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Development of augmented reality learning media based on assemblr studio web in ecosystem material

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Abstract
Augmented Reality displays realistic-looking 3D animations. Learning media utilizing Augmented Reality can assist students in comprehending Biology education, particularly ecosystem materials, with greater concreteness. This study reports the development of Augmented Reality learning media based on Assemblr Studio Web, known for its validity and positive response from students. The research employs the Research and Development (R&D) approach with a 3D modification development model derived from the 4D model developed by Thiagarajan. The Augmented Reality learning media based on Assemblr Studio Web received highly valid assessments from subject matter experts (85.18%), media experts (90%), and language experts (80.83%). In a small-scale trial involving 27 students, a response rate of 78.51% (positive) was recorded, while in a large-scale trial with 63 students, the response rate was 76.4% (positive). It is concluded that the developed Augmented Reality learning media based on Assemblr Studio Web is highly suitable for use in the learning process and has received positive feedback from students.

Keywords: Augmented Reality; Assemblr Studio Web; Ecosystem; Biology Education.

INTRODUCTION

Learning media serves as a tool to assist learners in understanding content, undoubtedly influencing students' learning outcomes. Interactive learning media has the potential to stimulate students (Rahmawati, 2021). Well-packaged, unique, and accurate learning media can be utilized as information, entertainment, and educational tools (Nur, 2021). In the current era, various aspects of life, including education, are experiencing rapid development, which inevitably impacts the field of education. The digitalization era has seen the emergence of numerous websites and applications utilized as learning media, one of which is Augmented Reality (Alfitriani, 2021). This research aims to develop learning media that incorporates technology by combining objects from the virtual world applied in the real world in two or three dimensions, making them tangible, visible, and audible (Aprilinda, 2020). Augmented Reality learning media is developed using the Assemblr Studio Web website.

Augmented reality learning media creates a new experience in education. The material delivery can be accessed on mobile devices such as smartphones. This learning media is also attractive and interactive. Some previous studies found developing augmented reality learning media to be relatively challenging. The applications used are numerous, and 3D objects must be created manually. For instance, Mustaqim et al.'s (2017) study required application code, and video converter rendering with a minimum laptop capacity of Core i3, 3GB RAM, and 320GB HDD. Efendi et al.'s (2018) study required supporting applications like Adobe Photoshop CS6, Zbrush, Marmoset Toolbag 3, Blender, Unity 3D, Momo Vuvoria, SDK, and JPK. Haekal et al.'s (2022) study necessitated supporting applications such as Vuporia SPK, Unity 3D, and Photoshop. This study introduces innovation by using the Assemblr Studio Web website, making it easier for users to access 3D content through the browser without the need for account registration and payment, thereby facilitating teachers in applying the research findings in teaching.

Augmented reality learning media can enhance students' learning outcomes. This is supported by Yuliono's (2018) research, indicating that the use of Augmented Reality learning media can improve students' learning outcomes from an average of 50.16 to an average of 77.4. This result is consistent with the findings of Aryani (2019) and Aripin (2019). Aryani's (2019) research demonstrated an increase in understanding science concepts using Augmented Reality learning media from an average of 37.35 to an average of 93.38. Aripin's (2019) research showed a 76% increase in understanding science concepts using Augmented Reality learning media.

One of the subjects that can be addressed in the development of augmented reality learning media is the ecosystem. Ecosystem material in Biology education is characterized by its focus on concrete objects that can be perceived by the senses. According to Nurfadillah's (2021) study, ecosystem material often leads to misconceptions, where students can answer questions, but their explanations are illogical. This indicates that students still struggle to construct and understand concepts accurately. Ecosystem material can be effectively conveyed by presenting realistic imagery. However, constraints such as time, safety, and distance in classroom learning environments make it challenging to conduct direct ecosystem material lessons. Therefore, there is a need for easily accessible and user-friendly learning media for students, one of which is Augmented Reality learning media based on Assemblr Studio Web.

Based on these considerations, this study aims to develop Augmented Reality learning media based on Assemblr Studio Web for ecosystem material that is valid and receives positive responses from students. The research results are expected to provide a learning media solution to address students' needs in comprehending ecosystem material.

METHODS

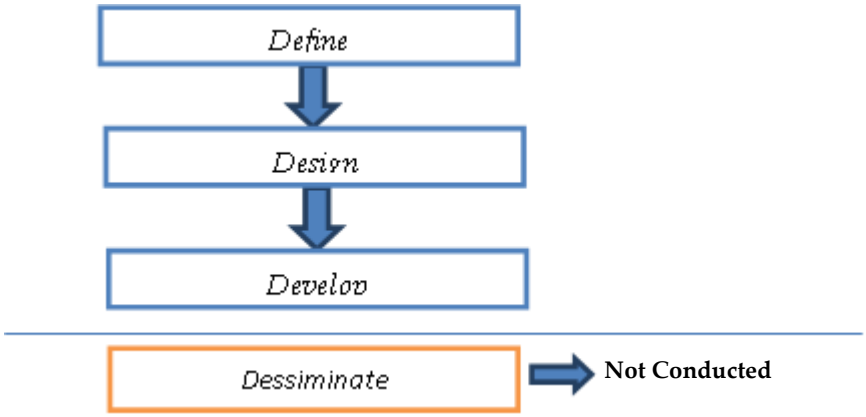

Figure 1. Phases of 4D Model

The type of research that was conducted is research and development, specifically Research and Development (R&D), covering the Augmented Reality framework based on Assemblr Studio Web for Biology learning, particularly the Ecosystem material at SMA Negeri 1 Siantan. The learning media adopts a development model derived from the 4D model. The 4D model serves as a source of ideas and development procedures for creating learning tools, but at this stage, it is restricted to the development phase. The dissemination phase involves the dissemination of the developed learning tools. The research and development procedures using the 4D model can be observed in Figure 1.

Definition

Definition aims to define the conditions of the media to be developed. The Define procedure consists of 4 steps: (1) Initial-Final Analysis (Front-end analysis) aims to analyze the fundamental problems faced in learning ecosystem materials through interviews with Biology subject teachers. (2) Learner Analysis aims to analyze learners to gain an understanding of the issues they face related to the materials and teaching aids used in the learning process through interviews with learners. (3) Concept Analysis determines the material by documenting the syllabus that will be visualized in Augmented Reality learning media. (4) Formulating Objectives (Specifying instructional objectives), the ecosystem material is adjusted to the Learning Objective Flow (ATP) of the Merdeka Curriculum, specifically in Phase E concerning ecosystem components and interactions among biotic components in the ecosystem. Data Collection Techniques in the define phase are as follows (a) Direct interviews with Biology teachers at SMA Negeri 1 Siantan), (b) Documentation of the syllabus to obtain an initial overview in determining the material and formulating learning objectives. Data Collection Tools: (a) Interview guidelines are used to outline the main issues to be addressed, (b) Documentation is used to acquire data not obtained through interviews.

Design

Design aims to create a prototype or initial design of Augmented Reality learning media based on Assemblr Studio Web, consisting of 3 steps: (1) determining the topic; (2) aligning with ecosystem material, and (3) creating a storyboard. Augmented Reality learning media based on Assemblr Studio Web consists of two main components: 3D cards containing ecosystem material and a tutorial on media operation.

The 2D form of Augmented Reality learning media based on Assemblr Studio Web contains ecosystem content consisting of 3 scenes (ecosystem components, food chains, and food webs). The final step is to create the media on the Assemblr Studio Web website and the creation of cards. Media creation involves inputting 3D objects provided on the Assemblr Studio Web website, followed by the addition of text and videos to match the created sub-material. Then, download the marker to operate the created media.

The creation of content cards is designed with two main parts: the front containing the marker used to operate the media and the back containing explanations of the material from each sub-material. The tutorial usage cards are also designed with two main parts: the front containing media operation, and the back containing notes.

Develop

Develop aims to produce revised Augmented Reality learning media based on Assemblr Studio Web based on input from subject matter experts, media experts, and language experts. The Development activities consist of expert validation (expert appraisal) to validate Augmented Reality learning media based on Assemblr Studio Web before pilot testing. The validation results will be used to revise the initial product. The developed media is assessed by 9 validators, including 2 teachers, 1 subject matter expert, and 3 media experts, evaluating learning materials, content, software engineering, display design, and system feasibility. The language expert consists of 1 teacher and 2 professors, assessing language aspects.

The second procedure is product testing (development testing) after expert validation, followed by field testing to assess the application of Augmented Reality learning media based on Assemblr Studio Web in the classroom. Small-scale testing involves 27 students, while large-scale testing involves 63 students. The measured response indicators are students' attitudes and interests in Augmented Reality media based on Assemblr Studio Web. Data analysis from expert validation questionnaires and participant and teacher response questionnaires is used to assess the validity of the developed media. The results from the questionnaires are analyzed in Table 1.

Tabel.1 Score of learning media validity statements

No	Statement Score	Score
1.	Strongly Agree	5
2.	Agree	4
3.	Partially Agree	3
4.	Disagree	2
5.	Strongly Disagree	1

Next, to measure the level of validity of the learning media, it is calculated using the following formula (1):

$$P = \frac{\sum_{i-1}^{4} xi}{\sum_{j-1}^{4} xj} x\ 100\% \quad (1)$$

◎xi = Sum of scores from expert assessment | ◎xj = Sum of highest scores
As a basis for decision-making to revise the learning media, assessment criteria from Table 2 are used.

Table 2. Criteria for learning media validity

Percentage (%)	Validity Criteria	Explanation
85,01-100	Very Valid	Can be used without revision
70,01-85,00	Valid	Can be used but needs minor revision
50,01-70,00	Less Valid	Not recommended for use because major revisions are needed
01,00-50,000	Not Valid	Must not be used

response questionnaires are also used to determine users' responses to the developed learning tools regarding how suitable and easy the implementation of the learning tools is. Student response statement scores can be seen in Table 3.

Table 3. Student rsponse statement scores
Analysis of student responses for description, the questionnaires filled out by students are processed using the following formula (2):

$$\% \text{ Response} = \frac{Skor\ data\ yang\ diperoleh}{Skor\ total} \text{ x } 100 \quad (2)$$

No	Statement Criteria	Positive Score	Negative Score
1.	Strongly Agree (SS)	5	1
2.	Agree (S)	4	2
3.	Neutral (N)	3	3
4.	Disagree (D)	2	4
5.	Strongly Disagree (SD)	1	5

basis for decision-making to revise the learning media, assessment criteria from Table 4 are used.

Table 4. Student response criteria

Criteria	Percentage	Interpretation
Very Positive	82%<score≤100%	No Need Revision
Positive	64%<score≤82%	No Need Revision
Neutral	46%<score≤64%	No Need Revision
Negative	28%<score≤46%	Revision
Very Negative	10% <score≤28%	Revision

Data Collection Techniques

a. Expert Validation

Expert validation is used for testing the feasibility of the learning media product. The learning tool is prepared by the researcher, consulted with the advisor, and then validated by 9 validators consisting of teachers and professors who specialize in language, media, and ecosystem material.

b. Indirect Communication

Through questionnaires to generate accurate quantitative data.

Data Collection Tools

a. Learning Media Validation Sheet

Designed as a feasibility test for the created media, addressed to experts in language, media, and material.

b. Student Response Sheet

Aims to determine student responses after using the learning media.

RESULT AND DISCUSSION

The stages undertaken in the define phase include front-end analysis, learner analysis, concept analysis, and the formulation of instructional objectives. This is followed by the design of the instructional media, followed by development, involving product validation, revision, and refinement based on the analysis of data from content, media, and language experts.

Define

The research begins with front-end analysis conducted through interviews on January 10, 2023, with Biology teachers. Based on the interview results, it can be concluded that the main issue for students at SMA Negeri 1 Siantan is difficulty in learning biology due to the challenging nature of the subject, and the learning activities are perceived as suboptimal. Student engagement in the learning process needs improvement, as the current instructional media primarily consists of videos and blackboards. The students' ease or difficulty in learning biology is influenced

by the use of instructional media. Well-designed instructional media allows students more flexibility in their learning activities, regardless of the presence of a teacher (Wahid, 2018). Another issue concerns learning resources and the teaching methods employed by teachers. Students rely on learning resources such as textbooks and worksheets, with teaching methods centered around lectures where the teacher is the information provider, and students passively receive information. This leads to boredom in the learning process, impacting students' understanding of the taught material (Ikhwan, 2021). This is supported by research Lubis (2019) indicating that varied teaching methods can reduce student boredom, assisting them in achieving learning objectives. In response to these challenges, the researcher proposes an alternative solution using Augmented Reality-based instructional media developed with Assemblr Studio Web to make the learning process more engaging. Augmented Reality instructional media integrates virtual and real-world objects, allowing students to deepen their understanding by visualizing content through their smartphones.

The subsequent activity is Learner Analysis conducted through interviews with 10th-grade students (X MIA 1, MIA 2, and MIA 3) at SMA Negeri 1 Siantan on January 10, 2023. The findings reveal that students, especially in Biology, find the terminology related to the ecosystem challenging, indicating their reliance on memorization of terms and concepts. Most students express that the ecosystem material is perceived as difficult due to its complexity. Therefore, there is a need for the delivery of engaging ecosystem material designed with the use of instructional media tailored to students' characteristics and needs (Fitri, 2022). The instructional model employed by teachers can assist students in understanding the material, improving skills, and conceptualizing the content through Augmented Reality-based instructional media with Assemblr Studio Web.

Subsequently, Concept Analysis aims to select the material. The material selection is based on the existing problems in the school, where some students find it challenging to understand the ecosystem material due to the lack of engaging instructional media, resulting in student grades not meeting the teacher's criteria or falling below the Minimum Mastery Criteria (KKM). In this context, the development of Augmented Reality-based instructional media with Assemblr Studio Web significantly aids the learning process, as students can independently use the media at home with the assistance of the provided application usage tutorial cards. Considering the characteristics of the ecosystem concept that utilizes living organisms and objects in the surrounding environment, the use of Augmented Reality-based instructional media with Assemblr Studio Web becomes advantageous.

Formulating instructional objectives in the Define phase is aligned with the ecosystem material and the Learning Objective Flow (ATP) of the Merdeka Curriculum, particularly in Phase E concerning the ecosystem's components and interactions among biotic components in the ecosystem. Thus, the instructional objectives for student learning include identifying the components composing the ecosystem, understanding the food chain in the marine ecosystem, grasping the

concept of food webs in the marine ecosystem, and distinguishing between the food chain and food webs in the marine ecosystem.

Design

The Design phase generates Augmented Reality instructional media with two main components: content and media operation cards. The content comprises scenes of ecosystem components, food chains, and food webs on the Assemblr Studio Web page, along with instructional media cards designed using Canva. The media operation is structured in card form. The results of the revision for the ecosystem component scenes can be observed in Figure 2a and Figure 2b. The revised scenes of the food chain are presented in Figure 3 and Figure 4. The revised scenes of the food web are illustrated in Figure 5 and Figure 6. After designing the content, the next step involves designing content cards with the assistance of the Canva application. The revised front and back views of the content cards for ecosystem components can be viewed in Figure 7 (a), 7 (b), and Figure 8 (a), 8 (b). The revised front and back views of the content cards for the food chain scenes are depicted in Figure 9 (a), 9 (b), and Figure 10 (a), 10 (b). The revised front and back views of the content cards for the food web scenes are displayed in Figure 11 (a), 11 (b), and Figure 12 (a), 12 (b).

Figure 2a. Ecosystem component scene before revision

Figure 2b. Ecosystem component scene after revision

The ecosystem component scene depicts the explanation of ecosystem components, including explanations of abiotic and biotic environments as well as levels within the ecosystem. This scene includes 3D objects such as coral reefs, algae, jellyfish, seaweed, fish, and whales. The revision addresses errors in the scene title and modifies the color scheme from the previous purple to yellow. This aims to create an attractive color concept that captures the attention of learners, supported by Damayanti's (2021) stating that the color yellow belongs to the warm color group, which can create an enthusiastic, cheerful atmosphere and bring joy. Further revisions involve adjusting text layouts and adding explanatory videos to provide a more in-depth understanding of the material. Lubis's (2019) supports the utilization of videos in learning, as it can facilitate comprehension and strengthen students' memory.

Figure 3. Food Chain Scene Before Revision

Figure 4. Food Chain Scene After Revision

The food chain scene illustrates the process of eating and being eaten within the food chain. This scene includes 3D objects such as coral reefs, seaweed, algae as producers, Nemo fish as a consumer at level 1, brown fish as a consumer at level 2, a whale as a consumer at level 3, and bacteria as decomposers. Revisions involve adding text to convey detailed material, supporting Dewi's (2021) research findings that the use of appropriate text can clarify the learning message. Furthermore, numbers were added to the 3D objects to help users operate the media sequentially, starting from number 1 and so on.

Figure 5. Food Web Scene Before Revision

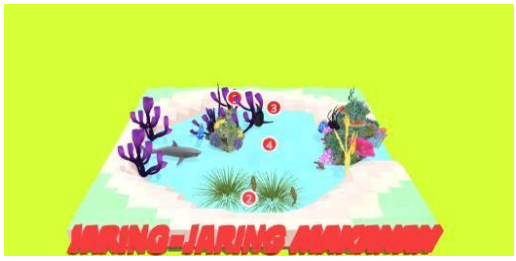

Figure 6. Food Web Scene After Revision

Figure 7a. Front View Card and 7b. Back View Component Ecosystem Scene Card Before Revision

Figure 8a. Front View Card and 8b. Back View Component Ecosystem Scene Card After Revision

Figure 9a. Front View Card and 9b. Back View Food Chain Scene Card Before Revision

Figure 10a. Front View Card and 10b. Back View Food Chain Scene Card After Revision

Figure 11a. Front View Card and 11b. Back View Food Web Scene Card Before Revision |

Figure 12a. Front View Card and 12b. Back View Food Web Scene Card After Revision

The food web scene illustrates the process of eating and being eaten within the food web. This scene includes 3D objects such as algae, coral reefs, seaweed, crabs, Nemo fish, brown fish, sharks, whales, and bacteria. Revisions involve changing the design color from blue to yellow.

Figure 13. Application Download Step Card Before Revision

Figure 14. Application Download Step Card After Revision

In all cards, revisions involve assigning numbers to the front of the card to facilitate users in operating the media sequentially. The appearance of the application download steps card before the revision can be seen in Figure 13, while the appearance of the application download steps card after the revision can be seen in Figures 14 (a) and 14 (b). The appearance of the media operation card before the revision can be seen in Figure 15, while the appearance of the media operation card after the revision can be seen in Figures 16 (a) and 16 (b). The appearance of the learning objectives card before the revision can be seen in Figure 17, while the appearance of the learning objectives card after the revision can be seen in Figures 18 (a) and 18 (b).

Figure 15. Media Operation Card Before Revision

Figure 16a. and 16b. Media Operation Card After Revision

The media operation card is created to facilitate users in operating the media. Revisions involve adding notes for users to operate the media more smoothly, so a note card is added.

Figure 17. Learning Objectives Card Before Revision

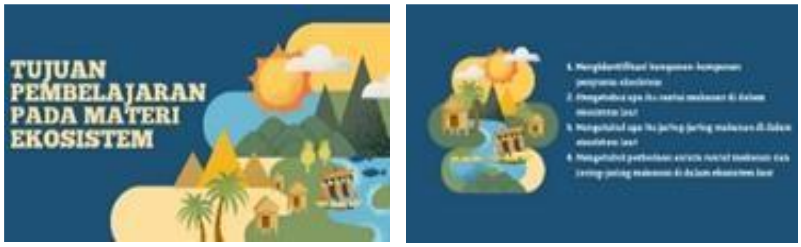

Figure 18a. and 18b. Learning Objectives Card After Revision

The learning objectives card is created so that users can directly see the learning objectives independently. Revisions to the card design, then two sides are made, namely the front side with the title of the learning objectives and the back side with the content of the learning objectives.

Develop

The development stage aims to produce Augmented Reality-based learning media with Assemblr Studio Web as usable learning media, based on input from experts (validators), development tests, and product refinement.

Validity

The validity of Augmented Reality-based Assemblr Studio Web learning media was assessed by expert evaluation. Material expert assessment was conducted by 1 lecturer and 2 biology teachers, media expert assessment was conducted by 3 media expert lecturers, and language expert assessment was conducted by 2 language expert lecturers and 1 language teacher. The results of the expert assessment can be seen in Table 5.

Table 5. Validity of media based on expert validation

Aspect	Validator			Average	Criteria
	1	2	3		
Material	91,1	84,4	80	85,18	Very Valid
Media	100	95	75	90	Very Valid
Language	82,5	80	80	80,83	Valid

Material Validation

Learning material includes knowledge, skills, and attitudes that students must master to meet established competency standards (Ayu, 2019). The feasibility and validity of Augmented Reality-based Assemblr Studio Web learning media were evaluated by material, media, and language experts. The maximum value from the material expert questionnaire overall is 100 (Nurhaidah, 2021). The material experts gave a percentage score of 85.18%, corresponding to the aspect assessed, which is the subject matter and content.

In terms of subject matter, it received a very valid rating of 86.6%. This indicates that the subject matter aligns with the Core Competencies (KI) and Basic Competencies (KD) in the learning objective flow. This is supported by Hasan (2018), emphasizing that teachers must understand and adjust the material with KI and KD, impacting student understanding. It is

also supported by Wahid's (2018) research, stating that instructional media should contain accurate information to avoid student misunderstandings.
The content aspect is considered very valid because it has a percentage score of 83.3%. This indicates alignment with the development of science and technology. Augmented Reality media is a digital-based technology that focuses on student-centered learning, stimulating thinking skills in line with current scientific developments (Amalia et al., 2020). This is also supported by Sapriyah (2019), which emphasizing the transformation of conventional instructional media into digital form, namely Augmented Reality technology.

Media Validation

Learning media encompasses everything such as tools, environments, and all forms of activities conditioned to increase knowledge, change attitudes, or enhance skills in anyone who utilizes them (Aghni, 2018). The feasibility and validity of Augmented Reality-based Assemblr Studio Web learning media were evaluated by material, media, and language experts. The maximum value from the media expert questionnaire overall is 100 (Nurhaidah, 2021). Media experts provided a percentage score of 90% with a highly valid criterion. Considering the aspects assessed—software engineering, display design, and system feasibility—it received a highly valid score of 89.3% in software engineering. This indicates that Augmented Reality usage is easy to operate independently in learning, as supported by Ikhwan (2021), emphasizing that Augmented Reality produces a learning experience that can be done independently, anywhere, and anytime.
In terms of display design, it received a highly valid score of 93.3%. This indicates that the display design is easy to understand, with accurate font selection and color suitability. This is supported by Dewi's (2020) research, emphasizing that the right design attracts students' attention to focus on the conveyed information. It is also supported by Mawadah (2019) research, stating that proper font arrangement and selection make readers comfortable reading to the maximum. The system feasibility aspect received a highly valid score of 93.3%. This indicates that Augmented Reality learning media is user-friendly.

Language Validation

The feasibility and validity of Augmented Reality-based Assemblr Studio Web learning media were evaluated by material, media, and language experts. The maximum value from the language expert questionnaire overall is 100 (Nuramidah, 2021). Based on the aspect assessed, which is language, the language expert assessment obtained a score of 82.5%. This indicates that Augmented Reality learning media uses language that is good and correct, easy to understand, and communicative.

Student Response

Student responses were assessed through small-scale trials and large-scale trials. Small and large-scale trials were conducted after validation by subject matter experts, media experts, and language experts. Small-scale trial responses were gathered from 27 students of class X MIA 1 based on their abilities: high, medium, and low. Large-scale trial responses were collected from 63 students of classes X MIA 2 and 3 based on their high, medium, and low abilities. The results of the student response questionnaire can be seen in Table 6.

Table 6. Student response result

No	Trial Scale	Response Percentage (%)	Criteria
1	Small Scale	78, 51	Positive
2	Large Scale	76, 4	Positive

Based on the questionnaire results involving 27 students in the small-scale trial with a response percentage of 78.51% and 63 students in the large-scale trial with a percentage of 76.4%, the assessment in the large-scale trial is slightly lower than in the small-scale trial. This occurred because the trials involved students with high, medium, and low abilities. This assessment is based on the evaluated aspects: attitude (ease of operating the media), interest (interest in the media), and appearance motivating in learning.

In the aspect of attitude, a valid assessment was obtained, indicating that Augmented Reality learning media is easy to operate. The interest aspect also received a valid assessment, stating that Augmented Reality learning media is interesting. Interest is related to students' drive towards interest in an object, person, activity, or experience, often in the form of affective experiences stimulated by the activity itself, for example, enthusiasm in participating in lessons (Nugroho, 2020).

In the appearance aspect, a valid assessment was obtained, suggesting that Augmented Reality learning media can motivate students to learn. Motivation is a change in energy within an individual marked by the emergence of feelings and reactions to achieve goals (Anggraini, 2022). Interactive Augmented Reality learning media can illustrate abstract material to enhance student motivation (Rozak, 2018). This is also supported by Alizamar (2016) research, stating that stimuli in the learning process will be captured by the senses. The stimulus here is the use of interactive Augmented Reality learning media, and the response is students' motivation to learn.

CONCLUSION

Based on the research findings and discussions presented, it can be concluded that a development product of Augmented Reality learning media based on Assemblr Studio Web has been produced. This product was developed using the Thiagarajan research model and serves as one of the learning media at SMA Negeri 1 Siantan. The developed product has achieved a high level of validity with regard to content (85.18%), media (90%), and language (80.83%). The Augmented Reality learning media based on Assemblr Studio Web was tested in classes X MIA 1, 2, and 3 at SMA Negeri 1 Siantan and was found to be practical with an average small-scale trial score of 78.51% and a large-scale trial score of 76.4%. It is recommended for use in the learning process, with attention to other supporting facilities such as a stable internet connection, a minimum of 4GB RAM on smartphones, and the installation of the Assemblr Edu application.

REFERENCES

Aghni, R. I. (2018). Fungsi Dan Jenis Media Pembelajaran Dalam Pembelajaran Akutansi. Jurnal Pendidikan Akutansi Indonesia, XVI (1): 99.

Alfitriani, N., Maula, W. A., & Hadiapurwa, A. (2021). Penggunaan Media Augmented Reality dalam Pembelajaran Mengenal Bentuk Rupa Bumi. Jurnal Penelitian Pendidikan, 38(1), 30-38.

Alizamar. (2016). Teori Belajar & Pembelajaran: Implementasi dalam Bimbingan Kelompok Belajar di Perguruan Tinggi. Yogyakarta: Media Akademi.

Amali, L. N., Zess, N., & Suhada, S. (2020). Motion Graphic Animation Video as Alternative Learning Media. Jambura Journal of Informatics, 2 (1): 23.

Anggraini, T. S. (2022). Pengaruh Kecerdasan Emosional dan Motivasi Belajar Terhadap Hasil Belajar Matematika Siswa. JmathEdu, 1 (3): 2.

Aprilinda, Y., Endra, R. Y., Afandi, F. N., Ariani, F., Cucus, A., & Lusi, D. S. (2020). Implementasi augmented reality untuk media pembelajaran biologi di sekolah menengah pertama. Explore: Jurnal Sistem informasi dan telematika (Telekomunikasi, Multimedia dan Informatika), 11(2), 124-133.

Aripin, I. & Yeni, S. (2019). Pengembangan Media Pembelajaran Biologi Menggunakan Teknologi Augmented Reality (AR) Berbasis Android Pada Konsep Sistem Saraf. Jurnal Sainsmat, VIII (2): 52.

Aryani, P. R. (2019). Penerapan Model Pembelajaran Inkuiri Terbimbing Berbentuk Augmented Reality Pada Peserta Didik Untuk Meningkatkan Minat dan Pemahaman Konsep IPA. Unnes Physics Education Journal, 8 (2): 95.

Ayu, I. G, & Sukelasmini, M. (2019). Penerapan Model Pembelajaran Role Play Pada Mata. JIPP, 3 (1): 28.

Damayanti, L., Suana, W., & Riyanda, A. R. (2022). Pengembangan media pembelajaran interaktif berbasis augmeneted reality pengenalan perangkat keras komputer. IKRA-ITH INFORMATIKA: Jurnal Komputer Dan Informatika, 6(1), 10-19.

Dani, H. (2021). Studi Terhadap Media Augmented Reality Dalam Meningkatkan Hasil Belajar Peserta Didik Pada KD Memahami Jenis-jenis Alat Berat. Jurnal Kajian Pendidikan Teknik Bangunan (JKPTB), 7 (1): 42.

Dewi, L. R. & Mita, A. (2020). Pembuatan Media Pembelajaran Fisika Dengan Augmented Reality Berbasis Android Pada Materi Alat Optik. IPF: Inovasi Pendidikan Fisika, 9 (3): 14.

Dewi, N. M. L. C, & I. G. O. N. (2021) Meningkatkan Semangat Belajar Siswa Melalui Video Animasi IPA Pada Pokok Bahasan Sistem Pernapasan Kelas V. Jurnal Edutech Undiksha, 1 (8): 127.

Efendi, M. Y. (2022) Pengembangan Media Pembelajaran Sejarah Augmented Reality Card (ARC) Berbasis Pada Pokok Materi Peninggalan Kerajaan Singhasari Untuk Peserta Didik Kelas X KPR 1 SMK Negeri 11 Malang. JPSI, 1 (2): 182.

Fitri, A. A. (2022). Pengembangan Media Pembeajaran Interaktif "E-Cosystem" Berbasis Problem Based Learning Pada Materi Ekosistem Mata Pelajaran IPA Kelas 5 Sekolah Dasar. JPGSD, 10 (7): 1587.

Haekal, Z. A. T. (2022). Pengembangan Media Pembelajaran Interaktif Berbasis Augmented Reality Pada Materi Instalasi Jaringan Komputer. Jurnal IKRAITH-INFORMATIKA, 6 (1): 93.

Hasan, M. (2018). Media Pembelajaran. Sukaharjo: Tahta Media Group.

Ikhwan, A. C. 2021. Pengaruh Metode Ceramah dan Metode Diskusi Terhadap Hasil Belajar Siswa Pada Materi Pelajaran Aqidah Akhlak Kelas VIII mts Miftahul Ulum Kradinan Dolopo Madiun. Skripsi tidak Diterbitkan. Ponorogo: Fakultas Tarbiyah dan Ilmu Keguruan Institut Agama Islam Negeri Ponorogo.

Karo, K. I. R & Rohani. (2018) Manfaat Media Dalam Pembelajaran. AXIOM, VII (1): 15.

Khairunnufus, U. (2019). Pengembangan Modul Praktikum Kimia Berbasis Problem Basic Learning Untuk Kelas XI SMA. Chemistry Education Pratice. Universitas Mataram, 1 (2): 36.

Lubis, A. H & Wangid. (2019). Upaya Peningkatan Hasil Belajar Siswa Sekolah Dasar Melalui Model Cooprtative Learning Tipe Numered Heads Together. In FORUM PAEDOGOGIK, 10 (2) : 127.

Mawadah, W. Et.,al (2019) Uji Kelayakan Multimedia Interaktif Berbasis Powerpoint Disertai Permainan Jeopardy Terhadap Motivasi Belajar. Natural Scence Education Reseach, 2 (2): 45.

Mustaqim, I. & Nanang, K. (2017). Pengembanagan Media Pembelajaran Berbasis Augmented Reality. Jurnal Edukasi Elektro, 1 (1): 6.

Nisak, N. A. (2021). Analisis Kebutuhan Bahan Ajar Biologi untuk Siswa SMA Ditinjau dari Tingkat Kesulitan Materi, Keterapilan Berpikir Tingkat Tinggi, dan Keaktifan Belajar Siswa. EduBiologia, 1 (2): 130 – 131.

Nugroho, M. A. (2020) Pengaruh Minat Belajar Siswa Terhadap Hasil Belajar Mata Pelajaran Matematika. Jurnal Pendidikan dan Pengajaran Guru Sekolah Dasar (JPPGuseda), 1 (3): 44.

Nur, Musdalifa (2021). Media Pembelajaran E-learning Menggunakan Aplikasi Edmodo Pada Masa Pandemi. Jurnal Ilmiah Pendidikan. 13 (1): 2. https://journal.unpak.ac.id/index.php/pedagogia/article/view/2743/2429

Nurrita, T. (2018). Pengembanagan Media Pembelajaran Untuk Meningkatkan Hasil Belajar Siswa. MISYKAT, 3 (1): 24.

Nurfadillah, Z. & Diana, R. (2021). Analisis Miskonsepsi Materi Ekosistem Pada Siswa Kelas X. ISEJ: Indonesian Science Education Journal, 2 (3): 31.

Nurhaidah, D. (2021) Pengembangan Instrumen Penilaian Berbasis Media Nearpoddalam Mata Kuliah Bahasa Indonesia. Pena Literasi, 4 (2): 87.

Rahmawati, F., & Atmojo, I. R. W. (2021). Analisis media digital video pembelajaran abad 21 menggunakan aplikasi canva pada pembelajaran IPA. Jurnal Basicedu, 5(6), 6271-6279.

Rozak, A. (2018). Pengembangan Media Pembelajaran Sasa-Aura Untuk Meningkatkan Prestasi Peserta Didik SMK Cendekia Madiun Tahun Ajaran 2017/2018. Jurnal Pendidikan dan Ilmu Pengetahuan, 18 (1) : 38.

Sapriyah. (2019). Media Pembelajaran Dalam Proses Belajar Mengajar. Prosiding Seminar Nasional Pendidikan FKIP, 2 (1): 15.

Wahid, A. (2018) Pentingnya Media Pembelajaran dalam Meningkatkan Prestasi Belajar. ISTIQRA, 5 (2): 11.

Yuliono, T. (2018). Keefektifan Media Pembelajaran Augmented Reality Terhadap Penguasaan Konsep Sistem Pencernaan Manusia. Jurnal Pendidikan Dasar, 1(9): 72.