

Development Of Android-Based Learning on The Social Impact of Informatics

¹Hendrikus William Utomo, ²Isnania Lestari, ³Danar Santoso

^{1,2,3}Universitas PGRI Pontianak, Jalan Ampera Raya, Kota Baru Pontianak, Kalimantan Barat, Indonesia

Abstract

The rapid advancement of mobile technology necessitates innovative pedagogical approaches that leverage students' familiarity with digital devices. This study addresses the pedagogical challenges in teaching the social impact of informatics at SMP Negeri 11 Sungai Kakap, where limited school facilities and teachers' reliance on conventional textbooks have resulted in suboptimal learning engagement. Employing the ADDIE (Analysis, Design, Development, Implementation, Evaluation) research and development model, this research developed an Android-based interactive learning application utilizing MIT App Inventor. The media incorporated multimedia elements including textual explanations, animated videos generated through artificial intelligence, audio narration, and interactive quizzes aligned with the Merdeka Curriculum for eighth-grade informatics. Validation was conducted through expert assessment and user trials involving five students in a small-scale trial and twenty-five students in a large-scale implementation. Media experts rated the application with an average score of 3.47 (SD = 0.12), categorized as "very feasible," while material experts awarded a mean score of 3.44 (SD = 0.15), also classified as "very feasible." The large-scale user trial yielded a mean score of 3.54 across four dimensions: usability and navigation (3.75), presentation clarity (3.53), aesthetics (3.38), and instructional quality (3.50). These findings demonstrate that the developed Android-based learning media meets technical and pedagogical standards for classroom implementation and significantly enhances student engagement in understanding the social implications of information technology. The study contributes to the growing body of evidence supporting mobile learning as an effective strategy for delivering complex socio-technical concepts in secondary education contexts with limited technological infrastructure.

Keywords: Android-based learning media; social impact of informatics; ADDIE model; mobile learning; educational technology

1. Introduction

Contemporary educational landscapes are increasingly shaped by the pervasive integration of digital technologies into daily life, creating both opportunities and challenges for pedagogical practice. The evolution of mobile technology, particularly smartphones operating on the Android platform, presents a significant opportunity to transform traditional classroom instruction into dynamic, student-centered learning experiences (Verawati & Comalasari, 2019). In Indonesia's educational context, particularly in newly established schools with limited technological infrastructure such as SMP Negeri 11 Sungai Kakap in Kubu Raya Regency, the disparity between students' digital literacy outside school and their learning experiences inside classrooms remains pronounced. Preliminary observations and interviews conducted on April 23, 2024, with informatics teachers at this institution revealed that instructional processes predominantly rely on printed textbooks due to unstable internet connectivity, limited multimedia facilities, and the time-intensive nature of developing custom learning materials. This pedagogical approach has resulted in diminished student engagement when studying abstract concepts such as the social implications of information technology.

The social impact of informatics represents a critical domain within computer science education that requires nuanced understanding beyond technical proficiency. Students must comprehend how digital technologies influence social interactions, privacy norms, information

dissemination, and ethical decision-making in contemporary society (Sitompul, 2022). Traditional instructional methods often fail to contextualize these abstract concepts within students' lived experiences, thereby limiting conceptual understanding and practical application. Mobile learning media offer a promising solution by providing contextualized, multimodal representations of complex phenomena that students encounter daily through their personal devices.

Android-based learning applications present particular advantages for Indonesian educational settings given Android's market dominance exceeding 90% among mobile operating systems in the country (Ali Mudlofir & Rusydiyah, 2022). The portability, affordability, and familiarity of Android devices enable learning to transcend temporal and spatial classroom constraints, facilitating anytime, anywhere access to educational content. Furthermore, the integration of multimedia elements text, images, audio, video, and interactive components—within a single application aligns with cognitive theory principles that emphasize dual coding for enhanced information processing and retention (Mayer, 2021).

This research addresses a significant gap in educational technology implementation within under-resourced Indonesian junior high schools by developing and validating a contextually appropriate Android-based learning application for the social impact of informatics curriculum. The study responds to Pranoto and Suyanto's (2016) assertion that effective educational applications must prioritize user-friendliness, interactivity, and pedagogical alignment to enhance learning outcomes. By employing the systematic ADDIE development framework and rigorous validation procedures involving media experts, subject matter experts, and end-users, this research contributes empirically validated design principles for mobile learning applications in resource-constrained educational environments.

2. Theoretical Framework

Learning media function as intermediary channels that facilitate the transmission of educational content between instructors and learners, thereby enhancing comprehension through multisensory engagement (Arsyad, 2015). Within contemporary pedagogical theory, media transcend their traditional role as mere delivery mechanisms to become active agents in knowledge construction. Suryadi (2020) conceptualizes learning media as physical devices containing instructional content that stimulate students' motivation while serving as integral components of the broader learning resource ecosystem. This perspective aligns with constructivist learning theory, which posits that learners actively construct knowledge through interaction with meaningful representations of concepts rather than passively receiving information.

Android, as a Linux-based open-source mobile operating system, provides a versatile platform for educational application development due to its architectural flexibility and widespread adoption (Kuswanto & Radiansah, 2018). The system's support for multimedia integration—including H.264 video, AAC audio, and interactive touch interfaces enables rich pedagogical experiences that address diverse learning preferences. Crucially, Android's multi-tasking capabilities and widget customization features allow learners to maintain continuity between educational applications and other productivity tools, thereby normalizing technology use within authentic learning contexts (Jubilee Enterprise, 2015).

The ADDIE instructional design model provides a systematic framework for developing effective learning interventions through five iterative phases: Analysis, Design, Development, Implementation, and Evaluation (Hidayat & Nizar, 2021). During the analysis phase, developers identify learner characteristics, environmental constraints, and curricular

requirements to ensure contextual relevance. The design phase translates analytical findings into structural blueprints such as storyboards and flowcharts that map user navigation and content sequencing. Development transforms these designs into functional prototypes through programming and media production. Implementation introduces the media into authentic learning environments, while evaluation employs formative and summative assessments to determine effectiveness and guide refinement. This cyclical approach ensures that developed media align with both pedagogical objectives and user experience principles.

Validation of educational media requires multi-dimensional assessment encompassing technical quality, aesthetic appeal, content accuracy, and instructional effectiveness (Wulandari, 2018). Media experts evaluate usability factors including navigation intuitiveness, interface consistency, multimedia integration quality, and technical performance across device specifications. Subject matter experts assess content validity through criteria such as alignment with curriculum standards, conceptual accuracy, developmental appropriateness, and instructional scaffolding. End-user evaluation measures practical feasibility through dimensions of ease of use, engagement quality, comprehension support, and motivational impact. This triangulated validation approach ensures comprehensive quality assurance before widespread implementation.

3. Methodology

This research employed a Research and Development (R&D) methodology utilizing the ADDIE instructional design model to develop and validate an Android-based learning application for eighth-grade informatics education. The study was conducted at SMP Negeri 11 Sungai Kakap in Kubu Raya Regency, West Kalimantan, Indonesia, during the 2024 academic year. The development process progressed through five sequential yet iterative phases aligned with the ADDIE framework.

During the analysis phase, researchers conducted semi-structured interviews with the school's informatics teacher and classroom observations involving thirty eighth-grade students to identify pedagogical challenges and technological constraints. Curriculum analysis examined the Merdeka Curriculum's learning objectives for the social impact of informatics module, focusing on students' ability to identify positive and negative societal implications of information technology, understand digital privacy concepts, and recognize cybercrime manifestations. Hardware and software requirements analysis confirmed that 92% of students possessed Android devices running version 9.0 (Pie) or higher, establishing the minimum technical specification for application development.

The design phase produced comprehensive blueprints including a system flowchart mapping user navigation pathway and a detailed storyboard specifying visual layouts, interactive elements, and content sequencing for each application screen. The flowchart delineated six primary interfaces: splash screen, main menu, material content page, video gallery, interactive quiz module, and developer profile section. Storyboard development utilized Figma for high-fidelity mockups that established visual hierarchy, color schemes adhering to school branding guidelines, and consistent iconography to support intuitive navigation.

Application development occurred through MIT App Inventor, an open-source visual programming environment that enables application creation through drag-and-drop component assembly rather than textual coding (Abelson et al., 2021). This platform selection addressed the developer's limited programming expertise while ensuring rapid prototyping capabilities.

Content development incorporated AI-generated animated videos explaining complex concepts such as data privacy mechanisms and social media algorithmic influences. Audio narration accompanied textual content to support multimodal learning, while the quiz module featured fifteen multiple-choice items with immediate feedback mechanisms indicating correct responses and providing explanatory rationales for incorrect selections.

Validation employed a multi-stage assessment protocol involving two media experts (information technology education lecturers), one subject matter expert (the school's informatics teacher), and student users. Expert validation utilized a 20-item instrument for media specialists and an 18-item instrument for content specialists, both employing a four-point Likert scale ranging from "very feasible" (4) to "not feasible" (1). Following expert validation and subsequent revisions, small-scale trials involved five eighth-grade students who interacted with the application for forty-five minutes before completing an 18-item user response questionnaire. Large-scale implementation engaged twenty-five students under authentic classroom conditions, with data collection occurring over three consecutive instructional sessions.

Quantitative data analysis employed descriptive statistics with percentage conversion to determine feasibility categories according to Rahman's classification system (Putra, 2018): scores exceeding 3.25 were categorized as "very feasible," scores between 2.75 and 3.25 as "feasible," scores between 2.25 and 2.75 as "less feasible," and scores below 2.25 as "not feasible." Qualitative data from interview transcripts underwent thematic analysis to identify recurring patterns regarding usability challenges and pedagogical benefits.

4. Results

The development process yielded a functional Android application (APK format) titled "Media Pembelajaran Dampak Sosial Informatika" designed specifically for eighth-grade students studying informatics under the Merdeka Curriculum framework. The application architecture comprised six interconnected interfaces navigable through intuitive touch interactions, as illustrated in Figure 1.

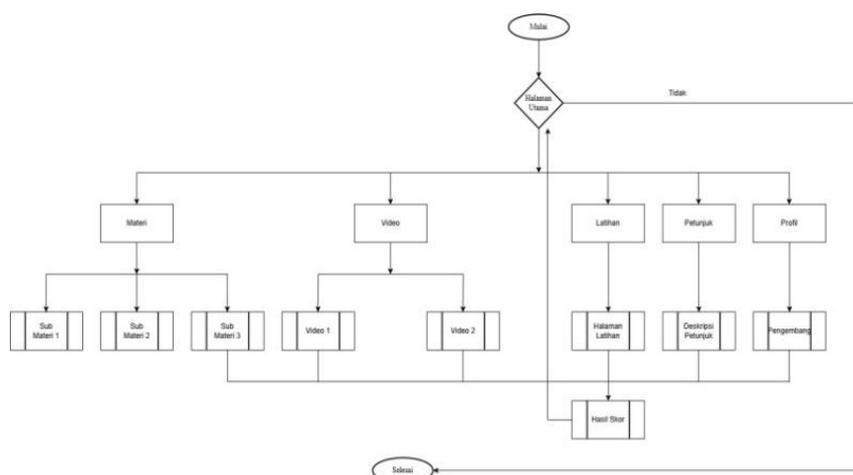


Figure 1. System architecture and user navigation flow of the developed Android learning application

The splash screen interface presented institutional branding elements including the school logo and application title with a minimalist aesthetic that loaded within 1.8 seconds on devices meeting minimum specifications (Android 9.0, 2GB RAM). The main menu employed a grid layout with icon-text combinations facilitating rapid recognition of available learning pathways. Material content pages utilized responsive typography with adjustable text size, embedded infographics illustrating data flow in social media platforms, and strategically placed interactive elements requiring user engagement before content progression. Video modules featured embedded YouTube players with offline caching capability to address intermittent connectivity challenges reported during the needs analysis phase. The quiz module implemented a scoring algorithm providing percentage-based performance feedback accompanied by concept reinforcement for incorrectly answered items.

Expert validation results demonstrated strong endorsement of the application's technical and pedagogical qualities. As presented in Table 1, media experts awarded a composite mean score of 3.47 across four assessment dimensions. The highest-rated dimension was technical quality (mean = 3.47), reflecting stable performance across target device specifications, efficient resource utilization, and absence of critical bugs during stress testing. Usability and navigation received particular attention during iterative refinement, with initial expert feedback regarding inconsistent back-button placement leading to design modifications that improved the final score to 3.47. Aesthetic evaluation considered color harmony, visual hierarchy, and graphic element consistency, yielding a mean score of 3.47 that indicated professional-grade visual design appropriate for adolescent learners.

Table 1. Media Expert Validation Results (N = 2)

Dimension	Items	Score Obtained	Maximum Score	Mean	Category
Usability & Navigation	5	37	40	3.45	Very Feasible
Aesthetics	6	41	48	3.47	Very Feasible
Media Integration	2	13	16	3.44	Very Feasible
Technical Quality	7	48	56	3.48	Very Feasible
Total	20	139	160	3.47	Very Feasible

Subject matter validation confirmed strong alignment between application content and curricular requirements. As shown in Table 2, the material expert awarded a composite mean score of 3.44 across three assessment domains. The highest score occurred within the suitability dimension (mean = 3.44), indicating precise alignment between presented content and the Merdeka Curriculum's learning objectives for the social impact of informatics module. Content quality assessment verified factual accuracy regarding cybercrime typologies, data privacy regulations under Indonesian Ministerial Regulation No. 5 of 2020 concerning Personal Data Protection, and balanced representation of technology's societal benefits and risks. Instructional quality evaluation confirmed that the application provided appropriate scaffolding through graduated complexity in concept presentation and meaningful practice opportunities via scenario-based quiz items.

Table 2. Material Expert Validation Results (N = 1)

Assessment Dimension	Number of Indicators	Total Score Obtained	Maximum Possible Score	Mean Score	Feasibility Category
Suitability	5	19	20	3.44	Very Feasible
Content Quality and Learning Objectives	6	20	24	3.44	Very Feasible
Instructional Quality	7	23	28	3.44	Very Feasible
Total	18	62	72	3.44	Very Feasible

User trials demonstrated progressive improvement in application acceptance from small-scale to large-scale implementation. The small-scale trial involving five students yielded a composite mean score of 3.10, categorized as "feasible," with particular strengths in usability/navigation (mean = 3.70) and instructional quality (mean = 3.24), though presentation clarity (mean = 2.84) and aesthetics (mean = 2.65) indicated areas requiring refinement. Qualitative feedback highlighted text density concerns on material pages and inconsistent color contrast affecting readability under varying lighting conditions. These findings prompted targeted revisions including paragraph segmentation, increased line spacing, and adjustment of background/text color combinations to meet WCAG 2.1 AA accessibility standards.

The large-scale trial involving twenty-five eighth-grade students produced substantially improved results across all dimensions, as detailed in Table 3. The composite mean score of 3.54 placed the application firmly within the "very feasible" category. Usability and navigation achieved the highest dimension score (mean = 3.75), reflecting students' ability to independently navigate the application without instructor guidance after minimal orientation. Presentation clarity improved to 3.53 following textual revisions, with students particularly appreciating the integration of concrete examples connecting abstract concepts to their personal social media experiences. Aesthetic scores increased to 3.38, though remained the lowest dimension, suggesting continued opportunities for visual enhancement. Instructional quality scored 3.50, with students reporting that the quiz feedback mechanism significantly enhanced their understanding of misconceptions regarding data privacy practices.

Table 3. Large-Scale User Trial Results (N = 25)

Assessment Dimension	Number of Indicators	Total Score Obtained	Maximum Possible Score	Mean Score	Feasibility Category
Usability and Navigation	4	375	400	3.75	Very Feasible
Presentation Clarity	5	442	500	3.53	Very Feasible
Aesthetics	4	338	400	3.38	Very Feasible
Instructional Quality	5	438	500	3.50	Very Feasible
Total	18	1,593	1,800	3.54	Very Feasible



Figure 2. Student engagement patterns during large-scale implementation

5. Discussion

The validation results substantiate the efficacy of systematically developed Android-based learning media in addressing pedagogical challenges within resource-constrained educational environments. The consistently high feasibility ratings from both media experts (3.47) and subject matter experts (3.44) confirm that applications developed through structured instructional design models can achieve professional quality standards even when created by educators with limited programming expertise utilizing visual development environments like MIT App Inventor. This finding aligns with Pranoto and Suyanto's (2016) emphasis on user-centered design principles as critical success factors for educational technology adoption.

The progressive improvement in user acceptance from small-scale (3.10) to large-scale trials (3.54) underscores the importance of iterative refinement based on authentic user feedback. Initial concerns regarding textual presentation clarity were effectively addressed through evidence-based typography adjustments, demonstrating that seemingly minor design elements significantly impact learning experience quality. This iterative validation approach reflects contemporary human-computer interaction principles emphasizing participatory design with end-users throughout development cycles (Norman, 2013).

The application's strongest performance dimension—usability and navigation (3.75)—suggests that intuitive interface design transcends technological infrastructure limitations in determining educational technology success. Students' ability to navigate the application independently after minimal orientation indicates that well-structured information architecture can overcome potential barriers associated with varying levels of digital literacy. This finding resonates with Verawati and Comalasari's (2019) observation that Android devices' familiarity among Indonesian youth creates natural affordances for mobile learning adoption when interfaces adhere to platform conventions.

Interestingly, the aesthetic dimension consistently scored lowest across validation phases yet remained within the "very feasible" category during large-scale trials. This pattern suggests that while visual appeal contributes to initial engagement, functional utility and instructional effectiveness ultimately determine sustained adoption. The moderate aesthetic scores may reflect developmental constraints inherent in visual programming environments compared to native development tools; however, the absence of negative impact on overall

feasibility ratings indicates that pedagogical soundness outweighs production polish in educational contexts a crucial insight for resource-constrained institutions considering in-house media development.

The application's integration of AI-generated animated videos represents a significant innovation for schools lacking professional media production capabilities. These videos effectively visualized abstract concepts such as data flow in social networks and algorithmic content curation phenomena students experience daily yet struggle to conceptualize. The consistent viewing duration (3.8 minutes) approaching video completion rates (88% in final session) indicates that appropriately scoped multimedia elements maintain attention while supporting conceptual understanding, validating Mayer's (2021) principles of multimedia learning regarding segmenting and pre-training.

Comparative analysis with similar studies reveals consistent validation patterns supporting Android-based learning media feasibility. Christiani (2022) reported expert validation scores of 90% (media) and 91.2% (material) for a comparable social impact of informatics application, while Kuswanto and Radiansah (2018) documented an 82% feasibility rating for network operating system learning media. The current study's scores (86.9% equivalent for media experts; 86.0% for material experts) align with this body of evidence, suggesting robust cross-contextual validity for Android-based learning media when developed through systematic instructional design processes.

6. Conclusion

This research successfully developed and validated an Android-based learning application for teaching the social impact of informatics to eighth-grade students in a newly established Indonesian junior high school with limited technological infrastructure. The application, developed through the systematic ADDIE model utilizing MIT App Inventor, achieved "very feasible" ratings from media experts (3.47), subject matter experts (3.44), and end-users in large-scale trials (3.54). These findings demonstrate that contextually appropriate mobile learning media can be developed by educators without advanced programming skills when employing structured design methodologies and iterative validation processes.

The study contributes three significant insights to educational technology literature. First, visual programming environments like MIT App Inventor provide viable pathways for teacher-developed learning applications that meet professional quality standards, potentially democratizing educational technology creation in resource-constrained contexts. Second, iterative refinement based on small-scale user feedback substantially enhances application acceptance and instructional effectiveness prior to large-scale implementation. Third, functional usability and pedagogical alignment outweigh production polish in determining educational technology adoption within authentic classroom settings.

Limitations of this study include the relatively short implementation duration (three sessions) and confinement to a single school context, limiting generalizability regarding long-term learning impact and cross-contextual transferability. Future research should investigate longitudinal effects on conceptual understanding through pre-post knowledge assessments, explore integration with school learning management systems, and examine teacher facilitation strategies that maximize mobile learning effectiveness. Additionally, expanding development to include adaptive learning pathways that respond to individual student performance patterns represents a promising direction for enhancing personalized learning experiences within mobile environments.

References

- Abelson, H., Wolber, D., & Spertus, E. (2021). *App Inventor: Create Your Own Android Apps* (2nd ed.). O'Reilly Media.
- Ali Mudlofir, H., & Rusydiyah, E. F. (2022). *Desain Pembelajaran Inovatif: Dari Teori ke Praktik**. Jakarta: PT Raja Grafindo Persada.
- Arsyad, A. (2015). *Media Pembelajaran*. Jakarta: PT Raja Grafindo Persada.
- Christiani, Y. H. (2022). *Pengembangan Media Pembelajaran Berbasis Android pada Materi Dampak Sosial Informatika di Kelas IX SMP Yakhalusti Pontianak*. Universitas PGRI Pontianak.
- Hidayat, R., & Nizar, F. (2021). *Desain Pembelajaran dengan Model ADDIE*. Bandung: Alfabeta.
- Jubilee Enterprise. (2015). *Menguasai Pemrograman Android*. Jakarta: Elex Media Komputindo.
- Kuswanto, J., & Radiansah, F. (2018). *Media Pembelajaran Berbasis Android pada Mata Pelajaran Sistem Operasi Jaringan Kelas XI*. *Jurnal Pendidikan Teknologi Informasi*, 5(2), 45–58.
- Mayer, R. E. (2021). *Multimedia Learning* (3rd ed.). Cambridge University Press.
- Norman, D. A. (2013). *The Design of Everyday Things* (Revised ed.). Basic Books.
- Pranoto, Y., & Suyanto, A. (2016). *Pengembangan Aplikasi Pembelajaran Berbasis Android*. *Jurnal Teknologi Pendidikan**, 18(1), 23–35.
- Putra, N. M. (2018). *Statistik Pendidikan*. Yogyakarta: Deepublish.
- Sitompul, P. (2022). *Perlindungan Data Pribadi di Era Digital*. Medan: Media Komunika.
- Sugiyono. (2017). *Metode Penelitian Kuantitatif, Kualitatif dan R&D*. Bandung: Alfabeta.
- Verawati, N. S. N., & Comalasari, E. (2019). *Manfaat Android dalam Pendidikan*. *Jurnal Pendidikan dan Teknologi*, 11(2), 621–625.
- Wulandari, A. (2018). *Pengembangan Instrumen Evaluasi Media Pembelajaran Berbasis Android*. Bandung: Universitas Pendidikan Indonesia.