BAHASTRA
Vol. 46 (1) 2026, pp. 183-195
P-ISSN: 0215-4994 | E-ISSN: 2548-4583
http://journal1.uad.ac.id/index.php/BAHASTRA/index

Prototype design of AR-based flipbook with local wisdom for reading media

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Received: November 18, 2025 **Revised:** April 13, 2026 **Accepted**: April 15, 2026

KEYWORDS
Augmented Reality
Development
Flipbook
Local Wisdom
Reading Skill

ABSTRACT

This research is motivated by a critical educational paradox in West Sumatra, where high public reading interest indexes contradict the low functional reading competence among secondary school students. This cognitive discrepancy is primarily caused by the reliance on nationally standardized teaching materials that alienate students from their socio-cultural environment. To address theoretical and practical gaps in digital ethnopedagogy, this research aims to systematically design a conceptual blueprint of an interactive flipbook prototype that utilizes Augmented Reality (AR) to materialize abstract Minangkabau cultural concepts. The methodology employed in this research is a descriptive-analytical approach focused specifically on a preliminary study and conceptual design. The scope of this research is deliberately delimited to comprehensive needs analysis and structural product design. Empirical data were gathered from eighth-grade students and teachers at SMP Negeri 7 Padang through questionnaires, interviews, and document analysis, utilizing ethnopedagogy as an analytical tool and cognitive multimedia theories as a reference framework. The findings of this research empirically confirmed a critical demand for interactive visual media rooted in the socio-cultural environment. Based on these needs, the design phase in this research successfully formulated a pedagogically sound blueprint integrating the 5M scientific approach with immersive 3D AR features, wherein local cultural icons are represented as analytical case studies for popular scientific texts. In conclusion, this research establishes a novel pedagogical framework synergizing immersive technology and local wisdom. For future academic endeavors, transitioning from the structural blueprint of this research to empirical technological development is highly recommended to quantitatively evaluate its effectiveness in improving reading literacy.

Introduction

Education in the 21st century requires the development of human resources competencies that are able to adapt to technological changes and the complexity of information (Magableh & Abdullah, 2021; Pujiastuti et al., 2022). Fundamental literacy skills, especially reading literacy, are a key prerequisite for mastering higher-level competencies such as critical thinking, analysis, and information synthesis (Gea et al., 2024; Pratiwi et al., 2024). However, fostering a culture of literacy among secondary school students in Indonesia faces significant challenges (Khellab et al., 2022; Nurchasanah, 2024). The phenomenon of declining interest in reading is a crucial issue that requires strategic and innovative intervention. Reading long texts, which is

essential for training concentration and deep understanding, now competes fiercely with digital content that offers instant gratification (Adzidzah & Yudiawan, 2024; Anggeraini et al., 2019). As a result, reading is often perceived as an academic burden, losing its role as an intellectual necessity for broadening one's horizons.

This shift represents a complex social phenomenon that goes beyond mere changes in media preferences (Amir & Afnita, 2019; Kurnia et al., 2025; Sambayon et al., 2023). Its roots are embedded in various aspects, including family dynamics, the effectiveness of the education system, and paradigm shifts in information consumption (Sadya, 2023; Simarmata et al., 2019). The dominance of visual media and digital platforms has conditioned the younger generation to a pattern of rapid and fragmented information interaction (Counsil, 2024; Haleem et al., 2022; Smith et al., 2021). If this trend is not effectively mitigated, there is a risk of creating a generation that is adept at surface-level information retrieval but lacks contextual understanding. Limited critical analysis and the ability to synthesize complex ideas from various sources may hinder their competitiveness in facing future global challenges.

Various national literacy initiatives, such as the School Literacy Movement (GLS), have been implemented to cultivate a literate educational ecosystem (Kisayani & Laksono, 2019). The integration of structural reading habituation within these programs was further evaluated by Pantiwati et al. (2020). Furthermore, the vital role of these systemic initiatives in establishing foundational literacy environments was emphasized by Smith et al. (2021). However, the effectiveness of these conventional interventions is frequently undermined by the complexities of the digital era, as identified (Naufal, 2021).

Specifically, the cognitive capacity of modern students to focus on a single reading source is significantly disrupted by information overload (Maritsa et al., 2021). This concentration barrier is further exacerbated by continuous digital notifications, a phenomenon critically analyzed by Afnita et al. (2025). Consequently, traditional printed textbooks and static electronic books are increasingly considered unengaging by the digital generation (Firdaus et al., 2024). The failure of these static formats to retain sufficient student involvement for comprehensive understanding (Yuniarti et al., 2023).

This educational educational disparity is explicitly observed in West Sumatra Province, where a distinct literacy paradox is manifested. On one hand, highly positive community literacy achievements, marked by high Community Literacy Development Indexes (IPLM) and Reading Interest Levels (TGM), are reported nationally (Cargando & Jacela, 2025; Lewis, 2025; Subandiyah et al., 2025). Yet, this macroeconomic success is not translated into functional reading competencies within the classroom. Therefore, a strategic intervention is required to bridge the gap between high public reading interest and the low cognitive engagement of students during formal learning.

However, a contradictory picture emerges when analyzing student competency data within the formal education system. The results of the 2023 National Assessment reveal that the literacy and numeracy competency levels of students at the high school, vocational school, and special education levels in West Sumatra remain in the low category (Klassen, 2020; Willian, 2025). This phenomenon has become a serious concern for the Provincial Education Office. The sharp discrepancy between the high public reading interest (IPLM and TGM) and the low functional literacy skills of students in schools indicates a failure to translate reading habits into measurable cognitive competencies. Success in building a literacy-rich environment has not fully converted into an improvement in the quality of learning in the classroom.

This literacy paradox is identified as a direct consequence of the education system's reliance on nationally standardized teaching materials. The continuous use of uniform materials across Indonesia (Indrayadi et al., 2020; Tressyalina et al., 2023) as a practice that frequently overlooks contextual aspects, particularly the wealth of local wisdom inherent to each region. Consequently, reading materials that are not rooted in the socio-cultural environment are perceived as alien by students, a condition of cultural disconnect that was empirically validated by Ghaluh et al. (2022). This absence of contextual relevance prevents the teaching materials from establishing an emotional and intellectual connection with the learners, which ultimately leads to low learning motivation and a diminished interest in exploring the presented texts.

Based on these contextual challenges, a distinct gap in the current educational practice and literature is clearly manifested. Specifically, existing reading media are identified as failing to simultaneously provide cultural relevance and immersive cognitive engagement. To address this well-articulated research problem, the development of an innovative reading medium is proposed in this study. An educational technology product is formulated by synergizing an interactive flipbook format, Augmented Reality (AR) technology, and Minangkabau local wisdom. This integrated approach is designed to create a reading experience that transcends passive text interaction, an immersive pedagogical potential that was recently. Driven by this identified gap, a specific research objective is established: to systematically design a conceptual blueprint of a culturally relevant and highly interactive reading medium, thereby enhancing student engagement and functional comprehension.

The interactive flipbook format is explicitly selected as the primary medium in this study. Noviani et al. (2023) fundamentally established the capacity of this digital format to mimic the physical book reading experience. By using AR, students can understand the reading and get the vocabulary needed when reading (Muryanti et al., 2023; Vonna et al., 2022). Furthermore, Salahuddin et al. (2023) corroborated its high level of immersiveness. Within this digital environment, the simulated page-turning effect serves as a critical feature that positively influences educational engagement (Hiasa et al., 2024; Paculdar, 2025; Subon, 2016; Topping et al., 2022). The integration of multimedia elements, such as audio and interactive animations, also proves highly beneficial for student retention (Furenes et al., 2021; Villarente & Moral, 2021; Yapp et al., 2023). Consequently, Fajri (2018) highlighted the dynamic superiority of this interactive medium over static PDF-format e-books. Recent comparative studies further confirm this enhanced engagement metric in reading contexts (Fendi et al., 2024; Marwan & Yuliantri, 2023; Sukenti et al., 2024)

To augment visual appeal and cognitive immersion, Augmented Reality (AR) technology is systematically integrated into the flipbook. Ebinger et al. (2022) extensively analyzed the fundamental capability of AR to project two-dimensional and three-dimensional virtual objects into real-world environments. Hermawan (2019) detailed similar technological mechanics, which Suryaningsih (2019) later applied practically to enhance reading materials. In educational frameworks, Agung et al. (2024) proved the effectiveness of AR in visualizing abstract concepts. This pedagogical advantage in facilitating deeper cognitive understanding receives substantial support from Rachim et al. (2024) and is comprehensively expanded upon in the findings of Utama et al. (2024).

The third fundamental element constructed within this medium is content based on the local wisdom of West Sumatra. This instructional approach is firmly grounded in the theoretical framework of ethnopedagogy. Amir & Afnita (2019) comprehensively explored the utilization of local cultural values as a primary learning medium. Erni et al. (2023) additionally verified the efficacy of this heritage-based educational practice. Furthermore, embedding content proximate to the students' lived realities, specifically Minangkabau cultural heritage, systematically creates a contextual learning process (Aditiawarman et al., 2025; Almos et al., 2025). Afnita et al. (2023) documented the positive impact of such contextual proximity on student comprehension. Agustina et al. (2016) articulated the foundational philosophy of this cultural integration, while Ghaluh et al. (2022) empirically observed its practical relevance in preventing student alienation. Thus, through this integrated design, textual information is not merely presented, but abstract cultural content is brought to life through interactive 3D AR objects deeply rooted in the students' cultural identity.

A comprehensive review of the literature indicates that these instructional components have been extensively investigated in separate domains. For instance, the positive impact of interactive reading strategies and flipbook formats on student motivation was thoroughly analyzed by Haryati & Kuning (2024). Simultaneously, the urgency of integrating local wisdom into digital modules to strengthen educational character was validated by Asrial et al. (2022). Furthermore, the effectiveness of immersive technologies, specifically Augmented Reality (AR), in modern educational contexts was comprehensively evaluated by Al-ansi et al. (2023). However, studies that specifically synthesize these three elements into a single, cohesive reading medium remain significantly limited. While preliminary research has explored AR media with Minangkabau cultural content in standalone applications, a systematic integration within a structured literacy medium is currently lacking. Therefore, this research is systematically conducted to design an AR-based flipbook integrated with West Sumatran local wisdom to fill this identified gap. To establish a robust scientific foundation for this development, the specific role of the employed theories is explicitly defined in this study. The theory of ethnopedagogy is utilized not merely as a reference framework, but primarily as an active analytical tool. This theoretical lens is applied to critically select and evaluate the Minangkabau cultural content, ensuring that abstract reading texts are firmly anchored within the students' cultural realities. Concurrently, cognitive theories of multimedia learning function as the foundational reference framework to systematically design the integration of AR features, thereby optimizing the cognitive processes involved in reading comprehension. Through this dual theoretical application, a highly contextualized and interactive literacy medium is comprehensively designed for secondary school students.

Method

Before you begin to format your paper, first write and save the content as a separate text file. Keep your text and graphic files separate until after the text has been formatted and styled. Do not use hard tabs, and limit use of hard returns to only one return at the end of a paragraph. Do not add any kind of pagination anywhere in the paper. Do not number text heads-the template will do that for you. Finally, complete content

and organizational editing before formatting. Please take note of the following items when proofreading spelling and grammar.

A descriptive-analytical methodology focused specifically on a preliminary study and conceptual design is employed in this research. The primary objective is established to systematically formulate a prototype blueprint of an interactive flipbook, which integrates Augmented Reality (AR) and local wisdom to enhance reading skills in secondary schools. Rather than executing a full-scale Research and Development (R&D) cycle, the scope of this methodological approach is intentionally delimited to the foundational phases of instructional media creation. Consequently, a comprehensive needs analysis is conducted to empirically map the pedagogical requirements of the learning environment. Subsequently, a detailed design phase is executed to construct the conceptual architecture and visual integration of the reading medium. Through this specific methodological framework, an accurate and thorough representation of the preliminary development stages is provided, thereby establishing a rigorous scientific foundation for future implementation and empirical evaluation.

The research subjects were determined purposively, including eighth-grade students and Indonesian language teachers at SMP Negeri 7 Padang. Students were selected as representatives of end-users to directly identify their contextual and cognitive needs. Meanwhile, teachers acted as subject matter and pedagogy experts to validate the content and suitability of the learning methods. To ensure methodological rigor, the data collection instruments, including the student questionnaires and teacher interview guidelines, were strictly validated through expert judgment for construct and content validity prior to administration. Furthermore, the reliability of the qualitative interview data was established through source triangulation. Data collection activities were carried out in the odd semester of the 2025/2026 academic year.

The research procedure began with the Analysis stage, which included three main activities. *First,* conducting a user needs analysis by distributing questionnaires to eighth-grade students at SMP Negeri 7 Padang. *Second,* conducting interviews with Indonesian language teachers to identify needs from the teacher's perspective. *Third,* conducting a curriculum document analysis to ensure content alignment.

The second stage is Design. At this stage, the results of the analysis are transformed into product designs. The procedures at this stage include designing a storyboard to map the content flow and interactions. Next, the User Interface and User Experience for the flipbook are designed, as well as 3D object modeling and markers for Augmented Reality components. The final result of this procedure is a flipbook prototype.

The data analysis techniques used in this study were tailored to the type of data collected. Quantitative data from closed-ended questions in the student questionnaire were analyzed using descriptive statistics. This analysis included frequency and percentage calculations to provide an overview of trends in student preferences and needs. Qualitative data, obtained from open-ended questions in the questionnaire and interviews with teachers, was analyzed using thematic analysis. This process included data reduction, data presentation, and conclusion drawing. The goal was to identify patterns, themes, and key ideas that emerged from the data to formulate specifications for flipbook development needs.

Results and Discussion

The empirical findings derived from the descriptive-analytical preliminary study are systematically presented in this section. The results are intentionally structured around two foundational phases of instructional media creation: the comprehensive needs analysis and the conceptual prototype design. In the first phase, the pedagogical requirements and contextual constraints of the learning environment are empirically mapped. Subsequently, in the second phase, the conceptual architecture and visual integration of the reading medium are systematically constructed. Ultimately, the empirical data and structural blueprints elucidated in this section establish a rigorous scientific foundation for the interactive learning media prototype being formulated.

Student Needs Analysis

A needs analysis of eighth-grade students at SMP Negeri 7 Padang was conducted using a questionnaire consisting of 25 statements. The questionnaire contained mixed data in the form of numbers and comments. The results of the quantitative analysis showed that 85,2% of students considered printed textbooks to be monotonous and unable to maintain their attention. A total of 87,8% of respondents expressed a strong preference for interactive digital learning media. These findings indicate a discrepancy between the available teaching media and the expectations and characteristics of students as the digital generation can be seen in Figure 1.

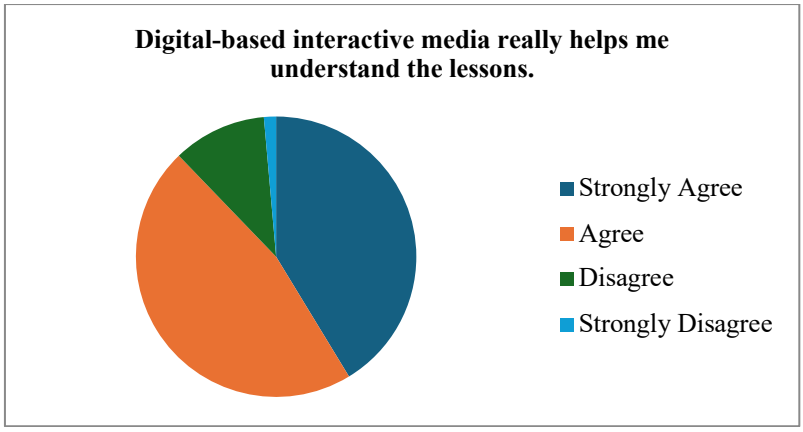


Fig. 1. Students' Need for Digital Media is Quite High

Qualitatively, three main themes were identified. First, students had difficulty visualizing abstract or dynamic concepts from 2D representations. Second, students showed a high interest in learning content relevant to their local cultural context, in this case, Minangkabau culture. Third, it was confirmed that 93,8% of students were active smartphone users, indicating the readiness of personal infrastructure for the implementation of gadget-based media.

Teacher Needs Analysis

Semi-structured interview with Indonesian language teachers at SMP Negeri 7 Padang. This interview contained seven indicator questions. The list of questions and answers from the interview with the teachers is presented in Table 1.

Table 1. Indicators and List of Questions for Teachers

No.	*Indicators*	*Answer*
1	Implementation of the National Curriculum	Already implemented in schools
2	Challenges in teaching	Difficulties in developing teaching materials, as they are still in the process of adapting to the new materials in curriculum.
3	Scope of learning content	The Indonesian language subject is considered to have a broad scope of material, requiring adequate learning media for implementation by students.
4	Frequently used teaching materials	Government textbooks, such as Cerdas CergasBerbahasa dan Bersastra Indonesia
5	Availability of books in electronic form	Teachers of the relevant subjects do not yet have electronic books.
6	Teacher's opinions on flipbooks as teaching materials for reading skills	Agree, because flipbooks as teaching materials for reading skills can make it easier for students to get into the habit of reading and can increase their interest in reading independently without having to go to the library. Moreover, if these flipbooks are integrated with local culture, it will increase students' love for their culture.
7	Your suggestions regarding flipbooks as teaching materials for reading skills	Flipbooks presented to students must be appropriate for junior high school students' needs, taking into account the Alur Tujuan Pembelajaran.

This interview confirmed the findings from the student analysis. The teacher identified pedagogical challenges in explaining the structure and content of Popular Scientific Articles using examples that were generic and lacked context for students. There is a need for supplementary teaching media that can (1) visualize the objects or concepts described in the text, and (2) integrate the local wisdom of West Sumatra to increase student relevance and engagement.

Curriculum Analysis

Curriculum analysis was conducted to validate the alignment of the learning media products developed with the currently applicable national education framework. This analysis focused on the standardized learning outcomes document for eighth-grade secondary education, which is explicitly integrated into the designed flipbook prototype. The purpose of this analysis was to ensure that every

component in the flipbook, from content and activities to technological features, directly supported and implemented the mandated educational objectives. The results of the analysis are presented in matrix form in Table 2.

Table 2. Interactive Flipbook Alignment Analysis Matrix with the National Education Framework

No.	*Curriculum Components*	*Description According to Curriculum Documents*	*Implementation in Interactive Flipbooks*
1	General Learning Outcomes	Students have the language skills to communicate and reason according to purpose and context. Students are able to understand, process, and interpret information from a variety of topics, participate actively in discussions, and write various types of texts in a structured manner.	The entire structure of the flipbook is designed to achieve this competency. Students not only receive information (read texts), but also process it (answer questions in the Questioning and Reasoning stages) and interpret it (draw conclusions in the Communicating stage).
2	Element: Reading	Students understand information in the form of ideas, thoughts, or messages from various types of texts (e.g., descriptions, expositions) from visual and audiovisual texts to find explicit and implicit meanings. Students use other sources of information to assess the accuracy of data.	Students analyze four Popular Scientific Articles based on Minangkabau local wisdom (Rumah Gadang, Tari Piring, Rendang, Randai).
3	National Character Education: Global Diversity	This dimension is realized through the key elements of recognizing and appreciating culture.	This is the most fundamental implementation of this flipbook. All text and multimedia content (video, AR) is exclusively oriented towards the local wisdom of West Sumatra. This directly introduces and encourages students

Document analysis of the national education framework indicates that the product design is strictly in line with standardized learning objectives. The development of this media directly supports the achievement of the reading elements and character building mandated by national standards, particularly in the dimensions of global diversity and creativity. This curriculum structure also provides flexibility for educators to develop contextual teaching materials, thereby providing a strong foundation for the integration of local wisdom.

Design Stage

Based on the data and findings from the analysis stage, the next stage is the design of the learning media product. This process translates the specifications of pedagogical, user, and curriculum requirements into a structured and operational blueprint. The design of this product covers three fundamental aspects, namely content and pedagogical structure design, user interface and user experience (UI/UX) design, and multimedia and Augmented Reality (AR) integration design.

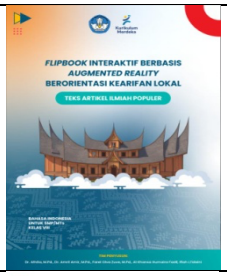
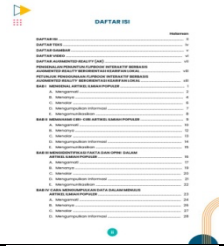
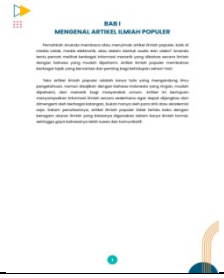
Each chapter consistently uses one aspect of Minangkabau local wisdom as the object of study or case study in the popular scientific article presented, namely Rumah Gadang (Chapter I), Tari Piring (Chapter II), Rendang (Chapter III), and Randai (Chapter IV). These topics were selected based on their relevance to the students' cultural environment, with the aim of increasing personal connection and meaningfulness of the material.

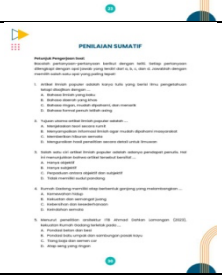
Pedagogically, the learning flow in each chapter is designed using the 5 scientific approach (Observing, Questioning, Gathering Information, Reasoning, Communicating). This framework was chosen for its systematic nature in actively building students' knowledge based on inquiry, in line with the student-centered learning principles of the national curriculum. This structure ensures that students do not merely consume information passively but are also involved in a structured cognitive process, from initial observation to synthesis and communication of their thoughts.

The User Interface (UI) and User Experience (UX) design was developed by adopting user-centered design principles. Based on the results of a needs analysis that showed students' high familiarity with gadgets, the interface was designed to be intuitive, clean, and responsive on various devices. The main navigation uses the metaphor of a physical book, where users can turn pages by swiping or pressing the

arrow icon, an interaction that is widely known and minimizes the cognitive load on users. The design can be seen in Tabel 3.

Table 3. UI/UX Design of Flipbook

No.	*Chapter*	*Visual*	*Description*
1	Cover		The cover design thematically communicates the product's identity. It features the main title, "Interactive Flipbook Based on Augmented Reality with a Local Wisdom Orientation," and specifies the subject matter and target grade level. The background, depicting a Rumah Gadang silhouette, visually anchors the content in Minangkabau local wisdom, while official logos signify its alignment with the national curriculum.
2	Foreword		The foreword outlines the product's pedagogical objectives, primarily to enhance students' skills in reading popular scientific articles. It highlights the integration of innovative features, including Augmented Reality (AR) and local wisdom content, and underscores the flipbook's design to support self-paced learning and increase student motivation.
3	Table of Contents		The Table of Contents is structured hierarchically to provide a comprehensive overview and facilitate user navigation. It details not only the main chapters but also supplementary lists of texts, images, videos, and AR features, indicating the product's rich multimedia nature. The consistent breakdown of each chapter into the five stages of the 5M scientific approach provides a clear pedagogical roadmap.
4	Learning Outcomes,		This section serves as the product's curricular foundation, transparently mapping its alignment with the national curriculum. It outlines the general and element-specific learning outcomes for language skills and explicitly states the targeted dimensions of the Pancasila Student Profile, namely Faith and Piety, Global Diversity, and Creativity, affirming a focus on both cognitive and character development.
5	Chapter I		Chapter I establishes the conceptual foundation of popular scientific articles using the Rumah Gadang as a cultural case study. Following the 5M pedagogical framework, it begins with multimodal stimuli (video, text) and proceeds through inquiry-based questions. The integrated Augmented Reality feature functions as a 3D visualization tool to provide a concrete understanding of the architectural concepts discussed.
6	Chapter II		This chapter is designed to develop students' analytical skills in identifying the key characteristics of the genre, using Tari Piring (Plate Dance) as the subject of analysis. The 5M structure guides students in dissecting the text for authorial opinion, supporting evidence, and logical reasoning. The AR feature, which animates the dance, provides a dynamic understanding of movement that static text cannot convey.

7	Chapter III		Chapter III concentrates on the essential critical thinking skill of distinguishing between fact and opinion, contextualized through the topic of Rendang. The learning activities require students to analyze a text that intentionally blends verifiable data with subjective assessments. The AR feature provides an interactive 3D diorama of the ingredients, reinforcing the factual components of the topic.
8	Chapter IV		This chapter provides practical knowledge on simple data collection methodologies for writing popular scientific articles, using the Randai folk theatre as a case study. It introduces three primary methods: interviews, questionnaires, and literature review. The learning activities and AR visualization are designed to deepen students' understanding of the research object and the methods used to study it.
9	Summative Assestment		The Summative Assessment section functions as the final evaluation instrument, designed to comprehensively measure students' mastery of the competencies taught across all four chapters. It consists of multiple-choice questions that assess both theoretical knowledge and the practical application of concepts related to the four cultural topics, ensuring contextualized evaluation.

Visually, the interface design subtly integrates Minangkabau aesthetic elements into the color palette and graphic ornaments to reinforce the product's cultural identity without compromising content readability. The user experience also focuses on accessibility. The flipbook is designed to be accessible via a single link and ensures cross-platform compatibility (smartphones, tablets, and computers). This is in line with the goal of providing flexible learning media that supports independent learning.

The main innovation of this product lies in the strategic integration of multimedia and Augmented Reality (AR) technology embedded in the 5M pedagogical flow. At the Observe stage at the beginning of each chapter, students are presented not only with text, but also with learning videos relevant to the topic of local wisdom being discussed. The integration of these videos aims to provide a dynamic and engaging initial context, as well as accommodate students' diverse learning styles. The AR design can be seen in Figure 2.

Fig. 2. AR Design of the Rumah Gadang Object

Marker-based Augmented Reality (AR) features are integrated into each chapter as the culmination of the Observe stage. AR was chosen for its superior ability to visualize abstract concepts or complex three-dimensional objects, a direct solution to overcome the visualization barriers identified in the analysis stage. By scanning QR codes markers using a device camera, students can project and interact with 3D models of cultural objects, transforming a passive learning experience into an immersive and concrete exploration.

Design

The design of this interactive flipbook product is a strategic response to a series of pedagogical challenges identified during the analysis stage. This media design was developed as a learning ecosystem

that synergizes three elements, namely interactive digital media format, local wisdom-based content, and immersive Augmented Reality (AR) technology. The synergy of these three elements aims to bridge the gap between the characteristics of students as the digital generation and Indonesian language learning practices that often still rely on conventional media.

The choice of digital flipbook format as the main medium is based on its potential to increase student engagement and motivation to learn (Yapp et al., 2023). Unlike printed textbooks or static PDF documents, which tend to be monotonous, flipbooks offer a more dynamic reading experience by mimicking the gesture of turning the pages of a physical book and the ability to embed multimedia elements (Mhlongo et al., 2023). Previous studies have consistently shown that interactive flipbook media are effective in increasing students' interest in literacy and learning outcomes in various subjects (Apriliyani & Mulyatna, 2021; Marwan & Yuliantri, 2023; Noviani et al., 2023). This advantage lies in its ability to present material in a more interesting and participatory manner, which ultimately diverts students' attention from digital distractions and focuses them on the learning content.

Furthermore, the integration of Minangkabau local wisdom content as the main case study in each chapter is a direct implementation of the ethnopedagogical approach. This approach utilizes culture as both a source and medium of learning to increase the relevance and meaningfulness of the material (Afnita et al., 2023, 2025). When nationally applicable teaching materials are perceived as foreign and decontextualized, they systematically fail to build personal intellectual connections (Ghaluh et al., 2022). Conversely, by embedding topics rooted in the cultural environment, this medium actively fosters students' appreciation and sense of belonging toward their cultural heritage. This contextualization aligns perfectly with the goals of national character education, which emphasizes global diversity and local wisdom preservation (Nurrahmah & Afnita, 2025).

The most significant pedagogical innovation in this product is the strategic use of Augmented Reality (AR) technology as a cognitive scaffold. AR systematically overcomes students' difficulties in visualizing abstract, dynamic, or three-dimensional concepts derived from text descriptions. For example, understanding the complex architectural structure of the Rumah Gadang or mapping the dynamic spatial movements of the Tari Piring is significantly facilitated when students interact directly with projected 3D models. This is supported by Vaida & Pongracz (2022), which proved that AR is highly effective in improving spatial conceptual understanding, memory retention, and intrinsic learning motivation. By providing multisensory stimuli, AR bridges the cognitive gap between text-based descriptions and real-world visualization, a mechanism fundamentally superior to traditional two-dimensional images.

Conclusion

Based on the descriptive-analytical preliminary study and conceptual design process, this study successfully formulates a valid prototype blueprint for an interactive flipbook that integrates Augmented Reality (AR) with Minangkabau local wisdom. The needs analysis empirically confirms a significant pedagogical gap between the cognitive characteristics of digital-native students and the currently available decontextualized teaching materials, thereby strongly justifying the urgency for an innovative and culturally grounded educational medium. These identified needs are systematically translated into a pedagogically sound product design that integrates a dynamic digital flipbook format, immersive 3D AR technology, contextually relevant cultural content, and the 5M scientific learning framework. The resulting conceptual prototype demonstrates a cohesive synergy among immersive technology, cultural values, and instructional design, positioning it as a strategic solution to enhance cognitive engagement and address students' difficulties in visualizing abstract cultural concepts. Furthermore, this study contributes a novel pedagogical model for teaching reading skills in popular scientific texts by placing local culture as the primary analytical context. However, this study remains at the conceptual stage; therefore, future research is recommended to proceed with the development of a functional digital product, conduct extensive classroom implementations, and quantitatively evaluate its effectiveness in improving students' functional reading competencies and intrinsic learning motivation.

Declarations

Author contribution : Afnita contributed to the conceptualization, methodology design, and provided overall supervision of the study. Amril Amir performed the formal data analysis and prepared the original draft. Farel Olva Zuve and Al Khansa Humaira Fadil were responsible for field investigation and data collection. Marzni Mohamed Mokhtar validated the research findings and critically reviewed and edited the manuscript. Iflah Li'idaini

managed project administration and data curation. All authors have read and approved the final manuscript.

Funding statement : This research is funded by the LPPM of Universitas Negeri Padang with contract no. 1634/UN35.15/LT/2025.

Conflict of interest : All authors declare that they have no competing interests.

Ethics Approval : All procedures performed in this study involving human participants were in accordance with the ethical standards of the institutional and/or national research committee.

Additional information : No additional information is available for this paper.

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