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Effect of Assemblr Edu on fifth graders' learning outcomes in the respiratory system

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ABSTRACT

The background of this study is based on the low learning outcomes of students, which are attributed to the abstract nature of the material and the lack of engaging visual media. Advances in digital technology offer new opportunities in the learning process, including the use of interactive Augmented Reality (AR) media. This study aims to investigate the effect of Assemblr Edu media on science learning outcomes, specifically on the topic of the human respiratory system. The study employed a quantitative approach with a quasi-experimental method using a non-equivalent control group design. The subjects were fifth-grade elementary school students divided into an experimental class and a control class. Data were collected through pretests and posttests and analyzed using normality tests, homogeneity tests, and an Independent Samples T-Test. The results showed a significant effect of Assemblr Edu media on students' science learning outcomes. The three-dimensional visualization provided by Assemblr Edu clarified abstract concepts, encouraged active student engagement, and created a more interactive and meaningful learning experience. Thus, the use of Assemblr Edu media is proven to be effective in improving science learning outcomes on the topic of the human respiratory system.

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ABSTRAK

Latar belakang penelitian ini didasarkan pada rendahnya hasil belajar peserta didik yang disebabkan oleh kualitas materi yang bersifat abstrak dan kurangnya media visual yang menarik. Kemajuan teknologi digital membuka peluang baru dalam proses pembelajaran, termasuk penggunaan media Augmented Reality (AR) yang interaktif. Penelitian ini bertujuan untuk mengetahui pengaruh media Assemblr Edu terhadap hasil belajar IPAS pada materi sistem pernapasan manusia. Penelitian ini menggunakan pendekatan kuantitatif dengan metode eksperimen semu dan desain non-equivalent control group design. Subjek penelitian adalah peserta didik *kelas V SD yang terbagi menjadi kelas eksperimen dan kelas kontrol. Pengumpulan data dilakukan melalui pretest dan posttest, dengan analisis data menggunakan uji normalitas, homogenitas, dan uji Independent Samples T-Test. Hasil penelitian menunjukkan bahwa terdapat pengaruh yang signifikan penggunaan media Assemblr Edu terhadap hasil belajar IPAS* peserta didik*. Visualisasi tiga dimensi yang disediakan oleh Assemblr Edu mampu memperjelas konsep abstrak, mendorong keterlibatan aktif peserta didik, serta menciptakan pengalaman belajar yang lebih interaktif dan bermakna. Dengan demikian, penggunaan media Assemblr Edu terbukti efektif dalam meningkatkan hasil belajar IPAS pada materi sistem pernapasan manusia.*

Kata Kunci: *Assemblr Edu; hasil belajar; IPAS; sistem pernapasan; teknologi pendidikan*

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INTRODUCTION

Twenty first century learning requires students to have the ability to adapt to rapid technological developments. This condition positions learning outcomes as the primary indicator of educational success because they reflect students ability to master and apply the knowledge they have acquired (Tania *et al*., 2023). The achievement of learning outcomes is strongly influenced by the quality of instruction, particularly educators ability to manage interactive and innovative learning processes. One approach recommended in twenty first century learning is the strengthening of 4C skills, namely communication, collaboration, critical thinking, and creativity (Lestari and Hindun, 2024). These skills develop optimally when integrated with the use of digital technology in learning (Yanti *et al*., 2024). Therefore, the role of educators is crucial in designing learning strategies that foster these skills, including in IPAS subjects at the elementary school level.

IPAS at the elementary school level is an important subject that provides students with opportunities to understand themselves and their environment through direct learning experiences. IPAS learning also aims to develop students thinking and scientific abilities (Juhaeni *et al*., 2022). One of the topics studied is the human respiratory system, which includes the structure and function of respiratory organs as well as the importance of maintaining respiratory health. However, this material is abstract and complex, which creates difficulties for students, particularly those at the concrete operational stage of cognitive development, such as fifth-grade students. Jean Piaget stated that students at this stage require visual support or concrete objects to understand abstract concepts (Agfirlana, 2023). Unfortunately, field conditions indicate that many educators still rely on lecture-based methods without incorporating supportive learning media.

The results of an initial observation at an elementary school in East Jakarta showed that many students had not yet achieved the minimum mastery criterion of 78, with average daily test scores on the respiratory system topic of 67.86 in class V-A and 71.79 in class V-B. The low test scores indicate that students experience difficulties in understanding the material. This condition is caused by educators having used learning media, but not yet fully utilizing media that effectively support conceptual understanding. As a result, learning becomes passive, less interactive, and less engaging, which affects the low level of student involvement in the learning process and the failure to achieve learning objectives. This situation risks hindering students' development of academic understanding and awareness of the importance of maintaining personal and environmental health.

In addressing these problems, instructional innovation is needed to visualize abstract concepts engagingly and interactively. One potential medium is Assemblr Edu, a learning application based on Augmented Reality (AR) technology that allows the integration of 2D and 3D objects into real world environments (Handayani & Asih, 2024). Several previous studies have shown that this medium has a positive impact on learning outcomes. Research has demonstrated the effectiveness of Assemblr Edu in improving students learning outcomes. One study found that the use of this medium had a positive effect on the learning outcomes of seventh-grade students (Laili & Nurmawati, 2024). Another study reported that Assemblr Edu also contributed to increased interest in learning and improved learning outcomes among junior high school students in Cilegon (Masri *et al*., 2023). In addition, instructional media play an important role in supporting the visualization of learning materials that are difficult to understand through verbal explanation alone, thereby facilitating more effective achievement of learning objectives (Wahidin, 2025).

Nevertheless, previous studies have largely focused on the junior high school level and have not been widely applied in the context of IPAS learning at the elementary school level, particularly for the topic of the human respiratory system. Therefore, this study focuses on the implementation of Assemblr Edu in IPAS learning for fifth grade elementary school students, with the expectation that it can help learners

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understand abstract concepts through interactive and visual learning experiences. This medium was also selected because it had not previously been used in the teaching and learning process at the school where the research was conducted.

Based on the foregoing explanation, the research problem in this study is formulated as whether the use of Assemblr Edu media has an effect on the learning outcomes of fifth grade elementary school students in IPAS on the topic of the human respiratory system. This formulation arises from several issues identified in the learning process, including students low level of understanding of the human respiratory system material in IPAS, the dominant use of conventional learning media that do not sufficiently engage students active participation, and the limited ability of teachers to integrate digital media, particularly Assemblr Edu, into innovative learning practices. To address this problem, this study proposes two hypotheses: the alternative hypothesis (H_a), which states that the use of Assemblr Edu media has a significant effect on students IPAS learning outcomes on the topic of the human respiratory system in fifth grade elementary school, and the null hypothesis (H_0), which states that there is no effect of using Assemblr Edu media on learning outcomes for this topic.

The purpose of this study is to examine the effect of Assemblr Edu media on IPAS learning outcomes related to the human respiratory system among fifth-grade students at an elementary school in East Jakarta. In addition, this study is expected to provide an alternative solution for teachers in selecting innovative learning media that align with the cognitive developmental characteristics of elementary school students. The findings of this study are also expected to contribute to the development of more meaningful, active, and relevant IPAS learning practices that meet the demands of 21st-century education.

LITERATURE REVIEW

Learning Outcomes in the Context of Basic Education

Learning outcomes are a primary indicator of the success of the educational process because they reflect students' overall achievement. The scope of learning outcomes extends beyond the cognitive domain to include affective and psychomotor domains. Learning outcomes can be defined as the level of students' achievement in understanding specific subject matter, which can be measured through assessment processes (Andryannisa *et al*., 2023). Learning outcomes serve as a benchmark for evaluating students' success after participating in learning activities. In addition, learning outcomes provide important information for teachers to assess the extent to which students have achieved predetermined learning objectives. Learning outcomes are the competencies acquired by students, including knowledge, attitudes, and skills (Mulia *et al*., 2021). From the perspective of Bloom's taxonomy, cognitive learning outcomes consist of six categories: remembering (C1), understanding (C2), applying (C3), analyzing (C4), evaluating (C5), and creating (C6) (Ramdhani & Susanti, 2024).

The factors influencing learning outcomes are generally divided into two categories: internal and external factors (Pingge & Wangid, 2016). Internal factors include physical condition, psychological aspects such as motivation, interest, intelligence, and study habits, as well as students' emotional maturity (Nasri *et al*., 2022; Simamora *et al*., 2020). Meanwhile, external factors encompass the physical environment, including learning facilities and classroom conditions; the social environment, such as interactions with teachers, peers, and family; as well as cultural aspects and societal values (Nurohmah et al., 2022). Collaboration among the family, school, and community environments is therefore essential to support students' learning success.

Assemblr Edu as an Innovative Augmented Reality-Based Learning Media

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The development of information technology has driven significant transformations in the field of education, particularly through the use of augmented reality-based learning media. The integration of AR in educational settings offers substantial potential to enhance the learning process (Hasannah *et al*., 2024). Assemblr Edu is an innovative AR-based learning application designed to visualize abstract concepts through virtual two-dimensional and three-dimensional objects that can be integrated into real-world environments (Nugrohadi & Anwar, 2022). This application enables students to interact directly with learning materials through realistic and engaging visual representations, thereby improving conceptual understanding and increasing learning motivation.

Assemblr Edu does not merely function as a presentation medium, but also serves as a platform for idea exploration that fosters students' creativity in the learning process (Febriningrum & Purwaningsih, 2022). This media provides opportunities for both students and teachers to develop learning content in an interactive and engaging visual format. Furthermore, the presentation of material in three-dimensional form makes information more accessible and easier to understand, thereby increasing students' learning interest (Simamora & Fauzi, 2022). The steps for using Assemblr Edu begin with downloading the application, creating an account, and then developing content projects by adding objects, text, or videos that are relevant to the learning material.

Assemblr Edu offers several advantages, including ease of operation, the ability to present learning materials in concrete terms, support for visual learning, and the encouragement of creativity among both teachers and students (Chairudin *et al*., 2023). However, several limitations need to be considered, including the requirement for an internet connection, large storage capacity, paid premium features, and technical issues such as audio problems or the application closing automatically during use (Sari *et al*., 2024). Despite these limitations, the potential use of Assemblr Edu as a learning medium in the context of IPAS remains very high, particularly for complex topics such as the human respiratory system.

Learning Natural and Social Sciences in the Context of the Merdeka Curriculum

Learning Natural and Social Sciences is an integration of two disciplines that were previously taught separately at the elementary school level. In the Merdeka Curriculum, the integration of Natural Sciences and Social Sciences into IPAS aims to provide a comprehensive understanding of natural and social phenomena encountered in students' daily lives (Naelendra *et al*., 2024). This approach is aligned with the characteristics of elementary school students, who tend to understand concepts more effectively when they are presented in a concrete, holistic, and integrated manner (Marwa *et al*., 2023).

According to the Ministry of Education, Culture, Research, and Technology (Kemendikbud), IPAS aims to equip students with the ability to understand natural and social environments, as well as to develop characters that are caring toward the environment, socially responsible, and capable of critical thinking (accessible at: https://kurikulum.kemdikbud.go.id/file/cp/dasmen/13.%20CP%20IPAS.pdf). IPAS learning is also designed to develop students' interest, curiosity, and skills in identifying and solving real-life problems. Experience-based approaches, such as observation, discussion, and simple experiments, are considered important in optimizing student engagement in the learning process (Astuti, 2019). In the context of Natural and Social Sciences learning, learning objectives include developing curiosity toward natural and social phenomena, increasing ecological awareness, strengthening problem solving skills, understanding IPAS concepts and phenomena in everyday life, and forming student character in accordance with the Pancasila Student Profile (Adnyana & Yudaparmita, 2023). Therefore, the use of learning media such as Assemblr Edu that supports visual and interactive approaches is highly relevant to be applied in IPAS learning, especially for abstract materials.

The Human Respiratory System as IPAS Learning Material

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The human respiratory system is an essential topic in IPAS learning because it is closely related to the vital functions of the human body. Respiration is a biological process that involves a series of organs, including the nose, pharynx, trachea, bronchi, lungs, and diaphragm. These organs work together in the process of oxygen intake and carbon dioxide release (accessible at: https://kurikulum.kemdikbud.go.id/file/cp/dasmen/13.%20CP%20IPAS.pdf). This material also includes an understanding of respiratory disorders such as influenza, asthma, bronchitis, and tuberculosis (TBC), which is important for increasing students' awareness of the importance of maintaining health.

However, difficulties in IPAS learning materials often pose challenges for students, particularly because the content is abstract and cannot be directly observed (Maraharani & Susanti, 2025). Therefore, learning about the human respiratory system requires instructional media that are able to visualize these concepts in a concrete manner. In this context, the use of digital media such as Assemblr Edu can serve as an effective solution to enhance students understanding and engagement. This media is able to present 2D and 3D simulations of respiratory organs and the gas exchange process, thereby helping students learn the material through more authentic learning experiences (Lissa'adah & Widiyatmoko, 2023). Considering the cognitive characteristics of fifth grade students who are at the concrete operational stage according to Piaget's theory of cognitive development, the use of visual learning media is highly appropriate to support the achievement of learning objectives and to facilitate optimal learning outcomes.

METHODS

This study employed a quantitative approach, using a quasi-experimental design with a non-equivalent control group. This design involved two groups: an experimental class that received treatment in the form of using Assemblr Edu as a learning medium in IPAS instruction on the human respiratory system, and a control class that used PowerPoint as the learning medium. To determine the effect of the treatment on learning outcomes, measurements were conducted through pretests and posttests in both groups. The research was conducted in one elementary school in East Jakarta, with a total population of 56 fifth grade students. The entire population was used as the sample through a saturated sampling technique, with class V-A assigned as the experimental group and class V-B as the control group, each consisting of 28 students.

The research procedure was carried out in several stages, namely administering a pretest to both groups, implementing the treatment in the experimental group for three meetings using the AR based Assemblr Edu learning media, and conducting instruction in the control group using PowerPoint. After the treatment, a posttest was administered to both groups to identify changes in learning outcomes. The implementation steps of Assemblr Edu in the learning process referred to usage procedures developed in previous studies, beginning with downloading the application, creating 3D visual projects aligned with the learning material, and integrating them into interactive, group-based learning activities (Chairudin *et al*., 2023). The learning model applied in this study was Problem Based Learning (PBL) to create an active and collaborative learning environment.

The research instrument consisted of a written multiple choice test developed based on the IPAS learning achievement indicators in the Merdeka Curriculum, covering cognitive aspects at levels C3 to C5. Instrument validity was tested using the product moment correlation technique, while reliability was examined using the Cronbach's Alpha formula. Data analysis was conducted quantitatively, including prerequisite tests and hypothesis testing with the assistance of SPSS software. Normality was tested using the Shapiro Wilk test, while homogeneity of variance was examined using Levene's test. Hypothesis testing was carried out using an independent samples t-test at a 5% significance level. In addition, an

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effect size test was conducted to determine the magnitude of the effect of using Assemblr Edu media on students learning outcomes, calculated using Cohen's d formula and interpreted based on standard criteria. Thus, this method was designed to objectively identify and measure the effectiveness of Assemblr Edu media on students' learning outcomes in the human respiratory system material.

RESULTS AND DISCUSSION

This research was conducted at one elementary school in East Jakarta, which has adequate facilities to support learning activities. The study was carried out over a three week period, from May 21 to June 4, 2025, and involved two classes: class V-A as the experimental group using Assemblr Edu media, and class V-B as the control group using PowerPoint media. Prior to implementation in the study, the research instrument in the form of a multiple choice test was first tested for validity and reliability to ensure its appropriateness in measuring IPAS learning outcomes on the human respiratory system material. The instrument try-out was conducted at one elementary school in South Jakarta and involved 30 students.

A total of 20 test items were analyzed using the Pearson Product Moment correlation technique to examine validity. The results showed that 17 items had correlation coefficients greater than the r_{table} (0,361), and were therefore declared valid. The remaining three items were considered invalid because their calculated r_{values} were lower than the r_{table}. Furthermore, reliability testing was conducted using the Cronbach's Alpha formula, yielding a coefficient of 0.727, which exceeds the minimum r_{table} (0,600). Thus, the instrument was determined to be reliable and appropriate for use in the study.

Pretest and Posttest Results of the Experimental and Control Classes

This section presents a description of the data obtained from the initial test (pretest) and the final test (posttest) for both the experimental class and the control class. The analysis aims to identify changes in students learning outcomes before and after the treatment was administered. The following table presents descriptive statistics, including maximum and minimum scores, mean, median, mode, and standard deviation.

Table 1. Summary of Pretest and Posttest Statistics

Description	Experiment		Control	
	Pretest	***Posttest***	***Pretest***	***Posttest***
Highest Value	82,3	100	76,4	88,2
Lowest Value	47	70,5	41,1	58,8
Average (Mean)	63,8	86,3	61,3	74,9
Median	64,7	88,2	64,7	76,4
Modus	64,7	88,2	64,7	76,4
Standard Deviation	10,82	7,37	10,05	8,10

Source: Research 2025

Based on the data presented in **Table 1**, the mean posttest score of the experimental class reached M = 86.3, showing a substantial increase compared to the pretest score (M = 63.8). This result indicates that students learning outcomes improved positively after the implementation of the Assemblr Edu media. In

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contrast, the control class also showed an increase in the mean score, from M = 61.3 to M = 74.9; however, the magnitude of this improvement was not comparable to that observed in the experimental class. The smaller standard deviation in the experimental class posttest results (SD = 7.37) suggests a more homogeneous distribution of students scores. Overall, the higher score gains and more consistent score distribution in the experimental class reflect the effectiveness of the learning media in IPAS instruction.

Results of Assumption Testing

To ensure that the data met the requirements for analysis, normality and homogeneity tests were conducted. The normality test was performed using the Shapiro Wilk test, while the homogeneity test employed Levene's test. **Table 2** presents the results of the normality test for all data groups.

Table 2. Result Normality Test

Data Group	Statistics	Sig.	Description
Experimental Pretest	0,939	0,107	Normal
Experimental Pretest	0,945	0,148	Normal
Control Pretest	0,942	0,127	Normal
Control Posttest	0,940	0,109	Normal

Source: Research 2025

Based on the data presented in **Table 2**, all data groups obtained significance values greater than 0.05 (p > 0.05), namely the experimental pretest (p = 0.107), experimental posttest (p = 0.148), control pretest (p = 0.127), and control posttest (p = 0.109). These results indicate that the data are normally distributed and meet the assumptions required for parametric statistical testing.

Table 3 presents the results of the homogeneity test based on Levene's analysis.

Tabel 3. Result Homogenity Test

Variabel	Levene Statistic	Sig. (p)	Description
Posttest	0,138	0,713	Homogen

Source: Research 2025

Based on the data presented in **Table 3**, the significance value of Levene's test is 0.713 (p > 0.05), indicating that the variances between the experimental class and the control class are homogeneous. Therefore, the data meet the homogeneity assumption required for conducting an independent samples t-test.

Results of Hypothesis Testing

To examine whether there is a significant difference in learning outcomes between students who used the Assemblr Edu media and those who did not, an independent samples t-test was conducted using SPSS. The following criteria were applied in making decisions for this hypothesis testing.

H_o : *There is no effect of implementing Assemblr Edu learning media on IPAS learning outcomes in the human respiratory system material among fifth grade elementary school students.*

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H_a : *There is an effect of implementing Assemblr Edu learning media on IPAS learning outcomes in the human respiratory system material among fifth grade elementary school students.*

T-Test (*Independent Samples T-Test*)

The following table shows the mean scores and standard deviations of the posttest results for both classes.

Table 4. T-Test Results and Value Comparison

Class	Mean	Std. Deviation	N
Experiment	86,30	7,368	28
Control	74,94	8,100	28

Source: Research 2025

Based on the data presented in **Table 4**, the mean posttest score of students in the experimental class (M = 86.30, SD = 7.368) was higher than that of the control class (M = 74.94, SD = 8.100). This finding indicates that the use of Assemblr Edu media contributes positively to students' learning outcomes. Furthermore, the results of the independent samples t-test are presented in the following table.

Table 5. Result Independent Samples T-Test

Statistics	Score
t value	5,490
t table	2,048
Sig. (2-tailed)	0,000
Conclusion	There is an effect

Source: Research 2025

Based on the data presented in **Table 5**, the significance value of 0.000 ($p < 0.05$) indicates that there is a statistically significant difference between the learning outcomes of students in the experimental class and those in the control class. The calculated t-value (5.490) is substantially higher than the critical t-value (2.048) at df = 54, leading to the rejection of H_0 and the acceptance of H_a. These results provide strong evidence that the use of Assemblr Edu media is effective in improving IPAS learning outcomes among fifth grade elementary school students.

Effect Size Test

To determine the magnitude of the effect of using Assemblr Edu media on learning outcomes, Cohen's d was calculated with the assistance of SPSS.

Table 6. Result Effect Size Test

Parameters	Score
Cohen's d	1,467
Category	Kuat

Source: Research 2025

Based on the data presented in **Table 6**, the Cohen's d value of 1.467 indicates a strong effect of using Assemblr Edu media on students' learning outcomes. According to Cohen's criteria, values greater than 0.8 are categorized as having a strong effect. Therefore, this result provides quantitative evidence that the use of Assemblr Edu media has a substantial impact on students' academic achievement.

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Discussion

The results of this study indicate that the use of Assemblr Edu media has a significant effect on students learning achievement in the topic of the human respiratory system. This is evidenced by the results of the Independent Samples t-test, in which the calculated t-value (5.490) exceeded the critical t-value (2.048) at a 5% significance level ($\alpha = 0.05$). Therefore, the alternative hypothesis (H_a) was accepted and the null hypothesis (H_0) was rejected. The mean posttest score of students in the experimental class was 86.30, which was significantly higher than that of the control class that did not use Assemblr Edu media.

Furthermore, the effect size analysis yielded a value of 1.467, which, according to Cohen's classification in "*Statistical Power Analysis for the Behavioral Sciences"*, falls into the strong category, indicating that the use of Assemblr Edu media has a substantial impact on students understanding. This result suggests that the visual and interactive presentation of content through Assemblr Edu is effective in overcoming cognitive barriers to understanding abstract material, such as the human respiratory system, which involves internal structures and processes that are difficult to visualize through conventional instructional methods.

These findings are consistent with previous studies showing that the use of Assemblr Edu is effective in improving learning outcomes among tenth grade vocational high school students in statistics (Tania *et al*., 2023). That study, which also employed a quasi experimental design with a control group, reported a significant increase in posttest scores following the implementation of the media. Although differing in educational level and subject matter, the consistent pattern of improved learning outcomes through interactive visualization strengthens the conclusion that this media is effective across various learning contexts.

Similarly, previous studies have identified a moderate correlation between the use of Assemblr Edu and learning outcomes in history among eleventh grade social science students (Febriningrum & Purwaningsih, 2022). Although their study employed a one shot case study design, which does not allow for direct causal inference, the findings still suggest that AR-based media such as Assemblr Edu have potential for application across various subject areas. Furthermore, other research has shown that the implementation of Assemblr Edu in biology learning, particularly on the topic of the animal kingdom, resulted in a significant increase in students' gain scores (Ahmad *et al*., 2022). These findings reinforce the idea that Assemblr Edu's ability to represent abstract objects visually and flexibly supports the learning of concepts that are difficult to visualize, including the human respiratory system discussed in this study (Yasa *et al*., 2024).

Theoretically, the findings of this study reinforce Jean Piaget's perspective on children's cognitive development, particularly during the concrete operational stage (ages 7–11), in which students require support through concrete objects or visual aids to understand abstract concepts (Marinda, 2020). Assemblr Edu addresses this need by providing an interactive, visually engaging, and contextually meaningful learning experience that is easily accessible, making it highly compatible with the cognitive development characteristics of elementary school students. Practically, the implementation of Assemblr Edu in IPAS learning offers teachers the opportunity to adopt more innovative media, especially when faced with the challenge of delivering complex material in an engaging and easily comprehensible manner. The results showed that only 18% of students in the experimental class scored below the minimum mastery criterion (KKM), a significant improvement compared to the initial condition, where the majority of students had not yet achieved mastery. These findings indicate that the use of Assemblr Edu not only supports more

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consistent competency achievement but also promotes active student engagement in the learning process.

However, this study has several limitations that need to be considered. First, the effectiveness of Assemblr Edu is highly dependent on the availability of digital devices and stable internet connectivity, which can pose technical challenges for students in accessing the material optimally. Some students experienced technical difficulties that affected their engagement during the learning process. Second, the intervention was conducted over a relatively short period of three weeks, which does not provide a comprehensive view of the long term effects of this media on material retention or the development of other competencies, such as critical thinking skills. Therefore, further research is needed with a broader scope, longer learning duration, and varied learning contexts to explore the full potential of Assemblr Edu in education, particularly in supporting the achievement of 21st-century learning outcomes.

CONCLUSION

This study concludes that the integration of Assemblr Edu into IPAS learning on the human respiratory system significantly influences the learning outcomes of fifth grade students. Learning, which previously did not fully utilize instructional media that support the visualization of abstract material, became more interactive, concrete, and easier to understand when combined with Assemblr Edu technology. This media not only clarifies concepts through three dimensional visual illustrations but also creates a more engaging learning environment that encourages active student participation. These findings confirm that the use of educational technology such as Assemblr Edu aligns with the learning needs at the concrete operational stage and supports student-centered learning principles as emphasized in the Merdeka Curriculum. Therefore, the results of this study not only address the research problem regarding the effect of Assemblr Edu on IPAS learning outcomes but also support the main objective of the study, namely providing an innovative alternative for delivering IPAS material that is more meaningful, relevant, and adaptable to contemporary educational demands.

This study opens the door for further research that can expand the scope of topics, including the context, approaches, and variables examined. Future studies are recommended to involve larger and more diverse samples across multiple schools to test the generalizability of the findings across different social and geographic backgrounds. In addition, it is suggested to investigate the influence of Assemblr Edu on other dimensions of learning outcomes, such as 21st-century skills (e.g., critical thinking, collaboration, communication, and creativity), as well as to evaluate the long term impact of this media on students attitudes and learning motivation. Subsequent research could also explore the integration of Assemblr Edu with specific instructional models to optimize learning outcomes across various subjects.

AUTHOR'S NOTE

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REFERENCES

Adnyana, K. S., & Yudaparmita, G. N. A. (2023). Peningkatan minat belajar IPAS berbantuan media gambar pada siswa sekolah dasar. *Edukasi: Jurnal Pendidikan Dasar*, *4*(1), 61-70.

Agfirlana, A. M. (2023). Analisis implementasi perkembangan kognisi Piaget dan Vygotsky dalam pencapaian tujuan pembelajaran Pendidikan Agama Islam di SDN Margaasih. *Jurnal Tambora*, *7*(1), 226-234.

Ahmad, Z., Ahmad, H., & Rahman, Z. A. (2022). Penggunaan media pembelajaran augmented reality berbantuan *Assemblr Edu* untuk meningkatkan hasil belajar siswa SMA Negeri 5 Kota Ternate. *Jurnal Ilmiah Wahana Pendidikan*, *8*(23), 514-521.

Andryannisa, M. A. Z., Wahyudi, A. P., & Sayekti, S. P. (2023). Upaya meningkatkan hasil belajar siswa dengan menggunakan metode resitasi pada mata pelajaran akidah akhlak di SD Islam Riyadhul Jannah Depok. *Jurnal Pendidikan Sosial dan Humaniora*, *2*(3), 1-15.

Astuti, T. P. (2019). Model problem based learning dengan mind mapping dalam pembelajaran IPA abad 21. *Proceeding of Biology Education*, *3*(1), 64-73.

Chairudin, M., Nurhanifa, N., Yustianingsih, T., Aidah, Z., Atoillah, A., & Hadi, M. S. (2023). Studi literatur pemanfaatan aplikasi Assemblr Edu sebagai media pembelajaran Matematika jenjang SMP/MTs. *Communnity Development Journal*, *4*(2), 1312-1318.

Febriningrum, D. P., & Purwaningsih, S. M. (2022). Pengaruh aplikasi Assemblr Edu berbasis teknologi augmented reality terhadap hasil belajar mata pelajaran Sejarah Indonesia kelas XI IPS SMAN 8 Surabaya. *Avatara: e-Journal Pendidikan Sejarah*, *13*(1), 1–12.

Handayani, T., & Asih, S. S. (2024). Penerapan media augmented reality menggunakan Assemblr Edu untuk meningkatkan prestasi akademik bidang IPAS di tingkat sekolah dasar. *Sekolah Dasar: Kajian Teori dan Praktik Pendidikan*, *33*(2), 129-146.

Hasannah, N., Afina, A. F., Nuraeni, P., & Hadiapurwa, A. (2024). Is education possible in the metaverse especially in Indonesia?. *Hipkin Journal of Educational Research, 1*(1), 13-24.

Juhaeni, J., Wiji, S., Wadud, A. J., Saputra, H., Azizah, I. N., & Safaruddin, S. (2022). Pengaruh media pembelajaran teka teki silang terhadap hasil belajar IPA materi perkembangbiakan tumbuhan. *Journal of Instructional and Development Researches*, *2*(6), 241–247.

Laili, A. M., & Nurmawati, R. (2024). Pengaruh model pembelajaran PBL berbantuan media Assemblr Edu terhadap hasil belajar IPA. *LENSA (Lentera Sains): Jurnal Pendidikan IPA*, *14*(2), 75-83.

Lestari, R. V. A., & Hindun, H. (2024). Penerapan 4C (communication, collaboration, critical thinking, creativity) pada kurikulum merdeka di tingkat SMA. *Reduplikasi: Jurnal Penelitian Pendidikan Bahasa Indonesia*, *3*(2), 15-26.

Lissa'adah, L., & Widiyatmoko, A. (2023). The effectiveness of augmented reality based on *Assemblr Edu* to increase learning interest and student learning outcomes. *Journal of Environmental and Science Education*, *3*(2), 79-85.

Maraharani, S. D., & Susanti, L. R. (2025). Analisis kebutuhan pengembangan media game edukasi berbantuan Canva pada mata pelajaran IPAS untuk sekolah dasar. *Social: Jurnal Inovasi Pendidikan IPS*, *5*(1), 275-283.

Marinda, L. (2020). Teori perkembangan kognitif Jean Piaget dan problematikanya pada anak usia sekolah dasar. *An-Nisa Journal of Gender Studies*, *13*(1), 116-152.

https://doi.org/10.64014/jik.v22i3.91

Marwa, N. W. S., Usman, H., & Qodriani, B. (2023). Persepsi guru sekolah dasar terhadap mata pelajaran IPAS pada kurikulum merdeka. *Metodik Didaktik*, *18*(2), 54-64.

Masri, M., Surani, D., & Fricticarani, A. (2023). Pengaruh penggunaan media augmented reality Assemblr Edu dalam meningkatkan minat belajar siswa SMP. *Jurnal Penelitian, Pendidikan dan Pengajaran: JPPP*, *4*(3), 209-216.

Mulia, E., Zakir, S., Rinjani, C., & Annisa, S. (2021). Kajian konseptual hasil belajar peserta didik dalam berbagai aspek dan faktor yang mempengaruhinya. *Dirasat: Jurnal Manajemen dan Pendidikan Islam*, *7*(2), 137–156.

Naelendra, F. G., & Azizah, S. (2024). Upaya meningkatkan hasil belajar peserta didik menggunakan model problem based learning metode eksperimen IPAS SD. *Pengertian: Jurnal Pendidikan Indonesia (PJPI)*, *2*(3), 459-470.

Nasri, E., Setiawan, T. H., Warianto, H., Aden, A., & Ilmadi, I. (2022). Faktor-faktor yang mempengaruhi rendahnya prestasi belajar ujian Matematika siswa dengan menggunakan metode analisis faktor. *Jurnal Lebesgue: Jurnal Ilmiah Pendidikan Matematika, Matematika dan Statistika*, *3*(1), 12-28.

Nugrohadi, S., & Anwar, M. T. (2022). Pelatihan Assembler Edu untuk meningkatkan keterampilan guru merancang project-based learning sesuai kurikulum merdeka belajar. *Media Penelitian Pendidikan: Jurnal Penelitian dalam Bidang Pendidikan dan Pengajaran*, *16*(1), 77-80.

Nurohmah, N., Suchyadi, Y., & Mulyawati, Y. (2022). Pengaruh gaya belajar terhadap hasil belajar Matematika di SD Negeri Sukaharja 01 Kabupaten Bogor. *Journal of Social Studies Arts and Humanities (JSSAH)*, *2*(1), 67-70.

Pingge, H. D., & Wangid, M. N. (2016). Faktor yang mempengaruhi hasil belajar siswa sekolah dasar di kecamatan kota Tambolaka. *Jurnal Pendidikan Sekolah Dasar Ahmad Dahlan*, *2*(1), 107-122.

Ramdhani, S. S., & Susanti, R. (2024). Cognitive level of Program for International Student Assessment (PISA) questions based on the revised Bloom's taxonomy. *European Journal of Education and Pedagogy*, *5*(2), 104-112.

Sari, D. M., Afriandi, P., Simanungkalit, E., Mailani, E., & Manurung, I. F. U. (2024). The effect of Assemblr Edu learning media on social science learning outcomes. *Mahir: Jurnal Ilmu Pendidikan dan Pembelajaran*, *3*(2), 291-300.

Simamora, R. R., & Fauzi, R. (2022). Pengaruh media pembelajaran menggunakan aplikasi Assemblr Edu terhadap minat belajar siswa. *Jurnal Vinertek (Vokasional Informatika Edukasi Riset dan Teknologi)*, *2*(3), 30-35.

Simamora, T., Harapan, E., & Kesumawati, N. (2020). Faktor-faktor determinan yang mempengaruhi prestasi belajar peserta didik. *JMKSP (Jurnal Manajemen, Kepemimpinan, Dan Supervisi Pendidikan)*, *5*(2), 191.

Tania, E. P., Patmaningrum, A., & Aini, A. Z. (2023). Penerapan media pembelajaran augmented reality melalui aplikasi Assemblr Edu terhadap hasil belajar siswa pada materi statistika kelas X SMK Negeri 1 Gondang. *Dharma Pendidikan*, *18*(2), 126-133.

Wahidin, W. (2025). Pengembangan media pembelajaran visual untuk meningkatkan pemahaman konsep siswa. *Jurnal Ilmiah Edukatif, 11*(1), 285-295.

Yanti, E., Utari, M., & Putra, S. (2024). Media digital dalam memberdayakan kemampuan berpikir kritis abad 21 pada pembelajaran IPA di sekolah dasar. *Jurnal Tarbiyah Al-Awlad*, *14*(1), 91-101.

https://doi.org/10.64014/jik.v22i3.91

Yasa, A. D., Kumala, F. N., Alfianto, R. N. A., & Salimi, M. (2024). Development of human digestive organ media based on Assemblr EDU. *Inovasi Kurikulum, 21*(3), 1371-1382.

https://doi.org/10.64014/jik.v22i3.91