

# Development of Android-Based Interactive Media KaLoT on Cultural Diversity and Local Wisdom

Arin Eko Yulianto<sup>1</sup>, Rahyu Setiani<sup>2</sup>, Ajar Dirgantoro<sup>3</sup>, Dian Septi Nur Afifah<sup>4</sup>

Universitas Bhinneka PGRI, Tulungagung, Indonesia

Author Email: ryn.izzaa@gmail.com<sup>1</sup>, rahyusetiani@gmail.com<sup>2</sup>, ajardirgantoro@gmail.com<sup>3</sup>, dian.septi@ubhi.ac.id<sup>4</sup>

**Abstract.** The availability of interactive learning media determines the success of educational processes, especially in implementing the Merdeka Curriculum. This study was motivated by low learning interest (mean 53.9%) and IPAS learning outcomes (mean 68.5; below the KKTP of 75) among fourth-grade students at SD Negeri 1 Nglebo, Trenggalek, attributable to limited instructional media. This study developed the Android-based interactive learning application "KaLoT" (*Keragaman Budaya memuat Kearifan Lokal Trenggalek*), integrating national cultural diversity with Trenggalek local wisdom. The Research and Development (R&D) methodology with the ADDIE model was employed, involving 14 students (SD Negeri 2 Suruh) for small-group trials and 23 students (SD Negeri 1 Nglebo) for large-group trials. Data were collected via expert validation sheets, teacher response questionnaires, classroom observation sheets, learning interest questionnaires, and HOTS-based pre-test/post-test assessments, analyzed using quantitative descriptive analysis and N-Gain. Results demonstrated: (1) very high validity at 93.85%; (2) very high practicality averaging 93.46%; and (3) effective improvement of learning outcomes with N-Gain of 0.71 (small group), 0.75 (Class IVA), and 0.66 (Class IVB), with learning interest rising from 53.5–55.8% to 91.0–93.2%. The study concludes that "KaLoT" is valid, practical, and effective for IPAS learning in Grade IV elementary school.

**Keywords:** Android, interactive learning media, learning interest, learning outcomes, IPAS

## 1 Introduction

The rapid advancement of digital technology in the 21st century demands that education innovate in delivering media that is relevant and engaging for the digital generation. Kemendikbudristek (2022), states that the Merdeka Curriculum is designed to provide flexibility for educational units in developing student-centered learning through the approach of teaching at the right level. In this curriculum, the Natural and Social Sciences (IPAS) subject integrates natural and social science content holistically, encompassing cultural diversity and local wisdom as Phase B learning achievements for Grade IV.

Meaningful IPAS learning requires media capable of visually representing Indonesia's cultural diversity in an engaging manner. Susilana & Riyana (2019), emphasize that the availability of interactive instructional media is one of the determining factors in learning success. However, observations and interviews at SD Negeri 1 Nglebo, Suruh District, Trenggalek Regency in October 2025 revealed the contrary: teachers faced limitations in interactive media, causing learning to proceed conventionally through lecture-dominant methods and static printed materials.

These conditions produced measurably low student learning interest. Pre-research questionnaire data from 23 Grade IV students showed an average learning interest of only 53.9%, with the lowest indicators in willingness to seek additional learning resources (48.7%) and attentiveness during learning (47.4%). Safari (2019), developed a comprehensive six-indicator learning interest framework encompassing positive feelings toward learning, desire to learn, attentiveness, participation, autonomous learning awareness, and willingness to seek supplementary resources. Slameto (2015), affirms that learning interest is a key factor influencing learning success. This low interest correlated with suboptimal outcomes: the average summative score was 68.5, below the KKTP of 75, with only 26.1% of students meeting the criterion.

The theoretical basis for IPAS integration lies in Piaget's developmental theory as discussed by (Santrock, 2018), which situates Grade IV students within the concrete operational stage, requiring holistic and experiential approaches to learning. Bruner in Trianto (2014), further argues that elementary learning should provide opportunities for exploration and direct investigation of the surrounding environment. These developmental realities necessitate instructional media that present abstract cultural concepts through concrete, multimodal representations.

The Android platform presents a compelling solution. Safaat (2015), explains that Android enables the integration of diverse media modalities—text, images, audio, video, and interactive animations—within a single application with high accessibility. All 23 Grade IV students at SD Negeri 1 Nglebo had access to smartphones, creating significant potential for mobile-based learning. Prensky (2001), refers to this generation as digital natives who respond more effectively to technology-based learning. Furthermore, Mayer (2009), Cognitive Theory of Multimedia Learning posits that simultaneous presentation of verbal and visual information optimizes cognitive processing and enhances long-term retention.

Previous studies validate this approach. Prasetyo & Nisa (2018), found that Android-based Natural Sciences media effectively improved learning outcomes with an N-Gain of 0.68. Wulandari (2020), reported increased learning interest in Grade IV Social Sciences via Android media with an N-Gain of 0.75. Dirgantoro et al. (2025), developed an Android Studio-based application achieving very high feasibility from media experts (91.5%) and content experts (96%). Hidayat & Saputro (2019), similarly confirmed improved student comprehension of cultural diversity content with an N-Gain of 0.72. However, no application has been found that specifically integrates national cultural diversity with Trenggalek local wisdom for Grade IV IPAS under the Merdeka Curriculum, nor simultaneously measures both cognitive and affective outcomes.

The present study addresses these gaps by developing "KaLoT" (Keragaman Budaya memuat Kearifan Lokal Trenggalek): an Android application featuring comprehensive cultural content from six provinces, Trenggalek local wisdom integration, educational games, HOTS-based assessments at Bloom's C4–C5 levels, and a WhatsApp-enabled progress monitoring feature. The study aims to produce media that is valid, practical, and effective in improving learning interest and IPAS outcomes for Grade IV elementary school students.

## 2 Methode

### 2.1 Research Design

This study employed the Research and Development (R&D) methodology, which Borg and Gall describe as a systematic process of developing and validating educational products through iterative cycles of design, development, and empirical testing. The ADDIE model (Analysis, Design, Development, Implementation, Evaluation) was selected as the development framework due to its systematic and cyclical character, which enables continuous quality improvement at each stage (Gafari, 2024). The ADDIE model's structured approach is particularly appropriate for educational technology development projects that require rigorous validation before large-scale deployment. The Analysis phase involved needs assessment through teacher interviews and student questionnaires; the Design phase addressed content mapping and interface architecture; the Development phase covered application construction in Android Studio, instrument creation, and expert validation; Implementation encompassed structured classroom trials; and Evaluation integrated formative and summative assessment of product quality.

### 2.2 Research Subjects and Instruments

Research subjects were drawn from two elementary schools in Suruh District, Trenggalek Regency. For the small-group trial, 14 Grade IV students from SD Negeri 2 Suruh participated, selected purposively to represent a range of academic abilities and technological familiarity. For the large-group trial, 23 Grade IV students from SD Negeri 1 Nglebo participated, distributed across two classes: Class IVA (15 students) and Class IVB (8 students). The differentiation between classes provided an opportunity to examine the media's effectiveness across groups with differing initial knowledge baselines. Expert validators included a content experts (IPAS curriculum specialists) and two media experts (educational technology specialists).

Data collection instruments included: (1) expert validation sheets using a 1–5 Likert scale; (2) teacher response questionnaires; (3) structured classroom observation sheets evaluated across three complete learning sessions; (4) six-indicator learning interest questionnaires based on (Safari's, 2019), framework; and (5) HOTS-based pre-test/post-test instruments comprising 20 multiple-choice items at cognitive levels C4 (analyzing) and C5 (evaluating) following (Anderson & Krathwohl, 2001) revised taxonomy.

### 2.3 Data Analysis

Validity and practicality were assessed through quantitative descriptive analysis. Products were classified as very valid or very practical when scores reached or exceeded 85%. Learning outcome effectiveness was measured using the Normalized Gain (N-Gain) formula, with  $N\text{-Gain} \geq 0.70$  categorized as high,  $0.30 \leq N\text{-Gain} < 0.70$  as moderate, and  $N\text{-Gain} < 0.30$  as low (Hake, 2002). Learning interest change was expressed as the percentage-point difference between pre- and post-intervention questionnaire scores.

## 3 Results and Discussion

### 3.1 Results

#### 3.1.1 Validity of "KaLoT" Media

Validation was conducted by two content experts, who assessed curriculum alignment, material accuracy, and assessment quality, and two media experts, who evaluated visual design, navigation, multimedia integration, and technical functionality. All feedback was incorporated before product trials.

**Table 1.** Validation Results of "KaLoT" Media

Validation Type	Score	Maks.	Percentage	Category
Context Expert	57	60	95,0%	Very Valid
Media Expert	83,5	90	92,7%	Very Valid
<b>Average</b>	-	-	<b>93,85%</b>	Very Valid

As shown in Table 1, KaLoT achieved 95.0% content validity and 92.7% media validity, yielding an aggregate of 93.85%—categorized as Very Valid (threshold  $\geq 85\%$ ). Content experts noted the need for orthographic corrections and additional contextual examples linking national cultural elements to Trenggalek. Media experts recommended adding ambient audio to the game features. This validity exceeds the 88% and 86% reported by (Prasetyo & Nisa, 2018) for Android Natural Sciences media, attributable to KaLoT's dual-focus content and HOTS-integrated assessment design.

### 3.1.2 Practicality of "KaLoT" Media

Practicality was measured across three concurrent sources: teacher response questionnaires during individual trials, and structured observations during small-group and large-group trials evaluated across all learning stages (opening, core, and closing activities).

**Table 2.** Practicality Measurement Results of "KaLoT" Media

Source	Percentage	Category
Teacher Feedback Survey	95,0%	Practical
Small Group Observation	93,6%	Practical
Large Group Observation IVA	92,0%	Practical
Large Group Observation IVB	93,3%	Practical
<b>Average</b>	<b>93,46%</b>	<b>Practical</b>

Table 2 shows that all practicality measures exceeded 92%, with a composite average of 93.46%—Very Practical. Teachers highlighted ease of installation, completeness of learning features, and suitability for independent student use. Observation data confirmed that students navigated the application intuitively from the first session, requiring minimal technical assistance. The WhatsApp score-sharing feature was consistently identified by teachers as the most practically valuable innovation, enabling real-time student progress monitoring without additional infrastructure.

### 3.1.3 Effectiveness on Learning Outcomes

Learning outcome effectiveness was assessed through pre-test and post-test data analyzed using the N-Gain formula across all trial groups.

**Table 3.** Summary of Learning Outcomes and N-Gain

Training Group	Pretest Avg	Posttest Avg	N-Gain	Category
Small Group	53,57	86,79	0,71	High
Large Group IVA	62,00	91,33	0,75	High
Large Group IVB	52,50	84,39	0,66	Medium

Table 3 reveals consistent improvement across all groups. The small-group trial yielded N-Gain = 0.71 (high). In the large-group trial, Class IVA achieved N-Gain = 0.75 (high) and Class IVB achieved N-Gain = 0.66 (moderate). All post-test averages exceeded the KKTP of 75. The N-Gain difference between IVA and IVB is attributable to differing initial knowledge baselines: IVA entered with a higher pre-test average (62.00) compared to IVB (52.50). Chu (2014), cognitive load theory suggests that students with lower prior knowledge may experience higher extraneous cognitive load when initially engaging with multimedia content, temporarily limiting acquisition efficiency.

### 3.1.4 Effectiveness on Learning Interest

Learning interest questionnaires were administered before and after the media intervention to large-group students, measuring all six indicators from (Safari's, 2019) framework.

**Table 4.** Learning Interest Before and After Media Use

Class	Aspect	Before	After	Increase
IVA	Average interest in learning	53,5%	91,0%	+37,5%
IVB	Average interest in learning	55,8%	93,2%	+37,4%

As Table 4 demonstrates, learning interest increased substantially in both classes—IVA from 53.5% to 91.0% (+37.5%) and IVB from 55.8% to 93.2% (+37.4%). The most pronounced gains appeared in attentiveness and willingness to seek additional resources—precisely the indicators with the lowest baseline scores. This inverse relationship between initial weakness and improvement magnitude is consistent with motivational models demonstrating that well-designed engaging stimuli have greater marginal impact on initially disengaged learners.

### 3.2 Discussion

The validity result of 93.85% confirms that KaLoT meets rigorous content, visual, and technical quality standards. This is consistent with (Prasetyo & Nisa, 2018), yet higher—reflecting the advantage of KaLoT's dual integration of national cultural diversity with Trenggalek local wisdom, supported by HOTS-based exercises at taxonomy levels C4 and C5 (Anderson & Krathwohl, 2001). Wagiran (2012), emphasizes that integrating local wisdom into learning strengthens cultural identity and increases the contextual relevance of academic material. When students encounter familiar local traditions—including the Trenggalek song "Kutho Trenggalek" via the application's audio player, the Larung Sesaji ceremony, and local batik motifs—within the broader framework of Indonesian cultural diversity, learning achieves both national cultural literacy and local cultural pride simultaneously.

The practicality average of 93.46% demonstrates that KaLoT is readily implementable across diverse classroom contexts. This finding resonates with (Septi et al., 2023), who report that interactive learning media promotes more participatory classroom environments. Unlike prior studies focusing solely on technical practicality, this study also measured pedagogical practicality through multi-session observation, demonstrating sustained consistency. KaLoT not merely as a content delivery vehicle but as a component of an integrated pedagogical ecosystem—an innovation not identified in comparable products.

The effectiveness of KaLoT on learning outcomes—with N-Gain of 0.71 (small group) and 0.75 (Class IVA)—aligns with (Wulandari, 2020) reported N-Gain of 0.75 for Android Social Sciences media and confirms convergent validity. Mayer (2009), Cognitive Theory of Multimedia Learning provides the theoretical explanation: multimedia learning integrating text, images, audio, and video through the dual-coding principle optimizes cognitive processing and improves information retention. The educational game features (matching game and word puzzle) further consolidate memory encoding through repeated multimodal engagement.

The substantial increase in learning interest from 53.5–55.8% to 91.0–93.2% reflects the positive effect of gamification on intrinsic student motivation. Setiani (2019), demonstrated that the satisfaction element in the ARICESA model effectively increases motivation and conceptual understanding in elementary learners. The educational game features, interactive scoring, and result-sharing functionality within KaLoT operationalize this satisfaction element by providing immediate, positive feedback that conventional media cannot replicate. The improvement in "willingness to seek additional learning resources"—from 48.7% (the lowest baseline indicator) to above 91%—suggests that the application successfully transformed passive learners into autonomous knowledge seekers.

The N-Gain difference between Class IVA (0.75/high) and Class IVB (0.66/moderate) provides input for future development. Chu (2014), warns that cognitive load inconsistent with students' initial abilities can reduce digital media effectiveness. This finding underlines the priority of developing adaptive scaffolding features within the application—structured hints, progressive content revelation, or adaptive difficulty—to better accommodate learners with lower initial knowledge baselines. Future researchers should also consider expanding cultural content coverage from six to all 34 Indonesian provinces to fully realize the application's national cultural literacy potential.

### 4 Conclusion

This research and development study produced the "KaLoT" Android-based interactive learning application for IPAS cultural diversity and local wisdom content, demonstrating fulfillment of all three product quality criteria. First, the media achieved very high validity at 93.85%, reflecting alignment with Merdeka Curriculum standards, content accuracy, and HOTS-based assessment quality. Second, the media demonstrated very high practicality at 93.46% across teacher and observational measurements, confirming ease of use in diverse classroom contexts. Third, the media proved effective in improving both learning outcomes (N-Gain: 0.71–0.75 in high category; 0.66 in moderate category) and learning interest (from 53.5–55.8% to 91.0–93.2%).

Based on these findings, the following recommendations are advanced. For classroom teachers, the KaLoT application is recommended as a primary interactive medium for IPAS cultural diversity and local wisdom units, with particular attention to using the WhatsApp monitoring feature to inform differentiated instruction. For school administrators, investment in classroom technology infrastructure — including stable internet connectivity for YouTube-embedded video content — is recommended to maximize the application's multimedia capabilities. For future researchers, the development of adaptive scaffolding features sensitive to students' initial knowledge baselines represents the highest-priority enhancement opportunity, alongside expansion of cultural content coverage to encompass all 34 Indonesian provinces. For policy stakeholders, this study provides empirical evidence that locally-produced, culturally-anchored Android applications represent a cost-effective and highly effective strategy for supporting Merdeka Curriculum implementation in resource-diverse educational contexts.

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