relatively easy to use and can help students' understanding. However, their enthusiasm tends to decline if learning is only based on explanations on the board.

The results of the questionnaire, conducted among 34 grade XI students, showed that 65.7% of students wanted learning media innovations to make ecosystem materials more engaging. As many as 42.8% of students stated that they were more enthusiastic about learning when using interactive media, 48.5% considered it very helpful in understanding the material, and 68.5% expressed a preference for 3D animation media. Students also hope that learning media will use gadgets so that learning is more practical and easier to understand.

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The use of technology-based learning media has been proven to attract students' interest in learning ([Scott, 2020](#)). The suitability between learning strategies, methods, and media will increase the effectiveness of the learning process ([Annisa et al., 2018](#)). Interactive learning media can facilitate student understanding, develop creativity, and encourage teacher innovation ([Kamilah et al., 2023](#)). The incorporation of visual displays, such as images and animations, has a significant impact on student motivation and learning outcomes ([Sulistiawati & Prastowo, 2021](#)).

One of the innovations that can be used is Assemblr Edu, a digital-based platform that combines *Online Classes* and 3D animation, and can be accessed through a *Smartphone* ([Iskandar et al., 2023](#)). This media allows teachers to design creative learning materials and present new learning experiences by visualizing students' ideas in three dimensions ([Febrinigrum & Purwaningsih, 2022](#)). On ecosystem material, which studies the interaction between organisms and their environment ([Sadikin & Hakim, 2019](#)). The use of Assemblr Edu is expected to increase students' interest, motivation, and understanding, while creating a fun learning atmosphere.

The development of Assemblr Edu's interactive learning media ecosystem materials at Ignatius Slamet Riyadi High School has revealed the need for innovations to meet the needs of both teachers and students at the school. Therefore, the purpose of this study is to find out the characteristics of the results of Assemblr Edu on ecosystem materials, assess the feasibility of the media based on the assessment of the validators, and find out the perception of students after using Assemblr Edu learning media. Through this research, it is hoped that the media produced will not only be suitable in terms of content and presentation, but also effectively increase students' interest, motivation, and understanding of ecosystem concepts.

Method

Research Method

This research is a Research and Development (R&D) project with development steps outlined by [Sugiyono \(2019\)](#). The steps of R&D includes: (1) potentials and problems, i.e. identifying the underlying problems or needs of product development; (2) data collection, which aims to obtain supporting information, both from theoretical studies and field findings; (3) product design, i.e. designing products to be developed based on data that has been collected; (4) Design assessment, conducted by experts to assess the feasibility of the product; (5) design revision, i.e. product improvement based on input from the Assessment process; (6) product trials, which may include limited or broader trials; (7) product revision, as a follow-up to the test results; (8) trial use; (9) final product revision; and (10) mass production. In this study, the R&D process was limited to the perception test stage, which was carried out only with students and therefore did not progress to the trial use or mass production stage. This research was carried out at Ignatius Slamet Riyadi Private High School, East Jakarta, with initial observations through interviews with biology teachers and the dissemination of questionnaires on the needs of students in grades XI-C. The media assessment stage and completion of the student perception questionnaire for Assemblr Edu's interactive learning media were conducted afterward.

Data Collection

The data collection techniques in this study encompass three types of data: the characteristics of Assemblr Edu media, media assessment, and student perception of the media. Characteristic data was obtained qualitatively through the description of the shape and features of the Edu Assemblr and its relationship with the ecosystem material. The assessment data were obtained through the assessment of experts using an assessment sheet that covers three aspects: material experts, linguists, and media experts. Material experts assess the suitability of the material, its content, and its ability to encourage students' curiosity. Linguists assess the straightforwardness, conformity with the rules of the Indonesian Language, as well as the communicative and interactive aspects. Meanwhile, media experts assess

the ease of use and visual appearance. Student perception data were collected using questionnaires that included indicators of material understanding, learning activities, and the use of learning media.

Data Analysis

The data analysis in this study was carried out with three approaches according to the type of data collected. First, the data on the characteristics of Assemblr Edu's interactive learning media were analyzed using descriptive qualitative analysis techniques, namely describing their forms, features, and relationships with ecosystem materials narratively. Second, the data from material experts, linguists, and media experts were analyzed with descriptive statistics through the calculation of average scores, then converted into eligibility categories based on the validity criteria of interactive learning media (Anindya, 2023). The percentage score was calculated using the following formula:

$$P: \frac{\text{Total Score Obtained}}{\text{Maximum Score}} \times 100\%$$

The results were then categorized as: 81–100% (very feasible), 61–80% (feasible), 41–60% (moderately feasible), 21–40% (less feasible), and 0–20% (not feasible). Third, student perception data on the media was analyzed using descriptive statistics by calculating the average questionnaire score, then categorized according to the student's response criteria (Kartini & Putra, 2020), i.e.: 81–100% (very good), 61–80% (good), 41–60% (adequate), 21–40% (less), and 0–20% (very less).

Research Results and Discussion

Characteristics of Assemblr Edu Material Ecosystem

The media design was designed using *the* Assemblr edu website. In the initial appearance of *this* Assemblr edu media, it contains the title, the author's identity, instructions on how to use it, and the purpose of learning. The cover design, before entering the material, is created with *the* Assemblr edu application, which includes characters, material titles, and a "start" button. The inside of *the* Assemblr edu *learning media* is designed according to the material, consisting of a description of the concept of ecosystems, ecosystem functions (food chain and water cycle).

The Edu Assemblr Edu media ecosystem material consists of three main parts, namely the initial appearance and identity of the compiler (Figure 1.a), instructions for use (Figure 1.b), and the cover and description of the material (Figure 1.c). The initial view contains the title, author name, learning objectives, and a link to access the instructions for use. The instructions for use are prepared to make it easier for teachers and students to operate the media, including a preface as a gesture of gratitude to those who have helped, expectations for the usefulness of the media, and an explanation of the steps to use the Assemblr edu *website*. This section is designed to help users understand the procedures for using media systematically before accessing the learning materials.

After logging in to the Assemblr edu *website*, students will see a cover that reads "Welcome to the Ecosystem Material," accompanied by a *start button* that leads to the description of the material. The description of the ecosystem material is presented using 3D animation to make it easier to understand concepts and create a fun learning experience. The advantage of this medium lies in the use of 3D animated objects, which make the material appear more realistic, allowing students to understand the topic of the ecosystem more clearly. This learning media can be accessed by teachers and students of Ignatius Slamet Riyadi High School through the provided link and has the potential to serve as a Direct Biology learning resource for the classroom.

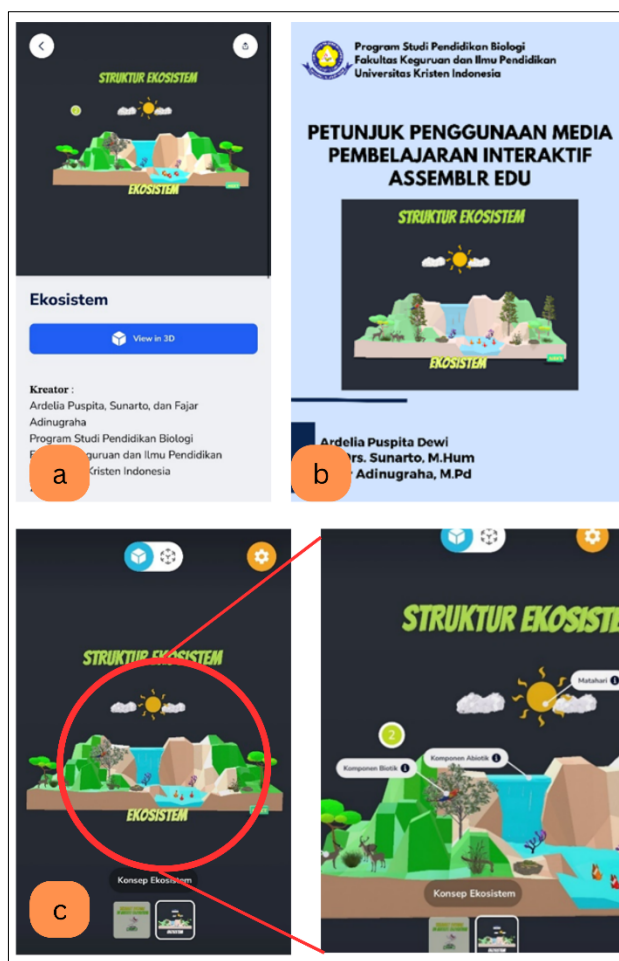


Figure 1. Assemblr Edu on Ecosystem Materials. (a) the initial appearance and identity of the compiler, (b) instructions for use, and (c) the cover and description of the material

Evaluation of Assemblr Edu Ecosystem Materials by Experts

The expert assessment of the Assemblr edu ecosystem material resulted in a 100% assessment with a very feasible category. It proves that the breadth and depth of material about ecosystems presented in interactive learning media, such as Assemblr edu, are in accordance with the concept and learning objectives to be achieved ([Rochma & Ibrahim, 2019](#)). Interactive packaging of materials and the suitability of materials, combined with 3D animations, can help students focus more on the learning presented ([Iskandar et al., 2023](#)). The data is presented in Figure 2.

Linguists' assessment of Assemblr edu the ecosystem material developed as a whole, it received a percentage of 75% with a feasible category. It is supported by opinions ([Wijayanti & Isnawati, 2023](#)) that effective learning media should use language that is informative, clear, and easy to understand. The use of language that is clear and understandable to students is key to the success of a learning medium ([Zega et al., 2022](#)). The data are presented in Figure 2.

Assessment by media experts on Assemblr edu in the ecosystem materials developed resulted in a feasibility percentage of 77% and placed it in the feasible category, where the use of interactive learning media, in the form of the Assemblr edu website, is deemed good and can provide benefits for students. Learning media can be considered adequate if it offers benefits to its readers ([Adinugraha, 2018](#)). The validator also provides a note to use a different colour for the background and the object, so that the researcher can revise the object in the learning medium to ensure it is visible. The use of design colours in the teaching materials developed has a positive influence on helping students remember the material they are learning ([Febrianto & Puspitaningsih, 2020](#)). The data is presented in Figure 2.

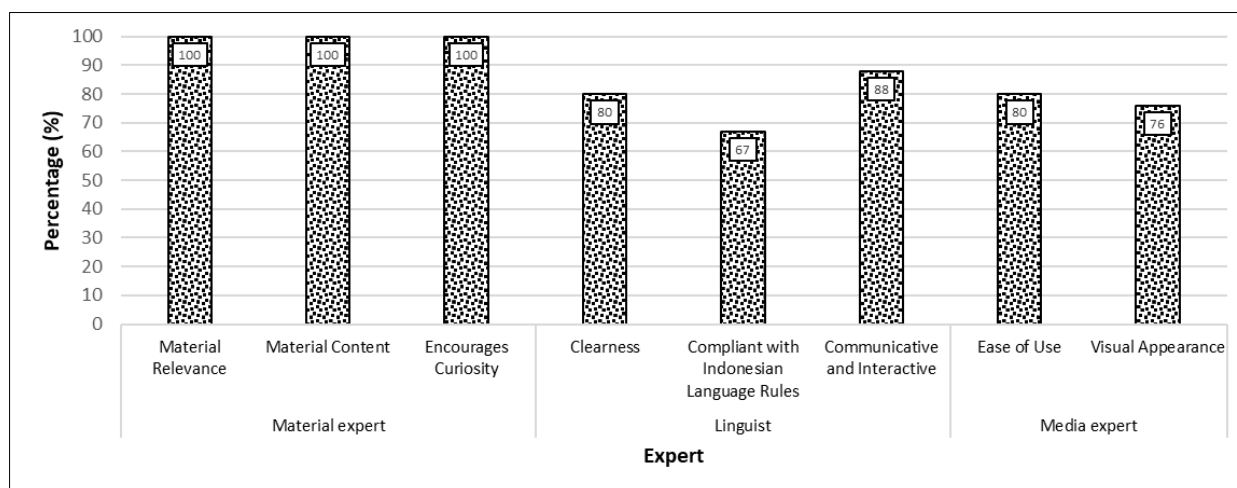


Figure 2. Assessment by experts

Students' Perception of the Ecosystem Material Edu Assembly

Student perceptions include aspects of convenience, material, language, and benefits. Learning media are one of the important learning tools or substances in the learning process in schools ([Kamuihkar et al., 2023](#)). Therefore, in order to provide benefits for its readers, learning media must meet the qualification guidelines before being used in the learning process. Students' perception of learning media, compiled and developed by researchers, is needed to determine the usefulness of the learning media ([Napitupulu et al., 2021](#)). Results of student responses to interactive learning media Assemblr edu in the ecosystem material in terms of convenience, appearance, materials, language, and benefits that have been obtained from the results of providing a student response questionnaire containing 19 statements through *Google Form* to 34 students of class XI-C SMA Ignatius Slamet Riyadi. Students' Perception of the Development of Interactive Learning Media Assemblr edu in the ecosystem material class X of Ignatius Slamet Riyadi High School received a good response with a percentage of 80.7%.

Based on the results of data analysis (Figure 3), statement item number 3 ("the display of learning media Assemblr edu very interesting"), number 15 ("Assemblr edu use good and correct Indonesian so that the sentences presented are clear and easy to understand"), and number 19 ("learning media Assemblr edu in the ecosystem materials developed creatively and innovatively") obtained the highest score, which was 145 or 85.3% with the category Excellent. It demonstrates that interactive learning media, such as Assemblr edu, are Suitable for use in the classroom. These findings align with research by [Dewi et al. \(2022\)](#), which states that creative and innovative learning media can enhance the success of the learning process, help achieve goals to the maximum, and contribute to improving student learning outcomes.

Meanwhile, statement item number 1 "*learning media Assemblr edu easily accessible*" gets the lowest score, which is 119 or 70% with the category *good*. Although it is still in the category of *good*, this aspect requires more attention ([Humaidi et al., 2021](#)) so that the utilization of Assemblr edu can be optimized. The low score in the ease aspect is due to the need for a stable internet connection and relatively long loading times, which are caused by the use of numerous 3D animations. This condition hinders the smooth use of media in the classroom. These findings are consistent with research by [Febrinigrum & Purwaningsih \(2022\)](#), which reports that school network limitations can cause apps to appear differently on students' devices and hinder the learning process.

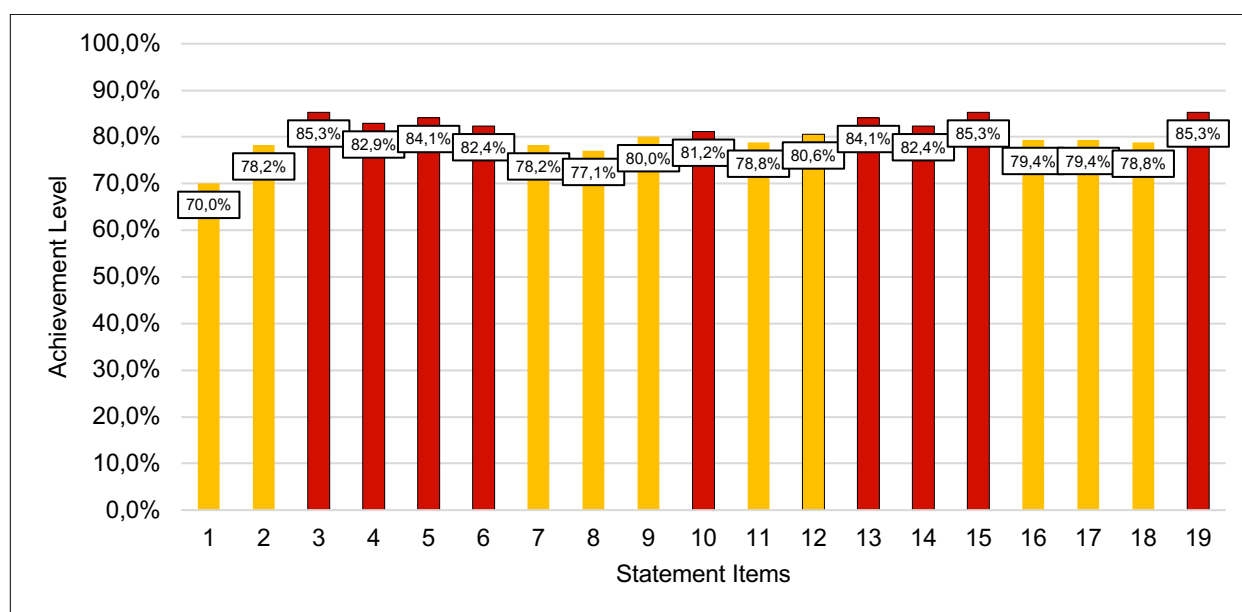


Figure 3. Students' perception of the Ecosystem Material Assembly.
(Description: yellow colour category "good" and red colour category "very good")

The results of the perception of students showed an average percentage of 80.7%, categorized as *good*. These findings indicate that interactive learning media, specifically Assemblr edu, in the class X ecosystem material of Ignatius Slamet Riyadi High School received a positive response from students. Perception or positive response to teaching materials, in this case interactive learning media Assemblr edu, can encourage students to be more enthusiastic in reading and mastering the material ([Adinugraha & Ratnapuri, 2020](#)). In addition, students can also be facilitated to conduct learning optimally ([Humaidi et al., 2021](#)).

This Assemblr Edu interactive learning media is expected to be an interactive and innovative teaching material, helping students understand Biology lessons, especially ecosystem materials, and function as an independent learning resource that can be used outside the classroom. The presence of this media aligns with the principles of 21st-century learning, which emphasize active engagement, technology utilization, and independent learning. It supports the achievement of Sustainable Development Goals (SDGs) point 4, which is to ensure inclusive, equitable, and quality education, as well as increase lifelong learning opportunities for all.

However, this study has limitations because a media effectiveness test was not carried out due to time constraints. Therefore, further research is needed to test the effectiveness of media in enhancing students' understanding of ecosystem materials. This effectiveness test will be a crucial step in ensuring that Assemblr Edu's interactive learning media have a significant positive impact on the quality of biology learning in secondary schools. The use of digital technology to empower society in social and academic contexts still requires greater attention ([Nurdiyanti et al., 2025](#)). Assemblr Edu is also related to the use of technology, so it needs to be explored to realize the quality of education by SDG 4.

Conclusion

The Edu Assemblr *media* in the ecosystem material developed consists of the initial appearance along with the identity of the compiler, instructions for use, as well as the cover and description of the material. This media is equipped with 3D and 2D animations that align with the material, making ecosystem learning more engaging and realistic. It supports teachers in delivering the material, fosters a fun learning atmosphere, and helps students understand Biology, especially ecosystem concepts. The results of the assessment by experts indicate that this learning medium falls into the "Feasible" category, with a percentage assessment from subject matter experts of 100% (*very feasible*), linguists

of 75% (*feasible*), and media experts of 77% (*feasible*). Student perception showed a positive response with a percentage of 80.7% (*good*), so that Assemblr edu has the potential to be an effective alternative interactive learning media to support the Biology learning process.

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