Development of an Augmented Reality Media on Natural Phenomena to Enhance Eighth-Grade Students' Skills in Presenting Explanatory Texts

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https://doi.org/10.17977/um065.v7.i4.2027.14

Article history
Submitted: 2 September 2026
Revised: 28 September 2026
Accepted: 15 October 2026
Published: 17 October 2026

Keywords
Augmented reality
Explanatory text
Presentation skills

Abstract
Learning explanatory texts requires students to understand natural phenomena and processes and to communicate them systematically, yet conventional learning media provide limited opportunities for concrete, sequential, and interactive visualization. This study aims to develop augmented reality (AR) learning media containing natural phenomena to support students' learning of explanatory texts and oral presentation activities. The study employed a research and development approach consisting of needs analysis, media development, and expert validation. The needs analysis involved 58 students and two Indonesian language teachers from two junior high schools. The developed media were validated by one material expert and one media expert using a five-point validation scale. The needs analysis indicated that students required visual, realistic, three-dimensional, and sequential representations of natural phenomena to support their understanding and presentation activities. The validation results showed that the material aspect obtained a score of 57 out of 75, corresponding to 76%, and was categorized as feasible, while the media aspect obtained a score of 71 out of 75, corresponding to 94.6%, and was categorized as highly feasible. The use of only one expert in each validation domain limited the strength of the validation evidence because inter-rater agreement could not be examined. Therefore, further research should involve multiple experts in each validation domain to provide stronger evidence of content and media validity, in addition to conducting practicality and effectiveness testing before broader implementation.

1. Introduction

Presentation skills are among the key competencies in Indonesian language learning because students are expected not only to understand information but also to convey their ideas, knowledge, and insights orally Chan (2026). These skills include the ability to organize content, present information coherently and logically, use appropriate language, and demonstrate self-confidence when communicating in front of others. In the study of explanatory texts, presentation skills play a crucial role because students need to explain the process behind a phenomenon based on cause-and-effect relationships and the correct sequence of events. Thus, the study of explanatory texts should not be limited to understanding the text's structure and content but must also provide students with opportunities to communicate their understanding orally.

Issues with presentation skills are still evident in Indonesian language instruction at the junior high school level. Based on observations and interviews with Indonesian language teachers, the presentation skills of eighth-grade students remain suboptimal. Students face several challenges, including nervousness when presenting material, disjointed delivery, unclear speech, a tendency to read directly from slides, inappropriate word choice, and limited ability to project a presence that supports the presentation. At both schools, presentation skills have not yet been a component that receives optimal practice during instruction. Learning activities are still largely dominated by reading texts, taking notes, and answering questions, while opportunities to verbally communicate their understanding remain limited. These conditions indicate a need for instruction that not only provides information to students but also offers stimuli and learning experiences that help them understand the material and communicate their understanding verbally.

This issue becomes more complex when applied to the teaching of explanatory texts. Explanatory texts require students to understand and systematically explain how a phenomenon occurs, including the relationships among causes, stages of the process, and effects. Natural phenomena, which are the subject of explanatory texts, have process-oriented characteristics and cannot always be directly observed during

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instruction. Based on the observed learning conditions, limitations in visualization prevent students from gaining sufficient experience to observe phenomena concretely. Learning that still relies on textbooks, verbal explanations, videos, and slides does not fully provide an interactive experience for observing phenomena and their processes from various perspectives. These conditions can hinder students' ability to understand the sequence and relationships among the stages of a phenomenon. This understanding is subsequently required when they must explain it verbally.

The need for learning media that provide visual and interactive experiences is increasingly relevant, given the characteristics of students immersed in a digital technology environment. Learning media that present information only in text or static images do not fully address students' learning needs, who require direct observation of objects and processes. Therefore, the media developed must serve a purpose beyond merely conveying content; it must help students build an understanding of phenomena and provide stimuli they can use to communicate that understanding. In this context, augmented reality (AR) is particularly relevant because it allows virtual objects to be displayed within a real-world environment, thereby enabling the visual and interactive representation of objects or phenomena that are difficult to observe directly.

The use of AR in learning has demonstrated various potentials. Studies by Alkhabra et al., (2023), Sukatiman et al. (2026), and Kasiyun et al. (2026) utilized AR in instructional materials to support content comprehension and critical thinking skills through more interactive learning experiences. Meanwhile, Nabil et al. (2024) developed AR media for Indonesian language instruction focused on descriptive texts for junior high school students, demonstrating the potential for applying AR in junior high school Indonesian language education. This study showed that AR has been utilized to provide more concrete and interactive learning experiences, though the focus and context of its application remain diverse.

In addition to research on AR, studies on speaking and presentation skills also indicate that students' oral communication abilities can be developed through learning that provides practical experience, training, and media that support the communication process. For example, developed a public speaking training program using an experiential learning approach because students still face fear, nervousness, low self-confidence, and difficulty conveying their speech content clearly and in a structured manner. Other studies cited in previous research, such as those by Yan et al. (2024), Saidin et al. (2024), Kazanskaia (2025), Wang (2025), Homme et al., (2025), (Manlapig and Lawsin, 2026) Hsu and Liu (2025), Prasandha et al. (2021), and Karagol et al., (2025), highlight the importance of developing speaking and presentation skills through various models, methods, training, and learning media. In general, these studies provide a basis for the notion that strengthening oral communication skills requires learning that allows students to organize and convey ideas systematically.

On the other hand, the development of digital media for teaching explanatory texts has taken various interactive forms. Studies by Prasandha et al. (2023), Faria, (2024) and Cabello et al. (2026) provide insights into the use of digital media to support student engagement and learning abilities. However, these studies have not specifically integrated AR media with visualizations of natural phenomena to help students understand their processes while simultaneously presenting explanatory texts orally.

Based on these research trends, previous studies have demonstrated that AR can provide more concrete and interactive learning experiences, while other studies have shown that speaking and presentation skills develop through opportunities to organize and communicate ideas. However, these two strands of research have not yet been sufficiently connected through a specific instructional mechanism. Existing AR-based studies in language learning generally position AR as a medium for presenting or visualizing learning content, while studies on speaking and presentation skills emphasize practice, training, or communication activities. What remains less explored is how AR-based visualization can function as an instructional stimulus that supports the transition from observing a phenomenon to constructing and orally presenting an explanation.

This distinction is important in explanatory text learning because students are not only required to recognize information about a phenomenon but also to understand how the phenomenon occurs, identify relationships between causes, stages, and effects, organize this information into a coherent sequence, and communicate the resulting understanding orally. Thus, the instructional challenge is not simply the availability of visual or interactive media, but how the media facilitates the cognitive and communicative process connecting observation, understanding, organization of information, and oral presentation. Previous AR studies cited in this study have not specifically described or developed this sequence as an integrated learning mechanism. Similarly, studies on speaking and presentation skills have generally focused on training, models, or communication practice without using AR-based visualization of phenomena as the initial stimulus for constructing an oral explanation.

Alkhabra et al., (2023) demonstrates the use of AR in Indonesian language instruction, but the media is primarily positioned as an interactive learning resource rather than as part of an explicit observation-to-presentation instructional process. These studies therefore provide relevant foundations, but they do not yet address the same instructional mechanism developed in the present study.

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Accordingly, the research gap is located not merely in the combination of AR, explanatory texts, natural phenomena, and junior high school students, but in the absence of an instructional design that uses AR-based visualization of a phenomenon as a bridge between observation and oral presentation. The distinction therefore lies in the instructional function assigned to AR. In previous studies, AR is primarily used to visualize content, provide interactive learning resources, or support general language skills, whereas the present study positions AR visualization as the initial stimulus in an observation-to-presentation mechanism. Through this mechanism, students do not merely observe a phenomenon through AR but use the observed visual information to identify causal and sequential relationships, organize an explanatory structure, and transform their understanding into an oral presentation. In this mechanism, AR is not treated only as a technological feature for making content more attractive or interactive, but as an instructional stimulus that supports the transformation of visual experience into organized verbal communication.

Therefore, the novelty of this study lies in the instructional integration between phenomenon-based AR visualization and oral presentation of explanatory texts. The media is designed to connect what students observe with what they need to explain, so that visualization serves as the starting point for understanding and organizing information before students communicate it orally. This focus responds directly to the identified learning needs, particularly students' difficulties in visualizing phenomena, organizing explanations, and communicating their understanding coherently and confidently.

2. Method

This study employs a Research and Development (R&D) approach to develop augmented reality (AR)-based learning media featuring natural phenomena to strengthen eighth-grade junior high school students' skills in presenting explanatory texts. The development process adapts the ADDIE model, which consists of five stages: analysis, design, development, implementation, and evaluation (Sugiyono, 2022). However, given the scope and time constraints of the study, the development in this research was limited to three stages: analysis, design, and development. The R&D approach was chosen because the study focused on identifying learning needs, designing and developing the product, and assessing the prototype's feasibility through expert validation. The product developed is an AR learning medium that presents natural phenomena as visual, interactive objects to support eighth-grade students in understanding and composing explanatory texts.

2.1. Participants and Target Population

The target population in this study consists of eighth-grade junior high school students enrolled in Indonesian language classes, specifically those studying explanatory texts. The study participants comprised 58 eighth-grade students. In addition to the students, the study involved two Indonesian language teachers one from each school as informants in the learning needs analysis. The study also involved two independent expert validators, consisting of one subject-matter expert and one media expert, who assessed different aspects of the developed AR media. The subject-matter expert evaluated the content and instructional aspects, whereas the media expert evaluated the visual, technical, and interactive aspects. The use of one expert for each validation domain was determined by the scope and resources of the development study. Accordingly, the expert-validation results are interpreted as preliminary evidence of prototype feasibility rather than as a comprehensive estimate of inter-rater reliability or generalizable validity.

Participants were selected using purposive sampling (Sugiyono, 2022). Schools were selected based on the alignment of their characteristics with the research objectives and the context of digital learning media development. Were chosen because both have implemented the Merdeka Curriculum and have experience in utilizing digital learning media. The selection of eighth-grade students was tailored to the target users of the media being developed. At the same time, teachers were selected because they were directly involved in teaching explanatory texts and were familiar with students' conditions and needs related to presentation skills.

The study also involved two independent expert validators, consisting of one subject-matter expert and one media expert. Each expert independently assessed the prototype within their respective area of expertise. The subject-matter expert evaluated the content and instructional aspects, particularly the alignment of the material with learning objectives and presentation skills, whereas the media expert evaluated the visual, technical, and interactive aspects of the AR media. Because the development study was limited to one expert in each validation domain, the expert assessment was intended to provide domain-specific preliminary evidence of prototype feasibility rather than to establish inter-rater reliability or consensus across multiple raters.

2.2. Research Instruments

This study used several data-collection instruments, namely a student needs-analysis questionnaire, a teacher interview guide, an observation sheet, and a validation questionnaire for subject-matter and media experts.

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The needs analysis questionnaire was administered to 58 students to gather information on their understanding of explanatory texts, presentation skills, experience with instructional media, needs for new instructional media, and experience with digital media. The questionnaire covered four main aspects: learning explanatory texts, presentation skills, the use of instructional media, and experience using digital media.

Interview guidelines were used to gather information from two Indonesian language teachers regarding learning conditions, students' difficulties in studying explanatory texts and presenting material, the learning media currently in use, students' responses to digital media, and the need for AR-based learning media. The interviews covered three main aspects: difficulties in learning explanatory texts, the use of learning media and digital media, and the potential for utilizing AR in learning.

The validation questionnaires consisted of a subject-matter expert validation questionnaire and a media expert validation questionnaire. The subject-matter expert validation instrument was used to assess the alignment of the material with learning outcomes and objectives; the accuracy and completeness of the material; language usage; presentation of the material; the relevance of natural phenomena to explanatory texts; and the support provided by the media for presentation skills. This instrument comprised 15 evaluation items.

The validation instruments were developed based on the assessment aspects relevant to the objectives of the product development. The subject-matter expert validation instrument consisted of 15 items covering alignment with learning outcomes and objectives, content accuracy and completeness, language use, material presentation, relevance of natural phenomena to explanatory texts, and support for presentation skills. The media expert validation instrument consisted of 15 items covering visual design, ease of use, technical quality, interactivity, and suitability for learning.

Before being used for prototype assessment, the validation instruments were reviewed for the relevance, clarity, and suitability of each item to the intended assessment domain. This review was used to ensure content alignment between the indicators and the aspects being assessed. Because the study involved one expert in each validation domain and did not include a separate multi-expert instrument-validation procedure, no statistical content-validity index was calculated. Therefore, instrument validity in this study is reported as evidence of content alignment and item clarity rather than as a statistically estimated validity coefficient.

Both the needs analysis questionnaire and the validation instrument use a five-point Likert scale, with scores ranging from 1 to 5 (Ningsih et al. 2024). A higher score indicates greater agreement or a more favorable evaluation of the assessed aspect.

2.3. Measuring Tools

Observations were used to gather data on learning conditions, student activities, teacher-student interactions, the media used, and students' skills in presenting information. Observations were conducted to obtain a picture of the actual learning conditions before the media were developed.

A student questionnaire was used to measure students' needs and perceptions regarding the learning of explanatory texts, presentation skills, the use of learning media, and their experience using digital media. Teacher interviews were used to gather data on learning difficulties and the characteristics of the media needed. Meanwhile, an expert validation questionnaire was used to assess the suitability of the developed AR media in terms of content and media.

2.4. Research Procedures and Timeline

The research was conducted from May to September 2026. The needs analysis was conducted at one Junior High School in Semarang and one at Bantarbolang. In contrast, the media development process was conducted at the Usmar Ismail Language Laboratory, Semarang State University. The research procedure adapted the three stages of the ADDIE model as follows.

2.4.1. Analysis Stage

In this stage, an analysis was conducted of learning conditions, students' difficulties in presenting explanatory texts, teachers' needs, media already in use, students' experiences using digital media, and the need for AR-based learning media. Data were obtained through observation, a student needs analysis questionnaire, and interviews with Indonesian language teachers.

2.4.2. Design Phase

The results of the needs analysis were used as the basis for designing the AR learning media. The design took into account the characteristics of eighth-grade students, the learning objectives for explanatory texts, material on natural phenomena, the need for presentation skills, and the visual, interactive, and technical characteristics of the learning media.

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2.4.3. Development Phase

In this stage, the media design was implemented as a prototype of AR learning media focused on natural phenomena. The prototype was independently assessed by one subject-matter expert and one media expert according to their respective areas of expertise. The subject-matter expert assessed the feasibility of the content and instructional aspects, while the media expert assessed the visual, technical, interactive, and usability aspects. The quantitative scores were used to describe the feasibility of each validation domain, while qualitative comments and suggestions were used to identify aspects requiring revision.

Because only one expert assessed each validation domain, inter-rater reliability and statistical agreement could not be calculated. Accordingly, the validation results were treated as domain-specific expert judgments and preliminary evidence of prototype feasibility. The validation process was used to identify content and media aspects requiring revision rather than to establish generalized validity or instructional effectiveness. No classroom implementation or pretest-posttest comparison was conducted in this study.

2.4.4. Data Analysis Techniques

The research data were analyzed both qualitatively and quantitatively. Qualitative data were obtained through observations, teacher interviews, and comments and suggestions from expert validators. This data was analyzed descriptively by organizing the information, identifying emerging issues and needs, interpreting it in accordance with the development objectives, and using it to define characteristics and revise the developed AR media.

Quantitative data from the student needs-analysis questionnaire and expert-validation questionnaires were analyzed descriptively. Student questionnaire responses were converted into percentages to describe students' reported needs and perceptions. Expert-validation scores were converted into feasibility percentages by dividing the obtained score by the maximum possible score and multiplying the result by 100.

The feasibility percentages were interpreted using predetermined categories of 0–20%, 20.1–40%, 40.1–60%, 60.1–80%, and 80.1–100%. These cut-off intervals were adopted from the assessment criteria reported by Sugiyono (2022). In this study, the 60.1–80% interval was interpreted as feasible, whereas the 80.1–100% interval was interpreted as highly feasible. The cut-off criteria were used as descriptive decision rules to interpret the prototype assessment consistently, rather than as statistically derived thresholds of validity or effectiveness. Thus, the feasibility category indicates the level of expert assessment of the prototype within the assessed domain and does not by itself demonstrate instructional effectiveness.

3. Results and Discussion

This section presents the results of developing augmented reality (AR) learning media to strengthen eighth-grade students' skills in presenting explanatory texts. The research findings were obtained through an analysis of student needs, teacher interviews, the identification of media development principles, and the development of an initial AR media prototype. The research results are presented descriptively and then discussed in relation to the learning of explanatory texts and oral presentation skills.

3.1. Results

3.1.1. Student and Teacher Needs Regarding Augmented Reality Learning Media

A needs analysis was conducted to identify the learning conditions, difficulties, and media needs of eighth-grade students and Indonesian language teachers in the learning of explanatory texts. The student needs analysis involved 58 students from two junior high schools: 29 eighth-grade students from junior high school A and 29 eighth-grade students from junior high school B. The student questionnaire consisted of 25 statements covering aspects of explanatory text learning, presentation skills, the use of learning media, the need for augmented reality technology, and the strengthening of critical thinking skills. Meanwhile, teachers' needs were identified through interviews with two Indonesian language teachers at each school.

3.1.1.1. Students' Initial Conditions in Explanatory Text Learning and Presentations

The analysis of initial conditions covered students' understanding of explanatory texts, their ability to explain phenomena orally, their ability to present processes in a logical sequence, and their self-confidence when giving presentations. The results of the analysis are presented in Table 1.

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Table 1. Students' Initial Conditions in Learning Explanatory Texts and Presentations

Indicator	Interval				
	1	2	3	4	5
Students understand the process of a phenomenon explained in an explanatory text.	0%	3.4%	8.6%	**65.5%**	22.4%
Students have difficulty imagining a phenomenon when it is presented only through books or pictures	6.9%	25.9%	**34.5%**	22.4%	10.3%
Students have difficulty explaining a phenomenon orally	10.3%	29.3	17.2	**34.5%**	8.6%
Students have difficulty presenting a phenomenon coherently and clearly	5.2%	19%	25.9%	**36.2%**	13.8%
Students lack confidence when presenting a phenomenon	8.6%	25.9%	19%	**34.5%**	12.1%

Notes
1 = Strongly Disagree
2 = Disagree
3 = Somewhat Disagree
4 = Agree
5 = Strongly Agree

The results show that most students already have a basic understanding of the processes described in the explanatory text. A total of 65.5% of students agreed, and 22.4% strongly agreed, that they could understand the process of a phenomenon described in the explanatory text. However, difficulties were still encountered in visualizing the phenomenon, explaining it orally, presenting the process in a coherent sequence, and maintaining self-confidence during the presentation. The highest percentage of agreement was found for the statement concerning students' difficulty in presenting phenomena coherently and clearly, with 36.2% agreeing and 13.8% strongly agreeing. These findings suggest that students' needs extend beyond understanding explanatory text content to include support for organizing and communicating information in oral presentations.

3.1.1.2. Students' Needs Regarding Learning Media

Further analysis identified the learning media currently in use as well as students' perceptions regarding the need for media innovation. Table 2 presents the results of the analysis.

Table 2. Students' Needs Regarding Learning Media for Explanatory Texts

Indicator	Interval				
	1	2	3	4	5
Current learning media help students explain phenomena orally.	0%	5.2%	5.2%	51.7%	37.9
The learning media used in explanatory text learning are varied.	0%	3.4%	22.4%	58.6%	15.5%
Books remain the dominant learning material	3.4%	13.8	25.9%	41.4%	15.5%
Teachers have used media other than books and PowerPoint.	1.7%	8.6%	32.8%	50%	6.9%
Existing explanatory text learning media are attractive and interactive.	0%	3.4%	12.1%	63.8%	20.7%
Explanatory text learning media requires innovation.	0%	10.3%	17.2%	36.2%	36.2%

Notes
1 = Strongly Disagree
2 = Disagree
3 = Somewhat Disagree
4 = Agree
5 = Strongly Agree

The results show that students generally rated the media used as helpful, varied, and quite interesting. However, 36.2% of students agreed, and 36.2% strongly agreed that explanatory text learning media require innovations. Additionally, 41,4% of students agreed, and 15,5% of students strongly agreed that books remain the dominant learning material.

3.1.1.3. Students' Needs Regarding Augmented Reality Technology

The needs analysis also covered students' perceptions of visual learning, three-dimensional objects, self-directed learning, and the use of augmented reality technology. The results are presented in Table 3.

Table 3. Students' Needs Regarding Augmented Reality Technology

Indicator	Interval				
	1	2	3	4	5
Current media clearly helps students understand phenomenon processes	10.3%	19%	34.5%	24.1%	12.1%
Students understand explanatory texts more easily when phenomena are presented visually and attractively	0	3.4%	12.1%	44.8%	39.7
Students have difficulty understanding phenomena when they only read the text	5.2%	13.8	20.7%	43.1%	17.2%

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Indicator	Interval				
	1	2	3	4	5
Students need media that present phenomenon processes more realistically	0	1.7%	12.1%	46.6%	39.7
Students need media that can be accessed anytime and anywhere	0	5.2%	6.9%	46.6%	41.4%
Students are more interested when learning media presents 3D objects	0	3.4%	12.1%	53.4%	31%
Notes 1 = Strongly Disagree 2 = Disagree 3 = Somewhat Disagree 4 = Agree 5 = Strongly Agree					

The results indicate a strong need for visual and three-dimensional representations. A total of 44.8% of students agreed, and 39.7% strongly agreed that they could understand explanatory texts more easily when phenomena were presented visually and attractively. Interest in three-dimensional objects was also relatively high, with 53.4% of students agreeing and 31% of students strongly agreeing. In addition, 46.6% of students agreed, and 41.4% strongly agreed that learning media should be accessible anytime, anywhere to support independent learning.

3.1.1.4. Students' Needs for AR Media Featuring Natural Phenomena

The final analysis focuses on the characteristics of AR media featuring natural phenomena and their potential to support the skill of presenting explanatory texts. The results of this analysis are presented in Table 4.

Table 4. Students' Needs for AR Media Featuring Natural Phenomena

Indicator	Interval				
	1	2	3	4	5
Clear visualization from various viewpoints increases confidence in explaining phenomena	0%	5.2%	19%	**50%**	25.9%
Students need media to practice explaining phenomena coherently	1.7%	1.7%	15.5%	**50%**	31
Students are interested in 3D AR learning media	0%	3.4%	12.1%	**48.3%**	36.2
3D AR visualization helps students understand explanatory texts	0%	1.7%	17.2%	**50%**	31
Sequential AR visualization helps students present phenomena coherently	0%	0%	22.4%	**48.3%**	29.3%
Direct observation through AR makes explaining phenomena easier	0%	5.2%	15.5%	**59.9%**	22.4%
AR visualization increases confidence in presenting phenomena	0%	6.9%	15.5%	**51.7%**	25.9%
Notes 1 = Strongly Disagree 2 = Disagree 3 = Somewhat Disagree 4 = Agree 5 = Strongly Agree					

The results also showed that 51.7% of students agreed and 25.9% strongly agreed with the statement that AR visualization could increase their confidence in presenting phenomena. This finding reflects students' perceptions and indicates a perceived need for visualization that may support presentation activities, rather than evidence of an actual increase in confidence.

3.1.1.5. Teachers' Needs

Interview results revealed relatively similar learning challenges at both schools. At junior high school A, students struggled to understand scientific vocabulary, abstract concepts, distinguish between facts and opinions, and comprehend lengthy explanatory texts. These difficulties also impacted presentation activities, as some students still relied on slides or notes when explaining the material. Students' levels of self-confidence also vary; some students feel shy or nervous when giving presentations.

At junior high school B, students generally have a sufficient understanding of explanatory texts but still struggle to understand scientific terms and abstract concepts. Presentation skills also vary. Some students can explain the material coherently, while others struggle to describe the stages of a phenomenon and cite sources independently. Some students also become nervous and lose focus during presentations.

Teachers reported that instructional media included textbooks, PowerPoint presentations, images, educational videos, Canva, and Quizizz. Teachers reported that interactive media such as quizzes and games were perceived to increase students' enthusiasm. However, the media used have not specifically provided students with the opportunity to observe the entire process of a phenomenon, explore information

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independently, and use their observations as the basis for oral presentations. Both teachers also noted that they have never used AR-based learning media.

3.1.2. Principles of Augmented Reality Media Development

A needs analysis determined the principles for developing the media, the characteristics of eighth-grade students, learning objectives, and the characteristics of AR technology. The five principles applied in the development of the media include interactivity and constructivism, signaling, spatial and temporal contiguity, segmentation, and personalization. The principles of interactivity and constructivism are applied by providing students with opportunities to interact with three-dimensional objects, observe phenomena from various perspectives, explore information, identify cause-and-effect relationships, and use their observations to construct explanations.

The principle of signaling is applied through visual and audio cues to direct students' attention to important aspects of a phenomenon. These cues include highlighted objects, arrows, changes in visual display, brief text, and audio instructions. In the case of a flood, for example, the visualization directs students' attention to rainfall, the increase in water volume, the flow of water toward lower-lying areas, and ultimately the formation of the flood. The principle of spatial and temporal contiguity is applied by placing explanatory information near relevant three-dimensional objects and synchronizing text, narration, and animation with the process of the phenomenon being observed.

The principle of segmentation is applied by dividing the flood phenomenon process into five stages: heavy rainfall, increased water volume, reduced soil absorption capacity, water flow toward lower-lying areas, and the formation of floods. Students can observe each stage before proceeding to the next one using the available controls. The principle of personalization is applied through communicative language and direct instructions, such as "Point the camera at the marker to view the phenomenon," "Observe the changes that occur," and "Try to explain why the water is starting to pool." The media also provides direct guidance during presentation activities.

3.1.3. Augmented Reality Media Prototype

The AR media prototype was developed based on the needs of students and teachers as well as the five established development principles. The media is designed to help students understand natural phenomena through three-dimensional visualization and to support their ability to present explanatory texts coherently and logically. An overview of the developed AR media prototype is presented in Figure 1.



Figure 1. Augmented Reality Educational Media Prototype

The prototype consists of several interconnected sections. The first section contains an introduction and instructions for using the media, including an overview of the media, learning objectives, and instructions for accessing and operating AR objects. The second section provides activities for exploring natural phenomena through three-dimensional objects. The third section presents an explanation of the phenomenon's process in segmented stages, accompanied by text, narration, visual cues, and observation instructions. The fourth section involves an activity where students present explanatory texts, guiding them to identify key information, organize the sequence of processes, and verbally explain the observed phenomena.

The prototype is structured in stages according to the principle of segmentation. Students can observe one stage of a phenomenon, understand the accompanying information, and then proceed to the next stage. Visual cues, text, and instructions are used to direct students' attention to key elements. Information related to the objects is also placed near the visual objects and presented at the appropriate time.

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The media also includes interactive activities that allow students to observe, explore, answer questions, and communicate their observations. Thus, the prototype serves not only as a medium for conveying information but also as a learning environment that enables students to build understanding and apply that understanding in oral presentations.

The developed augmented reality (AR) learning media was validated by one material expert and one media expert to determine its feasibility before implementation. The material expert assessed three aspects: substance, language, and material feasibility, while the media expert assessed four aspects: design and layout, technical quality and ease of use, interactivity and learning experience, and support for presentation skills. The results of the expert validation are presented in Table 5.

Table 5. Expert Validation Results

Validator	Assessment Aspect	Score (%)	Category
Material Expert	Substance	80%	Feasible
	Language	72%	Feasible
	Material Feasibility	76%	Feasible
Overall Material Validation		76%	Feasible
Media Expert	Design and Layout	88%	Highly Feasible
	Technical Quality and Ease of Use	100%	Highly Feasible
	Interactivity and Learning Experience	95%	Highly Feasible
	Support for Presentation Skills	100%	Highly Feasible
Overall Media Validation		94.6%	Highly Feasible

The material expert obtained a total score of 57 out of a maximum score of 75, resulting in a feasibility percentage of 76%, which was categorized as feasible. The assessment covered the alignment of the explanatory text material with the learning objectives, the adequacy of the material for understanding natural phenomena, the clarity of language, and the extent to which the material supported students in presenting explanatory texts orally. In particular, the material feasibility aspect addressed students' ability to present ideas without relying solely on written texts, reduce fear of presenting, develop confidence in speaking, and practice presentations gradually.

The media expert obtained a total score of 71 out of 75, corresponding to a feasibility percentage of 94.6%, which was categorized as highly feasible. The highest scores were found in technical quality and ease of use, as well as support for presentation skills, both of which reached 100%. The interactivity and learning experience aspect obtained 95%, while the design and layout aspect obtained 88%. These results indicate that the AR media was considered technically functional, interactive, visually supportive of understanding natural phenomena, and capable of providing opportunities for students to practice presenting information orally.

The experts also provided suggestions for improvement. The material expert recommended balancing the composition of instructional material and illustrations, while making the font and wording more interactive and appropriate for junior high school students. The media expert considered the media highly feasible but suggested improving the placement of buttons, the audio in the initial phenomenon section, and the quality of the presentation video to increase its attractiveness to students.

Overall, the expert validation results indicate that the developed AR learning media is feasible to highly feasible for supporting learning activities on presenting explanatory texts. The recommendations from both experts were used as a basis for revising the prototype before its implementation with students.

3.2. Discussion

The needs analysis indicates that the main challenge in learning explanatory texts is not only students' understanding of the text, but also their ability to visualize, organize, and verbally explain phenomena. Although 87.9% of students agreed or strongly agreed that they could understand the processes described in explanatory texts, difficulties remained in visualizing phenomena and presenting them coherently. This finding reflects students' reported learning conditions and perceived needs rather than a direct measurement of their presentation performance. The finding supports the view that explanatory-text learning requires students to understand not only information but also the relationships among processes, causes, and effects. Teacher interviews similarly indicated perceived difficulties related to abstract concepts, scientific terminology, organizing stages of phenomena, and presentation activities (Yan et al., 2024).

These reported needs provide a basis for developing AR media. The rationale for developing the media therefore does not rest solely on the novelty of AR technology, but on the identified need for visual, realistic, three-dimensional, and sequential representations of phenomena that may be difficult to observe directly in classroom settings (Alkhabra et al., 2023). Based on these needs, the AR media were designed to connect observation with language production. Students are first provided with opportunities to observe the

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ISSN: 2797-3174

phenomenon, identify relevant information and its sequence, and subsequently use the observed information as a basis for presenting the explanatory text orally. At this stage, this sequence represents a design response to the identified needs rather than evidence that AR improves students' presentation performance.

The prototype also positions AR as a medium intended to support presentation activities rather than merely as a visualization tool. This orientation is consistent with previous studies highlighting the use of AR and interactive digital media to support learning through visualization and interaction (Prasandha et al., 2023). The presentation activity is placed after the exploration and explanation stages so that students have visual and sequential information available before communicating the phenomenon orally. This design corresponds to the characteristics of explanatory texts, which require students to explain how and why a phenomenon occurs in a logical sequence.

The feasibility of the developed prototype was subsequently examined through expert validation. The material expert assessed the substance, language, and material feasibility, resulting in an overall feasibility score of 76%, categorized as feasible. The media expert assessed design and layout, technical quality and ease of use, interactivity and learning experience, and support for presentation skills, resulting in an overall score of 94.6%, categorized as highly feasible. These results indicate that the prototype was considered feasible for its intended instructional purpose by the two experts involved in the development stage. The validation findings therefore provide evidence of perceived feasibility of the prototype, not evidence of its effectiveness in improving students' understanding, confidence, or presentation performance.

Accordingly, the findings of this study should be interpreted according to the type of evidence collected. The needs analysis provides evidence of students' and teachers' reported needs and perceptions, while expert validation provides evidence regarding the assessed feasibility of the developed prototype. Neither dataset establishes the actual effectiveness of AR in improving students' ability to present explanatory texts. Therefore, the contribution of this study at the current development stage lies in translating identified learning needs into a feasible AR media prototype that has received expert assessment. Further research involving practicality testing, classroom implementation, and effectiveness testing, such as pretest-posttest comparisons, is needed to determine whether the media can produce measurable improvements in students' explanatory-text presentation skills.

3.3. Implications

The research results have implications for the teaching of explanatory texts and the development of digital learning media. In practical terms, AR media can be positioned as a supportive tool in learning activities that require students to understand and explain natural phenomena orally. The media provide three-dimensional visualizations, sequential depictions of phenomena, interactive exploration, and presentation-oriented activities. These characteristics align with the needs identified among students and teachers.

For teachers, the prototype offers an alternative to traditional teaching methods that have largely relied on textbooks, transparencies, images, or videos. The media can be used before presentation activities to provide concrete references regarding the phenomena that students will explain. In this context, AR is designed to function as scaffolding that may support students in organizing information before producing oral explanations.

Theoretically, the research findings indicate that AR learning media can be designed not only to meet the need for material visualization but also to reflect the relationship between visual experience and language production. The integration of the principles of interactivity and constructivism, signaling, spatial and temporal contiguity, segmentation, and personalization provides a framework for linking the observation of phenomena to the presentation of explanatory texts.

In a broader educational context, the prototype can be adapted for natural phenomena and other explanatory text topics. However, such adaptations must maintain the relationship between visualization, sequential processes, information organization, and presentation activities so that AR does not merely become an additional visual feature in learning.

3.4. Limitations

This study has several limitations that must be considered when interpreting the results. First, the needs analysis involved 58 students from two junior high schools and two Indonesian language teachers. Therefore, the study's findings represent the characteristics and needs of students within the research context and cannot yet be directly generalized to all eighth-grade students or all junior high schools.

Second, a limitation of the validation procedure is that each validation domain was assessed by only one expert. Consequently, the study could not assess inter-rater agreement within the same validation domain. The validation findings therefore represent individual expert judgments of the prototype rather than agreement

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across multiple raters. Future development studies may involve multiple experts within each validation domain to enable comparison among raters and provide stronger evidence of validation.

Third, student data were collected via self-report questionnaires, while teacher data were obtained through interviews. Both methods provide information on respondents' perceptions and experiences, but do not directly measure students' actual ability to present explanatory texts.

Fourth, the development reported in this study focuses on needs analysis, the formulation of development principles, and the creation of a prototype. Research at this stage has not yet provided empirical evidence on the effectiveness of AR media by comparing students' abilities before and after its use. Therefore, the research results cannot yet be used to conclude that the AR media has significantly improved students' skills in presenting explanatory texts.

Finally, the prototype was developed with a focus on natural phenomena and based on the conditions and needs identified at the two study schools. Further research is needed with a larger sample size, multiple experts within each validation domain, practicality testing, usability testing, and effectiveness testing to determine the media's validity, practicality, and effectiveness across different educational contexts.

4. Conclusion

This study developed a prototype of an augmented reality (AR) learning medium featuring natural This study developed a prototype of an augmented reality (AR) learning medium featuring natural phenomena for learning activities related to presenting explanatory texts. The needs analysis indicated that students and teachers required learning media that could present phenomena concretely, three-dimensionally, and sequentially, while providing opportunities for students to observe relevant information and use it as a basis for oral presentation activities. Based on these identified needs, the prototype was developed by integrating the principles of interactivity and constructivism, signaling, spatial and temporal contiguity, segmentation, and personalization. The prototype was subsequently assessed by one subject-matter expert and one media expert. The subject-matter expert assessment resulted in a feasibility percentage of 76%, categorized as feasible, while the media expert assessment resulted in 94.6%, categorized as highly feasible. These findings indicate that the developed prototype received positive expert assessments regarding its content and media characteristics. However, these results represent evidence of students' and teachers' reported needs and expert-assessed feasibility and do not establish that the AR medium improves students' understanding, confidence, or skills in presenting explanatory texts. Further research is therefore needed to examine the practicality and effectiveness of the developed media through classroom implementation and direct measures of students' presentation performance. Such testing is necessary to determine whether the use of the AR medium results in measurable improvements in students' ability to present explanatory texts.

Author Contributions

All authors contributed equally to this paper. All authors have read and approved the final manuscript.

Funding

No funding support was received.

Declaration of Conflicting Interests

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Data Availability

The datasets generated during and/or analyzed during the current study are available from the corresponding author on reasonable request.

Declaration on AI Use

AI were used only to improve readability and language under strict human oversight; no content, ideas, analyses, or conclusions were generated by AI.

References

Alkhabra, Y. A., Ibrahem, U. M., & Alkhabra, S. A. (2023). Augmented reality technology in enhancing learning retention and critical thinking according to STEAM program. *Humanities and Social Sciences Communications, 10*, Article 174. https://doi.org/10.1057/s41599-023-01650-w

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ISSN: 2797-3174

Cabello, V., Albarrán, M. J., & Çetin Dindar, A. (2026). Augmented reality simulations in science education for questioning and explaining geoscience phenomena. *LUMAT: International Journal on Math, Science and Technology Education, 13*(3), Article 2. https://doi.org/10.31129/LUMAT.13.3.3009

Chan, V. (2026). Virtual reality for presentation skill mastery: Measuring knowledge, performance and confidence with Chill Talk. *Interactive Technology and Smart Education, 23*(3), 471–496. https://doi.org/10.1108/ITSE-12-2025-0394

Faria, A. (2024). Augmented reality and teaching strategies in the study of volcanism in elementary and secondary schools. *Journal of New Approaches in Educational Research, 13*, Article 18. https://doi.org/10.1007/s44322-024-00018-5

Homme, J. L., Hall, D. J., & Homme, J. H. (2025). Longitudinal improvement in public speaking skills through participation in a resident public speaking curriculum. *Academic Pediatrics, 25*(1), Article 102559. https://doi.org/10.1016/j.acap.2024.08.004

Hsu, K.-C., & Liu, G.-Z. (2025). Towards a design of the best practices for AR-guided oral communication development: A systematic review of selected research published from 2000 to 2023. *Journal of Computer Assisted Learning, 41*(1), Article e13103. https://doi.org/10.1111/jcal.13103

Karagöl, E., Bilgen, D. Y., & Korkmaz, C. B. (2025). The impact of AI applications on pre-service teachers' public speaking anxiety and academic speaking skill in the context of oral presentations: A mixed-methods study. *Teaching and Teacher Education, 166*, Article 105180. https://doi.org/10.1016/j.tate.2025.105180

Kasiyun, S., Mariati, P., Alistiana, L., & Widyawati, I. W. (2026). Integration of augmented reality in reading literacy to improve conceptual understanding and communication skills of primary education students. *Multidisciplinary Science Journal, 8*, Article 2026503. https://doi.org/10.31893/multiscience.2026503

Kazanskaia, A. N. (2025). Practical strategies for effective public speaking: Preparation, engagement, and delivery. *NEYA Global Journal, 10*, 1–5. https://doi.org/10.64357/neya-gjnps-pb-sp-cn-tch-08

Manlapig, E. F., & Lawsin, N. L. P. (2026). Augmented reality-assisted worksheets in promoting conceptual mastery and attitude in thermodynamics through battery sessions. *Discover Education, 5*, Article 79. https://doi.org/10.1007/s44217-025-01046-9

Mohd Nabil, N. S., Nordin, H., & Ab Rahman, F. (2024). Immersive language learning: Evaluating augmented reality filter for ESL speaking fluency teaching. *Journal of Research in Innovative Teaching & Learning, 17*(2), 182–195. https://doi.org/10.1108/JRIT-04-2024-0111

Ningsih, R. Y., & Permatasari, S. (2024). Validitas pengembangan media pembelajaran interaktif berbasis trigger PowerPoint untuk pemahaman materi teks cerpen di SMA. *JIIP: Jurnal Ilmiah Ilmu Pendidikan, 7*(5), 4981–4988. https://doi.org/10.54371/jiip.v7i5.4470

Prasandha, D., Hidayah, I. R., Maharani, A. T., & Saputri, A. A. (2023). Pengembangan media pembelajaran teks eksplanasi berbasis Android bermuatan kesiapsiagaan bencana. *Prosiding Seminar Nasional PIBSI Ke-44 Yogyakarta, 1*(1), 319–329. https://prosiding.pbsi.upy.ac.id/index.php/2023/article/view/61

Prasandha, D., Pristiwati, R., Yuniawan, T., Hartono, B., Sulistyaningrum, S., & Febriani, M. (2021). Android based media for public speaking learning of Z generation containing humanistic value. *IOP Conference Series: Materials Science and Engineering, 1098*(3), Article 032078. https://doi.org/10.1088/1757-899X/1098/3/032078

Putri, S. A., Salim, V. P., & Jeremy, J. (2026). Augmented reality card game as a learning medium for Acehnese cultural. *Procedia Computer Science, 289*, 175–183. https://doi.org/10.1016/j.procs.2026.08.234

Rahimi, Sutikno, Syuhada, I. Z., Wilantara, P., & Febrina, N. (2021). The effect of multimedia presentation on the explanation text writing skills of eighth grade at Al-Bukhary Rantauprapat Islamic Junior High School 2020–2021 academic year. *Advances in Social Science, Education and Humanities Research, 536*, 313–317. https://doi.org/10.2991/assehr.k.210312.051

Saidin, N. F., Halim, N. D. A., Yahaya, N., & Zulkifli, N. N. (2024). Enhancing students' critical thinking and visualisation skills through mobile augmented reality. *Knowledge Management & E-Learning, 16*(1), 1–41. https://doi.org/10.34105/j.kmel.2024.16.001

Sugiyono. (2022). *Metode penelitian kuantitatif, kualitatif, dan R&D*. Alfabeta.

Sukatiman, Saputro, I. N., & Budiarto, M. K. (2026). Improving critical thinking skills through a flipped project-based learning model integrated with mockup media and augmented reality. *The Electronic Journal of e-Learning, 24*(1), 61–74. https://doi.org/10.34190/ejel.24.1.4176

Wang, Y. (2025). The impact of an augmented reality application on EFL learners' oral proficiency. *Innovation in Language Learning and Teaching, 19*(1), 83–98. https://doi.org/10.1080/17501229.2024.2333539

Yan, W., Lowell, V. L., & Yang, L. (2024). Developing English language learners' speaking skills through applying a situated learning approach in VR-enhanced learning experiences. *Virtual Reality, 28*, Article 167. https://doi.org/10.1007/s10055-024-01061-5

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ISSN: 2797-3174