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Needs Analysis for Developing an Augmented Reality-Based Picture Storybook Integrating Majalengka's Local Wisdom to Support Elementary Students' Creative Thinking Skills

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ABSTRACT

The integration of local wisdom and digital technology in learning is increasingly important to support meaningful and creativity-oriented education. This study examined the need to develop an Augmented Reality (AR)-based picture storybook integrating Majalengka local wisdom for elementary school students. A qualitative descriptive approach was employed involving five teachers and ten fifth-grade students at SDN Cieurih, Majalengka. Data were collected through interviews and classroom observations and analyzed using data reduction, data presentation, and conclusion drawing techniques. The findings revealed that teachers and students expressed the need for interactive learning materials that integrate Majalengka local wisdom, including local folktales, traditions, arts, traditional games, and environmental values. Participants perceived that AR technology could provide engaging visualizations, increase learning interest, and support activities related to idea generation, exploration, storytelling, and problem-solving. The findings also identified several implementation challenges, including limited devices, unstable internet connectivity, and teacher readiness. Overall, the findings suggest that an AR-based picture storybook may be a relevant learning medium to support students' creative thinking and culturally contextualized learning experiences. As a preliminary needs analysis, this study did not develop or test the proposed AR-based storybook and did not measure its effectiveness in improving students' creative thinking skills.

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1. INTRODUCTION

The 21st-century skill, along with the Industrial Revolution 4.0, refers to an era of openness and globalization. This revolution encourages every country, including Indonesia, to expand and diversify employment opportunities while increasing the efficiency and effectiveness of related task completion. The education sector also experiences the same

matter, such as the demand for critical thinking, creativity, collaboration, problem-solving, communication, social awareness, and character development. Among these competencies, creative thinking has become one of the most essential skills because it enables students to generate innovative ideas, adapt to changing situations, and solve problems from multiple perspectives. This skill functions as a core competency for students to survive in rapid global change [1].

Therefore, students must develop the relevant skills, particularly creative thinking, for the Industrial Revolution 4.0. This skill refers to the ability to combine existing ideas and solve problems using unique, unconventional approaches [2], [3]. Other scholars define the skill as the process of generating new ideas, integrating diverse concepts, and discovering innovative solutions, and formulating original problem-solving strategies [4], [5]. Creative thinking is commonly characterized by four indicators, namely fluency, flexibility, originality, and elaboration. Fluency refers to the ability to generate numerous ideas; flexibility reflects the ability to produce ideas from different perspectives; originality emphasizes the uniqueness and novelty of ideas; while elaboration refers to the ability to develop and refine ideas in detail.

Creative thinking skills are important for facilitating students' effective problem-solving. Creative students also demonstrate high curiosity, openness to new experiences, and the ability to generate original ideas or concepts [6]. The skill helps students process diverse perspectives and solutions. Teachers could cultivate creative thinking skills by designing encouraging learning activities to generate ideas, solve problems, and realize innovative projects [7], [8], [9].

Current research's preliminary observation found that many students are struggling to think creatively. During classroom activities, students were assigned to propose alternative solutions and generate ideas related to the learning topics. Most students produced similar responses, repeated examples previously provided by the teacher, and showed limited variation in their answers. Only a few students attempted to propose different ideas or develop their responses in greater detail. Students also highly relied on teachers' examples and rarely explored alternative possibilities or generated ideas independently. These situations indicated low levels of originality, flexibility, and elaboration in students' thinking.

On the other hand, teachers also tended to apply teacher-centered instruction without strategies to stimulate divergent thinking. Thus, the learning tended to focus on a single correct answer rather than exploring multiple possibilities. This situation aligns with previous studies indicating low creative thinking skills due to a passive learning environment. This environment refers to teacher domination and unengaging learning materials [10].

Teachers could have fostered creative thinking skills by applying a picture storybook. This book is useful as instructional material and functions as supplementary media. Thus, the students found the materials rich and well-expanded in terms of learning content. With this effort, students could achieve a more comprehensive understanding [11]. Aligning learning materials with students' local context and characteristics could motivate and

improve learning outcomes [12]. Therefore, teachers should develop instructional materials based on students' needs, for example, local wisdom.

Teachers could integrate local wisdom elements into teaching materials so their students could internalize the values. In this case, the integration could also help mitigate the negative impacts of technological and scientific development [13]. The mechanism of this prevention is realized through a region's distinctive cultural potentials, which embody prudence and moral values. These values serve as an identity marker for the community [14], [15]. Perseverance in local wisdom is important for maintaining cultural and moral values. However, this action requires education that plays as an effective means to instill them [16], [17].

Teachers can improve picture storybooks by incorporating Majalengka's local wisdom and integrating Augmented Reality technology. This technology merges real and virtual two- or three-dimensional environments into real-world settings simultaneously [18], [19]. AR technology could turn teaching materials into 3D visuals on smartphone screens. Interactive AR-based storybooks with Majalengka's local culture could create an immersive learning experience. This approach could improve students' comprehension and motivation to learn [20].

Previous studies on creative thinking, instructional materials, and local wisdom reveal similar benefits. Local wisdom-based picture storybooks from Indramayu improved students' ecoliteracy [21]. Other studies found that local wisdom-based teaching materials, incorporating familiar objects, events, and issues, made learning more meaningful and richer in values. Picture storybooks with Majalengka's local wisdom demonstrated potential for developing students' critical thinking skills [22]. In addition, AR-based interactive media also improved students' understanding and attention during learning [20], and so did AR-integrated art history textbooks [23].

Although previous studies have examined local wisdom-based picture storybooks and AR-based learning media, these studies have generally investigated the two approaches separately. Limited research has explored the need for AR-based picture storybooks that integrate Majalengka local wisdom to support elementary school students' creative thinking skills. This gap highlights the importance of developing innovative learning materials that simultaneously promote cultural preservation, technology integration, and the development of creative thinking.

Based on this gap, the present study aims to analyze the need to develop an Augmented Reality-based picture storybook integrated with Majalengka local wisdom to improve elementary school students' creative thinking skills. Specifically, this study seeks to identify students' and teachers' needs for developing such learning materials and to examine their potential to foster creative thinking.

2. METHOD

This qualitative descriptive study examined the need for AR-based picture storybooks grounded in Majalengka's local wisdom to improve elementary schoolers' creative thinking skills. The research involved five elementary school teachers and ten students from classes VA and VB at SDN Cieurih, Majalengka. They had received a topic

of "Daerah Kebanggaanku." The researchers purposively selected participants from schools that implemented the Merdeka Curriculum and had taught the specified material. The teacher participants had experience teaching at the elementary school level and were actively involved in implementing the curriculum. The student participants were fifth-grade students aged approximately 10–11 years and represented both male and female students from classes VA and VB.

The researcher collected data through interviews and observations. The in-depth interviews aimed to obtain detailed information [24]. The researchers asked ten main questions, along with follow-up questions to clarify the necessity of developing the learning media. The interviews were conducted individually with teachers and students, lasted approximately 20–30 minutes for each participant, and were conducted in Bahasa Indonesia. All interviews were audio-recorded with participants' permission and transcribed verbatim to facilitate data analysis.

The researchers also observed the teaching and learning process to examine classroom practices and identify the conditions that foster students' creative thinking during learning activities. The observations focused on teacher instructional strategies, student participation, use of learning media, opportunities for idea generation, and indicators of students' creative thinking. An observation sheet was used to ensure systematic data collection. The researchers conducted the observations during four classroom sessions over two weeks.

To ensure data validity, the researchers applied source triangulation by comparing information from teachers and students, and methodological triangulation by comparing findings from interviews and observations. The researchers then analyzed the data using qualitative data analysis procedures, including data collection, data reduction, data presentation, and conclusion drawing [24]. Data collection involved gathering information from interviews and classroom observations. Data reduction involved filtering, selecting, and simplifying information relevant to the research focus. The researchers transcribed the interview recordings and reviewed the observation notes to identify meaningful statements on the necessity of AR-based picture storybooks grounded in Majalengka's local wisdom. Data presentation was carried out by organizing the findings into categories and themes to facilitate interpretation. Finally, a conclusion was drawn by identifying patterns, relationships, and key findings across the data sources.

The researchers analyzed the data through a coding and theme development process. First, significant statements from interview transcripts and observation records were assigned initial codes. Similar codes were then grouped into broader categories representing participants' perceptions, learning needs, existing learning conditions, and expectations regarding AR-based picture storybooks. These categories were further developed into themes that reflected the necessity and potential contribution of the proposed learning media for improving students' creative thinking skills. The identified themes were continuously compared across data sources to ensure consistency and credibility of the findings.

Ethical considerations were applied throughout the study. The researchers obtained permission from the school before conducting the research activities. All participants were informed of the study's purpose and voluntarily agreed to participate. Informed consent was

obtained from teachers and from students through school and parental approval procedures. Participant anonymity and confidentiality were maintained by using codes instead of participants' real names in all records and reports.

3. RESULTS AND DISCUSSION

3.1. Results

The data obtained in this research were from observations and interviews. The researchers observed the VA and VB classes of SDN Cieurih, Majalengka. Those students had learned the topic of "Daerahku Kebanggaanku." Table 1 shows the interview results.

Table 1. Teacher interview guideline

No	Indicators	Interview Guideline
1	Teachers' Understanding of Majalengka's Local Wisdom	How do you understand Majalengka's local wisdom that can serve as instructional material in schools?
2	Teachers' Experience Using Picture Storybooks in Learning	Have you ever used picture storybooks in your teaching? How did the students respond?
3	Teachers' Attitude Toward Augmented Reality (AR) Technology	What is your opinion on using augmented reality technology in the learning process?
4	Teachers' Perception of AR's Role in Enhancing Student Creativity	Do you think AR technology can help improve students' creativity?
5	Types of Local Wisdom Content Important to Include in Teaching Materials	Which aspects of Majalengka's local wisdom should be included in the picture storybook?
6	Effective and Engaging Presentation of AR-Based Picture Storybooks	How can AR-based picture storybooks be presented effectively and engagingly for elementary school students?
7	Challenges in Using AR-Based Teaching Materials	What challenges might you face when using AR-based teaching materials in the classroom?
8	Need for Developing Teaching Materials that Promote Creative Thinking	What needs do you identify for developing teaching materials that can foster students' creativity?
9	Appropriate Teaching Methods for Using AR-Based Picture Storybooks	Which teaching methods are most suitable for integrating AR-based picture storybooks into learning?
10	Teachers' Expectations Regarding the Use of AR-Based Teaching Materials	What are your expectations for the implementation of AR-based picture storybooks in elementary school learning?

Tables 1 and 2 present the open-ended interview questions used for teachers and students. These questions were designed to obtain comprehensive information on the need to develop an AR-based picture storybook integrated with Majalengka local wisdom. The interviews enabled participants to provide detailed responses and rich perspectives on learning materials, local wisdom, technology integration, and the development of creative thinking.

Table 2. Student interview guideline

No	Indicators	Interview Guideline
1	Students' Understanding of Majalengka's Local Wisdom	What do you know about stories or traditions in Majalengka?
2	Students' Experience Using Picture Storybooks in Learning	Have you ever read a picture storybook at school? How did you feel while reading it?
3	Students' Attitude Toward Augmented Reality (AR) Technology	Have you ever seen or used technology like AR (animated or "living" images) during learning?
4	Students' Perception of AR's Role in Enhancing Creativity	Do you feel more excited when learning with moving or interactive images like AR?
5	Types of Local Wisdom Content Important to Include in Learning Materials	What things do you like most about Majalengka?
6	Effective and Engaging Presentation of AR-Based Picture Storybooks	In your opinion, what is the most fun and easy way to learn? For example, through stories, pictures, or games?
7	Challenges in Using AR-Based Learning Materials	Have you ever had difficulties when learning with new tools or technologies like AR?
8	Need for Developing Learning Materials that Support Creative Thinking	What do you want in a storybook that can help you think creatively and learn better?
9	Suitable Learning Methods for Using AR-Based Picture Storybooks	What learning activities do you enjoy most when using storybooks with moving or interactive pictures?
10	Students' Expectations Regarding the Use of AR-Based Picture Storybooks	What do you want to learn through picture storybooks that use AR technology?

Indicator 1: Understanding of Majalengka Local Wisdom

The interview findings showed that both teachers and students possessed a good understanding of Majalengka local wisdom. Teachers perceived local wisdom as cultural heritage containing noble values such as cooperation, politeness, respect for others, and environmental awareness. The findings also indicated that teachers had attempted to integrate these values into classroom learning activities.

Teacher A stated, "Majalengka local wisdom is not only about traditions but also about values that students can apply in their daily lives, such as cooperation and respect for others."

Teacher B explained, "Every region has unique characteristics. Majalengka local wisdom can help students understand their identity while learning important moral values."

Students generally associated local wisdom with regional traditions, language, culinary products, traditional games, and social practices. Student A stated, "I know some stories and traditions from Majalengka because they are part of our culture." These findings indicate that students recognized the cultural and moral significance of local wisdom.

Indicator 2: Experience in Using Picture Storybooks in Learning

Both teachers and students reported positive experiences when using picture storybooks. Teachers explained that picture storybooks increased students' interest in

reading, comprehension, and language development. Attractive illustrations helped students understand storylines more easily and maintained their learning motivation.

Teacher A stated, "Picture storybooks help students understand stories more quickly because the illustrations attract their attention."

Teacher B added, "Students are more enthusiastic when learning through storybooks because they do not feel bored by long texts."

Students also responded positively. Student A explained, "I like picture storybooks because the colorful pictures help me understand the story better."

Indicator 3: Students' Attitudes Toward Augmented Reality (AR) Technology

Teachers and students expressed positive attitudes toward AR technology. Teachers perceived AR as a technology that could improve visualization, interactivity, and contextual understanding of learning materials. However, they also identified several challenges, including limited facilities and insufficient teacher training.

Teacher B stated, "AR is an interesting innovation because students can observe three-dimensional objects directly."

Teacher C explained, "AR has great potential, but schools need adequate facilities and teacher preparation."

Students described AR as an engaging technology that could make learning more enjoyable. Student B stated, "Learning with moving and interactive images is more exciting than using ordinary pictures."

Indicator 4: Teachers' and Students' Perceptions of AR and Creativity

Participants generally believed that AR has the potential to support students' creative thinking. Teachers perceived that AR-based visualization could stimulate imagination, encourage idea exploration, and increase curiosity.

Teacher A stated, "Three-dimensional objects can encourage students to create stories or projects based on what they observe."

Teacher B added, "AR can stimulate curiosity because students become interested in asking questions and exploring new ideas."

Students also perceived that interactive visualizations could inspire them to generate ideas and interpret information in different ways. However, these findings represent participants' perceptions and expectations regarding AR rather than evidence of actual improvement in creative thinking.

Indicator 5: Types of Local Wisdom Materials Considered Important for Integration into Learning

Teachers emphasized the importance of integrating cultural traditions, ethical values, local arts, traditional games, and environmental awareness into learning materials. Students preferred familiar topics such as folktales, traditional foods, clothing, and local games.

Teacher A stated, "Students should learn about regional culture so they can develop cultural identity and pride."

Teacher B emphasized, “Values such as cooperation and environmental care should be included because they are relevant to students’ daily lives.”

Indicator 6: Effective and Engaging Presentation of AR-Based Picture Storybooks

Participants highlighted the importance of interactive and structured learning experiences. Teachers suggested that AR-based picture storybooks should include story introduction, AR exploration, discussion, and reflection activities.

Teacher C stated, “Combining reading, AR exploration, and discussion can make learning more active and less monotonous.”

Students preferred learning activities involving interactive images, exploration, and storytelling.

Indicator 7: Barriers and Difficulties in Using AR Technology in Learning

Teachers identified several barriers to implementing AR-based learning materials, including limited digital devices, unstable internet connectivity, and insufficient teacher readiness. Students reported difficulties when technical problems occurred during technology-based learning.

Teacher C stated, “Technical limitations can disrupt the learning process, especially when devices or internet access are unavailable.”

Teacher B emphasized, “Teachers need training to use AR effectively in classroom learning.”

These findings indicate that infrastructure and teacher competence remain important considerations for implementation.

Indicator 8: The Need to Develop Learning Materials that Foster Creative Thinking

Teachers and students expressed the need for learning materials that encourage independent thinking, problem-solving, and idea generation. Participants preferred materials that combine visuals, stories, real-life examples, interactive activities, and games.

Teacher A explained, “Learning materials should contain activities that encourage students to solve problems independently.”

Teacher C added, “Visualization and real-life examples help students understand concepts and develop ideas.”

Student C stated, “I like learning materials that contain pictures, stories, and games because they are easier to understand.”

Indicator 9: Appropriate Learning Methods for AR-Based Picture Storybooks

Teachers identified project-based learning, problem-based learning, demonstrations, and simulations as suitable approaches for integrating AR-based picture storybooks. Students preferred collaborative, exploratory activities that involved direct interaction with learning materials.

Teacher A stated, “Project-based learning is suitable because students can create products based on their ideas.”

Teacher C emphasized, "Problem-based learning encourages students to think critically and explore solutions."

Indicator 10: Expectations for AR-Based Learning Materials

Teachers expected that AR-based picture storybooks would make learning more engaging and support students' understanding and development of creative thinking. Students expected learning activities to become more enjoyable, interactive, and exploratory.

Student D stated, "I want learning to be more interesting and allow us to explore things by ourselves."

Classroom observations supported these findings. Students showed strong interest in lessons involving stories and pictures related to local culture. However, most existing learning materials remained conventional and provided limited opportunities for interactive exploration. During observations, students initially showed enthusiasm when teachers introduced Majalengka folktales using printed texts and images, but their attention gradually decreased as learning progressed. These findings indicate the need for more interactive, contextually relevant learning materials, such as AR-based picture storybooks that integrate local wisdom and offer opportunities for active exploration.

Table 3. Summary of Key Needs Identified from Teachers and Students

No	Aspect	Identified Needs
1	Learning Content	Majalengka folktales, traditions, arts, local values, and environmental awareness
2	Learning Media	Interactive picture storybooks integrated with Augmented Reality (AR) technology
3	Creative Thinking Support	Activities promoting idea generation, problem-solving, imagination, and exploration
4	Learning Activities	Storytelling, discussion, projects, simulations, and AR exploration activities
5	Teacher Support	Training on AR implementation
6	Infrastructure	Adequate devices and internet access
7	Student Expectations	Interactive, enjoyable, and technology-supported learning experiences

3.2. Discussion

Based on the findings, the study indicates a strong need to develop an AR-based picture storybook integrated with Majalengka local wisdom to support elementary school students' creative thinking skills. Both teachers and students demonstrated a good understanding of local wisdom and perceived it as an important part of cultural heritage. The participants associated local wisdom with values such as mutual cooperation, politeness, environmental awareness, and respect for others. Teachers also reported integrating these values into classroom learning activities, while students recognized local wisdom as part of their regional identity. These findings support previous studies highlighting the importance of local wisdom in strengthening cultural identity and preserving cultural diversity among younger generations [25], [26].

The identified need for integrating local wisdom into learning materials is important because culturally relevant content can provide meaningful learning experiences and

encourage students to connect academic knowledge with their daily lives. In the context of Majalengka, local wisdom content may include local folktales, traditional foods, arts, traditional games, cultural ceremonies, local language expressions, and environmental values. The integration of these elements into picture storybooks can help students understand their cultural heritage while creating opportunities for deeper engagement with learning materials. Familiar cultural contexts also provide rich sources of ideas that can stimulate students' imagination and creative expression.

The findings revealed that teachers and students expected learning materials to be interactive, enjoyable, and meaningful. These expectations suggest the potential value of AR-based picture storybooks, which combine visual narratives, local cultural content, and interactive technology. Previous studies have reported that AR-based learning materials provide strong visualization and interactivity that support conceptual understanding [27]. AR-based learning resources have also been associated with higher-order thinking skills, learning outcomes, and character development when implemented appropriately in educational settings [28]. However, the present study did not evaluate the effectiveness of an AR-based picture storybook. Instead, the findings indicate participants' perceptions and needs regarding the potential use of such learning materials.

The identified needs are closely related to the development of creative thinking skills. Through storytelling activities and AR exploration, students may be encouraged to generate multiple ideas, which reflects the indicator of fluency. Interactive visualization and exposure to diverse cultural perspectives may foster flexibility by encouraging students to view local culture from different perspectives. Opportunities to create stories, projects, or alternative interpretations of cultural content may foster originality. Detailed observation of AR visualizations and subsequent learning activities may support elaboration by encouraging students to expand and refine their ideas. Consequently, the proposed learning material has the potential to support all four dimensions of creative thinking, namely fluency, flexibility, originality, and elaboration.

The participants also expressed enthusiasm toward the integration of AR technology in learning. Teachers perceived that AR could provide richer visualization and increase student engagement, while students expected learning activities to become more interactive and enjoyable. Previous studies suggest that AR can connect interactive and creative learning experiences while supporting the development of 21st-century skills. Immersive visualization may help learners explore learning content more actively rather than passively receive information [29]. In addition, AR enables students to observe objects and situations in more realistic and attractive forms, creating opportunities for deeper exploration and idea development [30]. The integration of AR with creative learning activities may also facilitate connections between creativity and real-world applications [31].

Despite these potential benefits, the findings also identified several challenges that should be considered in the development and implementation of AR-based picture storybooks. Teachers reported concerns regarding limited device availability, unstable internet connections, insufficient technological infrastructure, and limited readiness to implement AR-supported learning. Students also experienced difficulties when encountering technical problems during technology-based learning activities. Beyond these challenges,

classroom implementation may face additional issues, including classroom management, technical failures, and potential digital distractions. These findings indicate that successful implementation requires not only innovative learning materials but also adequate technological and pedagogical support.

The identified challenges provide important implications for the design of AR-based picture storybooks. The learning materials should include simple, user-friendly AR instructions so that both teachers and students can use the application easily. Offline access should be considered to minimize dependence on internet connectivity. A teacher guidebook containing implementation procedures, troubleshooting guidance, and suggested learning activities may help improve teacher readiness. Cultural content should be presented accurately and authentically to preserve local wisdom values appropriately. In addition, the storybook should include creative follow-up activities such as storytelling tasks, project-based assignments, reflection questions, drawing activities, and group projects. These activities may provide opportunities for students to generate ideas, explore alternative perspectives, develop original products, and elaborate their understanding of local cultural content.

The findings further suggest that the development of creative thinking should not rely solely on technological features. The educational value of AR-based picture storybooks depends on how technology, local wisdom content, and learning activities are integrated into a coherent learning experience. Creative learning environments encourage students to think innovatively, develop new solutions, and actively engage with learning challenges [32]. Students who are given meaningful opportunities to express ideas and explore learning content tend to demonstrate greater enthusiasm and motivation, which may positively affect their learning outcomes [33]. Therefore, the development of AR-based picture storybooks integrated with Majalengka local wisdom represents a promising approach that addresses the needs identified by teachers and students while supporting the broader goals of cultural preservation and the development of creative thinking.

4. CONCLUSION

The findings indicate that teachers and students need an AR-based picture storybook integrating Majalengka local wisdom to create more interactive, contextual, and creativity-supportive learning experiences in elementary schools. The identified needs include integrating local folktales, traditions, arts, traditional games, environmental values, and other cultural elements of Majalengka into learning materials that use visual storytelling, AR technology, and creative learning activities. Such learning materials are perceived as having the potential to support students' creative thinking through idea generation, exploration, problem-solving, storytelling, and project-based activities across the dimensions of fluency, flexibility, originality, and elaboration. The findings also revealed several implementation challenges, including limited device availability, unstable internet connectivity, teacher readiness, and technical difficulties, highlighting the importance of developing accessible, user-friendly, and culturally accurate learning materials accompanied by teacher guidance. This study was limited to one elementary school and involved a relatively small number of participants, consisting of five teachers and ten students; therefore, the findings cannot be

generalized to broader contexts. Future research is recommended to develop the proposed AR-based picture storybook, validate its content and design through expert review, examine its practicality with teachers and students, and evaluate its effectiveness in improving creative thinking skills using a pre-test and post-test experimental design.

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