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Development of Aurbook Media (Augmented Reality Book) to Improve Learning Outcomes of Grade IV Students in Science Learning on Local Wisdom Material

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Abstract: The purpose of this study was to develop and test the feasibility, effectiveness, and practicality of the Aurbook (Augmented Reality Book) media in order to improve student learning outcomes. This research is categorized as development research (R&D) using the Borg and Gall model. A total of 36 fourth-grade students of SDN Kalinegoro 3 in the 2024/2025 academic year were involved in this study, with a small-scale trial conducted on 12 class IVA students and a large-scale trial on 24 class IVB students. The validation results from media, material, and language experts show that the Aurbook media is declared "very feasible" with an average score of 83%, which reflects its feasibility. The level of satisfaction that is "very good" is shown by the results of the teacher and student response questionnaire, with a score of 100% from teachers and 87% from students, which illustrates the practicality of e-teaching materials. The effectiveness of the Aurbook media is proven by the results of the t-test which shows a significance value of 0.000 (< 0.05) and an N-gain of 0.69, which is included in the "moderate" category. The criteria for eligibility, practicality, and effectiveness to improve learning outcomes in science learning for grade IV at SDN Kalinegoro 3 on local wisdom material have been met by the Aurbook media.

Keywords: Augmented reality; Aurbook; IPAS; Learning outcome

Introduction

Education is mandatory and cannot be separated from human life. Various challenges of the modern and increasingly advanced era in education are very urgent for humans by developing their potential (Haleem et al., 2022). In line with Permendikbudristek Number 12 of 2024 concerning the curriculum in early childhood education, elementary education levels and secondary education levels in the foundation of the independent curriculum, it states that Indonesian national education is directed at forming holistic humans, who can optimize their potential well, for broader and greater goals. In Indonesia, the role of education in community development such as education can create a workforce, create social control tools, and society can transform culture is very important. In relation to the existing view, it confirms education as the highest value that can make humans even better. Bas & Senturk (2019), in their research concluded that educational beliefs are a significant predictor of student-centered curriculum orientation, which has progressive, existentialist and reconstructive beliefs as seen from the high ranking in the prediction of student-centered orientation.

Therefore, the curriculum continues to change from time to time, starting in 1947 until now. Warsihna et al. (2023), in the results of their research, are of the view that the independent curriculum has the perfect opportunity

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to improve the existing curriculum. This can be seen from students being given freedom in learning through the Independent Curriculum which is required to be active, develop character reflected in the Pancasila Student Profile and is centered on students (Rahayu et al., 2022). This latest curriculum is expected to be able to make a good contribution to encouraging education that is more prepared for the progress of the times. Through the Independent Curriculum which has been designed according to the needs of students, it is hoped that the future of educational units in Indonesia can be more creative and inclusive. The freedom offered in this independent curriculum allows students to be creative and innovative in the teaching and learning process, and to explore their talents and interests.

The current implementation of the Independent Curriculum in science and social studies subjects is combined into a unified social studies. By integrating social studies with scientific and social content, it can foster interest, curiosity, and creativity to advance abilities and knowledge that are relevant to students. Social studies is also expected so that students can see something from a different and broader perspective. Social studies itself for students can easily manage the social environment and natural environment to increase their learning outcomes and understanding. Process skills in social studies learning will also be trained such as questioning, predicting, observing, evaluating or reflecting, planning, conducting investigations, processing, analyzing data, and communicating results (Izzati et al., 2024). The social studies content in the Independent Curriculum is closely related to the scope of human social life. New, innovative things are needed to support social studies learning, especially at the elementary school level. Being able to increase understanding of oneself and the surrounding society becomes a vehicle for students when studying social studies. In learning related to social knowledge, it can foster students' curiosity about their surroundings. In developing comprehensive thinking about the natural and social environment.

However, in reality, various problems are still found in elementary school learning, especially in science learning. Learning resources available in the school environment have limitations in the independent curriculum. Many schools that have used various learning resources such as teaching materials, LKS, and YouTube videos have not been effective in their implementation (Andini & Setyasto, 2025). The ineffectiveness of a learning resource can affect students' interest in learning. Students' interest in learning decreases due to monotonous and unattractive learning resources, so innovation and adjustment of learning resources need to be attempted (Nawwal & Setyasto, 2025; Risqiyono & Setyasto, 2025). Due to the limited availability of supporting, adequate, and practical teaching materials, teachers have difficulty in accessing and developing them, which further complicates the creation of appropriate, interactive learning media, and material adaptation is hampered (Hermayanti & Setyasto, 2025; Muharromi & Setyasto, 2025). The low interest in learning of students is found to be related to the use of learning media that are not interesting and are still conventional (Rosiyani et al., 2024). Both teachers and students often face various challenges, including limited learning resources and difficulties in adopting new technologies (Lestari & Setyasto, 2025), and some teachers still have difficulty in using technology due to a lack of understanding and literacy regarding it (Albar, 2022). The use of the internet network in the learning process has not been carried out optimally, so that the integration between learning and technology has not been achieved.

Some of the above problems were also found when conducting an introduction at SDN Kalinegoro 3. This was obtained from non-test data collection, in the form of interviews, questionnaires, observations, score lists, and documentation of class V of SDN Kalinegoro 3. The distribution of needs questionnaires to class IV students of SDN Kalinegoro 3, many students were less interested in the subject of science. Their interest was less in science and local wisdom material, because of the many reading texts. The learning resources used in schools tend to be reading texts only, such as LKS, textbooks, teaching modules, and YouTube. In learning, the main sources of students are obtained from LKS, teacher books and student books. These learning resources are also not carried out optimally because they only use pictures, or videos without combining them, so that students' motivation to learn decreases. On the other hand, sometimes learning resources do not match the characteristics of students, because of the variety of learning styles of students. In line with the results of interviews with grade IV teachers, where children in learning use learning resources occasionally use interactive media such as word walls, but not every day because they adjust to the material to be taught. Sometimes, students also observe through conventional media or look at the surrounding environment, so that they are not too interested in learning.

The use of technology is not maximized in learning and is only done occasionally. The Wi-Fi network has also not been utilized optimally, and is usually only used to watch YouTube videos, without combining it with other media. In the learning methods used, a problem was also found. Where teachers in learning predominantly use lecture techniques to deliver material. This is reinforced by the results of interviews

with grade IV teachers, in the learning process teachers will often use lecture techniques and are sometimes assisted by interactive media. Although not always in lessons using media, teachers will actually consider whether the material needs to use supporting media or not. The problem of technology also arises with evidence, students are not allowed to use smartphones if they are not really needed. With this evidence, it proves that in lessons, technology has not been implemented optimally by students of grade IV SDN Kalinegoro 3. As explained by the grade IV teacher during the interview, that in the learning process children still do not fully use smartphones because not all children in grade IV have them.

Teachers use technology, limited when using a projector in front of the class to explain, play YouTube, sometimes used for interactive media such as wordwalls, and in lessons do not always use the projector as a whole. With these problems, schools need to use smartphones to introduce effective learning media. Proven by the learning outcomes of 2023/2024 class IV SDN Kalinegoro 3 consisting of 29 students. In the results of learning science, the KKTP score of 10 students at that time obtained learning outcomes of 34.48% (KKTP) and 19 students obtained 65.52% (did not meet KKTP) in science. With the KKTP used, namely 70. Through these learning outcomes, it is known that science learning has not been effective in achieving the expected competencies. With these problems, it is necessary to have learning media in the form of textbooks or teaching materials, which are then developed and adjusted to the material to be transferred to make it easier for students. Various digital media are introduced to achieve the desired learning. Augmented Reality is a technology that focuses primarily on "visual enhancement of the combination of virtual objects and real objects directly, allowing observation of virtual objects in real time (Rauschnabel, 2021).

Augmented Reality (AR) is also a simulation that combines two dimensions and three dimensions into a real environment, allowing humans to interact with computers in a natural way (Utami et al., 2021). From the explanation above, it is concluded that Augmented Reality (AR) learning media is a modern technology that combines virtual objects, both two dimensions (2D) and three dimensions (3D), with the real world directly, creating an interactive and realistic experience. Augmented Reality can enable students to gain learning experiences based on the concepts and ideas provided and visualized through objects to be more exciting and enjoyable (Salim et al., 2022). With that, AR is used by educators in social studies subjects that require real visuals in delivery to easily understand the meaning of the material being taught. Augmented Reality media is very effective in the social studies learning process because it improves learning outcomes and student competencies and also makes them directly involved so that they are not easily bored, sleepy or lazy (Faiza et al., 2022). Multimedia that uses AR technology is also one method that makes the learning process by educators more interesting and enjoyable. With digital-based media, students can search and obtain information efficiently and effectively and enjoy the presentation of dynamic material that invites interaction (Sakti, 2023). In addition, AR opens up opportunities for educators to explore deeper learning approaches, especially in social studies subjects at the elementary school level. The use of Augmented Reality can also be applied in the form of books. AR in the form of books is said to make it easier for teachers to learn.

Augmented Reality (AR) is one of the promising fields in education by using augmented books, this can support educators to create and utilize these books in learning. Through augmented reality book media, motivation, understanding and learning, as well as students' curiosity can be increased (Abdilah & Wulandari, 2024; Sapira & Ansori, 2024). The novelty of learning media developed by researchers is the Augmented Reality Book (Aurbook) teaching material in the form of a concrete book, which contains a QR Code that can be moved using Google Lens. The Aurbook is intended for learning science on local wisdom material for grade IV elementary school with the help of the Assemblr Studio application. This Aurbook, when scanning the QR Code contained in the book will be redirected to a page containing 3D images. With a combination of images, 3D assets, text, and audio, it is hoped that students can explore and imagine each process of the traditional ceremony. And if that is still lacking, in the augmented reality there are also assets that when clicked will be redirected to the YouTube platform. With a combination of 3D that can be rotated 360 degrees, it also adds to the students' experience of getting to know 3D.

The selection of this local wisdom material was carried out because it is one of the subject matter that needs to be mastered at the elementary school level, which contains the environment around students. Through local wisdom learning, students learn about the potential of their home region. Local wisdom is valuable values that reflect the cultural richness of a particular region and are part of the identity of the local community where each region has ethics and morals that are considered noble values. With that, social studies learning on local wisdom material is important to be taught to students as an effort to introduce the potential of the surrounding culture from an early age. This local wisdom material explains the traditional

ceremonies contained in Java and some outside Java (such as Papua, Bali, Sulawesi, Riau, Maluku, North Sumatra, and NTB). In local wisdom material, students have difficulty imagining traditional ceremonies if there is no real picture. Plus, with the advancement of the times, many students do not know the local wisdom culture that exists in the local environment. Assisted by Augmented Reality, students can understand what local wisdom is like by integrating it in 3D form. so that understanding and motivation to learn the material can increase, and learning outcomes also increase.

Based on the background of the problems obtained by the researcher, the development of Augmented Reality media was chosen as a solution by creating an Aurbook (Augmented Reality Book) "Local Wisdom" as a development of interactive media that can improve learning outcomes, be interesting and innovative in learning science for grade IV. By testing the feasibility, practicality and effectiveness of the product is the goal in this media development research. Therefore, the researcher is interested in conducting this learning media development research in order to help students improve learning outcomes and understand local wisdom material in learning science more easily, so that grade IV students at SDN Kalinegoro 3 are supported in the learning.

Method

This study uses the research and development method or Research and Development (RnD). RnD is a method used in research to produce or test the effectiveness of a particular product. Development research is a way to create product innovations, learning and non-learning tools by strengthening their empirical basis. Research and development is a method for developing and testing products that will later develop in education. Thus, research and development can be defined as a research method used to develop or produce a product, which will then be tested for its effectiveness. In this research and development (RnD) method, the researcher chose the Borg and Gall development model in Brem & Wolfram (2014). General steps that need to be considered in producing a product. The steps consist of 10 steps, from: research and information collecting, planning, develop preliminary form a product, preliminary field testing, main product revision, main field testing, operational product revision, operational field testing, final product revision, and dissemination and implementation. From the statement of the steps above, the researcher will develop the product only until the trial usage or step 8, and at the mass production stage it is not carried out due to limitations in cost and time. The schematic of this research can be seen in Figure 1.

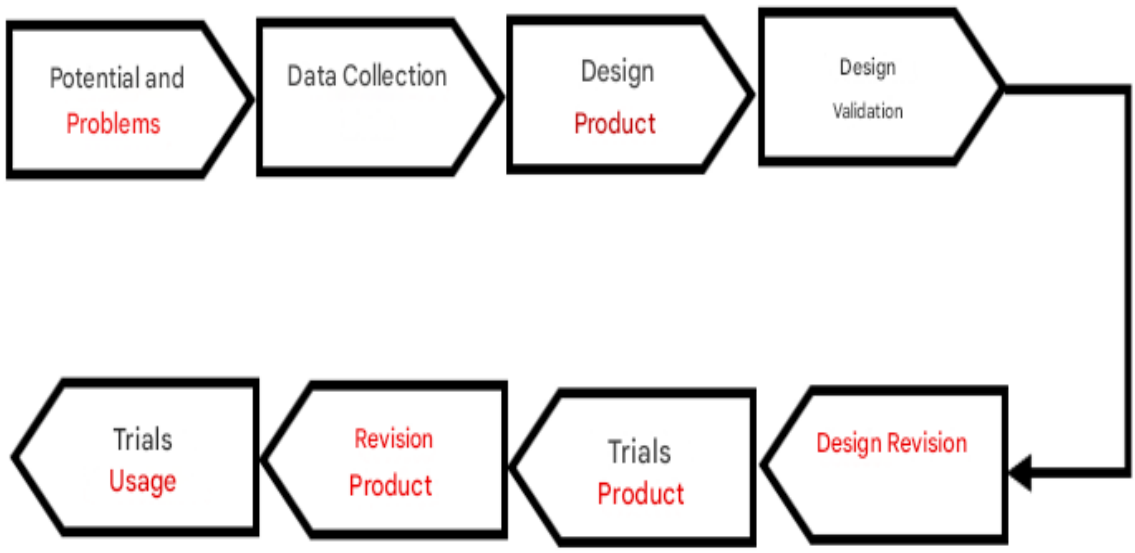

Figure 1. Borg and Gall development scheme

In the initial stage, in the potential and problem identification step at SDN Kalinegoro 3, by conducting observations, interviews, and documenting the learning outcomes of grade IV students. The data collection stage is the second step taken by distributing a needs questionnaire to grade IV students and teachers. Through the results of the questionnaire, a basis for product planning can be obtained to overcome the problems that have been found previously. Next, the product design stage, where aspects of media

appearance, language, and materials become important things in product design by considering the results of the needs questionnaire that has been distributed. Next, the product planning stage, the media created adjusts the local wisdom material for grade IV science subjects which contains Learning Achievements (CP) and Learning Objectives (TP) to be achieved. Where the learning achievements of students recognize cultural diversity, local wisdom, family history and the community where they live, and efforts to preserve it. This local wisdom material focuses on the characteristics of local wisdom, the functions and benefits of local wisdom, types of local wisdom, how to preserve local wisdom, and local wisdom traditional ceremonies in Java and outside Java.

After completing the product design, the next stage is the design validation by taking it to a validator who is an expert in media, material, and language by filling out a validation sheet which is then calculated using a Likert Scale of 1-4. In this design validation, the media will be validated by a lecturer at Semarang State University who is competent in media, material, and language. After obtaining product validation from media, material, and language experts, the researcher will revise the media until it is ready to be tested based on suggestions and criticisms from the competent validator. The next stage is the trial stage, where this is done in small-scale and large-scale trials in class IV of SDN Kalinegoro 3. This trial was carried out on a limited basis in small-scale groups consisting of 12 IVA students using cognitive ability levels or purposive sampling. At the product trial stage, the teaching and learning process is carried out using the Aurbook (Augmented Reality Book) media on local wisdom material and assisted by the PBL (Problem-Based Learning) learning model. To revise the tested product, researchers can find out responses to the media that has been created by asking teachers and students to fill out a response questionnaire after the learning is over. In measuring the response questionnaire, a descriptive analysis method was chosen to find out the results as a reference for revising the revised product. In a large-scale trial to determine the effectiveness of the developed product, the research target was carried out on 24 students in class IVB based on Learning Achievements (CP) and Learning Objectives (TP).

The data for the implementation of the research carried out in class IV SDN Kalinegoro 3 Magelang is divided into quantitative data and qualitative data which include primary data obtained directly during the research. With details of quantitative data obtained from the results of the pretest-posttest with a pre-experimental design with a one-group pretest-posttest design model. Data from the pretest were obtained from the results before students received treatment and the posttest after receiving treatment. Qualitative data is used to analyze data obtained from observations, questionnaires, documentation, interview results with homeroom teachers, as well as input and suggestions from expert validators. At the data collection stage, tests and non-tests are used. The test technique is an accumulation of questions or exercises used to assess the skills, knowledge, intelligence, abilities or talents possessed by a person or group of people. The test was taken with 30 multiple-choice questions as pretest and posttest questions. Through the questions distributed, researchers can find out the differences after and before being given treatment by implementing the developed media.

Validity Test

Validity is if an instrument can be used as it should to measure what is being measured. This validity study was viewed using the 5% significance method. The question instrument if the correlation coefficient value ($r_{count} > r_{table}$) or if the significance is less than 0.05 is declared valid. By using SPSS, the significance level is 5%, N = 12 then $r_{table} = 0.5760$. Based on the validity test table data using SPSS on the 50-item question test, 30 were valid and 20 were invalid. Of the 30 valid questions, they are categorized as suitable for research because the r_{count} value is higher than the r_{table}. Meanwhile, the 20 invalid questions are not suitable because the r_{count} is lower than the r_{table}. The data for the implementation of the research was carried out in class IV SDN Kalinegoro 3 Magelang, Central Java. The research data is divided into quantitative data and qualitative data. With details of quantitative data obtained from the results of the pretest and posttest and questionnaires. Qualitative data was obtained from the results of observations, interview results, photos, results of interviews with student homeroom teachers, input and suggestions from experts, teacher and student response questionnaires which were used as references for revising the product for class IV SDN Kalinegoro 3.

Reliability Test

Reliability is the acquisition of results that remain the same even though the instrument is used repeatedly to measure the same object. From this research, the method used is Cronbach's Alpha to test reliability, where the reliability coefficient value is drawn from the conclusion, if the value ≥ 0.6 then the reliability is stated to be good and can be trusted.

Table 1. Results of reliability test calculation

Cronbach's Alpha	N of Items
.904	50

Table 2. Difficulty level results

Analysis Criteria	Easy	Enough
Question	13 grains	17 grains

Table 3. Results of differential power

Analysis Criteria	Good	Very well
Question	18	12

Based on the results of the reliability test analysis in Table 1 with the help of SPSS version 25 shows 0.904 using the Cronbach's Alpha value. Where it can be concluded that the instrument in the study is reliable with a high category. And the results of the analysis of the level of difficulty and discrimination can be seen in Tables 2 and 3. Where it can be concluded from the three tables, that in this study, pretest and posttest questions can be used by looking at the results of validity, reliability, level of difficulty, and discrimination. Meanwhile, non-test techniques are carried out including questionnaire results, interviews, observations, value lists, and documentation. Product feasibility assessment is carried out using a Likert scale of 1-4 using a questionnaire. The validation process is carried out by competent validators in the fields of media, materials, and language, which are carried out by lecturers at Semarang State University. This analysis is carried out to get suggestions, input, and values for the products being developed, including media presentation, material suitability, and the use of appropriate language in the media.

In the assessment of product practicality, data analysis was obtained from teacher and student responses regarding the development of the Aurbook (Augmented Reality Book) product in the science lesson on local wisdom material. The purpose of this study was to determine the extent to which teachers and students accept and respond to the practicality of the product in supporting the learning process. Product effectiveness was obtained from the analysis of the pretest and posttest results. The analysis carried out was the normality test, T-test, and N-gain Score test assisted by SPSS version 25. The normality test was carried out using the Shapiro-Wilk method by seeing whether it could be normally distributed or not. To see the difference in significance of the pretest-posttest results, a T-test was carried out with the Paired Samples Test model. The N-gain score test was carried out to measure the effectiveness of the product using the pretest and posttest by looking at changes in the scores of the large-scale trial stage.

Result and Discussion

Potential and Problems

Based on the results of data collection conducted at SDN Kalinegoro 3, namely in the science lessons which tend to have a lot of reading texts in their learning, making it difficult for students to understand the material, the use of learning media that has not been focused on certain materials and the rare use of digital media. In learning, teachers do not fully utilize existing technology, such as Wi-Fi and smartphones in the teaching and learning process. The tendency of teachers to focus more on Youtube and PowerPoint shows in delivering learning materials, as well as the dominance of learning using lecture techniques are also factors in this problem. With these existing problems, students become less active so that their learning outcomes decline. In addition, based on the results of learning science for grade IV in the 2023/2024 academic year at SDN Kalinegoro 3, a total of 29 students were obtained, with the category of having met the KKTP of 11 children with a percentage of 34.48%, and the category of not meeting the KKTP of 19 children with a percentage of 65.52%.

Initial Data Collection

In the initial stage, data acquisition was obtained by conducting interviews with grade IV teachers. The activity continued with the distribution of questionnaires on needs for teachers and students, from the data from the questionnaire that had been distributed, it was obtained that teachers needed local wisdom material for science learning that was needed to help the teaching and learning process. In addition, teachers also need learning media that can help integrate the description of local wisdom material for science learning. Students also prefer to use media in learning to make it easier to understand the learning messages conveyed. Media with 3D assistance is highly expected by teachers to be able to make it easier to convey information.

The media is expected to contain images and videos to increase students' motivation in learning. It is also known that books published by the government, such as teacher books and student books, are used as the main source for teachers in learning. The use of PowerPoint and YouTube is also sometimes done by paying attention to the characteristics of students and needs according to their learning styles. In addition, in the learning process, the use of learning media and the use of technology in schools has not been optimally applied by teachers. Learning media in this situation is very crucial to be studied further. To improve student learning outcomes, teachers need Augmented Reality

learning media in the form of books that can be accessed at any time on local wisdom material. The media created must be equipped with images, text, 3D, and video links that lead to the Youtube platform to increase student insight. Through this combination, learning media can improve student learning outcomes in learning science on local wisdom material.

Product Design

Based on Learning Outcomes (CP) and Learning Objectives (TP) to be achieved in local wisdom material using Augmented Reality Book (Aurbook) media that is adjusted to the characteristics of students and easy to understand to improve student learning outcomes. The development of this Augmented Reality Book, in which it consists of 3D, images, audio, video, and writing made with the help of Assemblr Studio, Sketchfab, and Canva. In integrating three dimensions in Aurbook, Assemblr Studio is used, including three-dimensional arrangement, a combination of text, audio, and images. Sketchfab is used to obtain 3D assets that are not available in Assemblr Studio. Meanwhile, Canva functions as a place to design the layout of the book by combining image and text elements that are rich in culture, which are reflected in local wisdom material. The process of making an Augmented Reality Book begins with finding the material that will be included in it. In the Assemblr Studio application, it begins by arranging the surface of the plane where the assets are placed. After obtaining the surface, houses, people, trees, images, audio, text, and others, can be combined to look aesthetic. To watch the video, the researcher creates a link by clicking the play button in it, which will then switch to the Youtube platform to watch the traditional ceremony process. After making it, then publish and copy the link into Canva. In the Canva application, the link from Assemblr Studio is made into a QR Code so that it is easy to scan using a smartphone. This product will later be in the form of a printed book that can be accessed with a smartphone by requesting using Google Lens and Assemblr Edu. The sections in the Aurbook (Augmented Reality Book) are:

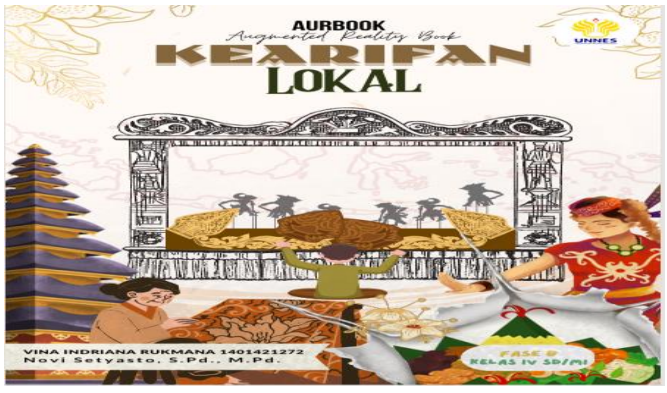

Figure 2. Front cover

Figure 3. Cover page

Figure 4. Foreword

Figure 5. Table of contents

Figure 6. Product usage instructions

Figure 10. Evaluation questions

Figure 7. Learning outcomes (CP) and learning objectives (TP)

Figure 11. Back cover

Figure 8. Material page 1

Figure 12. Augmented reality Padusan Traditional Ceremony

Figure 9. Mater page 7

Figure 13. Augmented reality Bau Nyale Ceremony

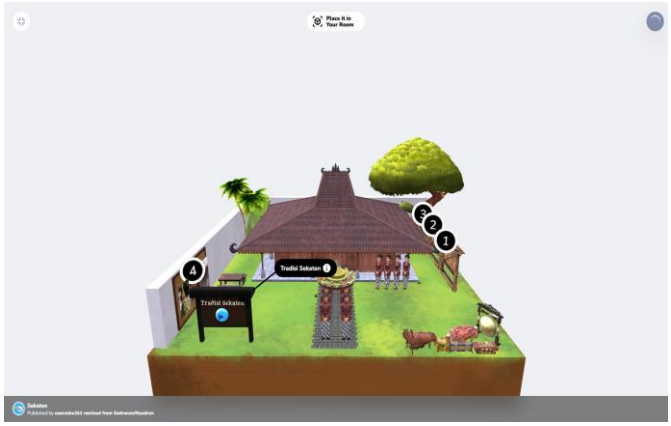

Figure 14. Augmented reality Sekaten Ceremony

Validation of Aurbook Design (Augmented Reality Book)

Table 4. Product assessment criteria

Percentage (%)	Criteria
81 – 100	Very Eligible
61 – 80	Eligible
41 – 60	Quite Eligible
21 – 40	Not Eligible
0 - 20	Very Eligible

The validation stage of Aurbook is carried out by experts who are competent in their fields. The experts who validate the media are media experts, material experts, and language experts. In this validation, researchers will not only get a score, but also get suggestions and input to improve the product to make it better. Regarding the assessment criteria, it can be seen in Table 4.

From the expert validator, the researcher obtained the recapitulation results which are stated in Table 5.

Table 5. Recapitulation results of values from validators

Parameter	Validator of Media	Validator of Language	Validator of Material
Score Acquisition	95	63	91
Maximum Score	100	100	100
Percentage (%)	95	63	91
Criteria	Very Worth It	Worthy	Very Worth It

Based on Table 5, the assessment results from media, material, and language experts show that the Aurbook (Augmented Reality Book) media is "Very Eligible" with an average score of 83%, so it can be used in this study. Media experts gave a high score with a percentage of 95%, language experts gave a score with a percentage of 63%, and material experts gave a score with a percentage of 91%. With the percentage results obtained, it is a reinforcement that the Aurbook media is included in good standards to be applied in learning, as evidenced by the presentation and content of the media. So, it is concluded that the Aurbook (Augmented Reality Book) media is declared eligible to be applied in the trial process after considering aspects of appearance, material, and language.

Design Revision

At this stage, the researcher obtained suggestions and input from expert validators in media, materials, and language. In the media section, the validator did not provide suggestions and input, because it was already good with the combination of images and writing in the book and Augmented Reality. The expert language also provided suggestions and input to revise the foreword, the writing of KBBI/PEUBI still contained errors and needed to be corrected, the writing of the Bibliography which must be in accordance with APA (American Psychological Association) standards, and improvements to the developer profile section, both of which use narrative. Meanwhile, suggestions and input from material experts were obtained if the glossary book must be written alphabetically.

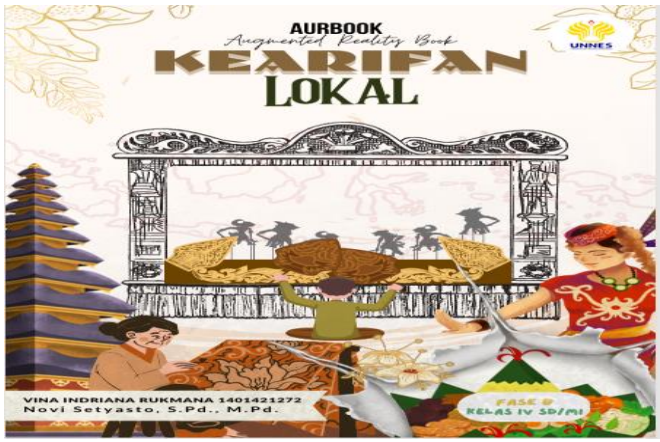

Figure 15. Front cover before revision

Figure 16. Front cover after revision

Figure 17. Cover page before revision

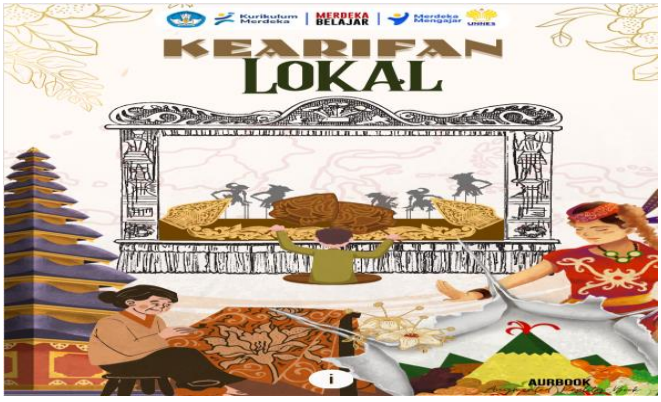

Figure 18. Cover page after revision

Figure 19. Foreword before revision

Figure 20. Foreword after revision

Figure 21. Characteristics before revision

Figure 22. Characteristics after revision

Figure 23. Functions & benefits before revision

Figure 24. Functions & benefits after revision

Figure 25. Conclusion before revision

Figure 26. Conclusion after revision

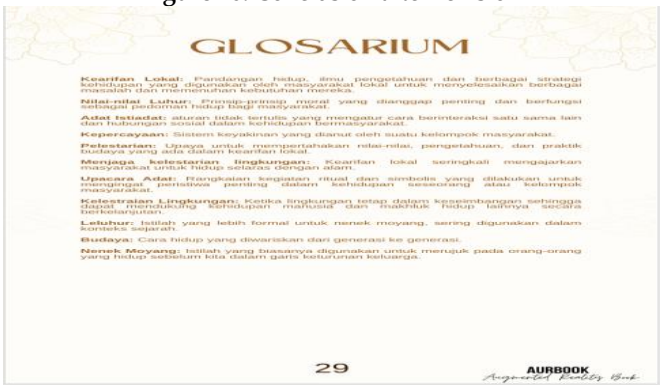

Figure 27. Glossary before revision

Figure 28. Glossary after revision

Figure 29. Bibliography before revision

Figure 30. Bibliography after revision

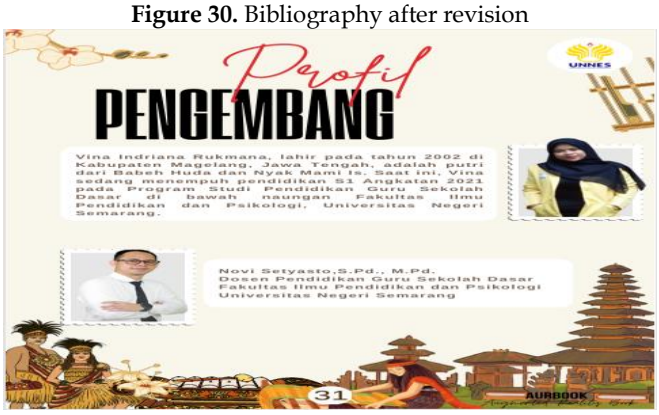

Figure 31. Developer profile before revision

Figure 32. Developer profile after revision

Trial of Aurbook (Augmented Reality Book) Product

At this stage, the product trial that has been carried out in a heterogeneous manner based on the level of cognitive ability of students. This small-scale trial was conducted on 12 students of SDN Kalinegoro 3 with the criteria of 3 students with high cognitive ability, 3 students with moderate cognitive ability, and 3 students with low cognitive ability. After testing in a small-scale class, students and teachers were given a response questionnaire to find out about the use of Aurbook media. The questionnaire questions distributed were 16 questions for teachers and 15 questions for students.

Table 6. Results of teacher and student response questionnaire small-scale trial

Respondent	Percentage (%)	Criteria
Teacher	100	Very Good
Students	87	Very Good

From the data obtained from the teacher and student response questionnaires in the small-scale Aurbook (Augmented Reality Book) trial, it looks better. Where the percentage of teacher responses reached 100% answering "yes" obtained from 16 questionnaire response questions, while for small-scale student responses, the percentage obtained was 87% answering "yes" from 15 questionnaire response questions. Thus, the Aurbook media can be categorized as being able to help in learning activities.

Table 7. Results of the teacher and student response questionnaire for the large-scale trial

Respondent	Percentage (%)	Criteria
Teacher	100	Very Good
Students	88	Very Good

From the data obtained from the teacher and student response questionnaires in the small-scale Aurbook (Augmented Reality Book) trial, it looks better. Where the percentage of teacher responses reached 100% answering "yes" which was obtained from 16 questionnaire response questions, while for small-scale student responses, 88% answered "yes" from 15 questionnaire response questions. Thus, the Aurbook media can be categorized as being able to help in learning activities.

Effectiveness of the Aurbook (Augmented Reality Book) Media

At this stage, it was carried out in large-scale and small-scale trials on grade IV students at SDN Kalinegoro 3 in the 2024/2025 academic year. A total of 24 large-scale students and 12 small-scale students were involved in this study, where the Aurbook (Augmented Reality Book) media was used in the Science subject on local wisdom material. This stage aims to determine the effectiveness of the product developed by the researcher based on student learning outcomes. The pre-experimental design using the one-group pretest-posttest design model was chosen in this study with a pretest without any prior treatment and a posttest conducted after providing treatment.

Table 8. Results of pretest-posttest of small-scale students

Test	Average	Average Difference
Pretest	55.17	29
Posttest	84.17	

In Table 8, it is obtained that the pretest-posttest that has been carried out in class IV on a small scale has a difference before and after being given learning using Aurbook (Augmented Reality Book) on the local wisdom material of the Science lesson at SDN Kalinegoro 3. This difference can be seen from the difference in the average learning outcomes between the pretest and posttest of 29.

In Table 9, it is obtained that the pretest-posttest that has been carried out in class IV on a large scale has a difference before and after being given learning using Aurbook (Augmented Reality Book) on the local wisdom material of the Science lesson at SDN Kalinegoro 3. This difference can be seen from the difference in the average learning outcomes between the pretest and posttest of 38.30.

Table 9. Large-scale student pretest-posttest results

Test	Average	Average Difference
Pretest	45.75	38.30
Posttest	84.05	

Normality Test

The following data analysis is a normality test with the aim of evaluating changes in the results of learning science on local wisdom material. Regarding the decision of significance > 0.05, the data can be said to be normally distributed, while if the significance < 0.05, the data is not normally distributed. The results of large-scale class normality are presented in Tables 10 and 11.

Table 10. Results of small-scale data normality test calculations

	Shapiro-Wilk		
	Statistic	df	Sig.
Small Class Pretest	.876	12	.079
Small Class Posttest	.919	12	.280

Table 11. Results of large-scale data normality test calculations

	Shapiro-Wilk		
	Statistic	df	Sig.
Large Class Pretest	.944	24	.204
Large Class Posttest	.932	24	.110

Based on Tables 10 and 11 above, after taking measurements using SPSS version 25 through the Normality test. It is known that the probability (sig.) Is 0.079 in the small-scale pretest, while the small-scale posttest value shows a probability of 0.280 (sig.). And the probability result (sig.) Is 0.204 in the large-scale pretest, while the large-scale posttest value shows a probability of 0.110 (sig.). Both results from the large and small scales are more than 0.05 so it can be concluded that the data from the large scale is normally distributed.

T-Test Test

This T-test is to compare two samples to determine whether there is a difference in the results of students using Augmented Reality media in student learning outcomes. After calculating, the results of the t-test can be determined into: T-statistic prob. value < significance level or calculated $t_{value} > t_{table}$, then reject H0 which means that the independent variable has an effect on the dependent variable model; If the T-statistic prob. value > significance level or calculated $t_{value} < t_{table}$, then do not reject H0 which means that the existing independent variable does not affect the dependent variable. At this stage, the researcher used the Paired Sample T-test, which produced the T-Test test in Tables 12 and 13.

Table 12. Results of small-scale T-test

Paired Sample Test	Statistic	df	Sig.
Large Scale Pretest – Large Scale Posttest	-12.077	23	.000

Table 13. Results of large-scale T-test

Paired Sample Test	Statistic	df	Sig.
Large Scale Pretest – Large Scale Posttest	-12.077	23	.000

Based on the results of the significance of the large-scale and small-scale T-Test, it obtained 0.000 or less than 0.05, which proves that H0 is rejected and Ha is accepted. The increase in learning outcomes on a large and small scale in the local wisdom material can be seen after using the Aurbook media in science lessons.

N-gain Score Test

The N-gain test in the study was used to determine how much the Augmented Reality Book media improves the understanding of science and science material. The criteria in the percentage of the score, if the value is < 0.3 then it is low, if 0.3 ≤g < 0.7 then it is moderate, and for values above 0.7 it is included in the high category.

Table 14. Results of the small-scale N-Gain score test

Average Difference	N-Gain	Criteria
41	0.60	Medium

Table 15. Results of the large-scale N-Gain score test

Average Difference	N-Gain	Criteria
44	0.69	Medium

In the table above, on a small and large scale, it can be seen that learning outcomes have increased by looking at the average value obtained by grade IV students of 0.60 for a small scale and 0.69 for a large scale. With these results, it can be said that student learning outcomes have increased with the "moderate" category. So, it can be concluded that on a small and large scale when using Aurbook media in the teaching and learning process, learning outcomes increase effectively in the local wisdom material of science learning at SDN Kalinegoro 3. The findings from the data analysis indicate that the Aurbook media (Augmented Reality Book) meets the standards of feasibility, practicality, and product effectiveness in improving the learning outcomes of IV students at SDN Kalinegoro 3 in science lessons on local wisdom material. this is supported by a number of supporting factors.

First, using this Augmented Reality media will create high motivation in students in learning (Prasetya et al., 2024; Buchner & Kerres, 2021). This is because this media is interesting and fun to learn (Mu'afiqoh & Wachidah, 2024; Pamorti et al., 2024; Kaviyaraj & Uma, 2021). Augmented Reality can also improve students' understanding which can be seen from the learning outcomes after using the media (Amirahma & Setyasto, 2024; Ravichandran & Mohan, 2025). Second, learning media that uses Augmented Reality is also very innovative to support the learning process (Alamsyah et al., 2023; Hafizhah & Setyasto, 2024). Augmented Reality can provide an experience to imagine in real form with the help of software, computers, or smartphones (Crogman et al., 2025; Yoo, 2023; Nhan et al., 2022). By using media development, students can engage with the material and use constructive cognitive strategies that tend to be better able to understand the meaning of the task, which then increases their interest in the task (O'Connor & Mahony, 2023; Kuhlmann et al., 2024; Barlow et al., 2020). Augmented Reality can help students memorize easily (Rahman et al., 2023; Lai & Chang, 2021).

Third, the use of Augmented Reality media by integrating it into local culture can have an impact. In a

study conducted by Boediono et al. (2023) and Arista et al. (2023), revealed that the ability of augmented reality technology as an educational tool that can increase awareness and support efforts to preserve traditional culture in Indonesia. The results of this study indicate that the Aurbook (Augmented Reality Book) media can be used for learning in order to improve student learning outcomes. Referring to the findings of previous research, the existing situation, and the challenges faced in the field, the researcher succeeded in developing Aurbook for science learning for grade IV students of SDN Kalinegoro 3. The results of the research and analysis that have been carried out show that the Aurbook media has been proven to meet the criteria of feasibility, practicality, and effectiveness in the science learning process for grade IV.

Conclusion

Based on research conducted at SDN Kalinegoro 3 in grade IV of the subject of Natural Sciences, local wisdom material has been proven to increase learning outcomes. This statement is supported by the results of the feasibility of the expert validator of media, materials, and language, with an average score of 83%. Through the questionnaire, teacher and student responses can measure the practicality of the Aurbook media with a percentage of 100% for teachers and 87% of small-scale students. While for large-scale students, the results of the teacher's response reached 100% and students 88%. The results of the response prove that the practicality of the Aurbook media is included in the "very good" category. From the effectiveness of media development, it can be seen from the normality test where the significance value on the small scale pretest is 0.079 while the posttest is 0.280 and the large scale pretest is 0.204 while the posttest is 0.110, which means more than 0.05 and can be said to be normally distributed. In the t-test, the significance value obtained was 0.000 < 0.05. And for the N-gain score test, the results showed a moderate category with a small scale gain of 0.60 and a large scale of 0.69. The data acquisition can be concluded if the Aurbook (Augmented Reality Book) media is in the category of feasible, practical and effective to improve the learning outcomes of science learning on local wisdom material for grade IV SDN Kalinegoro 3.

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V.I.R. contributed to the research activities, product development, data analysis and article preparation; N.S. as a supervisor who directed and accompanied the research process until the publication of the article.

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References

Abdilah, D., & Wulandari, D. (2024). Development of Augmented Reality Book (AR-Book) Based Science Learning Media on Human Digestive System Material to Improve Student Learning Outcomes. *Jurnal Penelitian Pendidikan IPA*, *10*(7), 4235–4245. https://doi.org/10.29303/jppipa.v10i7.7312

Alamsyah, D. P., Parulian, J. M., & Herliana, A. (2023). Augmented Reality Android Based: Education of Modern and Traditional Instruments. *Procedia Computer Science*, *216*, 266–273. https://doi.org/10.1016/j.procs.2022.12.136

Albar, J. (2022). Analisis Penerapan Kurikulum Merdeka Terhadap Kecerdasan Interpersonal Siswa Sekolah Dasar. *Jurnal Pendidikan Dasar*, *10*(2), 273–279. https://doi.org/10.46368/jpd.v10i2.891

Amirahma, S., & Setyasto, N. (2024). Development of Augmented Reality-Assisted Teaching Materials in Science Subjects: Solar System Topic. *Jurnal Penelitian Pendidikan IPA*, *10*(5), 2346–2355. https://doi.org/10.29303/jppipa.v10i5.7027

Andini, S. H., & Setyasto, N. (2025). Development of E-Books Assisted by Augmented Reality on Respiratory System Material for Grade V Elementary School. *Jurnal Penelitian Pendidikan IPA*, *11*(2), 663–674. https://doi.org/10.29303/jppipa.v11i2.10320

Arista, W. P. A., Hendra, S. D., Juwono, P. F., Abdillah, H. K., & Permana, F. (2023). Preserving Indonesian Culture in the Digital Age: Implementing Augmented Reality to Address Cultural Appropriation Issue. *Procedia Computer Science*, *227*,

762–771. https://doi.org/10.1016/j.procs.2023.10.581

Barlow, A., Brown, S., Lutz, B., Pitterson, N., Hunsu, N., & Adesope, O. (2020). Development of the Student Course Cognitive Engagement Instrument (SCCEI) for College Engineering Courses. *International Journal of STEM Education*, *7*(1), 22. https://doi.org/10.1186/s40594-020-00220-9

Bas, G., & Senturk, C. (2019). Teachers' Educational Beliefs and Curriculum Orientations: A Relational Research. *Teachers and Curriculum*, *19*(1), 45–53. https://doi.org/10.15663/tandc.v19i1.336

Boediono, J. A. S., Aulia, M. R., & Maulana, F. I. (2023). Markerless Augmented Reality Application for Indonesian Traditional House Education. *Procedia Computer Science*, *227*, 718–725. https://doi.org/10.1016/j.procs.2023.10.576

Brem, A., & Wolfram, P. (2014). Research and Development from the Bottom Up—Introduction of Terminologies for New Product Development in Emerging Markets. *Journal of Innovation and Entrepreneurship*, *3*(1), 9. https://doi.org/10.1186/2192-5372-3-9

Buchner, J., & Kerres, M. (2021). Students as Designers of Augmented Reality: Impact on Learning and Motivation in Computer Science. *Multimodal Technologies and Interaction*, *5*(8), 41. https://doi.org/10.3390/mti5080041

Crogman, H. T., Cano, V. D., Pacheco, E., Sonawane, R. B., & Boroon, R. (2025). Virtual Reality, Augmented Reality, and Mixed Reality in Experiential Learning: Transforming Educational Paradigms. *Education Sciences*, *15*(3), 303. https://doi.org/10.3390/educsci15030303

Faiza, M. N., Yani, M. T., & Suprijono, A. (2022). Efektivitas Penggunaan Media Pembelajaran IPS Berbasis Augmented Reality untuk Meningkatkan Kompetensi Pengetahuan Siswa. *Jurnal Basicedu*, *6*(5), 8686–8694. https://doi.org/10.31004/basicedu.v6i5.3901

Hafizhah, F. J., & Setyasto, N. (2024). Augmented Reality-Assisted Scrapbook Media Development in Natural and Social Science Learning. *Jurnal Penelitian Pendidikan IPA*, *10*(7), 4149–4157. https://doi.org/10.29303/jppipa.v10i7.7258

Haleem, A., Javaid, M., Qadri, M. A., & Suman, R. (2022). Understanding the Role of Digital Technologies in Education: A Review. *Sustainable Operations and Computers*, *3*, 275–285. https://doi.org/10.1016/j.susoc.2022.05.004

Hermayanti, F., & Setyasto, N. (2025). Development of E-Learning Materials Assisted by Augmented Reality on the Material of the Form of Matter and its Changes to Improve Learning Outcomes of Elementary School Students. *Jurnal Penelitian Pendidikan IPA*, *11*(1), 329–341. https://doi.org/10.29303/jppipa.v11i1.10218

Izzati, D. W. F., Setyowati, D., & Fatmawati, R. A. (2024). Deskripsi Pembelajaran IPAS dalam Kurikulum Merdeka Kelas IV di SD Negeri 01 Anjongan. *Indo-MathEdu Intellectuals Journal*, *5*(5), 5618–5626. https://doi.org/10.54373/imeij.v5i5.1832

Kaviyaraj, R., & Uma, M. (2021). A Survey on Future of Augmented Reality with AI in Education. *2021 International Conference on Artificial Intelligence and Smart Systems (ICAIS)*, 47–52. https://doi.org/10.1109/ICAIS50930.2021.9395838

Kuhlmann, S. L., Plumley, R., Evans, Z., Bernacki, M. L., Greene, J. A., Hogan, K. A., Berro, M., Gates, K., & Panter, A. (2024). Students' Active Cognitive Engagement with Instructional Videos Predicts STEM Learning. *Computers & Education*, *216*, 105050. https://doi.org/10.1016/j.compedu.2024.105050

Lai, J.-Y., & Chang, L.-T. (2021). Impacts of Augmented Reality Apps on First Graders' Motivation and Performance in English Vocabulary Learning. *Sage Open*, *11*(4), 21582440211047549. https://doi.org/10.1177/21582440211047549

Lestari, L. W., & Setyasto, N. (2025). Pengembangan E-Bahan Ajar Berbantuan Augmented Reality pada Mata Pelajaran IPAS Materi Mengubah Bentuk Energi untuk Meningkatkan Hasil Belajar Peserta Didik Sekolah Dasar. *Jurnal Penelitian Pendidikan IPA*, *11*(3), 385–396. https://doi.org/10.29303/jppipa.v11i3.10420

Mu'afiqoh, E. B., & Wachidah, K. (2024). Meningkatkan Kemampuan Membaca Siswa Kelas II dengan Augmented Reality. *Teaching, Learning and Development*, *2*(2), 101–108. https://doi.org/10.62672/telad.v2i2.35

Muharromi, D. Y., & Setyasto, N. (2025). Development of E-Learning Materials Assisted by Augmented Reality in the Science Subject of Water Cycle Material for Grade V Elementary Schools. *Jurnal Penelitian Pendidikan IPA*, *11*(2), 1157–1168. https://doi.org/10.29303/jppipa.v11i2.10346

Nawwal, F. H. K., & Setyasto, N. (2025). Pengembangan E-Bahan Ajar Berbantuan Augmented Reality pada Mata Pelajaran IPAS Materi Keanekaragaman Budaya. *Jurnal Penelitian Pendidikan IPA*, *11*(3), 397–407. https://doi.org/10.29303/jppipa.v11i3.10417

Nhan, V. K., Tam, L. T., Dung, H. T., & Vu, N. T. (2022). A Conceptual Model for Studying the Immersive Mobile Augmented Reality Application-Enhanced Experience. *Heliyon*, *8*(8), e10141. https://doi.org/10.1016/j.heliyon.2022.e10141

O'Connor, Y., & Mahony, C. (2023). Exploring the Impact of Augmented Reality on Student Academic

Self-Efficacy in Higher Education. *Computers in Human Behavior*, *149*, 107963. https://doi.org/10.1016/j.chb.2023.107963

Pamorti, O. A., Winarno, W., & Suryandari, K. C. (2024). Effectiveness of Augmented Reality Based Learning Media to Improve Critical Thinking Skills on IPAS Material. *Jurnal Penelitian Pendidikan IPA*, *10*(5), 2211–2219. https://doi.org/10.29303/jppipa.v10i5.7139

Prasetya, F., Fortuna, A., Samala, A. D., Rawas, S., Mystakidis, S., Syahril, S., Waskito, W., Primawati, P., Wulansari, R. E., & Kassymova, G. K. (2024). The Impact of Augmented Reality Learning Experiences Based on the Motivational Design Model: A Meta-Analysis. *Social Sciences & Humanities Open*, *10*, 100926. https://doi.org/10.1016/j.ssaho.2024.100926

Rahayu, R., Rosita, R., Rahayuningsih, Y. S., Hernawan, A. H., & Prihantini, P. (2022). Implementasi Kurikulum Merdeka Belajar di Sekolah Penggerak. *Jurnal Basicedu*, *6*(4), 6313–6319. https://doi.org/10.31004/basicedu.v6i4.3237

Rahman, M. A., Faisal, R. R., & Tho, C. (2023). The Effectiveness of Augmented Reality Using Flash Card in Education to Learn Simple English Words as a Secondary Language. *Procedia Computer Science*, *227*, 753–761. https://doi.org/10.1016/j.procs.2023.10.580

Rauschnabel, P. A. (2021). Augmented Reality is Eating the Real-World! The Substitution of Physical Products by Holograms. *International Journal of Information Management*, *57*, 102279. https://doi.org/10.1016/j.ijinfomgt.2020.102279

Ravichandran, K., & Mohan, U. (2025). Transforming Education with Photogrammetry: Creating Realistic 3D Objects for Augmented Reality Applications. *Computer Modeling in Engineering & Sciences*, *142*(1), 185–208. https://doi.org/10.32604/cmes.2024.056387

Risqiyono, M. W. A., & Setyasto, N. (2025). Development of E-Learning Materials Assisted by Augmented Reality on Human Digestive System Material to Improve Elementary School Students' Learning Outcomes. *Jurnal Penelitian Pendidikan IPA*, *11*(1), 244–256. https://doi.org/10.29303/jppipa.v11i1.10229

Rosiyani, A. I., Salamah, A., Lestari, C. A., Anggraini, S., & Ab, W. (2024). Penerapan Pembelajaran Berdiferensiasi dalam Kurikulum Merdeka pada Pembelajaran IPAS Sekolah Dasar. *Jurnal Pendidikan Guru Sekolah Dasar*, *1*(3), 10. https://doi.org/10.47134/pgsd.v1i3.271

Sakti, A. (2023). Meningkatkan Pembelajaran Melalui Teknologi Digital. *Jurnal Penelitian Rumpun Ilmu Teknik*, *2*(2), 212–219. https://doi.org/10.55606/juprit.v2i2.2025

Salim, S., Prajono, R., Misu, L., & Saputra, H. N. (2022). Development of Interactive Digital Modules Based on Augmented Reality. *AL-ISHLAH: Jurnal Pendidikan*, *14*(4), 5069–5078. https://doi.org/10.35445/alishlah.v14i4.1537

Sapira, S., & Ansori, I. (2024). Development of Science Learning Media Based on Augmented Reality Book with Problem Based Learning Model to Improve Learning Outcomes of Third Grade Students. *Jurnal Penelitian Pendidikan IPA*, *10*(6), 3249–3260. https://doi.org/10.29303/jppipa.v10i6.7642

Utami, F., Rukiyah, R., & Andika, W. D. (2021). Pengembangan Media Flashcard Berbasis Augmented Reality pada Materi Mengenal Binatang Laut. *Jurnal Obsesi: Jurnal Pendidikan Anak Usia Dini*, *5*(2), 1718–1728. https://doi.org/10.31004/obsesi.v5i2.933

Warsihna, J., Ramdani, Z., Amri, A., Kembara, M. D., Steviano, I., Anas, Z., & Anggraena, Y. (2023). Tantangan dan Strategi Implementasi Kurikulum Merdeka pada Jenjang SD: Sebuah Temuan Multi-Perspektif. *Kwangsan: Jurnal Teknologi Pendidikan*, *11*(1), 296. https://doi.org/10.31800/jtp.kw.v11n1.p296--311

Yoo, J. (2023). The Effects of Augmented Reality on Consumer Responses in Mobile Shopping: The Moderating Role of Task Complexity. *Heliyon*, *9*(3), e13775. https://doi.org/10.1016/j.heliyon.2023.e13775