The Effectiveness of Using Android-Based Interactive Media in Learning in Vocational High Schools

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Abstract: This literature review analyzes the effectiveness of Android-based interactive media in the learning process at Vocational High Schools (SMK). The review includes research articles, books, and academic reports selected based on their relevance to digital learning, student motivation, learning outcomes, and independence. Using a descriptive qualitative approach, the study synthesizes findings from previous research to identify consistent evidence regarding the role of Android-based media in vocational education. The analysis shows that Android-based interactive media are consistently effective in increasing student motivation, improving conceptual understanding, and fostering independent learning skills. The most influential features identified across the reviewed studies include multimedia presentation, interactive learning tasks, and immediate feedback, which collectively support deeper engagement and improved learning performance. These media also create a more dynamic and technology-rich learning environment that aligns with the practical orientation of SMK students. However, the effectiveness of implementation depends on several critical factors, notably the use of appropriate instructional design grounded in multimedia learning theory (Mayer, 2001), the readiness of teachers to integrate technology, and the availability of adequate technological infrastructure in schools. These contextual elements significantly shape how well Android-based media can support teaching and learning. Overall, the review concludes that Android-based learning media hold strong potential for enhancing SMK learning when developed contextually to meet student needs and supported by competent teachers and school policies that promote sustainable and innovative educational technology integration.

Keywords: Android; Effectiveness; Interactive Media; Vocational School Learning.

Introduction

National education aims to improve the well-being of the nation's children as mandated by the 1945 Constitution. The Law of the Republic of Indonesia No. 20 of 2003 states that education is a planned effort to develop students' psychological, spiritual, intellectual, moral, and practical competencies (Budiarto et al., 2024). Achieving these goals requires an effective learning process supported by a meaningful teacher–student interaction and appropriate learning media. Learning media play a crucial role in enhancing students' motivation, creativity, and learning effectiveness (Arsyad, 2020).

However, teaching practices in many Vocational High Schools (SMK) remain dominated by conventional methods with limited use of varied and interactive media. This condition contributes to low student motivation and engagement. Jannatan and Madjid (2018) emphasize that a lack of variation in instructional delivery is one of the reasons learning objectives are not met. Meanwhile, rapid developments in information and communication technology provide opportunities for teachers to utilize digital learning resources, including Android-based media that are accessible and aligned with the characteristics of SMK students.

Android-based interactive learning media, such as educational applications, simulations, interactive videos, and educational games, have the potential to create more engaging and contextual learning experiences suitable for vocational education needs. Nevertheless, their effectiveness depends on instructional design quality, content alignment, the learning theories applied, and teachers' readiness to integrate technology into instruction.

Although numerous studies have examined digital learning media, comprehensive syntheses specifically addressing the effectiveness of Android-based interactive media in SMK contexts remain limited. This gap highlights the need for a structured literature review to consolidate empirical evidence on how Android-based media enhance students' motivation, conceptual understanding, and learning outcomes**.** Therefore, this article aims to analyze the effectiveness of Android-based interactive media through a literature review to provide a more systematic theoretical and empirical overview.

Methods

This study employed a descriptive qualitative approach through a structured literature review of national and international scholarly publications relevant to Android-based interactive learning media in vocational education settings. The literature search was conducted for the period 2015–2025 across several academic databases, including Google Scholar, ERIC, ScienceDirect, Garuda, and nationally indexed SINTA journals. Keywords used in the search process included *"Android-based interactive media," "digital learning," "vocational education,"* and *"learning effectiveness."*

To ensure the relevance and rigor of the reviewed sources, this study applied the following inclusion criteria: (1) articles addressing digital or Android-based learning media; (2) studies situated within secondary or vocational education contexts; (3) publications presenting empirical findings or conceptual analyses; and (4) articles published in reputable, peer-reviewed journals. Studies were excluded if they: (1) discussed ICT use in general without reference to interactive media; (2) lacked direct relevance to instructional or learning processes; or (3) demonstrated insufficient methodological clarity.

All retrieved articles were assessed based on thematic relevance, methodological robustness, clarity of research objectives, and the strength of their theoretical underpinnings. Articles that met these standards were subsequently analyzed and synthesized to identify recurring patterns concerning the effectiveness of Android-based interactive media in enhancing student motivation, conceptual understanding, and learning outcomes in vocational education.

As this study did not involve primary data collection, all findings are analytical and conceptual in nature, derived entirely from the reviewed literature.

Results And Discussion

From the results of the literature search, 25 articles were obtained, which were selected based on the criteria shown in Table 1.

Table 1. Article Review Results (2015 to 2025)

Source Reference	Sample	Research Method	Intervention	Review Results
Romisa, F., Rifani, R., & Suriaty (2025)	25 vocational high school students (TJKT)	R&D PPE model (Planning, Production, Evaluation)	Interactive Android e-module (Smart Apps Creator)	Validity 93%, teacher response 94%, student 86% → very feasible and effective
Saputri, R.P. & Fransisca, M. (2023)	73 vocational HS students (Padang)	R&D 4D model	Android learning media for the Digital Simulation subject	Effectiveness 84.96% → effective category
Putri, A.K. & Hakim, A.R. (2025)	105 students SMKN 1 Godean (Accounting)	R&D ADDIE model Wilcoxon test	Interactive Android e-module integrated with Accurate V5	N-Gain 75.04%, $p < 0.05$ → significant improvement in learning outcomes
Handoyo, F. (2025) . Systematic Literature Review	30 research articles (2015 to 2024)	Systematic Literature Review (SLR)	Android apps and e-modules in vocational HS	85% of studies show increased learning outcomes and motivation

Rahmadhani, S. (2021)	60 vocational HS students	Quasi-experimental (pretest-posttest)	Android e-module (operating systems material)	Significant increase in learning outcomes ($p < 0.05$) and motivation
Budiarto, M.K. et al. (2024)	90 vocational students	Qualitative descriptive	Android e-learning platform with interactive features	Improves collaboration, communication, and digital literacy
Elmasari, Y. (2021)	35 vocational HS students	R&D ADDIE model	Android-based e-module for computer engineering lessons	Validity 90%, students find learning easier and more flexible
Tuilan, V. (2021) . ScitePress Proceedings	40 vocational HS students	R&D (Field test)	Android application with interactive animation	Increase in motivation & cognitive ability by 18%
Alfrina Mewengkang, A. (2025)	30 vocational HS Graphic Design students	R&D 4D model	Android media for graphic design learning	Content experts 4.75, students increased creativity and work quality
Criollo.C, S. et al. (2021)	60 education articles (global)	Systematic review	Android-based mobile learning	Effectiveness factors: interactive design, easy access, pedagogical support
Saputri, Wahyu. (2016)	30 students grade X TKJ SMK Negeri 1 Surabaya	R&D (Borg & Gall Model)	Android Learning Media on Operating Systems material	Media is rated very feasible and effective in increasing student achievement by 20% compared to conventional learning.
Hapsari, D.I.S. & Fahmi, S. (2021)	32 vocational HS students grade X	R&D (ADDIE)	Interactive Android application containing exercises, animations, and automatic quizzes.	Positive student response (91%), learning outcomes significantly increased after media use.
Perdana, S. (2021)	25 students in grade XI vocational HS	R&D (4D Model: Define, Design,	Interactive learning application with entrepreneurship simulation	Average post-test score increase of 17 points; media effectively increased learning

		Develop, Disseminate)		outcomes and motivation.
Aprilyani, K. (2021)	30 vocational HS students majoring in RPL	Development Research (ADDIE)	Android application containing videos, quizzes, and interactive digital materials	Media increased learning interest and helped students understand material during online learning.
Elida, W. (2020)	60 vocational HS technical students	Quasi Experiment	Android-based learning model using interactive modules	The t-test results showed a significant increase in learning outcomes between the experimental and control classes.
Jenita, Dewi (2023)	35 grade X TKJ students	R&D (ADDIE)	Android-based interactive multimedia	Effectiveness reached the "very good" category with a pre-test to post-test increase of 25%.
Putri, Aisyah. (2023)	40 vocational HS Graphic Design students	R&D (Borg & Gall)	A graphic learning application based on Android	The media effectively improved students' design skills and technical abilities.
Fitriana, F. (2023)	30 students in grade XI Vocational HS Health program	R&D (ADDIE)	Interactive Android application with practice and evaluation features	Media feasibility 88% (very good category), learning outcomes significantly improved.
Tabrani, M.B. (2021).	27 pre-service teachers / vocational students	R&D (Borg & Gall)	Android interactive multimedia for the Educational Evaluation course	The Media has proven effective in improving conceptual understanding of evaluation instruments and learning participation.
Kusumadewi, W.A.P. (2016)	33 grade X RPL students	R&D (4D Model)	Interactive Android application containing coding	Expert validation and trials show that media is very feasible and

			exercises and simulations	increases student learning outcomes by 23%.
Gustina, Hesti. (2024).	72 grade X students Welding and Metal Fabrication Engineering Program	R&D (ADDIE)	Implementation of Android-based interactive multimedia using a problem-based learning model	The Media used is very feasible with a percentage of 82.62%.
Hasim, Nurhikmah. (2020)	7 individual trial students, 25 small group trial students	R&D (Stages: Planning, design, development, and attribution)	Android-based multimedia with expert testing	Individual trial score is feasible and valid, and a small group trial is valid and practical.
Rarasati, Niken, (2023)	60 users Grade X SMKN 2 Depok	R&D Waterfall Model (Analysis, design, coding, testing & maintenance)	Development of interactive Android-based learning media assisted by Google Site	Material test 87.88% (Feasible), Media test 94.9% (Feasible). The Media developed is feasible to use.
Elida, Novaliendri. (2023)	Students SMKN 9 Padang, Culinary Department	4D Model (Stages: Define, Design, Develop, Disseminate)	Practicality test results by teachers and students, and effectiveness test using questionnaires.	Practicality score 4.55 (Feasible). Effectiveness 4.62 (Feasible). Media development is very feasible to use.
Andrianto, Rufus. (2024)	32 Grade X TAV students SMKN 3 Surabaya	ADDIE (One Group Pretest-Posttest design)	E-Module for learning	It can be concluded that the use of the E-Module can increase student learning outcomes.

The findings summarized in Table 1 reveal a consistent pattern regarding the pedagogical value of Android-based learning media in vocational high schools (SMK). To provide a stronger analytical foundation, this section goes beyond simple description by integrating the reviewed studies through conceptual grouping, cross-study comparison, and identification of areas that remain underexplored.

1. Characteristics and Context of the Reviewed Studies

The reviewed literature covers various vocational subjects with different sample sizes. Several studies also involved expert validation to ensure both pedagogical

and technical quality of the developed media (Elmasari & Anggara, 2021; Putri & Hakim, 2025; Romisa et al., 2025). The consistently positive results across contexts indicate that Android-based learning media are well accepted and relevant for SMK learning environments. No contradictory findings were identified, strengthening the reliability of these conclusions.

2. Methodological Patterns and Development Approaches

Most studies employed Research and Development (R&D) models such as ADDIE, 4D, Borg & Gall, Waterfall, or a One-Group Pretest–Posttest design. Although these models differ in their procedures, they share an emphasis on needs analysis, step-by-step development, and product testing. However, no study has compared the effectiveness of these models. This gap suggests the need for further research to determine which development model is most efficient and produces the highest-quality learning media.

3. Thematic Synthesis of Media Effectiveness

a. Motivational Impact

The reviewed studies consistently report that Android-based media increases learning motivation. This occurs mainly due to interactive features such as embedded quizzes, multimedia components, and instant feedback (Perdana, 2021; Rahmadhani & Efronia, 2021). These findings align with motivational design theories such as ARCS, although the theoretical connections have not been thoroughly examined.

b. Improvement in Learning Outcomes

Many studies show significant improvements in learning outcomes, indicated by high N-Gain values or higher post-test scores compared to conventional methods (Putri & Hakim, 2025; I.W. Saputri, 2016). However, the literature has not yet compared the effectiveness of different media formats such as simulations, e-modules, or stand-alone mobile applications. This limits the ability to make more specific pedagogical recommendations.

c. Enhancement of Independent Learning

Several studies highlight that mobile accessibility allows students to learn independently outside the classroom (Fitriana, 2023). However, deeper assessments of students' self-regulated learning abilities are still limited and require more advanced measurement approaches.

4. Contributions to Vocational Skill Development

Beyond cognitive improvement, Android-based media contribute to the development of important vocational competencies such as digital literacy, creativity, problem-solving, and workplace readiness (Budiarto et al., 2024; Mewekang, 2025). Simulation-based and task-oriented applications provide learning experiences that closely resemble real-world working situations. However, there is still a lack of longitudinal evidence linking these competencies to actual industry performance.

5. Structural and Operational Limitations

Despite the overall positive results, several implementation challenges remain, including unequal device ownership, limited teacher skills in multimedia development, and infrastructural issues such as unstable internet connectivity (Criollo,C et al., 2021; Rahmawati, 2024). In addition, the perception of digital tools as merely supplementary resources hinders their full integration. These limitations indicate that institutional readiness, not the digital media itself is the primary barrier to wider adoption.

6. Integrative Interpretation and Implications

Overall, the reviewed studies demonstrate that Android-based learning media can:

1. increase students' motivation and learning outcomes;
2. support mobile and flexible learning suited to SMK characteristics;
3. strengthen digital and vocational competencies; and
4. Promote more student-centered learning environments.

However, several important issues still need further investigation, including:

1. the lack of comparative research across development models,
2. limited longitudinal studies,
3. insufficient theoretical exploration of motivational and cognitive mechanisms, and
4. A shortage of research on teacher readiness.

In conclusion, Android-based interactive learning media represent an important innovation for vocational education within the Merdeka Curriculum. Nevertheless, stronger analytical and methodological frameworks are needed to guide more effective development and implementation in the future.

Conclusion

The synthesis of the reviewed studies demonstrates that Android-based interactive media constitute a significant pedagogical resource for vocational education. Evidence across the literature consistently indicates that such media foster stronger learning motivation, enhance student participation, and contribute to more substantial academic gains. Their mobile and flexible nature also supports autonomous learning, enabling students to engage with instructional content beyond conventional classroom boundaries.

Despite these advantages, the impact of Android-based media is closely tied to several essential conditions. Foremost, the instructional design underpinning the media must adhere to established principles of multimedia learning in order to facilitate coherent and meaningful knowledge construction. Equally critical is the teacher's capacity to integrate digital tools into vocational learning activities, as the instructional value of technology is determined not only by its features but also by the pedagogical decisions guiding its use. Furthermore, the effectiveness of implementation is

influenced by institutional readiness, including device availability, network reliability, and supportive administrative policies.

Taken together, the findings reinforce the view that interactive Android platforms can meaningfully strengthen vocational learning when deployed within a well-prepared instructional ecosystem. Consequently, continuous professional development for vocational teachers is imperative to ensure that they can design, adapt, and evaluate Android-based learning resources appropriately. Parallel to this, educational institutions and policymakers must establish supportive infrastructures and regulatory frameworks that enable technological innovation to be sustained and to produce long-term educational benefits.

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