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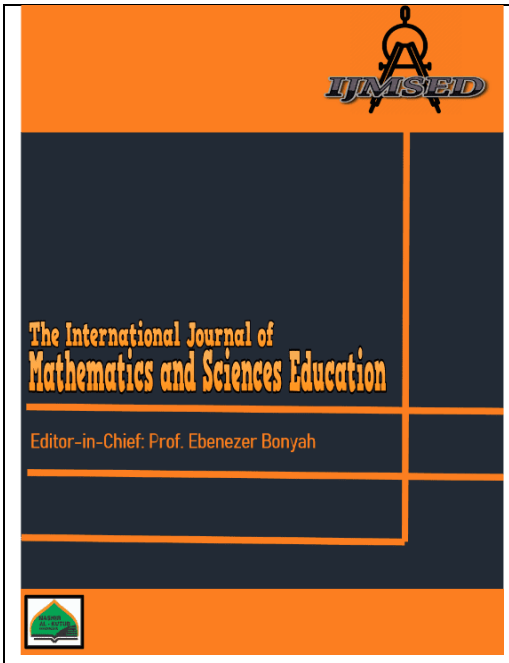

AR Snakes and ladders game innovation to romote learning to live together in elementary schools

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AR Snakes and ladders game innovation to romote learning to live together in elementary schools

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Abstract
The declining acceptance of diversity among elementary school students poses a significant challenge, particularly in the context of rapid technological advancement in education. This study aims to: (1) develop a multicultural snakes and ladders learning media to promote learning to live together in elementary schools, and (2) evaluate its feasibility based on expert validation, teacher feedback, and student responses. The study employed a Research and Development (R&D) approach adapted from the ADDIE model. Data were collected through questionnaires and interviews and analyzed using descriptive quantitative techniques. The validation results indicated high feasibility, with subject matter experts rating the media at 88%, media experts at 77.3%, learning experts at 92%, and language experts at 86.6%, all categorized as very feasible. Teacher evaluations yielded a score of 86%, highlighting the media's relevance, ease of use, and instructional clarity. Field testing involving 28 students at SD Negeri Giwangan demonstrated strong engagement and enthusiasm, achieving a score of 236 out of 270 (87.4%). These findings suggest that the multicultural snakes and ladders media is both technically and pedagogically feasible for fostering a harmonious learning environment and strengthening students' understanding of Pancasila values within a culturally diverse context. However, this study was limited to small-scale trials; therefore, further research is recommended to examine the effectiveness of the media on learning outcomes in broader educational settings.

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1. Introduction

Quality education is one of the primary targets of the Sustainable Development Goals (SDGs). However, the quality and standard of education in Indonesia remains relatively low (Saini et al., 2023). The misuse of technology also influences social interaction patterns and leads to moral degradation and character decline, which can erode mutual respect (Amalia et al., 2025; Toriyono et al., 2022). According to data from the Indonesian Child Protection Commission (KPAI) and the Indonesian Child Protection Association (FSGI), *bullying cases* in schools increased significantly from 2021 to 2023, from 53 to 1,478. This situation is exacerbated by Indonesia's diverse social reality, making it urgent to instill the value of respecting differences and learning to live together.

International Journal of Mathematics and Sciences Education
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Elementary schools play a crucial role as the primary foundation for character development (Dahliyana et al., 2024; Sa'ida & Dirgantoro, 2022). In this context, Civics Education is defined as a strategic tool that not only builds character but also internalizes multicultural values. (Yusuf et al., 2024). Multicultural education itself refers to efforts to ensure all students understand the importance of understanding differences and living together in diversity. The integration of these two concepts is fundamental, given that the values of acceptance and appreciation are among the pillars of character developed in Civics Education.

Field findings indicate that many Pancasila education learning practices in schools are still limited to cognitive objectives. This is supported by several studies (Rahmawati & Salsabila, 2024; Fihrisi et al., 2025; Firgiyana & Arief Cahyo Utomo, 2024; Vavrus, 2023) revealing a lack of variety in Civic Education learning practices, such as the use of monotonous methods, material explanations that tend to be abstract and only focus on memorization, and limited interesting learning resources and media . Therefore, innovation is needed to achieve learning success indicators that include innovations in influencing factors such as methods, approaches, environments, teachers, and learning media .

As an alternative solution, this research proposes the development of an Augmented Reality (AR)-based snakes and ladders learning medium. This research conceptually and empirically aims to enrich existing studies by presenting three key advances. First, within the realm of AR for education, this research implements AR not merely as a visual aid, but as the core mechanism of interactive game-based learning, thus filling the gap between immersive technology and meaningful pedagogical design (Sies et al., 2025; Sudirman et al., 2023). Second, within the context of game-based learning, this medium adapts the pedagogically proven format of the classic board game snakes and ladders and enriches it with an interactive digital layer through AR, creating a blended learning experience that has not been widely explored. Third, regarding multicultural education, this research not only validates the feasibility of the medium but also specifically designs and tests its content to contextualize Pancasila values and instill the UNESCO pillar of "learning to live together" in Indonesia's pluralistic society for elementary school students.

Based on this, the aim of this research is to create innovative media that meets these aspects. The media is specifically designed to create meaningful learning experiences to instill the UNESCO educational pillar of "learning to live together" and contextualize Pancasila values in a pluralistic society for elementary school students. Therefore, this research product is expected to contribute as a pedagogical tool for teachers in building students' multicultural awareness.

2. Methods

2.1 Research Design

This study used a research and development (R&D) method by adopting the ADDIE model (Safitri & Aziz, 2022; Weldami & Yogica, 2023) which consists of the stages of Analysis, Design, Development, Implementation, and Evaluation. The development process for the Augmented Reality (AR)-based snakes and ladders media follows these five stages, as explained in Table 1.

Table 1
Research Stages

No	Stage	Activity
1	*Analyze*	Analysis of curriculum, materials and field needs
2	*Design*	Creating a product framework and compiling research instruments
3	*Develop*	Preparation of multicultural snakes and ladders media and validation test by 4 experts
4	*Implement*	Small scale trials and analyzing product trial responses
5	*Evaluate*	Evaluate and revise product development stages

This research began with a comprehensive needs analysis through curriculum studies, teaching materials, and identification of student needs in real contexts. Based on this analysis, the researcher then developed a product framework that included the design process for the game board, activity cards, *augmented reality applications* , and research instruments. In the development phase, the AR-based

snakes and ladders product was designed using CorelDraw to create the visual elements *of the board game* and the user interface (*UI*), while Unity was used as *the engine* to develop the functionality and user experience (*UX*) of the application. To ensure the feasibility of the product, a validation test was conducted by four experts who have competencies and academic qualifications (Master's and Doctoral) in the fields of media, learning design, language, and teaching materials. The findings from the validation test became the main reference in determining the need for product revisions before the field trial was carried out.

2.2 Participants

The research was conducted at Giwangan State Elementary School. The research subjects were 28 fourth-grade students selected by purposive sampling with the following criteria: (1) currently studying multicultural culture material, (2) having basic digital literacy skills, and (3) willing to participate in the trial process with the consent of parents/guardians.

The use of the terms “subject” and “sample” is in accordance with the quantitative-descriptive approach in product evaluation. Ethical considerations have been applied through the following procedures: (1) providing written permission to the school, (2) providing informed consent forms to parents/guardians of students explaining the purpose, procedures, and data confidentiality, and (3) emphasizing the principle of voluntary and non-coercion throughout the research.

2.3 Data Collection

Data collection in this study was conducted using three types of instrument (1) Expert Judgement, assessed by four experts (media, materials, learning, and language) with a minimum Master's degree. The questionnaire used a 1–5 Likert scale that included specific indicators for each expert. The eligibility criteria were set with a minimum threshold of an average score of 3.5 (scale 1–5) or a percentage of ≥ 61%, which is categorized as “Good” in Table 2.

Table 2
Learning Media Quality Assessment Categories

No	Interval	Category	Description
1	81 – 100%	Very Good	Very High Quality
2	61 – 80%	Good	Good Quality
3	41 – 60%	Cukup Baik	Good Poor Quality
4	21 – 40%	Kurang Baik	Low Quality
5	1 -20%	Sangat Kurang Baik	Very Low Quality

Soure: (Kumalasari & Kiswardianta, 2023)

(2) User Response Questionnaire: Given to students and teachers after the pilot to assess practicality, attractiveness, and user perceptions, and (3) Semi-Structured Interview Guide: Used to elicit in-depth teacher perceptions regarding learning needs and challenges in the classroom.

2.4 Data Analysis

Quantitative data from expert validation questionnaires and user responses were analyzed using descriptive statistical techniques and supplemented with effectiveness measures to strengthen the empirical evidence for the product. The analysis began by calculating the average score for each assessment aspect, which was then converted into a percentage of suitability using the formula:

$$N = \frac{\sum x}{max} \; x \; 100$$

N : Value
$\sum x$: Total score obtained
$\sum max$: Total score max

Furthermore, to measure the impact and effectiveness of the media in the learning context, a pre-post comparison analysis was conducted. This technique was implemented by comparing student questionnaire response scores completed before (pre-test) and after (post-test) media use. The increase in average scores and percentage changes in perception, motivation, and conceptual understanding were then used as concrete indicators to assess the success and effectiveness of the developed media.

Meanwhile, qualitative data obtained from semi-structured interviews with teachers and suggestions and comments from experts were analyzed in depth using an interactive analysis model (Milles et al., 1994; Nyimbili & Nyimbili, 2024). This analysis process proceeded cyclically through three main stages: (1) Data Reduction, which involves selecting, focusing, and simplifying raw data to identify core themes and patterns; (2) Data Presentation, which involves organizing the reduced information into a systematic, descriptive matrix or narrative to facilitate interpretation; and (3) Drawing Conclusions/Verification, where initial findings are verified and interpreted comprehensively to answer the research problem formulation.

3. Results and Discussion

3.1 Results

3.1.1 Analyze Stage

The analysis stage served as the foundational phase of this research and development study, encompassing three critical dimensions: curriculum analysis, student needs assessment, and material content examination. This comprehensive analytical process was conducted at Giwangan Public Elementary School, specifically focusing on Grade IV students to ensure that the developed AR-based snakes and ladders medium would align seamlessly with current educational frameworks, address authentic learner requirements, and integrate effectively with existing instructional objectives. The systematic approach to this analysis involved multiple data collection methods including document review, teacher interviews, classroom observations, and student behavior assessments to establish a robust empirical foundation for subsequent design and development decisions.

The curriculum analysis revealed that Giwangan Public Elementary School implements the Independent Curriculum (Kurikulum Merdeka) for Grade IV instruction, following a phased rollout strategy that progressively introduces the curriculum across Grades I, II, IV, and V. This curricular framework represents a significant departure from previous educational models, emphasizing flexibility, contextualization, and student-centered pedagogical approaches. The Independent Curriculum fundamentally transforms the traditional teacher-oriented paradigm by granting educators substantial autonomy to design meaningful and enjoyable learning experiences tailored to their specific classroom contexts and student populations. The underlying pedagogical philosophy prioritizes active learning methodologies, innovative instructional strategies, comfortable learning environments, and responsive adaptation to contemporary educational demands and evolving societal needs. This curricular orientation creates particularly favorable conditions for integrating technology-enhanced learning media that can engage digital-native learners while maintaining pedagogical rigor and alignment with prescribed learning objectives.

Within the Independent Curriculum structure, the Learning to Live Together dimension emerges as one of the four foundational pillars of education, representing a critical developmental domain expected to be cultivated systematically throughout students' elementary school experience. This dimension aligns directly with the competency frameworks established within the Pancasila Education subject, which encompasses four essential elements: Pancasila as Indonesia's philosophical and ideological foundation, the State Constitution establishing legal and governance structures, Bhinneka Tunggal Ika (Unity in Diversity) embodying the nation's multicultural identity, and the Unitary State of the Republic of Indonesia representing territorial integrity and national sovereignty. The Learning to Live Together dimension specifically targets six interconnected values for integration into instructional activities: first, awareness of diversity and difference as fundamental social realities; second, concern and empathy toward others regardless of background or identity; third, a sense of ownership regarding collective life goals and community welfare; fourth, transformative changes in perspective enabling deeper intercultural understanding; fifth, commitment to real action translating values into concrete behaviors; and sixth, meaningful involvement in collaborative endeavors promoting social cohesion and mutual respect.

The student needs assessment, conducted through in-depth interviews with classroom teachers and systematic observation of instructional practices, revealed critical gaps between curricular ideals and pedagogical realities. Teachers consistently reported that current classroom implementation of Pancasila Education continues to rely heavily on conventional, teacher-centered methodologies dominated by lecturing, textbook reading, and passive information reception. The learning media

employed in these contexts remain predominantly static and two-dimensional, consisting primarily of printed images, charts, and diagrams that fail to stimulate authentic student engagement or facilitate meaningful interaction with abstract value concepts. This reliance on conventional media creates a monotonous learning atmosphere characterized by low student motivation, minimal active participation, and limited emotional connection to the material being studied. Teachers explicitly articulated concerns that such pedagogical approaches fundamentally undermine the essential objectives of Pancasila Education, which seeks not merely to transmit factual knowledge about Indonesian diversity but rather to cultivate deep-seated values, empathetic dispositions, and behavioral commitments to intercultural respect and harmonious coexistence. The disconnect between intended learning outcomes and actual student experiences indicates an urgent need for innovative instructional media capable of transforming abstract multicultural concepts into concrete, experiential learning opportunities.

Based on these analytical findings, the research team proposed developing AR-based snakes and ladders media specifically designed to address identified pedagogical challenges while capitalizing on curricular opportunities for technology integration. This proposed medium adapts the familiar snakes and ladders board game format—a culturally resonant game structure well-known to Indonesian children—by enriching it with two innovative technological components: interactive activity cards and an augmented reality application. The AR-based snakes and ladders game maintains the traditional gameplay mechanics of advancing through numbered squares, encountering snakes that cause setbacks and ladders that provide advancement, thereby preserving the familiar game structure that requires no extensive learning curve for student adoption. However, the crucial innovation lies in the integration of activity cards strategically positioned throughout the game board, which players must engage with when landing on designated squares. These activity cards prompt various learning activities including multicultural quizzes, ethical dilemmas requiring value-based decisions, collaborative discussion tasks, and reflection exercises designed to stimulate critical thinking about diversity issues. The augmented reality application serves as the technological bridge between physical game play and digital content, enabling players to use mobile devices to scan activity cards and access enriched multimedia content including explanatory videos depicting cultural practices, three-dimensional animations visualizing abstract concepts, interactive narratives presenting multicultural scenarios, and supplementary cultural information contextualizing Indonesia's diverse ethnic, religious, and social landscape. This hybrid physical-digital design creates an immersive learning environment where students actively construct multicultural understanding through playful exploration, peer interaction, multimedia engagement, and reflective processing—pedagogical mechanisms substantially more effective than passive reception of conventional instructional content for achieving the affective and behavioral objectives inherent in Learning to Live Together competencies.

3.1.2 Design Stage

The design stage constituted the critical planning and blueprint development phase where conceptual frameworks were transformed into concrete design specifications for the AR-based snakes and ladders learning medium. This stage involved systematic progression through four interconnected steps, each building upon previous foundations to ensure comprehensive, coherent, and pedagogically sound media design.

The first step focused on compiling the foundational framework and assembling essential materials for the learning medium's physical and digital components. This involved designing the snakes and ladders board game structure, determining optimal board dimensions, establishing game square layouts, and positioning snake and ladder elements to create appropriate challenge levels for Grade IV students. Simultaneously, the research team developed activity card prototypes aligned with multicultural education objectives, ensuring each card would prompt meaningful engagement with diversity concepts. The AR application framework was conceptualized during this phase, outlining technical requirements, user interface specifications, and interaction patterns that would enable seamless integration between physical game components and digital augmentation. Material collection proceeded concurrently, involving careful curation and preparation of multimedia assets including culturally authentic images representing Indonesia's ethnic diversity, explanatory videos demonstrating traditional practices and cultural celebrations, three-dimensional animations visualizing abstract multicultural concepts, and interactive content illustrating scenarios requiring empathetic perspective-taking and intercultural understanding.

International Journal of Mathematics and Sciences Education
Volume 3, Issue 2, pp. 57-70
https://nakiscience.com/index.php/IJMSEd

The second step involved creating detailed design specifications through storyboard development and flowchart construction for all media components. Storyboards were meticulously crafted for each activity card, delineating the sequential presentation of content, describing visual elements and multimedia integration points, specifying user interactions and decision pathways, and articulating intended learning outcomes for each activity. Application flowcharts mapped the complete user journey from initial launch through game progression, card scanning procedures, multimedia content access, and return to gameplay, ensuring intuitive navigation and seamless user experience. Media design specifications encompassed comprehensive visual identity guidelines including color schemes reflecting Indonesian cultural aesthetics, typography selections ensuring readability for elementary students, iconography systems facilitating intuitive interaction, and layout principles maintaining consistency across physical and digital components.

The third and fourth steps concentrated on preparing rigorous validation mechanisms to ensure media quality and effectiveness prior to field implementation. Comprehensive validation instruments were developed targeting four expert domains: media experts who would evaluate technical quality, visual design effectiveness, and user interface appropriateness; material experts who would assess content accuracy, cultural representation authenticity, and alignment with multicultural education principles; learning design experts who would examine pedagogical soundness, instructional strategy coherence, and developmental appropriateness for target learners; and language experts who would verify linguistic clarity, vocabulary accessibility, and communication effectiveness for Grade IV reading levels. Additionally, separate evaluation instruments were prepared for post-implementation assessment, including teacher questionnaires examining implementation feasibility, instructional utility, and integration challenges, as well as student response surveys measuring engagement levels, perceived enjoyment, learning gains, and attitudinal changes toward diversity. This systematic instrument preparation ensured that subsequent validation and revision processes would be guided by comprehensive, criterion-referenced feedback enabling iterative refinement before broader field testing and eventual dissemination.

3.1.3 Develop Stage

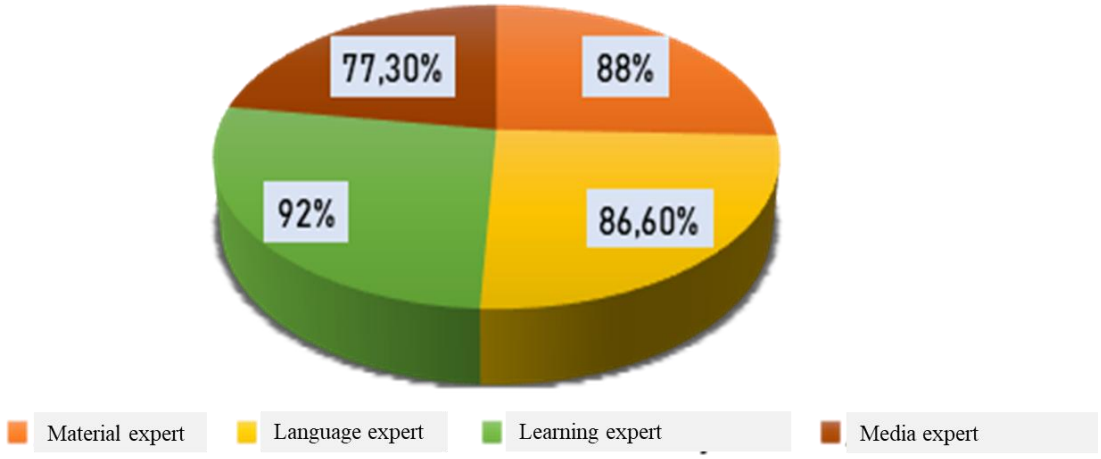
The development stage of AR-based snakes and ladders media in creating *Learning to Live Together* in Pancasila Education subjects in Elementary Schools is the most important stage and key to the success of product development used as an alternative source and learning material for students and teachers in grade IV in the Independent Curriculum. The steps taken are the preparation of AR-based snakes and ladders media adjusted to the *storyboard* that has been designed and media assessment in expert validation. The development of AR-based snakes and ladders media is completed after the preparation of the materials and designs that have been designed. Then the snakes and ladders media is tested for quality and feasibility by media experts, material experts, learning experts, and language experts, in addition to being assessed by experts, they also provide suggestions and input for revisions to the developed media. The expert validation assessment is in the form of a questionnaire assessment given using a *Likert scale* with a range of assessments, including 1) a score of 5 means very good, 2) a score of 4 means good, 3) a score of 3 means quite good, 4) a score of 2 means less good, and 5) a score of 1 means very less good. The following is the design of the developed product.

Figure 1
AR-based Snakes and Ladders *Game Board*

International Journal of Mathematics and Sciences Education
Volume 3, Issue 2, pp. 57-70
https://nakiscience.com/index.php/IJMSEd

The Multicultural Snakes and Ladders game is an educational learning medium designed to instill values of diversity, tolerance, and togetherness among elementary school students. The game board incorporates cultural symbols, colors, and numbers that represent Indonesia's multicultural context. Through the mechanics of climbing ladders and sliding down snakes, students learn that positive behaviors such as mutual respect, cooperation, and empathy lead to progress, while negative attitudes may hinder learning goals. This game encourages active interaction, discussion, and reflection on Pancasila values in an engaging and enjoyable manner. With its contextual and visually appealing design, the multicultural snakes and ladders game serves as an effective and meaningful support for character-based learning in elementary education.

Figure 2
Expert Validation Test Assessment Results Data

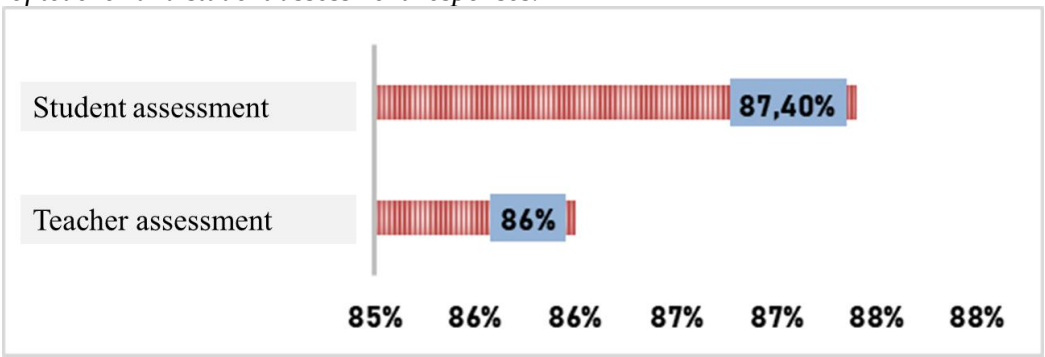


Based on the results of the image above from the assessment of the validator of media experts, material experts, learning experts, and language experts who obtained scores of 77.3%, 88%, 92%, 86.6% respectively, so it can be concluded that the learning media developed obtained an average score of 86% which is included in the very good category which means that the AR-based snakes and ladders media in creating *learning to live together* in the Pancasila Education subject in Elementary Schools is very suitable for use in the learning process .

3.3 Implementation Stage

The implementation was carried out on teachers and 28 fourth-grade students at Giwangan Elementary School. The average results of the validation and trial tests of the AR-based snakes and ladders learning media product in creating *learning to live together* in the Pancasila Education subject in Elementary Schools are as follows.

Figure 2
Results of teacher and student assessment responses.



Based on the results of the previous table, it shows that the average assessment from experts, teachers, and students of the learning media obtained a score of 86.4% which is included in the very good

category. Therefore, it can be concluded that the AR-based snakes and ladders media in creating *learning to live together* in the Pancasila Education subject in elementary schools is very high quality and very suitable for use in learning that has implemented the Merdeka Curriculum. It can be concluded that the use of this AR-based snakes and ladders media can have a positive impact on the learning process and student learning outcomes.

Table 3
Average results of expert, teacher, and student assessments

No	Evaluation	Mark	Category	Information
1.	Expert Validation	86%	Very good	Very High Quality
2.	Teacher	86%	Very good	Very Worthy
3.	Learners	87.4%	Very good	Very Worthy
	Average	86.4 %	Very good	Very Worthy

The evaluation results indicate that the developed product demonstrates a consistently high level of quality and feasibility across all assessment groups. Expert validation yielded a score of 86%, which falls into the very good category and reflects very high quality, indicating that the product meets theoretical, technical, and pedagogical standards. Similarly, the evaluation conducted by teachers resulted in a score of 86%, also categorized as very good, suggesting that the product is very worthy for classroom implementation in terms of practicality, relevance, and instructional usefulness. Furthermore, learners' responses showed an even higher score of 87.4%, categorized as very good and very worthy, highlighting positive user engagement, clarity, and learning support. Overall, the total score reached 295.4%, with an average score of 86.4%, which firmly places the product in the very good category and confirms its strong potential for effective educational use.

2.5 Evaluation Stage

The evaluation stage was conducted comprehensively throughout all phases of the development process, beginning with analysis, followed by design, product development, and product trials. Evaluation was not positioned merely as a final step, but rather as an integral and continuous process embedded in each stage to ensure systematic improvement of the developed product. At the analysis stage, evaluation focused on identifying learners' needs, curriculum alignment, and the relevance of multicultural values within Pancasila Education. During the design stage, formative evaluation was carried out to assess the suitability of learning objectives, game mechanics, AR integration, and instructional flow. The product development stage involved expert validation to examine content accuracy, media design, and pedagogical appropriateness, which resulted in a score of 86%, categorized as very good and indicating very high quality. Furthermore, product trials were conducted with teachers and learners to evaluate practicality, usability, and learning engagement. The teachers' evaluation achieved a score of 86%, while learners provided a higher score of 87.4%, both falling into the very good category and classified as very worthy for learning implementation. These findings demonstrate consistency between expert judgment and user perceptions, reinforcing the robustness of the developed media. The cumulative evaluation score of 295.4% and an average of 86.4% confirm that the multicultural AR-based snakes and ladders media meets high standards of quality, feasibility, and effectiveness. Overall, the evaluation results indicate that the product is suitable for use as a learning aid and learning resource in elementary schools, particularly in supporting the implementation of Pancasila Education within the Independent Curriculum, by fostering meaningful learning experiences and promoting values of living together in diversity.

3.2 Discussion

This research successfully developed a valid and effective Augmented Reality (AR)-based snakes and ladders platform for Pancasila education in elementary schools. Overall, this platform achieved an average expert validity of 85.9%, categorized as very feasible. Field trials with 27 students and teachers at Giwangan Public Elementary School showed high levels of agreement, at 84.5% and 86%, respectively. These findings align with previous research reporting increased motivation and learning outcomes after implementing similar learning platforms (Carolina, 2022; Hutagalung & Rachman, 2023; Lina & Anjarwati, 2022). However, the primary contribution of this research lies not in replicating these

findings, but rather in expanding and deepening the theoretical and pedagogical insights offered by the integration of AR technology in a multicultural education context.

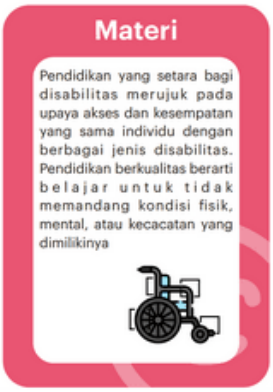
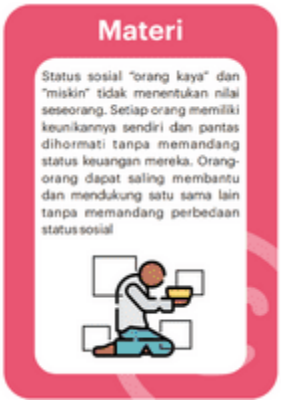
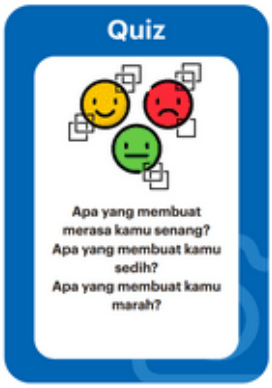
Theoretically, the effectiveness of this media can be explained through the convergence of three frameworks of thought. First, from the perspective of multicultural education(Banks, 2022; Fullinwider, 2022; Pradana et al., 2024). This media acts as a cultural vehicle that internalizes the values of awareness, empathy, and concrete action in a diverse community. Activities on the playing cards integrate the dimension of learning to live together (Gunn et al., 2022; Wang, 2023). Such as discussions about regional festivals, educational equality, and emotional management facilitate a transformative learning process (Hunduma & Mekuria, 2024).

Here, students not only learn about diversity but also experience a process of critical reflection to construct inclusive understanding and attitudes. Second, this approach aligns with the principles of character education, which emphasize habituation, role modeling, and value reflection (Wardani et al., 2025; Wuryandani et al., 2022). The game mechanism, which connects the consequences of actions with moral choices on activity cards, creates a simulation of logical consequences, thereby reinforcing the internalization of values of social responsibility and integrity. Third, AR integration serves as an enabler of immersive learning. Unlike static media, the AR features in this study are designed with a level of interactivity that allows students to explore through card scanning, observe 3D visual content/video, and respond in discussions or quizzes to the learning material. This sensorimotor experience creates situated learning (Arsiva et al., 2024 where abstract concepts about multiculturalism become concrete and contextualized, thereby increasing engagement and memory retention.

Meanwhile, the pedagogical implications of this study indicate that the integration of *the learning to live together dimension* through activity cards in UTMK media not only increases learning interest but also strengthens the understanding of multicultural values. S's research (Anengsih et al., 2024; Marcela & Aryaningrum, 2022) further strengthens this finding by showing an increase in learning interest of up to 92% in social studies learning. It can be concluded that AR-based snakes and ladders media is an effective innovation for creating meaningful Pancasila Education learning in elementary schools. The following is the integration of *the learning to live together dimension* on AR-based snakes and ladders activity cards.

Table 4
Integration of learning to live dimensions

Dimensions	Indicator	Information
Awareness	Society: diversity and differences in cultural values Integration: When students receive a *quiz activity card* , they can tell about regional festivals that contain the meaning and cultural values of their region.	

Dimensions	Indicator	Information
Caring and empathy	Other people: non-discriminatory and caring Integration: when students receive activity cards containing material on educational equality, they are able to present arguments about the importance of respecting people with physical differences (disabilities).	
A sense of ownership of life purpose	Others: Integrity and social responsibility Integration: when students receive activity cards, they are able to provide examples of differences in the consequences of social status not affecting friendships.	
Change of perspective	Yourself: understanding how to manage emotions Other people: understanding other people's views Integration: When students receive a *quiz activity card* , they are able to explain what makes them happy, sad, or angry. This indirectly helps other students gain a deeper understanding of their peers' situations and perspectives.	
Real action	Other people: empathy, sympathy, and mutual concern Integration: When students receive an opportunity activity card, they can directly practice empathy, sympathy, and mutual concern by offering advice or understanding when a friend makes a mistake.	

Dimensions	Indicator	Information
Meaningful engagement	Other people: a sense of unity and oneness Integration: When students receive a material card, they can *scan* the image and watch a video about racial groupings in Indonesia.	

The findings of this study align with those of studies (Elindasari et al., 2024; Mulyatno, 2022; Pahmi et al.,2024; Pratiwi & Hardini, 2022; Solihah et al., 2022) that demonstrated the effectiveness of the Snakes and Ladders game in improving second-grade elementary school students' arithmetic skills, demonstrated by an increase in post-test scores, with N-Gain categories mostly at the moderate and high levels. This similarity confirms that the Snakes and Ladders game format is a potentially powerful medium for engaging and engaging learning. However, the development of this Snakes and Ladders game research demonstrates several advantages and more contextual innovations (Hanifah et al., 2025; Wardani & Ghiffari, 2024). The contextual innovation offered shifts from narrow cognitive functions (such as counting) to holistic pedagogical functions as a medium for character and social skill development. The advantages of this media lie in: (1) alignment of content with the Merdeka Curriculum through the integration of learning to live together values, (2) technological innovation through AR that creates an immersive learning experience, and (3) a practical design with a guidebook to ensure ease of implementation.

Overall, this research contributes to the field of education by demonstrating how pedagogically designed AR technology integration can strengthen the framework of multicultural and character education. The AR-based snakes and ladders media proved not only an effective tool for increasing student engagement, but more importantly, a potential platform for fostering socio-emotional competencies and civic values in a multicultural society from an early age.

4. Conclusion

This research resulted in an AR-based snakes and ladders game aimed at supporting Learning to Live Together (Learning to Live Together) in the Pancasila Education subject in elementary schools. This media development was specifically designed for fourth-grade elementary school students, focusing on the topic of Indonesian Diversity, which encompasses ethnicity, culture, race, religion, social status, and physical and non-physical differences. This media was developed in response to the need for more interactive and contextual learning.

Specifically, the product developed is a snakes and ladders board game that utilizes AR technology on its activity cards, integrating elements of traditional games with modern technology. Each activity card is equipped with a symbol or code that can be scanned using a companion application, which then displays additional content in the form of images, videos, or cultural facts related to the learning material.

Based on a limited trial conducted in one school, the AR-based snakes and ladders media shows potential as an alternative learning tool that can increase student engagement in understanding the values of living together in diversity. However, given the limited scope and small scale of the study, the findings cannot be broadly generalized. The implications of this media development are more contextual to the research setting and require further study with a more diverse sample coverage and locations to test its effectiveness and applicability on a larger scale.

Limitations

Research Limitations

a) Narrow Scope: The media was only tested for Pancasila Education, with material limited to the topic of “diversity,” and did not cover the entire curriculum.

b) Technology Dependence: The media requires an Android device and can only be accessed offline, limiting content updates and real-time interaction.
c) Limited Validity: The trial involved only 27 students at a single school in Yogyakarta, making the research findings unable to be generalized to a broader and more diverse population.
d) Infrastructure Requirements: The effectiveness of this media is highly dependent on the availability of supporting facilities, such as Android smartphones, so its implementation may be hampered in schools with limited technological infrastructure.

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Author Contribution

Author 1: Conceptualization and writing original draft
Author 2: Validation and supervision
Author 3: Visualization and design

Conflict of Interest

The authors declare no conflict of interest.

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