Jurnal Pijar MIPA
https://jurnalfkip.unram.ac.id/index.php/JPM

ISSN 1907-1744 (Print)
ISSN 2460-1500 (Online)

Development of the Augmented Reality Book on the Material of the Sense of Smell and Taste to Improve Learning Outcomes

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Received: May 14, 2025. Accepted: May 23, 2025. Published: June 28, 2025

Abstract: Teachers have not been optimal in preparing teaching materials for technology-based sense of smell and taste materials, causing low cognitive learning outcomes for students. This study aims to describe the development design, test the feasibility and effectiveness of the Augmented Reality Book to improve the learning outcomes of IVA class students of SDN Kalibanteng Kidul 03, Semarang City. The type of research is Research and Development (R&D) with the Borg and Gall model. The research subjects were IVA class students of SDN Kalibanteng Kidul 03, Semarang City, totalling 21 students. Data collection techniques used tests (pre-test and post-test) and non-tests (observation interviews, questionnaires, and documentation). Data analysis techniques used normality test, t-test, and N-Gain test. The results showed that the Augmented Reality Book development design used Assemblr EDU, Canva and Heyzine applications with main page components, instructions for use, activity instructions, intended competencies, Project-Based Learning syntax-based materials, AR barcodes containing visual media in the form of 3D images using Assemblr EDU, LKPD, and evaluation using Wordwall. The feasibility of Augmented Reality Book from material experts is 91.25% and media experts are 92.18% which are very feasible criteria, supported by the results of the analysis of teacher response questionnaires of 95% and student response questionnaires of 99.3% which are also very feasible criteria. The effectiveness of the Augmented Reality Book is shown by an increase in pre-test and post-test of 28.4, supported by the results of the t-test, 0.001, and the N-Gain score of 0.6595, medium criteria. The conclusion of this study shows that Augmented Reality Book material successfully develops the sense of smell and taste, is very feasible, and effective in improving the science learning outcomes of IVA class students SDN Kalibanteng Kidul 03 Semarang City on the material sense of smell and taste.

Keywords: Augmented Reality Book; Learning Outcomes; Sense of Smell; Sense of Taste.

Introduction

Education is an important aspect in directing and shaping human resources into individuals with character, intelligence, innovation, and creativity [1] . Education can be realized through a series of learning activities that are active, innovative, creative, efficient, and fun, which is often called PAIKEM. By implementing PAIKEM learning, Indonesia's national education goals can be achieved [2]. One of the fields of study that strongly supports the development of character, intelligence, and creativity of learners through the PAIKEM approach is science, which not only provides factual knowledge but also trains logical and scientific thinking.

Science learning is one of the important components of the education curriculum in elementary schools [3]. Science learning is one of the fields that requires digital teaching materials, because it is in accordance with the objectives of science education to form students who think scientifically, are able to solve problems, and assess and prove information logically [4]. To support this goal, the use of technology-integrated teaching materials is needed so that students can more easily understand science concepts

Science emphasizes the discovery process, not only the ability of students to master a set of knowledge in the form of facts, concepts or principles. The nature of science itself has four dimensions, namely, products, processes, attitudes, and technology [5]. Science focuses on research activities and practical applications to help learners understand the natural environment more deeply [6]. Therefore, science learning needs to be designed to encourage students to actively observe, ask questions, conduct experiments, and draw conclusions based on the evidence found.

Technological developments encourage the importance of digital teaching materials, because printed modules are often less effective due to dense explanations and are less interesting for students. An alternative that can be done to overcome this problem is to develop an electronic module (E-Module) that utilizes digital technology, allowing students to access material anywhere and anytime without space and time restrictions [7]. The utilization of augmented reality (AR) technology in e-modules is used to incorporate 2D or 3D objects into the real world through electronic devices connected to the internet [8]. AR supports the integration of science concepts in science learning, so that parts that are invisible to the human eye can be visualized through AR technology.

Based on the results of pre-research through observation activities, questionnaire interviews and document data at SDN Kalibanteng Kidul 03 Semarang City on November 14, 2024, several problems were found in the

How to Cite:
T. N. Wardah and A. E. Andriani, "Development of the Augmented Reality Book on the Material of the Sense of Smell and Taste to Improve Learning Outcomes", *J. Pijar.MIPA*, vol. 20, no. 4, pp. 638–648, Jun. 2025. https://doi.org/10.29303/jpm.v20i4.9047

process of learning science in class IV, including teachers not being optimal in developing technology-based teaching materials [9]. So that teachers and students only use teaching materials in the form of science package books from the Ministry of Education and Culture in 2023. and in accordance with the Decree of the Head of BSKAP No.032/ H/KR/2024 found a mismatch between the Science Learning Outcomes in Phase B, especially the material of the five senses, namely learners analyze the relationship between the form and function of body parts in humans (five senses) with the contents of textbooks held by teachers and students so that the need for development of five senses material. Due to this, the teacher uses other relevant science book sources as additional material in the teaching and learning process. The mismatch between the Learning Outcomes and the content of this textbook means that the learning outcomes set by the government are not well implemented [10].

Teachers have not been optimal in applying innovative learning models. In its implementation, the learning applied by teachers is Teacher-centered. The Teacher-centered learning model is a teaching process where everything focuses on the role of the teacher, which means that the teacher holds the main control in the learning process because it is the only source of knowledge for students. While students as learning objects, so that students tend to be passive in the learning process [11]. One-way communication does not stimulate learners to express their opinions and encourages passive learning [12].

The learning outcomes of IVA class students at Kalibanteng Kidul 03 State Elementary School on material about the five senses, especially the senses of smell and taste, show relatively low achievement. Learning outcomes are the results that have been achieved by students after they have participated in learning activities [13]. This can be evidenced from the results of the diagnostic assessment scores in the science subject of the five senses “nose and tongue” which shows that 67% or as many as 14 students are still below the KKTP, while only 33% or as many as 7 students have managed to achieve scores above KKTP, namely with a minimum score of 78. Learners have difficulty understanding the material of the five senses, namely the sense of smell and taste, due to the absence of material that can be studied again at home, and students often experience misconceptions related to the five senses, especially in the sense of smell and taste. Misconceptions in human sensory material are caused by internal and external factors. Internal factors come from learners, such as association thinking and wrong intuition, while external factors include teaching methods, teaching materials, and the context used [14].

Based on the existing problems, an effort is needed to improve the learning process, one of which is by developing technology-based teaching materials. Teaching materials are a collection of information and subject matter that is neatly organized, and equipped with various learning tools and resources to assist the learning process [15]. Teaching materials are useful for conveying information about the material, encouraging students to think and understand concepts, and providing real experiences that support sustainable development [16]. In teaching materials, there are certainly several aspects or components.

The assessment components in teaching materials include content eligibility components, linguistic components, presentation components, and finally, the graphic component [17]. The feasibility of the content is assessed based on its suitability with the Learning Outcomes and Learning Objectives, as well as the suitability of the material presented. Meanwhile, the presentation aspect includes an assessment of the completeness of supporting material, the order of the presentation of the material, and the clarity of learning objectives and indicators. Assessment of the linguistic component includes the use of appropriate language, the level of readability, and suitability for the developmental stages of students. Meanwhile, the assessment of the graphical component includes the appearance of the cover design, content, and overall layout of the book. In terms of language, the use of diction and sentence structure is generally adapted to the intellectual, social, and emotional abilities of elementary school students [18].

The development of teaching materials that pay attention to the feasibility of content, language, presentation, and graphics is very important to ensure the success of the learning process. One form of teaching material development that is relevant in this digital era is the use of digital teaching materials, which can be an interactive and effective source of knowledge [19]. Therefore, teachers are expected to develop digital teaching materials as a source of knowledge that is more flexible and interesting [20].

Digital teaching materials are the development of printed teaching materials that utilize technology, providing various advantages to support students in obtaining learning experiences that are more real, relevant, interactive, and in accordance with advances in science and technology [21]. Advances in information technology also encourage the development of digital teaching materials, where features in digital book maker applications support interactive learning and can increase students' interest in learning [22]. And one of the current developments in digital teaching materials is the Augmented Reality Book.

Teaching modules are a combination of tools, media, methods, instructions, and guidelines designed in an organized and interesting way [23]. There are 3 components contained in the teaching module, namely general information components, core components, and attachments [24]. Augmented Reality (AR) is a research field in computers that combines 3D graphical data with the real world, or in other words, adds elements of reality to a medium. This media can be paper, markers, or markers that can be accessed through certain input devices [25]. The use of Augmented Reality helps learners understand difficult concepts in a more concrete and fun way, in accordance with the needs of learning in the technological era. By understanding the role of technology in improving the quality of learning, it allows us to utilize the potential of Augmented Reality (AR) in creating a more interactive, meaningful, and fun learning experience for learners [26]. So, in this study, researchers will develop teaching modules equipped with Augmented Reality technology using the Assemblr EDU application, resulting in a product in the form of an Augmented Reality Book.

Learning models also have an important role in creating a learning process that is aligned with learning objectives. The learning model is a design or pattern used to structure the curriculum (lesson plan), so that the teaching and learning process becomes more effective [27]. By applying the right learning model, teachers can find out the

characteristics of students and evaluate the advantages and disadvantages of the model that has been designed [28]. There are various types of learning models, one of which is Project-Based Learning (PBL).

PjBL is an innovative model that, in its implementation, involves students in creating a project and working independently in constructing their learning [29]. The syntax of the PjBL model consists of 6 steps, namely determining a problem with a fundamental question, designing a project plan, developing a schedule, monitoring learners and project progress, testing results, and evaluating the experience [30]. To improve learning outcomes, the PjBL model is appropriate because it trains students to think critically, solve problems, and learn actively through projects.

Some research results that are in line with Augmented Reality Book research conclude that it is valid, practical, and effective [31]. Other research related to developing Augmented Reality Book on science subjects concluded that it was very feasible to get validation results showing that the module teaching materials obtained a value of 100% from teaching material experts with a very feasible category, 99% from learning model experts with a very feasible category, and 90% from digital learning media experts who were also included in the very feasible category [32].

Based on the description of the above problems, researchers will develop an Augmented Reality Book on the material of the sense of smell and taste to improve the learning outcomes of IVA class students at SDN Kalibanteng Kidul 03, Semarang City. This study aims to describe the development design, test the feasibility, and effectiveness of Augmented Reality Book Reality material, sense of smell and taste, to improve the learning outcomes of IVA class students, SDN Kalibanteng Kidul 03, Semarang City.

Research Methods

This type of research is Research and Development (R&D) using the Borg and Gall development model. This research and development step consists of 10 steps, namely: 1) Research and information collecting, 2) Planning, 3) Develop preliminary form of product, 4) Preliminary field testing, 5) Main product revision, 6) Main field testing, 7) Operational product revision, 8) Operational field testing, 9) Final Product Revision, 10) Dessemination and implemention.

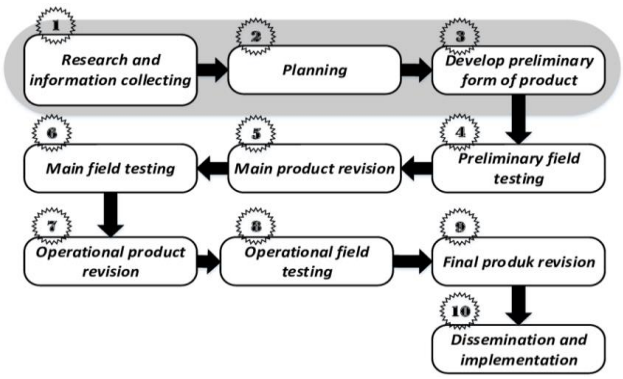

Figure 1. Borg and Gall's Research Design (Sugiyono, 2021)

This research was conducted at SDN Kalibanteng Kidul 03 Semarang City in the odd semester of the 2024/2025 school year, with the research subject being IVA class students of SDN Kalibanteng Kidul 03 Semarang City, totaling 21 people. The subject selection technique in this study used a purposive sampling technique, namely, samples were taken based on criteria determined by the researcher [33]. Researchers used 6 students as product trial subjects and 15 students as usage trial subjects. Data collection techniques are test techniques (pre-test and post-test) and non-test (observation, interview, questionnaire and documentation) [34]. The data analysis technique uses a normality test to determine whether the data obtained has a normal distribution or comes from a normally distributed population, t-test to determine whether there is a significant difference in the average value before and after use and the N-Gain test to see the criteria for the level of increase in learning outcomes according to Table 1 below [35].

Table 1. Normalized Gain Criteria (Sukarelawan et al., 2024)

N-Gain Score	Interpretation
$0.70 \leq g \leq 1.00$	High
$0.30 \leq g < 0.70$	Moderate
$0.00 < g < 0.30$	Low

Results and Discussion

This research focuses on the design development, feasibility and effectiveness of Augmented Reality Book material on the sense of smell and taste for IVA class students of SDN Kalibanteng Kidul 03 Semarang City.

Augmented Reality Book Design Development

This research is a development research using the model from Borg and Gall up to 10 stages.

The first stage is research and information collecting [36]. The gap between expectations and reality creates a problem, which can be solved through research and development to find effective solutions [37]. The purpose of this stage is to find out the potential and problems that occur in the learning process [38]. In analyzing the potential and problems at SDN Kalibanteng Kidul 03 Semarang City, researchers conducted observation activities at Kalibanteng Kidul 03 Semarang City, distributing questionnaires and documenting data on the results of cognitive diagnostic assessments. Through this activity, the researcher found several problems in learning, including teachers have not been optimal in developing technology-based teaching materials; Teachers have not been optimal in applying innovative learning models; and Learning outcomes of IVA class students at Kalibanteng Kidul 03 State Elementary School on material about the five senses, especially the senses of smell and taste, show relatively low achievement.

The potential that can support Augmented Reality Book by researchers is such as the readiness of students in the use of mobile phones during learning, the internet, LCD projectors, and speakers.

The second stage is planning. Planning is a stage for collecting information that will be used as a basis for planning product development [39]. Planning is used to adjust the needs of learners and teachers for products developed through development and research [40]. At this stage, researchers conducted activities to provide needs

questionnaires to teachers and students, conducted by researchers, aimed at identifying products needed to overcome existing problems. The results of the needs questionnaire show that teachers and students need teaching materials that are innovative and attract the attention of students. To increase the motivation of students, teaching materials are needed that can attract their attention so that the learning process becomes more fun and not boring [41]. The use of teaching materials itself has two main functions, namely for teachers and for students. For teachers, teaching materials function as a resource that helps in designing and implementing learning activities. Meanwhile, for students, teaching materials make learning more interesting, provide more opportunities to learn independently with direction from the teacher, and make it easier for them to understand and master each targeted competency [42]. The teacher said that teaching materials should be equipped with 3D images that support abstract learning concepts and learning videos that can provide deeper explanations related to material that is difficult for students to understand. Therefore, researchers will develop Augmented Reality Book material on the senses of smell and taste.

The third stage is to develop a preliminary form of the product. This product design explains the manufacture of products that will be developed by adjusting to the needs of students and teachers [43]. This stage is used to design products according to the needs of students and teachers. Researchers designed an Augmented Reality Book that began with a Prototype. Researchers designed this product using the Canva application. The Canva application was chosen for making teaching materials because it can be accessed via cellphones and laptops, making it easier for teachers to use it [44]. Canva can be used to create presentations, videos, and various other learning media, so that the resulting teaching materials become more interactive and interesting [45].

Researchers use the Assemblr EDU application to integrate 3D images into teaching materials. Assemblr EDU is an educational application that can be utilized by teachers and students. This application offers Augmented Reality (AR) based technology that allows the creation of interactive teaching materials through attractive 3D images and animations, so as to arouse the curiosity of students. The Assemblr EDU platform is equipped with features that allow users to manage, save, and share the content that has been created, thus supporting easy collaboration between teachers [46]. In addition, Assemblr EDU also encourages the creativity of its users and helps present subject matter in a more interesting and fun way [47]. The Assemblr EDU application helps researchers to create a more interesting and innovative Augmented Reality Book by adding interactive 3D images and animations. After designing using Assemblr EDU and Canva, researchers uploaded it to Heyzine, so that the Augmented Reality Book on the material of the sense of smell and taste can be shared with students through a link or barcode.

The novelty of this research lies in the design with visual media in the form of 3D images, videos, songs related to the material, menu options, text and sound that can attract the attention of students so that the learning process can run according to the objectives to be achieved. The results of product development are presented in the following figure:

Figure 2. PjBL Learning Syntax and LKPD on Augmented Reality Book

The PjBL learning syntax provides a systematic structure in the implementation of project-based learning, with 6 syntaxes. The first syntax is to determine the basic question that contains the story text to arouse learners' curiosity and explore questions that are relevant to the topic to be studied. In the second syntax, “designing project planning”, there is a flow of organizing learners in making projects, such as grouping steps. In the third syntax, “developing a schedule”, learning materials are inserted with 3D AR images and interesting learning videos related to the material. In the fourth syntax, “monitoring learners and project progress”, there are steps of project work, and the teacher monitors the progress of the project. In the fifth syntax, “testing results”, there are steps to present the results of each group's work. In the sixth syntax, “evaluating experience”, there is an evaluation of the experience of students in making projects, the difficulties experienced and evaluating learning materials. The LKPD contains one of the projects that students can do, namely, making a pop-up book. Learners can follow the steps of making projects as listed on the LKPD.

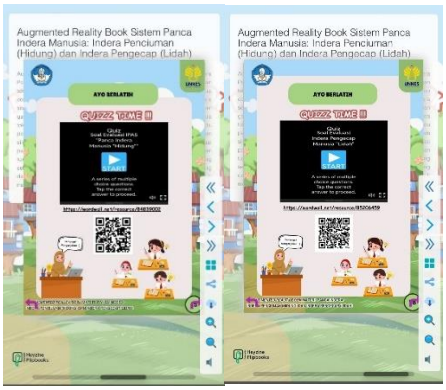

Figure 3. Evaluation Questions on the Augmented Reality Book

The evaluation questions contain questions to test students' understanding of the material studied, namely the sense of smell and the sense of taste. Researchers designed evaluation questions using Wordwall so that students can work on questions easily.

Figure 4. Visual media of 3D image "Nose Structure" and barcode on Augmented Reality Book

The visual media is placed on the nasal structure material in the third syntax, so that researchers include a barcode on the Augmented Reality Book that can be scanned by students. The barcode directs to visual media in the form of 3D images of the nasal structure that can be rotated, enlarged, and reduced as needed. The purpose of this design is that learners can understand the structure of the nose more clearly and concretely through interactive visual displays. In addition, the visual media also includes a basic understanding of the nose, so that students can gain an initial understanding of the nose as part of the human body when accessing images through the Assemblr Edu application.

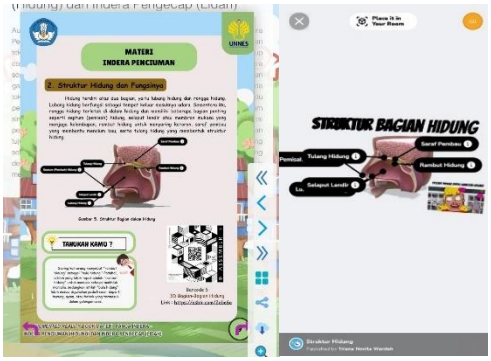

Figure 5. Visual media of 3D image "Nose Structure and Function" and barcode on Augmented Reality Book

This 3D visual image media is designed by researchers and placed on the material of the structure of the nose and its functions. This media can be accessed by students through the barcode available on the Augmented Reality Book, which then directs to the Augmented Reality display using the Assemblr Edu application. In it, students can see the structure of the nose in detail, complete with an explanation of the function of each part. In addition, this media is also equipped with a learning video that explains how the process of the sense of smell works. The 3D images and videos can be rotated, enlarged, reduced, and turned on or off according to the needs of students, so that learning becomes more flexible, interactive, and easy to understand.

Figure 6. Visual media of 3D image "Tongue Structure" and barcode on Augmented Reality Book

This 3D visual image media related to the structure of the tongue is designed to provide a deeper understanding of the sense. This media can be accessed by learners through the barcode printed on the Augmented Reality Book, which directs to the Augmented Reality display using the Assemblr Edu application. In it, learners can see the structure of the tongue in detail, including an explanation of the papillae/taste buds that function in taste. In addition, this media also includes the definition of the tongue as an important organ in the tasting process. The 3D image can be rotated, enlarged, reduced, and turned on or off according to the needs of students, so that learning becomes more interactive and easier to understand..

Figure 7. Visual media of 3D image "Tongue Structure and Function" and barcode on Augmented Reality Book

The last 3D visual image media contains the structure of the tongue and its functions, which are divided into 4 taste

parts: sweet, sour, bitter, and salty. This media can be accessed through the barcode on the Augmented Reality Book, which directs learners to the Augmented Reality display using the Assemblr Edu application. In the display, learners can see the structure of the tongue in detail, complete with an explanation of the function of each part of the tongue. In addition, this media is also equipped with a learning video that explains how the process of the sense of taste works to taste various types of flavors in food. The 3D images and videos can be rotated, enlarged, reduced, and turned on or off according to the needs of students, so that learning becomes more interactive, in-depth, and fun.

The fourth stage is preliminary field testing. Preliminary field testing is carried out to analyze the feasibility of the product [48]. In addition, the product validation stage is carried out to identify the shortcomings and weaknesses of the product developed based on input and responses from validators, so that a final product can be obtained that is ready and suitable for widespread use by students [49]. The validation stages carried out by researchers are product validation by media experts and material validation by material experts. After meeting with media and material validators, researchers obtained values, suggestions, and input into the Augmented Reality Book.

The fifth stage is the main product revision [50]. The main product revision is to make improvements to the initial product, resulting from the product trial [51]. At this stage, the researcher needed to fix the shortcomings in the developed product [52]. Researchers take product revision actions according to the directions given by media and material expert validators until the developed product is suitable for testing. This product revision is carried out to improve and perfect the product that has been assessed by experts, so that the resulting product becomes of higher quality than before [43].

The sixth stage is the main field testing. Researchers conducted main field testing in small groups. Main field testing is a stage where products that have been revised and declared feasible by experts are tested by developers to ensure their suitability for the concepts and objectives that have been designed previously [53]. This stage is carried out to test how feasible the use of Augmented Reality Book products is. [54]. In the small group trial conducted in class IVA SDN Kalibanteng Kidul 03 Semarang City using a purposive sampling technique, researchers used research subjects totalling 6 students based on students' understanding (high understanding, moderate understanding and low) [55]. Before the trial, researchers distributed pretest questions; after the trial, researchers distributed post-test questions to students. Researchers also provide teacher and student response questionnaires to find out whether there are suggestions and improvements related to Augmented Reality Book before testing in large groups.

The seventh stage is operational product revision. operational product revision is carried out to evaluate the feasibility and effectiveness of the product. Operational product revision (second stage) was carried out based on criticism or suggestions given by students as subjects who tested the product [56]. Operational product revision are based on the results of teacher and learner response questionnaires after the product trial is carried out. [57]. The results of the analysis of teacher and learner questionnaires stated that there were revisions to the display section, namely increasing the size of the story text and material in the first and third syntax.

The eighth stage is operational field testing [58]. Operational field testing aims to determine the effectiveness of Augmented Reality Book products in terms of learning outcomes after using Augmented Reality Book products. [59]. This stage was conducted in a large group in class IVA SDN Kalibanteng Kidul 03 Semarang City, which amounted to 15 students. Before the trial use, researchers distributed pretest and posttest questions after the trial use. Researchers also provide questionnaires for teacher and student responses to measure the feasibility of the Augmented Reality Book developed by researchers.

The ninth stage is the final product revision [57]. The final product revision aims to improve the final product by referring to the feedback and suggestions given by learners and teachers [60]. This revision stage is the final stage before mass production. Product revision at this stage is seen based on the teacher and learner response questionnaire to the use of the product [58]. Teacher and learner response questionnaires distributed by researchers in the trial use (large group) obtained a percentage of 99.3% from students and 95% from teachers.

The tenth stage is dissemination and implementation [57]. The final stage in the Borg and Gall research model is dissemination and implementation, which is the process of reproducing the product according to user needs [61]. In the tenth stage, researchers disseminate the developed product in the form of a link to the school, especially teachers and students in class IVA SDN Kalibanteng Kidul 03 Semarang City.

Feasibility of Augmented Reality Book

The feasibility of Augmented Reality Book material on the sense of smell and taste is determined based on the results of feasibility testing by material expert validators, media experts, and teacher and student responses. Material expert validators are given an assessment instrument consisting of 5 aspects, including 1) accuracy to learning components, namely to assess the suitability of the product with learning components, namely learning outcomes and objectives; 2) suitability to the level of thinking of students, namely to assess the level of difficulty of the material in accordance with the level of development of students; 3) supportability of Augmented Reality Book, namely to assess the suitability of product content with learning materials; 4) stimulus helps understand the material, namely to assess whether the stimulus supports students' understanding; and 5) supportability of learning content and instruments, namely to assess the extent to which products and instruments support the achievement of learning objectives. Media validation with 3 aspects, namely: 1) quality of content and objectives, which is to assess the extent to which the media content is in accordance with the learning objectives to be achieved and the suitability of the content; 2) construction, which is to assess whether the media is designed with a clear structure, logical, and easy to follow by its users; and 3) technical/appearance, which is to assess whether the product is easy to use, looks attractive, and functions properly. Researchers also distributed teacher and learner response questionnaires with aspects of material understanding, ease of use of products and learning, media presentation, media

quality, and learning quality. The results of the feasibility analysis by media and material expert validators can be seen in Table 2 below.

Table 2. The results of the feasibility assessment of media experts and material experts.

Validator	Percentage	Criteria
Media Expert	92.18%	Very Feasible
Material Expert	91.25%	Very Feasible

Based on the table above, the aspects of the assessment given by the material expert validators include accuracy with learning objectives, suitability with the level of thinking, support for content, stimulus to help understand the material, and accuracy of learning content obtained a percentage assessment of 91.25% with a very feasible category. The assessment given by the media expert validator assessed that the aspects assessed included accuracy with learning objectives, suitability to the level of thinking, support for content, stimulus to help understand the material, and accuracy of learning content. Aspects of content quality and objectives, construction, and technical/appearance, obtained a percentage assessment of 92.18% with a very feasible category. Suggestions from material experts include adjustments to indicators and question writing. While criticism and suggestions from media experts lie in changing the appearance of the cover, as well as clarifying the font on the content display, especially in the story text in syntax 1, namely determining the fundamental question.

Teachers and learners also filled out questionnaires to assess the suitability of the material and presentation design. The results of these responses are used to evaluate the feasibility and effectiveness of the development product in the learning process.

Table 3. Assessment results of teacher and learner response questionnaires.

Response	Persentase	Kriteria
Teacher	95%	Very Feasible
Leaners	99.3%	Very Feasible

Based on Table 3, with aspects of the teacher questionnaire assessment which includes the suitability of the material and the suitability of the design, aspects of the student questionnaire assessment which includes the suitability of the material and the presentation of the design display, shows that the results of the teacher and student response questionnaires are in the very feasible category, with a percentage of 95% from teachers and 99.3% from students. Criticisms and suggestions for improvement from the teacher response questionnaire lie in the font display on the story text to be enlarged. While criticisms and suggestions from the learner response questionnaire are on the type and size of the font used in the product.

Effectiveness of Augmented Reality Book

The effectiveness of the Augmented Reality Book is obtained based on the increase in pre-test and post-test scores. The pretest value is obtained by asking questions before using the Augmented Reality Book product on the senses of taste and smell in learning, while the post-test value is obtained by asking questions after using the Augmented Reality Book product on the senses of taste and smell in learning. The effectiveness of the Augmented Reality Book was tested through several analyses, including a normality test, a t-test, and an N-Gain test. The average pre-test score was recorded at 61.06, while the average post-test score increased to 89.46, which shows an average increase of 28.4.

Table 4. Pre-Test and Post-Test Scores of Learners

Action	Average	KKTP	Highest Score	Lowest Score
Pre-test	61.06	78	78	44
Post-test	89.46	78	100	82

Based on Table 4, the data collected by researchers include the results of the pre-test and post-test, which were then analyzed using the normality test. The analysis carried out on the pretest and post-test data is to determine whether the data follows a normal distribution. The decision-making criteria in the normality test are if the significance value (sig) is greater than 0.05, then the data is considered normally distributed; conversely, if the significance value is less than 0.05, then the data is considered not normally distributed.

Table 5. Pre-test and Post-test Normality Test Results

Shapiro-Wilk	Sig. Value	Description
Pre-test	.137	Normal
Post-test	.072	Normal

Based on Table 5, researchers conducted a normality test using the Shapiro-Wilk method because the number of samples used was relatively small [62]. The test results show that the significance value (Sig.) in the pre-test and post-test data is greater than 0.05, so it can be concluded that the data distribution is normal. After conducting the pre-test and post-test, the data were declared normally distributed through the normality test. Therefore, the next step is to conduct a t-test. This test uses a parametric statistical approach to analyze the average difference between pre-test and post-test scores.

Table 6. Pre-test and Post-test t-test Results

Paired Sample T-test	Mean	Sig. (2-tailed)
Pre-test-Post-test	-24.933	<.001

The Paired T-test states that there is a significant difference in the pre-test and post-test results if the Sig. (2-tailed) <0.05. In Table 6, it can be seen that the Sig. (2-tailed) < 0.05, namely < 0.001, so there is a significant difference between the pre-test and post-test results with a difference of 24.933%. Based on the results of the t-test calculation, it can be concluded that there is a significant difference between the learning outcomes before and after using the Augmented Reality Book material on the senses of smell and taste.

The last data analysis test used is the N-gain test, which aims to determine the level of effectiveness before and after the use of the Augmented Reality Book on the material of the sense of smell and taste in class IVA. Data processing is done using version 30 of the application. N-Gain test results can be seen in Table 7 below.

Based on Table 7 above, it can be seen that there is an increase in the average use of Augmented Reality Book material, sense of smell and taste in class IVA SDN

Kalibanteng Kidul 03 Semarang City, with N-Gain of .6595, which is in the medium category. The average increase in student learning outcomes in the trial use of Augmented Reality Book material, sense of smell and taste, in Figure 8 below.

Table 7. N-Gain Test Results on Trial Use

Action	Average	N-Gain	Criteria
Pre-test	61.06	.6595	Moderate
Post-test	89.46		

Based on Table 7, it can be seen that there is an increase in the average (N-Gain) between the pre-test and post-test. data of .6595, which is included in the moderate category, with an increase in student learning outcomes of 28.4. The increase obtained from the average learning outcomes is in the moderate category. Meanwhile, the developed product received excellent ratings from material and media experts as well as positive responses from teachers and students. The moderate category in the N-Gain test results is caused by several factors, including the readiness of students and their learning styles. Learners' readiness to participate in learning and classroom conditions can affect the smoothness of the teaching and learning process [63]. In addition, learning styles that are not suited to the visual or interactive approach offered by the product also affect learning effectiveness. The combination of these factors meant that the improvement in learning outcomes did not reach the high category.

Conclusion

Based on the description of the results and discussion it can be concluded that: (1) The design of Augmented Reality Book material on the senses of smell and taste in IPAS class IVA SDN Kalibanteng Kidul 03 Semarang City was successfully developed which was designed using the Assemblr EDU and Canva applications and used as an E-Module using Heyzine. The developed product consists of several components, namely cover, instructions for use and activities, concept maps, CP and TP, Project Based Learning-based learning materials, visual media in the form of 3D images using the Assemblr EDU application, learning videos, glossary, evaluation questions in the form of Wordwall, bibliography and developer profile; (2) The feasibility of Augmented Reality Book material on the sense of smell and taste is declared very feasible to use. With a percentage of material expert assessment of 91.25% and media experts 92.18% very feasible criteria, supported by the results of the analysis of teacher response questionnaires of 95% and student response questionnaires of 99.3% very feasible criteria and (3) The effectiveness of Augmented Reality Book is indicated by an increase in pre-test and post-test scores supported by the results of paired t tests and N-Gain tests. The paired t test on the small group trial produced an S.Sig. (2-tailed) value of 0.001 <0.05, so the conclusion is Ho is rejected and Ha is accepted. If the paired t test on the large group trial results in that the S.Sig (two tailed) value is 0.0001 <0.05 then the conclusion is Ho is rejected and Ha is accepted. Then, the N-Gain test gets a score of 0.6595 with moderate criteria. So the development of the Augmented Reality Book is successful, feasible, and effective in improving the learning outcomes of IVA class students of SDN Kalibanteng Kidul 03, Semarang City, on the material of the sense of smell and taste. Hopefully, future researchers can develop an Augmented Reality Book on other learning materials and use different applications, so that innovations in the preparation of digital teaching materials are increasingly diverse and interesting for students.

Author's Contribution

Triana Novita Wardah: Contributed to product development, data analysis, and research article writing. Aldina Eka Andriani: Contributed to drafting and revising the research.

Acknowledgements

Thank you to the PGSD FIPP UNNES study program, to the supervisor Mrs. Aldina Eka Andriani, S.Pd., M.Pd., Principal of SDN Kalibanteng Kidul 03 Semarang City, Class IVA Teacher of SDN Kalibanteng Kidul 03 Semarang City, and both parents for their invaluable support in facilitating this research to completion.

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