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Original Article

Interactive Local Wisdom E-Book with EARLS Features to Promote Tolerance Among Young Learners

Fina Zulfa Mustafidah[1]*, Wayan Dasna[1], Dedi Kuswandi[1], Shirly Rizki Kusumaningrum[1]

Abstract: This study aimed to develop and evaluate an interactive local wisdom based e-book integrated with the Environment Augmented Reality Learning System (EARLS) to support tolerance-oriented learning among elementary school students. EARLS is conceptualized as a pedagogical framework combining contextual cultural narratives, augmented reality based visualizations, reflective tasks, and collaborative learning activities to foster respect for diversity and cooperative behavior. A research and development approach based on the Lee and Owens model was employed, involving 17 fifth-grade students in a public elementary school in Indonesia during the field implementation phase. Tolerance was assessed through structured classroom observations, students' performance on learning tasks, and pretest–posttest outcomes related to tolerance concepts. The findings indicate that the e-book demonstrates high feasibility and practicality, with moderate effectiveness reflected in improved student engagement and tolerance-related understanding. Beyond product validation, this study contributes theoretically by operationalizing EARLS as a culturally grounded augmented reality framework for character education, providing empirical insight into how local wisdom–based digital media can support tolerance development in primary education. However, results should be interpreted cautiously due to the small sample size and the one-group pretest–posttest design, which may limit generalizability. Future research involving larger samples and comparative designs is recommended to examine the broader applicability of EARLS-based local wisdom digital learning.

Keywords :
Interactive e-book; Local wisdom-based learning; EARLS framework; Tolerance and character education

Author Affiliation:
[1] Department of Basic Education, Graduate School, Universitas Negeri Malang, Jawa Timur, Indonesia

***Corresponding author(s):**
Fina Zulfa Mustafidah, Universitas Negeri Malang, Indonesia
fina.zulfa.2321038@students.um.ac.id

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INTRODUCTION

Tolerance is increasingly critical in elementary education, especially in culturally diverse classrooms where respectful interaction is expected (Dunham & Oti, 2025;

Casmana et al., 2023). In Indonesia, it is a core value in character education, yet its implementation is often implicit, with students frequently showing low tolerance behaviors due to learning practices that prioritize cognitive achievement over reflection and interaction (Lestari et al., 2023; Lovren & Jablanovic, 2023). Teachers face challenges translating abstract tolerance values into engaging, age-appropriate experiences, and studies tend to emphasize normative expectations over actionable strategies (Zakso et al., 2021; Xu et al., 2023). This highlights the need to revitalize learning plans and instructional media, enabling students to practice tolerance through context-rich, experiential activities such as storytelling, guided reflection, and collaborative discussion (Huang et al., 2024; Aderibigbe et al., 2023).

To address these challenges, learning planning and content can be linked to daily-life stories that illustrate tolerance, with collaborative activities such as group discussions enabling students to demonstrate cooperative behavior, respectful communication, and active problem-solving (Lin et al., 2022). However, existing approaches rarely integrate these contextual and collaborative strategies into systematically designed digital learning media (Franco et al., 2012; Sofna, Zakwandi, & Purwasih, 2024) to support tolerance development among young learners. Previous research shows Pancasila education materials can cultivate students' tolerance by 53.6%, fostering harmony, respect for diversity, and personality development, while enhancing emotional, analytical, and participatory skills in learning activities (Prasetyo, 2023; Bayu et al., 2025; Kwangmuang et al., 2024).

Teaching tolerance faces multiple challenges, including students' diverse backgrounds and learning styles, time constraints, overly theoretical Pancasila content, and gaps in digital media quality and relevance (Putra & Kurniawan, 2021; Beyer & Brese, 2024; Feng et al., 2025; Siswanto et al., 2024; Ihsan & Fatah, 2021; Owen, 2017). Conventional learning tools, such as boxes, monopoly games, picture cards, and information boards, often fail to engage students, support reflection, or contextualize tolerance due to limited teacher competencies (Ormond & Vietti, 2022; Diana & Chairiyah, 2021; Huangfu et al., 2025). Observations in Malang show that, despite most students scoring above 75, frequent conflicts indicate a gap between conceptual understanding and behavior (Chen, Sherren, Smit, & Lee, 2023; Firman & Efendi, 2023; Imawan, Rahmatan, & Hania, 2023). Predominantly lecture-based instruction with minimal interactive media and weak links to local wisdom restricts independent learning and engagement. These issues highlight the need for teaching materials and media that integrate visualizations, contextual examples, and interactive strategies to foster concrete, tolerance-oriented learning experiences (Ridder, 2017; Robinson, 2020; Asencios-Trujillo et al., 2024).

The solution is to develop interactive multimedia teaching materials, incorporating images, videos, sounds, and augmented reality (AR), to enhance engagement, contextualize content, and improve student outcomes (Ongor & Uslusoy, 2023; Halvoník & Kapusta, 2020; Chang et al., 2023; Panciroli et al., 2023). E-books integrating indigenous knowledge and local wisdom, such as Malang's Panji Malang, foster empathy, cooperation, and respect while promoting experiential tolerance learning through narrative scenarios, reflective questions, and collaborative tasks (da Silva et al., 2024; Sakti et al.,

2024; Asmayawati et al., 2024). Grounded in the broader Panji tradition recognized as Southeast Asian cultural heritage, AR-based materials provide realistic visualizations that support students' love for their homeland and tolerance of diversity in elementary education.

METHOD

This study employs a research and development (R&D) approach using the Lee & Owens Model, with a descriptive pre-experimental design to evaluate the feasibility, practicality, and impact of the developed e-book on students' tolerance-related behaviors (William W. Lee & Owens, 2004). The model emphasizes interactive multimedia development for technology-based media in elementary schools, beginning with need assessment and front-end analysis to ensure solutions align with user needs (Aka, 2019; Kuswandi et al., 2022). This approach allows the e-book to be integrated with Learning Management Systems (LMS), supporting accessible e-learning anytime and anywhere (William W. Lee & Owens, 2004).

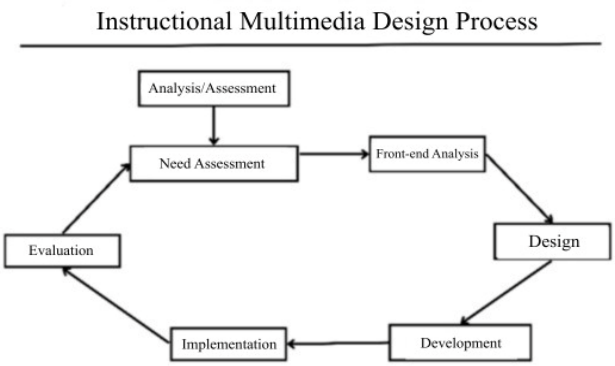

Figure 1. Multimedia Design Development Procedure

In this study, the Lee and Owens model was operationalized through several systematic stages. The needs assessment stage was conducted to identify instructional problems related to tolerance learning in Pancasila Education through classroom observations and teacher interviews. The front-end analysis stage focused on analyzing learner characteristics, curriculum demands, and learning context at the elementary school level, which informed the instructional requirements of the developed e-book. The design and development stages involved structuring learning content based on local wisdom, applying multimedia design principles, and integrating augmented reality features to support interactive and contextual tolerance learning.

The implementation stage was carried out by using the developed EARLS-based e-book in classroom learning activities, while the evaluation stage focused on assessing feasibility and practicality through expert validation and user responses, as well as observing students' tolerance-related learning behaviors during classroom implementation. Overall, the Lee and Owens model provided a structured and iterative framework that guided the development and evaluation of the EARLS-based e-book in alignment with the research objectives. The stages of research and development of the Lee

& Owens model are adjusted to the conditions and needs of the *local wisdom e-book* product of Panji Malang to increase the tolerance attitude presented in the following figure.

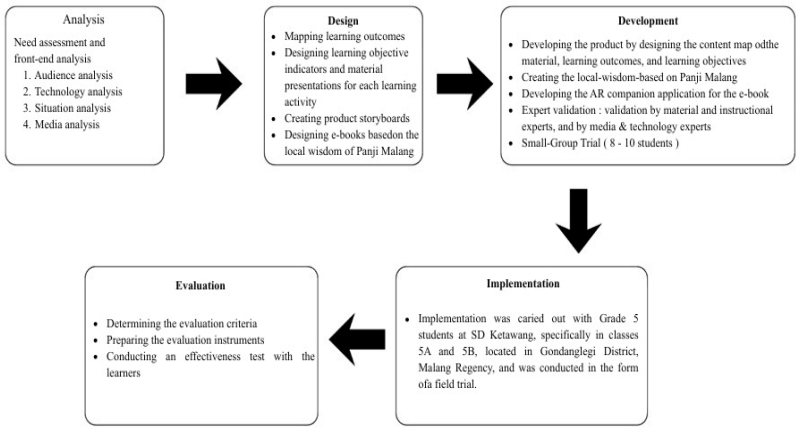

Figure 2. Lee & Owens Model Modified Development Procedure

Data were collected using a mixed-methods approach. Qualitative data came from semi-structured interviews, classroom observations of tolerance behaviors, validation questionnaires, and documentation of students' work and learning activities. Interviews explored instructional challenges and teachers' perceptions prior to EARLS-based e-book implementation, while questionnaires assessed feasibility and practicality, reviewed for content validity. Quantitative data were obtained from pretests and posttests measuring students' understanding of tolerance concepts in Pancasila Education, aligned with learning objectives and validated for reliability (Ozkazanc & Yuksel, 2015; Wijayanti & Mundilarto, 2015). Triangulation of observations, test scores, and questionnaires ensured comprehensive analysis, with descriptive quantitative and qualitative techniques applied and expert evaluations quantified to determine the e-book's feasibility.

$$V_{ah} = (T_{se} / T_{ah}) \times 100\%$$

In this formula, Tse represents the total score obtained from expert evaluation, while Tah denotes the maximum possible score that could be assigned. The resulting percentage, Vah, provides a standardized measure of the material's validity, allowing researchers to categorize the e-book as highly valid, quite valid, less valid, or invalid. This method ensures that the evaluation of teaching materials is both quantitative and comparable across different experts, providing a clear and objective basis for assessing instructional feasibility. The resulting percentage provides a standardized measure of the material's validity, which is then categorized to interpret the level of feasibility. Table 1 presents the validation categories used to classify the e-book based on the Vah percentage.

Table 1. Validation Categories

Validity Criteria	Assessment Criteria
85.01 – 100.00%	Highly Valid
70.01 – 85.00%	Quite Valid
50.00 – 70.00%	Less Valid
1.00 – 50.00%	Invalid

Table 1 presents the classification of the validation results for the EARLS-based e-book based on the percentage scores (Vah) from expert evaluations. Scores of 85.01%–100% are considered highly valid, indicating the material meets the highest standards of feasibility and instructional quality. Scores of 70.01%–85% are classified as quite valid, suggesting minor improvements for optimal implementation, while 50%–70% is less valid, requiring significant revisions. Scores below 50% are deemed invalid, reflecting material that does not meet acceptable classroom standards. This classification provides a clear, quantitative basis for evaluating the e-book and guiding refinements to enhance its effectiveness in supporting tolerance-oriented learning.

Quantitative learning outcome data were analyzed to evaluate the effectiveness of the e-book using a one-group pretest–posttest design (Asiyah, Putri, Restiana, & Lestari, 2023; Yani, Marliyani, Febry, & Armita, 2023), classified as a pre-experimental approach (Creswell & Creswell, 2018). This design was chosen to measure changes in students' learning outcomes before and after the intervention in real classroom settings where the use of control groups was not feasible. Prior to analysis, pretest and posttest scores were examined descriptively to ensure appropriate score distribution for subsequent gain calculations. To illustrate the research procedure, the study employed a one-group pretest–posttest design, which allows for the measurement of changes in students' learning outcomes before and after the implementation of the e-book. The overall structure of this design, including the sequence of pretest administration, intervention, and posttest assessment (Creswell & Creswell, 2018), is presented in Figure 3.

O_1	X	O_2

Figure 3. Research Design of One Group Pre-test Post-test

Figure 3 illustrates the one-group pretest–posttest design (Creswell & Creswell, 2018), where O_1 is the pretest, X is the EARLS-based e-book intervention, and O_2 is the posttest. This design evaluates changes in students' learning outcomes and tolerance behaviors by comparing scores before and after the intervention, providing a practical measure of instructional effectiveness despite the absence of a control group (Mazly & Syamsudin, 2025). Learning improvement was quantified using normalized gain (N-gain) as an effect size (Coletta & Steinert, 2020), calculated from pretest, posttest, and ideal scores (Febrilita, Yuliza, & Merlina, 2023; Saputra, Pamungkas, & Septriani, 2023). N-gain values were interpreted descriptively as low, medium, or high (Table 2) to assess the impact of the e-book on tolerance-related learning outcomes.

Table 2. Normalized Gain Categories

N-Gain Score	Criteria
$g > 0.7$	High
$0.3 \leq g \leq 0.7$	Medium
$g < 0.3$	Low

Table 2 presents normalized gain (N-gain) categories used to assess students' learning improvement. N-gain compares actual gain to the maximum possible gain, with

scores > 0.7 classified as high (significant improvement), 0.3–0.7 as medium (moderate improvement), and < 0.3 as low (minimal improvement), following Coletta and Steinert (2020). Qualitative observation data were reduced and categorized to contextualize quantitative findings, strengthening interpretation through triangulation.

RESULT AND DISCUSSION

Analysis

The initial stage in developing the product involved conducting a needs analysis to identify the appropriate requirements and objectives that would serve as the foundation for the product. This analysis was carried out in two phases: need assessment and front-end analysis. Additionally, audience analysis, an evaluation of school facilities and infrastructure, and technology analysis were conducted to further strengthen the findings related to the research context and subjects. These steps ensured that the product would be aligned with students' learning needs, the teachers' instructional practices, and the available technological resources. The data gathered helped to identify gaps in existing learning materials and guided the formulation of learning objectives and content structure. The detailed results of this analysis are presented in Table 3.

Table 3. Recapitulation of Analyses of Subject Need

No	Analysis Type	Result
1	Need Assessment and front-end analysis	• Local wisdom education in schools is still limited to cultural introduction, without exploring noble values for character building. • Local cultural values have not been integrated into Pancasila material, so students lack knowledge of the culture in their environment.
2	Audience Analysis	• The research targets were Year 5 primary school pupils aged 11–12 years, who still exhibited egocentric tendencies and needed guidance to develop tolerance. • The pupils stated that there was a lack of learning media on local wisdom, which led to boredom and had an impact on low learning outcomes.
3	Learning Facility Analysis	• The main learning resources used by teachers include government teacher handbooks, student workbooks, and instructional videos. • Supplementary learning media used for students include interactive presentations and YouTube videos adjusted to the material.
4	Technology Analysis	• The school has smartboards that support interactive learning. • There are six computers connected to the internet to support digital learning. • The use of mobile phones requires parental permission to ensure that it is carried out according to the rules.  

Findings indicate that local wisdom education in schools mainly focuses on cultural introduction, with limited emphasis on internalizing values such as tolerance. This gap guided the design of the EARLS-based e-book, integrating local wisdom narratives into Pancasila Education through interactive, reflective activities. Limited incorporation of cultural values into civic education highlights the need for media that connect abstract civic concepts to students' cultural context, supporting tolerance development among Year 5 pupils (Sakti et al., 2024). Audience analysis showed that 11–12-year-old students exhibit egocentric tendencies and low engagement, justifying the use of interactive digital and augmented reality features to enhance engagement, In the process of social interaction, and also perspective taking.

Design

The follow-up after the needs analysis for students is to design an e-book on local wisdom in Panji Malang with the EARLS feature for learning students' tolerance attitudes. This design was directly informed by the needs analysis, which revealed limited integration of local wisdom into value-based learning and a lack of instructional media that facilitate the internalization of tolerance. Therefore, the e-book components were designed not merely as structural elements, but as pedagogical tools intended to support contextual, reflective, and interactive learning experiences.

The e-book comprises (1) the front cover, (2) introduction, (3) table of contents, (4) e-module usage instructions, (5) augmented reality guidelines, (6) learning objectives and outcomes per sub-chapter, (7) learning materials, (8) group worksheets, (9) individual worksheets, (10) evaluation questions, (11) answer key, (12) glossary, (13) references, and (14) the back cover. Details of the materials and features are presented in the following table. Their selection and sequencing were based on needs analysis, which revealed students' limited exposure to tolerance values and low engagement with traditional text-based materials. The learning sequence progresses from familiar cultural diversity, to Panji Malang local wisdom as concrete moral narratives, and culminates in reflective activities such as sociodrama to foster perspective-taking and social interaction. This structure aligns with students' developmental characteristics, addresses egocentric tendencies, and uses augmented reality to enhance engagement and contextual understanding. Therefore, the materials serve not only as content delivery but also as empirically informed tools to promote meaningful tolerance-oriented learning outcomes.

Development

Product development is developed according to a pre-designed storyboard at the design stage. The material presented was obtained from books and journals and conducted interviews and visits to local museums to obtain information about Panji folklore. After all the materials are collected, then development is carried out regarding activities and activities that can be done by students both in group discussions and independent activities. Then the e-book layout process was carried out and the design arrangement was carried out related to the augmented reality features integrated in it. These stages of development will be presented in Table 4.

Table 4. Summary of Development Phases

No	Development Phase	Description
1	Phase 1	Developing front cover design for Panji Malang's e-book on local wisdom for teaching tolerance.
2	Phase 2	Determination of learning objectives and learning outcomes for the material presented in the e-book.
3	Phase 3	Development of instructions for using the Panji Malang local wisdom e-book and instructions for using the augmented reality feature.
4	Phase 4	Designing student activities in the Panji Malang local wisdom e-book in the form of group activities and independent activities.
5	Phase 5	Development of a companion application with augmented reality features as additional information to the material presented in the e-book.
6	Phase 6	Development of an e-book companion application using augmented reality features

During the product development stage, a prototype of the EARLS-based e-book was created to transform the design concepts and analysis findings into a functional learning resource. This prototype integrates content, interactive features, and visual elements to ensure it is both pedagogically effective and user-friendly. As can be seen in Figure 4, the developed e-book prototype presents its main features and overall layout, providing a preliminary model that can be further refined based on user feedback.

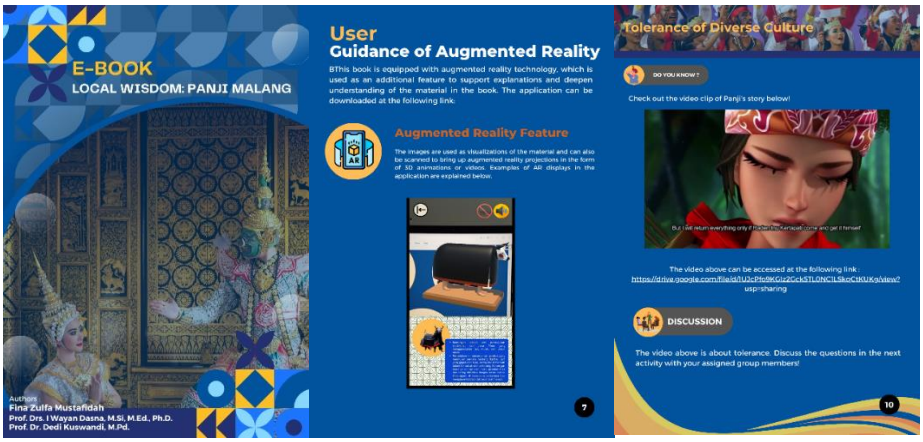

Figure 3. Product Prototype of E-book

The development phase of the EARLS-based e-book began with the design of the front cover, which was intended to visually represent Panji Malang local wisdom as an entry point for tolerance learning. This was followed by the determination of learning objectives and learning outcomes to ensure alignment between the instructional content and the targeted tolerance competencies. Subsequently, clear instructions were developed to guide students in using both the e-book and its augmented reality features, supporting independent and structured learning. Student learning activities were then designed in the form of group and individual tasks to facilitate collaboration, reflection, and the internalization of tolerance values.

Product Validity Test Analysis

Product validity was assessed by experts in their respective fields using standardized evaluation forms covering predefined aspects. Individual scores were aggregated to calculate an overall average, which was then analyzed to determine the product's compliance with the validation criteria shown in Table 1. A summary of the results from each validator is presented in Table 5.

Table 5. Recapitulation of Expert and User Validation Results

No	Subject	Validation Results (%)	Information
1	Material Expert	91.5	Highly Valid
2	Teaching Materials Expert	100	Highly Valid
3	Learning Media Expert	93.8	Highly Valid
4	User (teacher)	96	Highly Valid
	Average	98	

The e-book and AR-enhanced materials underwent four validations, showing high feasibility: material experts (91.5%) recommended aligning instructions and adding 3D explanations; teaching material experts (100%) suggested improvements in headings, font, and layout for readability (Cespedes & Navarro, 2023; Marchenko et al., 2021); learning media experts (93.8%) confirmed AR effectiveness, prompting revisions for responsiveness; and teachers (96%) endorsed usability, with clearer, student-friendly instructions. These validations confirm the product is pedagogically sound, age-appropriate, and optimized for interactive learning. Innovative technology-based platforms enhance learning experiences (Pandita & Kiran, 2023), and civic education for elementary students should foster values and societal contributions (Asencios-Trujillo et al., 2024). Accordingly, the student test was validated for alignment with tolerance objectives and piloted with 17 students to assess validity and internal consistency (Table 6).

Table 6. Recapitulation of Validity Test on Essay Questions

No	Number of Question	r-value	r-tabel (N:17)	Category
1	X1	0.517	0.482	Valid
2	X2	0.574	0.482	Valid
3	X3	0.508	0.482	Valid
4	X4	0.697	0.482	Valid
5	X5	0.809	0.482	Valid
6	X6	0.693	0.482	Valid
7	X7	0.689	0.482	Valid
8	X8	0.682	0.482	Valid
9	X9	0.543	0.482	Valid
10	X10	0.615	0.482	Valid

A pilot sample of 17 students was used to evaluate item quality before larger-scale implementation. Although sufficient for preliminary analysis, the small sample limits generalizability. Reliability tests were conducted, and as shown in Table 5, all essay items had r-values exceeding the r-table ($r > 0.482$), indicating statistical validity. Higher r-values reflect stronger alignment between student responses and the intended tolerance learning outcomes.

Table 7. Reliability Statistics

No	Number of Question	Cronbach's Alpha if Item Deleted	Category
1	X1	0.879	Sufficient Reliability
2	X2	0.852	Sufficient Reliability
3	X3	0.835	Sufficient Reliability
4	X4	0.838	Sufficient Reliability
5	X5	0.856	Sufficient Reliability
6	X6	0.841	Sufficient Reliability
7	X7	0.850	Sufficient Reliability
8	X8	0.856	Sufficient Reliability
9	X9	0.859	Sufficient Reliability
10	X10	0.832	Sufficient Reliability

The overall Cronbach's Alpha value of 0.863 demonstrates sufficient internal consistency of the instrument. Furthermore, the Cronbach's Alpha if Item Deleted values remain above 0.7 for all items, indicating that no individual item weakens the reliability of the test. These results confirm that the instrument consistently measures tolerance learning outcomes across items. Despite the limited pilot sample size, the validity and reliability findings provide adequate empirical support for the use of the instrument in the main study. Consequently, the validated and reliable essay items were employed in the pretest and posttest to assess changes in students' tolerance learning outcomes following the instructional intervention.

Product Attractiveness and Practicality Test Analysis

This test is carried out after the product feasibility test is carried out by experts and after the product is implemented in learning activities. This test was carried out by distributing user response questionnaires, namely students in small group trials and field trials. This response will be used as a benchmark in reviewing the practicality, convenience and attractiveness of the product by students. The following images depict the trials conducted on students.

Figure 4. Small Group and Field Trial on Developed Product

Figure 4. illustrates the implementation of the developed product during small group and field trials. The following table presents a recapitulation of the results from the student response questionnaire, summarizing learners' perceptions of the e-book and AR-enhanced materials in terms of usability, engagement, clarity, and the effectiveness of

learning activities. These data provide insight into students' acceptance of the product and its potential to support interactive and contextual learning experiences.

Table 8. Recapitulation of User (Students) Response Results

No	Subject	Validation Results (%)	Information
1	Small Group Trial Student	87,64	Practical and Attractive
2	Field Trial Students	80,27	Practical and Attractive
	Average	83,96	

In the practicality and attractiveness of this media, it is strongly supported using augmented reality features in it which make students more motivated in learning activities. This is evidenced from research carried out by Buchori et al., (2017) that students who use augmented reality learning can increase motivation which has an impact on improving learning outcomes. In addition, fun and memorable learning in students' daily lives also plays an important role in children's growth and development (Kuswandi & Fadhli, 2022).

Implementation

Product Effectiveness Test Analysis

Student Activity Data Analysis

This data was obtained from student learning activities carried out during the learning activity process when field trials were carried out. The results of this learning activity were collected from the learning activities carried out. Then the results of the learning data are analyzed through several steps, namely a) the calculation of the total score in the learning activity, b) the calculation of the average score in percentage related to the results of learning activities and c) the drawing of conclusions from the results of learning activities carried out by students. The recapitulation data is divided into two, namely reviewed from group tasks and independent tasks, which will be presented in the table 9.

Table 9. Recapitulation of Group Task Activities

No	*Group Assignments*	*Average Work Results (%)*
1	Material 1: Tolerance and Intolerance	76.25
2	Material 2: Malang Local Wisdom	75
3	Material 3: Tolerance and Its Elements	84.3
4	Material 4: Supporting and Inhibiting Factors of Tolerance	82
5	Material 5: Sociodrama	97.5
	Average	83.01

Based on the data in the table above, the results of the recapitulation of student group assignments carried out in the five learning activities carried out in the research activities obtained an overall average of 83.01% which shows a good category. This also indicates that students can solve problems presented in group activities well. The highest average score was obtained in Material 5 (Sociodrama), indicating that learning activities involving role-play and contextual scenarios were particularly effective in engaging students and supporting their understanding of tolerance concepts. This suggests that

interactive features of the e-book, supported by AR visualization, may have facilitated collaborative learning and active participation.

Students enthusiastically and collaboratively completed the group tasks, demonstrating that the Panji Malang Local Wisdom e-book with its companion application positively influenced knowledge, particularly in local wisdom and tolerance. However, variations in average scores across materials indicate that performance was not uniform, likely due to task complexity, prior familiarity with the content, and interaction requirements. Thus, observed learning gains reflect not only the e-book intervention but also pedagogical and contextual factors. In addition to group tasks, students completed independent activities at each session to assess individual mastery of the materials, with the results summarized in Table 10. These independent tasks provided insight into each student's ability to apply concepts without peer support and highlighted areas needing additional guidance or reinforcement. The combination of group and individual activities ensured a comprehensive evaluation of both collaborative skills and personal understanding. Monitoring both types of activities also allowed teachers to identify patterns of engagement and adapt instruction to support struggling learners. The image below illustrates students actively engaged in a group assignment, reflecting high levels of participation and interaction.

Table 10. Recapitulation of Individual Assignments in Students Activities

No	Name	Minimum Standard	Learning Activity				
			1	2	3	4	5
1	FRL	70	30	65	Absent	50	Absent
2	DRS	70	70	80	85	60	90
3	ADK	70	70	80	70	70	Absent
4	FND	70	70	Absent	Absent	Absent	100
5	NBL	70	100	80	85	90	80
6	FJR	70	100	50	Absent	50	85
7	ASY	70	75	Absent	Absent	90	100
8	NAR	70	80	80	85	90	100
9	AFH	70	100	90	90	90	100
10	HRM	70	100	80	85	100	85
11	WRA	70	100	95	90	100	100
12	AVR	70	100	90	90	90	88
13	BGS	70	60	50	70	Absent	50
14	ALD	70	80	80	Absent	Absent	Absent
15	VCY	70	80	Absent	90	50	88
16	ADM	70	Absent	77	70	50	40
17	TLT	70	Absent	Absent	88	90	100
Average			81	76.69	83.17	76.43	86.14
Overall average			80.68608059				

Based on Table 9, the overall average score of individual assignments reached 80.69%, indicating that students generally achieved satisfactory individual learning outcomes. Nevertheless, the data show several cases of absence and scores below the minimum standard, suggesting variations in individual engagement and learning consistency. These findings indicate that individual learning outcomes were influenced not only by the instructional media but also by student attendance, learning motivation, and participation during the learning process.

Student Learning Outcomes Data Analysis

The analysis of this data test was carried out descriptively and analyzed experimentally using a one group design pretest – posttest. The test was to determine the difference in the average increase in the trial group before the use of the Panji Malang Local Wisdom e-book with a companion application with treatment results after the use of the product. The average overall pretest score of students was 70.80, while the posttest score increased to 82.94, showing a gain of 17.31%. These results indicate a positive impact of the e-book intervention on student learning outcomes. The data will be presented in detail in the following Table 11.

Table 11. Summaries of The Results of Student Pre-test and Post-test.

No	Name	Minimum Score Standard	Pre-test Score	Description	Post-test Score	Description
1	AFH	70	72	Completed students: 11 people or 65%	94	Completed students : 15 people or 88%
2	ALD	70	79		81	
3	ADK	70	60		50	
4	TLT	70	64	Students who have not completed : 6 people or 35%	100	Students who have not completed : 2 people or 12%
5	WRA	70	100		100	
6	DRS	70	79		76	
7	AVR	70	80		98	
8	FRL	70	33		72	
9	BGS	70	37		54	
10	FJR	70	81		83	
11	ASY	70	80		90	
12	NBL	70	72		95	
13	NAR	70	75		91	
14	ADM	70	61		76	
15	HRM	70	96		100	
16	VCY	70	49		76	
17	FND	70	84		74	
Average			70.70588235		82.9411764	

The e-book improved student outcomes in local wisdom and tolerance, with posttest gains reflecting achievement of learning objectives. Some variation in progress likely resulted from prior knowledge or engagement with AR features. Data will be further analyzed for normality (Table 12).

Table 12. Assumption Checks – Test of Normality (Shapiro-Wilk)

	W	p
Pretest - Posttest	0.963	0.694

The data above shows that the p-value in the table is 0.694 which means that above 0.05 the data is declared to be normally distributed, and the difference between pretest and posttest data will be calculated using paired analysis of t-test samples for the design of one group pretest posttest. The results of the t-test calculation are shown in Table 13.

Table 13. Paired Samples T-Test

Measure 1	Measure 2	t	df	p
Pretest	Posttest	-3.440	16	0.003

The p-value of 0.003 (< 0.05) indicates a significant difference between pretest and posttest scores, showing that the Panji Malang Local Wisdom e-book with its companion application positively affected student learning outcomes. However, causal interpretations are limited due to the one-group pretest–posttest design, and external factors such as teacher facilitation, parental support, and student motivation may have influenced the results. The analysis was then continued with a normalized gain test to evaluate the product's effectiveness during field trials.

Table 14. Normalized Gain Calculation

No	Subject	Average (in each category)	Number of Students
1	High N-Gain	0.90	5
2	Medium N-Gain	0.56	4
3	Low N-Gain	0.20	4
4	No increase	0.00	4
	Average	0.44 (Medium)	

The average normalized gain was 0.44, classified as medium, with varied scores among students. While most students improved, four showed no progress, and one student's score decreased below the minimum standard. Field trial results indicate that the Panji Malang Local Wisdom e-book, supported by AR features, facilitates independent learning under teacher and parent supervision and can enhance learning outcomes and tolerance-related understanding. Despite limitations, the findings support further refinement and potential broader implementation, aligning with Lee (2023), who highlights the benefits of digital teaching materials for students with low achievement, and Shalgimbekova et al. (2024), who emphasize the impact of teacher-selected materials on elementary student performance.

Evaluation

The last stage in research and development is the evaluation stage. This stage is carried out in two types of evaluation, namely formative evaluation and summative evaluation. Formative evaluation is carried out to evaluate the quality of the product development implemented. Meanwhile, a summative evaluation is carried out to determine

the effectiveness of the developed product. In detail, the evaluation will be explained in the following explanation.

Table 15. Summary of Evaluation Stage on Developed Product

No	Evaluation	Description
1	Formative Evaluation	Design Stage Evaluation • Improvement of the learning design in the e-book, as well as the order of materials and activities that need to be adjusted to the learning approach used • Improvement of the design of the e-book theme used from the original chocolate theme to blue and green themes to be more in line with the theme of local wisdom Evaluation of Development Stages • Evaluation carried out by the developer during the testing of the developed product and adjustments are made regarding the 3D model that appears in the form of augmented reality that is less stable • Improvements based on expert advice from materials, teaching materials, learning media and users (teachers) Evaluation of Implementation/Trial Stages • Product revisions are carried out according to the response from users based on the attractiveness and practicality of the product. One of the comments given was a typo on the e-book that was developed
2	Summative Evaluation	Summative evaluation showed that the Local Wisdom e-book and companion applications were effectively used in learning. The small-group trial produced an 87.64% response (very effective), while the field trial obtained 80.27% (effective). Overall, the product was declared effective in terms of attractiveness and practicality.

CONCLUSION

The development of the EARLS-enabled Panji Malang Local Wisdom e-book was found to be feasible, practical, and effective as a digital learning resource for fostering tolerance among elementary school students. Expert validations confirmed the product's high suitability, student feedback demonstrated strong engagement and usability, and posttest results indicated significant improvements in learning outcomes. These findings highlight the potential of integrating local cultural content with augmented reality to reduce conceptual abstraction, provide concrete learning experiences, and support character formation related to tolerance. However, these results should be interpreted with caution due to methodological limitations, including the small sample size, the one-group pretest–posttest design, and variability in individual student outcomes. Uneven learning gains suggest that effectiveness may have been influenced by prior knowledge, student motivation, teacher facilitation, and engagement with EARLS features, which limit causal inference and generalizability.

Based on the empirical evidence, the Interactive Local Wisdom E-Book with EARLS features can be recommended as a supportive classroom tool, particularly in language, social studies, and character education. Future implementation at scale should consider technological infrastructure, teacher readiness, and contextual differences across schools. Further research is encouraged using larger samples, more rigorous experimental designs, and expanded cultural content to strengthen evidence on the long-term impact of digital local-wisdom-based learning on students' character development.

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