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Development of Android Interactive Media to Improve Ethnosocial Integrated Numeracy Literacy

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Abstract:
This study aimed to develop an Android-based interactive learning media integrated with ethnosocial values to enhance numeracy literacy among fifth-grade Madrasah Ibtidaiyah students. The study employed a Research and Development approach using the Borg and Gall model, consisting of needs analysis, design, development, and product testing stages. The subjects included fifth-grade students of MIN 1 Sungai Tarab, classroom teachers, and expert validators. Data were collected through interviews, observations, questionnaires, and numeracy literacy tests. Data analysis was conducted using descriptive qualitative and quantitative techniques to assess the validity, practicality, and effectiveness of the developed media. The results showed that the media achieved a validity score of 83%, indicating a highly valid category. Practicality analysis revealed student response scores of 78.8% and teacher response scores of 66%, both categorized as practical. Effectiveness testing demonstrated that students' numeracy literacy achievement reached a classical mastery level of 85.6%. These findings indicate that the developed Android-based interactive learning media meets the criteria of validity, practicality, and effectiveness for use in numeracy learning at the Madrasah Ibtidaiyah level.

Keywords: Interactive Learning Media, Android, Numeracy Literacy, Ethnosocial, Mathematics Learning

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INTRODUCTION

The rapid development of digital technology in the era of the Industrial Revolution 4.0 has significantly transformed various sectors of life, including primary education. The integration of information and communication technology into the learning process has become an essential requirement to create interactive, effective, and learnercentered instruction that aligns with the characteristics of twenty-first-century learners. One technological innovation with strong potential is the use of Android-based learning media, considering the high accessibility and familiarity of smartphones among elementary school students, including those in Madrasah Ibtidaiyah (MI) (Hidayat, Mahmuzah, Qausar, & Sinaga, 2024).

Learning media are tools used to deliver instructional content in order to create effective and efficient interactions between teachers and students. The term interactive refers to reciprocal communication between the media and its users. According to Yanto, (2019), interactive learning media function as instructional aids that encourage direct interaction between students and learning materials. The use of learning media that aligns with students' needs can increase their motivation and willingness to learn, while also assisting teachers in delivering learning content more effectively (Nadiroh, Amalia, & Kalimatusyaro, 2025).

With the widespread use of smartphones and other digital devices by teachers and students, educational technology has increasingly shifted toward Android-based mobile learning media. This development enables teachers to utilize various Android-based learning applications with multimedia content that can be accessed by students both inside and outside the classroom (Anastasha & Hesti, 2024). Interactive learning media commonly utilize technology, particularly Android-based smartphones. Maiyana (2018) explains that Android is a Linux-based operating system designed for mobile devices. Furthermore, Robianto, Wahono, & Marsono (2019) state that the use of Android as a learning medium offers a new and engaging approach to education, as it allows learning to take place anytime and anywhere. Android is currently the most widely used smartphone operating system, accounting for approximately 88% of the market share in Indonesia according to Statista data in 2022. One prominent application of Android in education is through Learning Management Systems (LMS). Arifin (2020) notes that Android based LMS still have significant potential for further development, particularly in terms of learning materials, instructional videos, and evaluation tools. By utilizing interactive learning media, teachers are provided with greater opportunities to innovate and create more engaging and enjoyable mathematics learning experiences for students.

Mathematics is a subject taught at all levels of education. One of the main challenges in mathematics instruction is students' perception that mathematics is a difficult and intimidating subject. This negative perception often hinders students' ability to understand mathematical concepts, resulting in difficulties in mastering basic mathematical skills optimally (Yuliantika, Frasandy, Rahmatika, & Nyangfah, 2025). Consequently, this condition has a direct impact on students' mathematical literacy.

At the same time, numeracy literacy is a fundamental competence that students must develop to understand, interpret, and apply mathematical concepts in real-life situations. Numeracy literacy goes beyond basic arithmetic skills; it encompasses logical reasoning, problem-solving ability, and decision-making based on quantitative information. However, numerous studies have indicated that

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Indonesian primary school students' numeracy literacy levels remain relatively low. This condition is often attributed to mathematics instruction that is abstract, teacher-centered, and insufficiently connected to students' real-world contexts (Nurdin, Rahman, & Mahmud, 2021).

Numeracy literacy refers to the knowledge and skills required to use numbers and mathematical symbols to solve practical problems in daily life, analyze information presented in various forms, and interpret the results to make predictions and informed decisions. Meanwhile, arithmetic operations involve basic computational skills such as addition and subtraction (Anastasha, 2020). Numeracy literacy has become one of the essential competencies students must possess to face the challenges of the 21st century. This competency extends beyond computational skills to include understanding, interpreting, and applying numerical information in diverse real-life contexts.

Similar challenges are also evident in mathematics learning at Madrasah Ibtidaiyah. Numeracy instruction in MI is frequently dominated by conventional teaching methods and textbook-based learning, with limited use of innovative media and contextual approaches. Consequently, students often struggle to grasp numeracy concepts meaningfully and to apply them in daily life. This situation highlights the urgent need for instructional innovations that integrate technology, contextual learning, and students' sociocultural backgrounds (Suryani, Wulandari, & Lestari, 2022).

One promising approach to address this issue is the ethnosocial approach, which is rooted in the concept of ethnomathematics. The ethnosocial approach emphasizes the integration of mathematical concepts with social values, cultural practices, and local community activities. By contextualizing numeracy learning within students' cultural and social environments, mathematics becomes more meaningful and relevant to their lived experiences. Previous studies have demonstrated that ethnomathematics-based learning can enhance students' conceptual understanding, learning motivation, and positive attitudes toward mathematics (Irawan, Putri, & Hartono, 2022).

With advances in educational technology, integrating the ethnosocial approach into Android-based interactive learning media offers substantial potential. Android-based media enable the presentation of numeracy content through interactive visuals, animations, audio, and simulations, which can accommodate diverse learning styles and increase student engagement. Research conducted by Nurdin, Rahman, & Mahmud (2021) revealed that Android-based interactive numeracy learning media were valid, practical, and effective in improving elementary students' numeracy skills. Similarly, (Hidayat, Mahmuzah, Qausar, & Sinaga, 2024) found that Android learning media incorporating ethnomathematical

elements demonstrated high practicality and received positive responses from students.

Furthermore, a systematic literature review by Tania, Prasetyo, & Widodo (2023) indicated a growing trend in research on Android-based learning media integrated with ethnomathematics, with consistent evidence of positive impacts on students' mathematics learning outcomes. Nevertheless, the review also highlighted a significant research gap: there is still limited research focusing on the integrated development of ethnosocial-based numeracy literacy, particularly within the context of Madrasah Ibtidaiyah. This gap is noteworthy, given that MI education emphasizes not only cognitive development but also the cultivation of social values, cultural awareness, and character education.

Teachers are expected to integrate numeracy literacy with ethnosocial elements so that students not only develop numerical competencies but also gain an understanding of local wisdom and cultural values in their daily lives. Ethnosocial learning integrates cultural elements and local wisdom into social learning processes. Indonesia possesses a rich diversity of cultural heritage and local wisdom, which should be utilized by teachers as learning materials and instructional resources (Asrial, Syahrial, Kurniawan, Maryono, & Nugro, 2019).

Learning that incorporates ethnosocial values aims to create learning experiences that are closely connected to students' lives, as it is grounded in the local culture and wisdom of their communities. Moreover, the integration of ethnosocial knowledge contributes to strengthening students' awareness and appreciation of their national culture (Asrial, Syahrial, Kurniawan, Maryono, & Nugro, 2019).

Based on observations and discussions with classroom teachers, it was found that many students at MIN 1 Sungai Tarab still experience difficulties in solving problems that require numeracy literacy skills. This is proven by the fact that students' daily test results are still below average. Of the 30 students, only 40% scored above average, while the rest of the students are still below average. This proves that the students' numeracy literacy is still low. Teachers also reported that mathematics instruction at the school remains conventional and monotonous, relying primarily on textbooks as the main learning resource. This condition reduces students' learning enthusiasm due to limited instructional media. In addition, the mathematics problems provided have not yet integrated elements of Minangkabau local culture. Along with technological advancements, there is a growing need for Android-based interactive learning media that allow students to utilize their smartphones more effectively for learning, both inside and outside the classroom. Therefore, this study aims to examine the development procedures and

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effectiveness of Android-based interactive learning media in improving students' mathematical literacy.

One of the contributing factors to low numeracy literacy integrated with ethnosocial values is the lack of contextual, interactive learning media that align with the characteristics of 21st-century learners. Conventional learning media that rely solely on textbooks and verbal explanations often fail to capture students' interest and attention, resulting in suboptimal development of ethnosocially integrated numeracy literacy. In this context, innovative learning media are required that not only present information clearly but also actively engage students in the learning process.

Based on these considerations, the development of Android based interactive learning media that integrate ethnosocial contexts and numeracy literacy is both relevant and necessary. Such media are expected to serve as innovative instructional tools that enhance students' numeracy literacy while simultaneously fostering social awareness and appreciation of local culture. Therefore, this study focuses on developing an Android-based interactive learning medium that is valid, practical, and effective in improving ethnosocial-integrated numeracy literacy among Madrasah Ibtidaiyah students.

METHOD

The following are the data and data sources obtained from this Research and Development (R&D) study, which include the results of observations, interviews, documentation, and numeracy literacy tests. The data sources in this study were 30 fifth-grade students, and there were three expert validators: two lecturers from PGMI UIN Mahmud Yunus Batusangkar and a fifth-grade teacher from MIN 1 Sungai Tarab.

This study employed a Research and Development (R&D) approach to design, develop, and evaluate an Android-based interactive learning media. The R&D process involved systematic stages of needs analysis, product design, development, and testing to ensure the feasibility of the developed media. This approach was selected to produce an instructional product that could be empirically assessed in terms of its validity, practicality, and effectiveness in supporting numeracy literacy learning.The development process in this study adopted the Borg and Gall instructional media development design. As explained by Sugiyono (2019), the Research and Development method is used to develop or validate products applied in educational settings. This model consists of four main stages: Define, Design, Develop, and Disseminate. These methods and models were selected to produce a media-based learning product that is valid, practical, and effective. The data and data sources in this R&D study were obtained through observations, interviews, documentation, and tests. The research subjects consisted of fifth-grade students, as well as three expert validators, including two

lecturers from the Primary School Teacher Education (PGMI) program at UIN Mahmud Yunus Batusangkar and one fifth-grade teacher from MIN 1 Sungai Tarab.

Table.1. *Score of Validation*

Score	Interpretation
81 % - 100 %	Very worth
62 % - 80 %	Worth
41 % - 60 %	Enough
21 % - 40 %	Not Worthy
0 % - 20 %	Not Feasible

Furthermore, the data were analyzed using both qualitative and quantitative analysis techniques. Qualitative analysis was based on feedback, suggestions, and expert opinions from validators on each aspect of the Android-based interactive learning media for numeracy. Conclusions were then drawn to determine the feasibility of the developed mini book media.

For quantitative analysis, numerical data were used to measure students' learning motivation related to the use of the mini book media in third-grade Indonesian language learning. The stages of quantitative data analysis included descriptive statistical analysis to assess students' numeracy literacy before and after the implementation of the media, as well as inferential statistical analysis to calculate the percentage of responses from the expert validators regarding the learning media in order to determine product validity. The use of a conversion scale for achievement levels was essential to standardize the scores, which were then matched with predetermined criteria.

The table illustrates that a product is considered valid when the overall evaluation score from content experts and design validators ranges between 60 and 100. Revisions are required if the evaluation results fall below the validity threshold. Meanwhile, the analysis of students' responses to the interactive learning media was conducted to assess their perceptions and acceptance of the developed product.

RESULT AND DISCUSSION

Need Analysis

At the analysis stage, the researchers conducted several types of needs analysis, including teacher needs analysis, student needs analysis, and learning media needs analysis. Interviews were carried out with classroom teachers and fifth-grade students at MIN 1 Sungai Tarab to identify the problems encountered by students in the learning process. The findings indicated that students demonstrated low learning motivation, low numeracy literacy skills, and limited awareness of Minangkabau local culture, despite the fact that most students are native Minangkabau.

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These conditions occurred because, although interactive learning media such as YouTube videos had been used in the learning process, the materials were still insufficiently engaging for students and had not been integrated with Minangkabau local cultural elements. Therefore, the development of Android based learning media is considered necessary to enhance students' learning motivation, particularly when combined with more varied instructional methods. In addition, an analysis of learning outcomes and learning objectives was also conducted at this stage.

Design

The design stage focused on constructing the instructional and conceptual framework of the Android-based interactive learning media integrated with ethnosocial values. This stage emphasized the alignment between learning objectives, numeracy literacy indicators, ethnosocial contexts, and multimedia presentation to ensure pedagogical coherence. According to Branch (2009), the design phase in instructional development aims to translate learning needs into structured learning experiences that guide the development of effective educational products.

Instructional Content Design

The learning content was designed based on the fifth-grade mathematics curriculum and numeracy literacy indicators, which emphasize problem-solving, reasoning, and the application of mathematical concepts in real-life contexts. Numeracy literacy was conceptualized as students' ability to interpret, use, and communicate numerical information meaningfully (OECD, 2019). Therefore, mathematical materials were organized around contextual problems that require students to analyze, reason, and make decisions using numerical data.

Integration of Ethnosocial Elements

Ethnosocial elements were embedded into the learning media by contextualizing numeracy problems within Minangkabau cultural practices, social activities, and local wisdom. This design approach is grounded in ethnomathematics theory, which asserts that mathematical understanding is closely related to cultural and social contexts (D'Ambrosio, 2001). Integrating local cultural elements into learning materials enables students to connect abstract mathematical concepts with their lived experiences, thereby enhancing conceptual understanding and learning relevance (Asrial, Syahrial, Kurniawan, Maryono, & Nugro, 2019; Irawan, Putri, & Hartono, 2022).

Multimedia and Learning Media Design

The learning media was designed in the form of Android-based interactive instructional videos that combine visual elements, narration, text, and animations. The use of multimedia elements is supported by the Cognitive Theory of Multimedia Learning, which states that students learn more effectively when information is presented through well-integrated verbal and visual representations (Mayer, 2009). Multimedia components were arranged to avoid cognitive overload and to support students' information processing during numeracy learning.

Learning Interaction and Engagement Design

The instructional flow of the media was designed to promote active student engagement through contextual problem presentation, guided explanations, and reinforcement activities. This design aligns with constructivist learning theory, which emphasizes that learners actively construct knowledge through interaction with learning materials and meaningful contexts (Piaget, 1970; Vygotsky, 1978). Interactive features were included to encourage students' attention, motivation, and participation during the learning process.

Usability and Accessibility Design

The media design also considered usability aspects, including visual consistency, readability, and ease of navigation, to ensure accessibility for fifth-grade Madrasah Ibtidaiyah students. According to Nielsen, 2012, user-centered design principles are essential in educational media to ensure that learners can interact with digital products effectively without technical barriers. Accessibility considerations were incorporated to support independent learning and teacher-assisted instruction.

Through these design considerations, the Android-based interactive learning media was conceptually prepared as an instructional product that integrates numeracy literacy, ethnosocial values, and multimedia learning principles to support mathematics learning at the Madrasah Ibtidaiyah level.

Development

At this stage, the developed ethnosocia integrated mathematics learning video for fifth-grade elementary students was tested. The testing procedures included validity testing, product practicality testing, and product effectiveness testing. The evaluation employed questionnaire instruments and numeracy literacy test sheets.

During this development stage, the learning media were first validated by two expert validators. The validators consisted of two lecturers from UIN Mahmud Yunus Batusangkar and one fifth-grade elementary school teacher. Subsequently, the learning media were implemented by teachers and students during the learning process to examine the practicality of the instructional video. The results obtained

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at this stage are presented in the following section. The following table presents the analysis of the validation results of the interactive learning video completed by three validators:

Table 2. Analysis of Validation Results of Android Based Learning Videos

No	Assessment Aspects	Validator 1	2	3	amount	score	%	Information
1	Suitability of content/material	12	15	12	39	45	87%	very valid
2	Language eligibility	14	17	16	47	60	78%	Valid
3	Suitability of material presentation	12	15	12	39	45	87%	very valid
4	Graphical eligibility	15	19	16	50	60	83%	very valid
amount		**53**	**66**	**56**	**175**	**210**	**83%**	very valid

Based on the table above, the analysis of the validation results of the ethnosocial-integrated android-based interactive learning video media obtained a percentage of 87% in the aspect of content/material feasibility, which is included in the very valid category. For the aspect of language feasibility, a percentage value of 78% was obtained which is included in the valid category. Furthermore, in the aspect of material presentation feasibility, a percentage result of 87% was obtained which is included in the very valid category. Then, in the aspect of graphic feasibility, a value of 83% was obtained which is included in the very valid category. Therefore, the analysis of the validation results of the ethnosocial-integrated android-based mathematics learning video obtained a percentage value of 83% which is included in the very valid category.

Practical results of interactive learning videos based on Android integrated with ethnosocial learning in mathematics subjects for class V at MIN 1 Sungai Tarab

The practicality of the Android-based interactive learning video integrated with ethnosocial values in fifth-grade mathematics learning at MIN 1 Sungai Tarab was examined based on the results of teacher and student response questionnaires administered after the learning implementation. The practicality testing was conducted over two instructional meetings focusing on fraction material. The participants consisted of 25 fifth-grade students, and the implementation was carried out over two class periods (2 × 35 minutes) for a single learning topic. During the practicality testing, the learning model was aligned with the instructional module designed by the classroom teacher. The practicality activities were conducted collaboratively by the researchers and the fifth-grade classroom teacher at MIN 1 Sungai Tarab, Mrs. Novendriati, S.Pd.

The following section presents the results of the practicality testing of the Android-based interactive learning video integrated with ethnosocial values in fifth-grade mathematics learning at MIN 1 Sungai Tarab. The teacher practicality questionnaire was completed by the fifth-grade classroom teacher, with the media trial conducted twice across two learning sessions in accordance with the material embedded in the learning media and aligned with the instructional module prepared by the teacher.

Overall, the practicality results based on teacher responses indicated a practicality percentage of 66%, which falls into the practical category. This classification is consistent with (Sugiyono, 2018), who states that a product is considered practical if the practicality score ranges between 61% and 80%. Therefore, it can be concluded that the ethnosocial-integrated interactive learning video for mathematics is practical for use by teachers during the learning process and supports the achievement of the planned learning objectives.

Based on the results of the student practicality questionnaire regarding the use of the Android-based interactive learning video integrated with ethnosocial values to improve numeracy literacy at MIN 1 Sungai Tarab, the product obtained a practicality percentage of 78.8%, which is categorized as practical. Referring to Sugiyono (2018), this percentage falls within the 61%–80% range, indicating that the learning media are practical for student use. Thus, it can be concluded that the Android-based interactive learning video integrated with ethnosocial values is practical for enhancing numeracy literacy among fifth grade students at MIN 1 Sungai Tarab and effectively supports the attainment of learning objectives.

Effectiveness

The analysis of media effectiveness was conducted based on data obtained from data collection instruments in the form of numeracy literacy test items to determine the extent of improvement in students' numeracy literacy skills. Effectiveness was assessed through classical mastery of the test results administered to students. According to Trianto, learning is considered classically complete if at least 75% of students achieve the minimum mastery score (Minimum Competency Achievement Criteria/KKTP), as expressed by the following formula:

$$\text{Classical Completion} = \frac{T}{Tt} \boldsymbol{x\ 100\%}$$

Information:

T = The number of scores obtained by students

Tt = Total score

Interpretation (Trianto):

≥ 75% = effective / complete learning.

< 75% = learning is not complete.

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This formula is often used in literacy and numeracy assessments in elementary schools because it adheres to the principle of learning completion. Determining learning outcomes completeness uses learning completion criteria. Individual student learning completion is assessed from the results of formative tests administered and compared with the KKTP (National Qualifications for Primary Schools).

The results of student literacy and numeracy effectiveness after using ethnosocially integrated Android-based learning videos are as follows:

$$\text{Classical Completion} = \frac{T}{Tt}\ x\ 100\% = \frac{2140}{2500}\ x\ 100\% = 85{,}6\%$$

Based on the results of the literacy and numeracy effectiveness tests above, it can be concluded that they are capable of improving students' numeracy literacy. This is because the questions provided are designed to measure students' literacy and numeracy. Of the 25 students, 22 scored above the minimum competency standard (KKTP), and 3 scored below it.

CONCLUSION

This study constitutes development research focusing on the creation of an Android-based interactive learning video integrated with ethnosocial values to enhance numeracy literacy among fifth-grade students at MIN 1 Sungai Tarab. Based on the needs analysis, development process, and product testing, the following conclusions are drawn.

First, the developed Android-based interactive learning video achieved a high level of validity, with a validation score of 87.75%, indicating that the content, language, presentation, and graphical aspects meet instructional media quality standards.

Second, the learning media demonstrated practical usability in classroom implementation, as reflected in student response scores of 78.8% and teacher response scores of 66%, suggesting that the media can be effectively used to support numeracy learning activities.

Third, the learning media proved effective in improving students' numeracy literacy, with classical mastery reaching 85.6%, indicating that the majority of students achieved the expected learning outcomes.

The scientific contribution of this study lies in the development of an Android-based interactive learning medium that systematically integrates numeracy literacy with ethnosocial values rooted in local Minangkabau culture within the Madrasah Ibtidaiyah context. Unlike previous studies that predominantly emphasize either technological features or ethnomathematical content separately, this study offers an integrative instructional design that combines digital interactivity, numeracy literacy indicators, and ethnosocial contexts into a single

learning product**.** This contribution provides an empirical reference for the development of culturally responsive digital learning media in primary Islamic education.

Based on the findings of this study, several recommendations are proposed. First, the Android-based interactive learning video integrated with ethnosocial values can be used as an alternative instructional medium by teachers to enhance numeracy literacy in fifth grade mathematics learning, particularly in Madrasah Ibtidaiyah. Teachers are encouraged to integrate this media with various instructional strategies to maximize student engagement and learning outcomes.

Second, future researchers are advised to further develop interactive learning videos by incorporating more diverse learning materials, higher levels of interactivity, and additional ethnosocial elements from various local cultures to broaden students' cultural understanding. The integration of interactive features such as quizzes, feedback, and gamification is also recommended to increase student motivation.

Third, subsequent studies may involve larger and more diverse samples, extend the duration of implementation, and apply experimental or quasi-experimental designs to obtain more comprehensive evidence regarding the effectiveness of Android based interactive learning media on numeracy literacy development.

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