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Design and Development of Android-Based Interactive Learning Media for Basic Subjects in Computer and Telecommunication Network Engineering

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Abstract: The advancement of educational technology plays a pivotal role in improving student engagement and learning outcomes, especially in vocational education. This study aims to design and develop an Android-based interactive learning media application for the Basic Computer and Telecommunication Network Engineering course targeted at Grade X students of SMK Negeri 1 Sijunjung. The development process adopted the ADDIE model, encompassing five stages: Analysis, Design, Development, Implementation, and Evaluation. The application integrates multimedia elements such as text, images, instructional videos, and interactive quizzes, and was built using the Flutter framework to ensure compatibility across Android devices. Validation was conducted through expert reviews and user feedback. Material experts rated the application with an average feasibility score of 93.3%, while media experts provided a score of 91.3%. Additionally, student feedback revealed a high level of acceptance with an average satisfaction score of 88.52%. These results confirm the application's validity and effectiveness in enhancing student motivation and facilitating independent learning. This study highlights the potential of mobile-based interactive media as a complementary tool in vocational education and offers a foundation for future development integrating adaptive and collaborative learning features.

Keywords: Interactive learning media; Android application; Vocational education; Network engineering; ADDIE model; Mobile learning; Educational technology.

1. Introduction

Technological advancements have brought profound transformations across various sectors, including education. The Fourth Industrial Revolution has significantly impacted the development of science and technology, emphasizing the necessity of digital literacy and adaptability in educational practices [1], [2]. The ability to utilize technology effectively is now recognized as a crucial component in improving educational standards and outcomes.

Education plays a fundamental role in shaping human resources and preparing future generations to respond to the rapid pace of technological change [3]–[6]. In this context, vocational education, particularly subjects like Basic Computer and Telecommunication Network Engineering, is essential for equipping students with relevant skills and knowledge that align with the demands of increasingly digital and complex industrial environments [7]–[9].

The rapid evolution of information and communication technologies, especially Android-based platforms, presents significant opportunities to enhance learning experiences. These technologies have enabled the development of interactive learning media that can boost student engagement and facilitate comprehension by transforming abstract concepts into more tangible and accessible formats [10]–[12]. This study focuses on developing interactive learning media targeting two core elements within the subject: business processes and technological developments in the field of computer and telecommunication network engineering.

Instructional media serve as vital tools for teachers in delivering learning materials effectively. These tools must be capable of stimulating student motivation, encouraging independent learning, and keeping pace with technological advancements [13]–[15]. Devices such as smartphones, laptops, and tablets can serve as valuable learning aids when utilized appropriately. In particular, the Flutter framework offers an efficient solution for cross-platform mobile development, allowing for consistent and optimal performance across different devices [16], [17].

Preliminary observations conducted at SMKN 1 Sijunjung revealed that students experienced difficulties in understanding the subject matter due to the lack of interactive learning media. The teaching methods relied heavily on verbal explanation with limited use of multimedia, resulting in reduced student interest and comprehension. Furthermore, although most students possessed Android smartphones, these devices were not yet utilized as learning tools and were often used primarily for entertainment or social media.

Given these challenges, it is imperative to explore alternative instructional strategies that leverage digital tools to enhance learning outcomes. This study proposes the design and development of an Android-based interactive learning media using the ADDIE instructional design model and Flutter framework. The aim is to create a media solution that not only supports classroom learning but also facilitates independent study outside school hours, while increasing student motivation and engagement.

Interactive media plays a critical role in bridging pedagogical content and learners. When designed with clear educational objectives and contextual relevance, such media can foster student-centered learning, support the

development of critical thinking skills, and encourage students to engage more actively with the subject matter [18], [19]. Ultimately, the implementation of Android-based interactive media is expected to enhance both the quality and effectiveness of vocational education, particularly in areas requiring technical competence and digital readiness [20]–[23].

2. Material and methods

This study adopts the ADDIE (Analysis, Design, Development, Implementation, and Evaluation) instructional design model. ADDIE is a systematic framework for designing effective instructional experiences that emphasize learner-centered approaches through both immediate and long-term phases [24], [25]. The model integrates interactions between students, instructors, and the learning environment. The procedural steps of the ADDIE development model are illustrated in Figure 1.

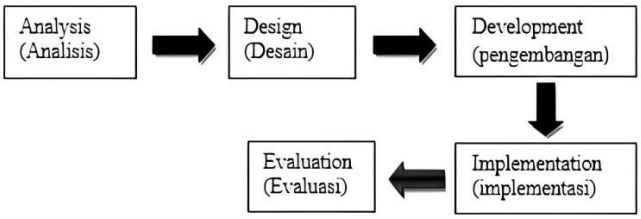

Figure 1. ADDIE Instructional Design Model

2.1 Analysis Stage

The analysis stage is the initial phase of the ADDIE model and involves identifying and understanding the context in which the learning product will be implemented. This stage includes three key analyses: user needs, content, and system requirements.

2.1.1 User Needs Analysis

User needs analysis is conducted to understand the expectations and learning challenges faced by students. This is based on observations and interviews at SMK Negeri 1 Sijunjung, particularly with Grade X students in the Computer and Network Engineering (TKJ) program. These findings reveal that students face difficulties in understanding course materials, and teachers lack interactive media tools to support explanations. The outcome of the needs analysis is summarized in Table 1.

Table 1. Summary of User Needs

Criteria	Findings
Target Users	Grade X students, Computer and Network Engineering Program, SMK Negeri 1 Sijunjung

Criteria	Findings
Media Type	An Android-based learning application to support independent learning
Required Features	(1) Display of Learning Outcomes; (2) Learning Materials; (3) Video Lectures; (4) Quizzes for Evaluation

2.1.2 Content Analysis

Following the user needs analysis, content analysis is performed to define the learning objectives and ensure alignment with national competency standards. The selected topics include business processes in computer and telecommunication network engineering, and current technological developments in the field. Table 2 presents the mapping between learning outcomes and instructional objectives.

Table 2. Learning Outcomes and Instructional Objectives

Learning Outcomes	Instructional Objectives
Students understand business processes in network engineering including customer handling, planning, needs analysis, implementation strategies, and service quality	1. Understand business process analysis in network engineering 2. Analyze customer needs 3. Understand implementation strategies 4. Understand customer service practices
Students comprehend emerging technologies in computer and telecommunication networking such as 5G, Microwave Link, IPv6, fiber optics, IoT, data centers, cloud computing, and cybersecurity	1. Understand recent developments in networking technologies 2. Describe microwave communication 3. Understand IPv6 protocol evolution 4. Identify fiber optic innovations

2.1.3 System Requirements Analysis

The system requirements analysis consists of two primary components: functional and non-functional requirements. The functional requirements pertain to the core features that the learning media must provide, including interactive elements such as integrated video content, self-assessment quizzes, and modular instructional materials to support student engagement and understanding. Meanwhile, the non-functional requirements focus on the technical aspects of system performance. In this regard, the learning media is developed using the Flutter framework, which ensures cross-platform compatibility and optimal performance, particularly on Android devices. This approach also enables consistent user experience across different devices and supports efficient application development and maintenance.

2.2 Design Stage

This stage translates analysis results into concrete design components. It includes interface design, feature layout, and navigation structure for the mobile application. The application comprises several key interfaces: a splash screen, a homepage, learning outcomes page, materials page, evaluation (quiz) page, about section, and help page.

2.2.1 Flowchart

The logical flow of the application is shown in Figure 2, illustrating user navigation and feature access.

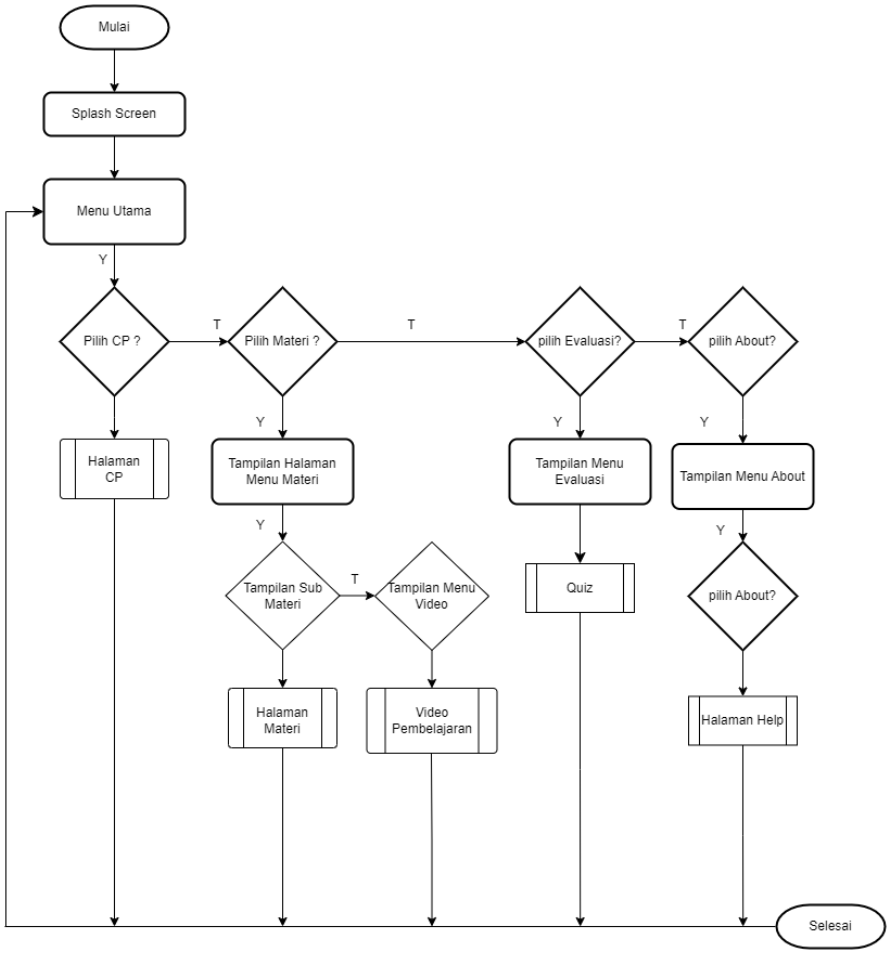

Figure 2. Application Flowchart of the Interactive Learning Media

2.2.2 Use Case Diagram

The use case diagram (Figure 2) outlines the functional interactions between the user and the application. Upon launching the app, users can navigate to different features such as learning outcomes, learning materials, quizzes, and information pages.

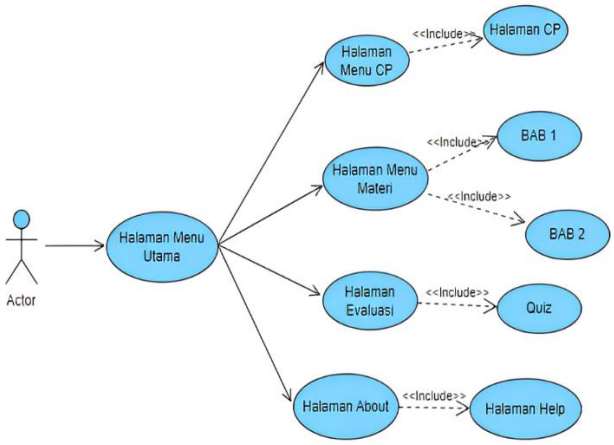

Figure 3. Use Case Diagram of the Interactive Learning Media

2.2.3 Activity Diagram

An activity diagram (Figure 3) illustrates the user journey from app installation to accessing learning content. This provides a detailed view of user interactions and system responses.

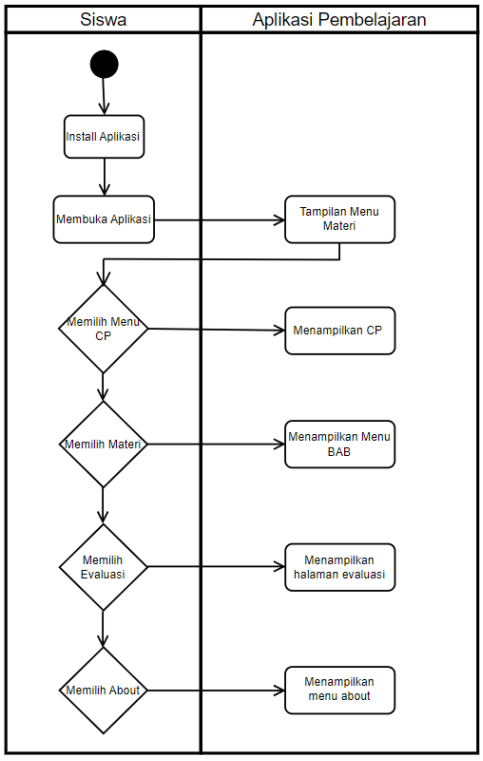

Figure 4. Activity Diagram of the Interactive Learning Media

2.3 Development Stage

In the development stage, the application is built based on the finalized design specifications derived from the previous phases. The first step involves

compiling and integrating all data and content collected during the analysis phase into the application structure. A preliminary version of the application is then produced and reviewed to ensure alignment with instructional goals before proceeding to validation. Subsequently, validation instruments are prepared, engaging both subject-matter experts and media specialists to evaluate the content and usability of the application. Additionally, student response questionnaires are developed to gather user feedback. The insights obtained from expert reviews and student input are then analyzed and used to refine and enhance the application prior to its implementation.

2.4 Implementation Stage

The implementation phase involves deploying the application to Grade X students of the Computer and Network Engineering program at SMK Negeri 1 Sijunjung. During this stage, feedback on usability, functionality, and content comprehension is collected through questionnaires.

2.5 Evaluation Stage

Evaluation focuses on assessing the effectiveness and feasibility of the developed application. This involves three evaluator groups: content experts, media experts, and students. Validation results are quantified using a Likert-scale-based scoring system. The feasibility score is calculated using the formula:

$$\text{Feasibility Score (\%)} = \frac{\sum \text{Total Score Obtained}}{\sum \text{Ideal Score}} \text{X } 100\% \quad (1)$$

Feasibility levels are interpreted according to Table 3.

Table 3. Product Feasibility Criteria

Percentage	Category
81% – 100%	Highly Feasible
61% – 80%	Feasible
41% – 60%	Moderately Feasible
21% – 40%	Less Feasible
< 21%	Not Feasible

Products are considered valid if they achieve a minimum feasibility score of ≥61%, and highly valid if ≥81%.

3. Results and discussion

3.1 Application Design Results

This research led to the successful development of an Android-based interactive learning media application tailored for the subject Basic Computer and

Telecommunication Network Engineering for Grade X students at SMK Negeri 1 Sijunjung. The application was constructed using the Flutter framework, which supports efficient development across multiple platforms while ensuring optimal performance on Android devices. Its primary objective is to facilitate independent, structured, and engaging learning experiences for vocational school students.

The resulting application consists of six main interface components, each designed to fulfill a specific instructional function, aligned with the pedagogical goals of the subject.

3.1.1 Splash Screen

The splash screen is the first visual element encountered by the user when the application is launched. It displays the application logo, reinforcing the identity and branding of the learning tool. Although brief in duration, this interface contributes to a professional and appealing first impression, a feature considered essential in enhancing user engagement from the outset.

Figure 5. Splash screen of the interactive learning media application.

3.1.2 Main Menu Interface

Following the splash screen, users are directed to the main menu. This interface acts as the central navigation hub, from which students can access all of the app's core functionalities. These include Learning Objectives (CP and TP), Instructional Materials, Video-Based Learning Content, Evaluation Module (Quiz), About Section and Help Page.

Each menu item is represented by a distinct icon and label, designed for ease of recognition and accessibility, even for novice users. The layout prioritizes clarity and intuitive user flow to minimize cognitive load.

Figure 6. Main menu with access to learning objectives, materials, videos, evaluation, and about/help sections.

3.1.3 Learning Objectives Page (CP and TP)

This page provides a clear articulation of the Learning Outcomes (CP) and Learning Objectives (TP) as mandated in the vocational education curriculum. By displaying these elements explicitly, the interface helps students understand what competencies they are expected to achieve, thereby aligning their learning trajectory with national standards.

This page plays a crucial role in goal orientation, a key principle in self-regulated learning, by providing learners with a roadmap of intended outcomes.

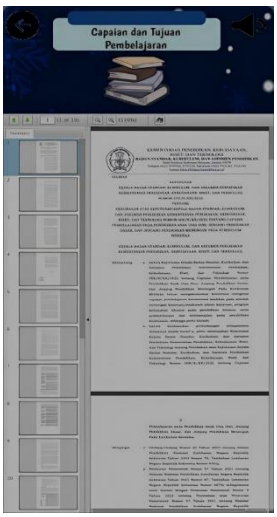

Figure 7. Learning outcomes and objectives page displaying CP and TP for the semester.

3.1.4 Instructional Materials Page

The learning content is presented in a structured format, organized into two primary topics, Business Processes in Network Engineering (e.g., customer handling, service planning, implementation, and support) and Technological Developments (e.g., 5G, IPv6, Fiber Optics, IoT, Cloud Computing).

Each topic contains text explanations, illustrative images, and links to supporting video content to enrich comprehension. The structure mirrors the semester syllabus, ensuring that students can follow the material sequentially or jump to specific topics as needed.

This modular layout is designed to support differentiated learning by allowing learners to access content based on their pace and prior knowledge.

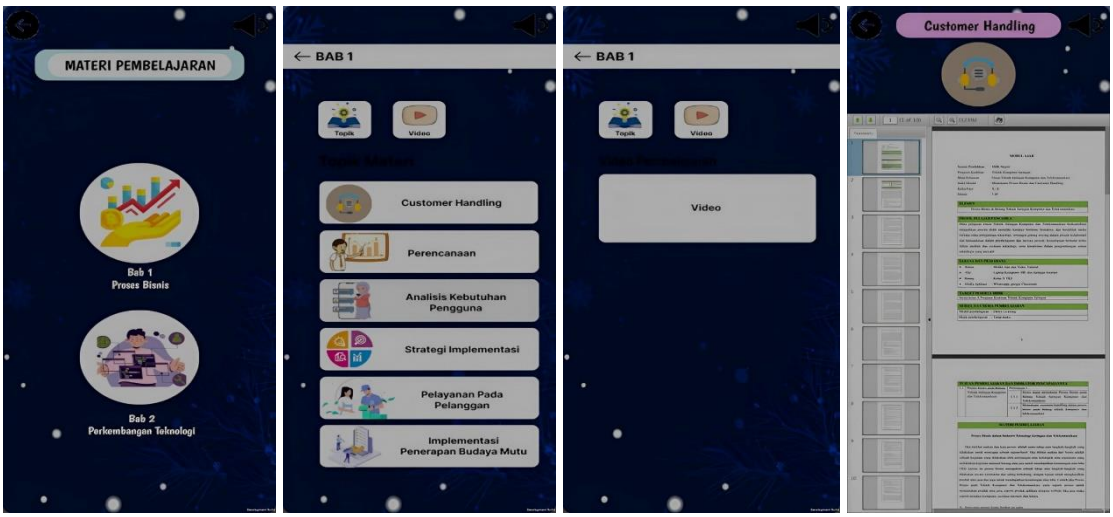

Figure 8. Learning materials page covering business process concepts and current technology trends.

3.1.5 Evaluation Interface

To support formative assessment, the application includes a quiz module comprising multiple-choice questions related to the presented materials. Upon completion, the application provides automated scoring and feedback, allowing students to gauge their understanding immediately.

This real-time evaluation approach not only reinforces learning but also promotes metacognitive awareness, as students can reflect on their performance and revisit materials as needed.

Figure 9. Evaluation page with interactive quizzes and instant scoring feedback.

3.1.6 About and Help Section

The final component of the application is the About Page, which contains information about the application developer, the purpose of the project, and acknowledgments. An integrated Help Section offers user guidance on how to navigate and utilize the application's features, providing support especially for first-time users.

This section is included to foster user autonomy and ensure that the application remains accessible and user-friendly for learners with varied levels of digital literacy.

Figure 10. About and help section providing developer information and usage instructions.

Collectively, the design of this interactive learning media emphasizes pedagogical alignment, user-centered interface, and technological adaptability. Each component was intentionally developed to support student engagement, mastery of content, and independent learning — all of which are essential in modern vocational education environments. The results demonstrate that the Flutter-based application effectively integrates content delivery, multimedia support, and interactive assessment into a cohesive and user-friendly platform.

3.2 Product Testing Design

To ensure that the developed application is valid, feasible, and pedagogically effective, a comprehensive product testing design was implemented. The evaluation process involved the development of three structured instruments: a Material Validation Questionnaire, a Media Validation Questionnaire, and a Student Response Questionnaire. Each instrument was specifically designed to assess different aspects of the application, with the goal of obtaining expert and user-based feedback to inform iterative improvements.

All instruments were reviewed for content validity by education technology experts and instructional designers to ensure that the indicators were aligned with best practices in instructional design, multimedia learning, and user experience (UX).

3.2.1 Material Validation Instrument

The material validation instrument was designed to evaluate the content quality and pedagogical relevance of the developed application. This instrument was administered to subject-matter experts (SMEs), specifically teachers of the Basic Computer and Telecommunication Network Engineering course who possess a deep understanding of the vocational curriculum and its intended learning objectives. The assessment focused on three primary components. First, curricular alignment examined whether the learning content within the application accurately reflected the Learning Outcomes (CP) and Learning Objectives (TP) established in the national vocational education framework. Second, content clarity and accuracy measured the scientific correctness, clarity, and currency of the material, including whether explanations, terminology, and examples were appropriate and understandable for Grade X students. Third, instructional effectiveness assessed the extent to which the content supported student comprehension of critical subject matter, particularly complex concepts such as network business processes and technological advancements in telecommunications. In addition to these core aspects, the instrument also evaluated the structure and sequence of the material, the appropriateness of the language used, and the relevance of integrated multimedia components such as images and videos in supporting the instructional goals. The insights gained from this validation process were instrumental in refining the content to ensure

it was accurate, accessible, and pedagogically sound prior to its implementation in the classroom.

3.2.2 Media Validation Instrument

The media validation instrument was specifically designed to assess the technical quality, visual design, and usability of the developed learning application. This instrument was administered to media experts and instructional technologists who possess relevant expertise in educational application development, interface design, and mobile user experience. The evaluation focused on several key aspects critical to ensuring the application's effectiveness and appeal in a real-world learning environment.

One of the primary areas assessed was the user interface (UI) design, including the consistency of the layout, the clarity of the visual hierarchy, the appropriateness of color combinations, the readability of typography, and the logical organization of navigation elements such as buttons and menus. In addition, interactivity and navigation were evaluated to determine whether users could easily interact with the application and move smoothly between different screens and features without confusion.

Another important criterion was platform compatibility and responsiveness, which examined the performance of the application across various Android devices, accounting for differences in screen sizes and resolutions. The instrument also assessed the integration of multimedia, such as audio and video elements, and their effectiveness in supporting and enhancing the learning content presented to students.

Furthermore, the instrument evaluated the aesthetic quality and engagement potential of the application, focusing on whether the visual design could attract and maintain students' attention, thereby promoting a more engaging and motivating learning experience. The feedback obtained from this media validation process was then used to identify technical weaknesses and improve the application's functionality and user experience during the subsequent development iteration.

3.2.3 Student Response Questionnaire

To obtain authentic and user-centered feedback, a student response questionnaire was developed and distributed to Grade X students enrolled in the Basic Computer and Telecommunication Network Engineering course at SMK Negeri 1 Sijunjung. This instrument aimed to evaluate the application's effectiveness from the learner's perspective by capturing their direct experiences and perceptions while using the learning media.

The questionnaire was structured around three primary dimensions. The first dimension, visual and functional appeal, explored students' impressions regarding the application's interface design, including its visual attractiveness, ease of use, and the clarity and intuitiveness of elements such as icons, buttons, and menus. The second dimension, content presentation, focused on how well the students could comprehend the instructional material. It examined whether the combination of text, images, and video content supported their understanding and whether the quiz questions aligned with the learning objectives set by the curriculum.

The third dimension, perceived learning benefits, investigated the extent to which the application enhanced students' motivation, interest, and confidence in learning. It also evaluated whether the application encouraged self-directed learning and supported students in mastering the targeted competencies both in and beyond the classroom context.

Responses were gathered using a 5-point Likert scale, allowing students to express their level of agreement with various statements. The resulting data were analyzed to determine overall student satisfaction and to identify specific areas that could be improved. This feedback played a crucial role in validating the application's design and instructional impact, as learner-centered evaluation is fundamental to the development of effective and responsive educational technology.

This multilayered validation strategy ensures that the application meets quality standards in content, design, and user experience. The integration of feedback from both experts and actual users allows for iterative improvements to maximize the educational impact of the developed media. Through this approach, the learning application is not only pedagogically sound but also technically robust and aligned with student needs.

3.3 Validation Results

The validation process was conducted to ensure that the content and media design of the developed interactive learning application met academic and technical standards. This validation involved two types of expert reviewers: subject-matter experts (SMEs) for material validation and instructional technology experts for media validation. Each group of validators used a structured instrument to evaluate different aspects of the application. The results of both validations are presented below.

3.3.1 Material Expert Validation

Material validation was conducted by two experts in the field of Basic Computer and Telecommunication Network Engineering. These validators were responsible for assessing the application content against criteria such as

alignment with the Learning Outcomes (CP) and Learning Objectives (TP), clarity and accuracy of information, pedagogical relevance, and appropriateness of language and examples. The results of this validation are shown in Table 1 below:

Table 4. Material Expert Validation Results

Validator	Score	Percentage	Category
1	72	96%	Highly Feasible
2	68	90.67%	Highly Feasible
Average	—	**93.3%**	**Highly Feasible**

The first validator provided a score of 72, which translates to a percentage of 96%. The second validator awarded a score of 68, equivalent to 90.67%. Both scores fall into the Highly Feasible category, which is defined for percentages between 81% and 100%. The average score of 93.3% indicates that the application content is pedagogically sound, effectively structured, and highly suitable for supporting the targeted curriculum.

3.3.2 Media Expert Validation

The technical and aesthetic aspects of the learning media were assessed by two media experts experienced in educational technology and mobile application development. Their evaluation focused on elements such as interface design, layout consistency, ease of navigation, responsiveness, interactivity, and multimedia integration. The results are detailed in Table 2 below:

Table 5. Media Expert Validation Results

Validator	Score	Percentage	Category
1	74	98.67%	Highly Feasible
2	63	84%	Highly Feasible
Average	—	**91.3%**	**Highly Feasible**

Validator 1 assigned a score of 74 (98.67%), while Validator 2 gave a score of 63 (84%). These scores again fall within the Highly Feasible category. The average of both evaluations is 91.3%, confirming that the user interface and functional design are highly effective for the intended learning environment. Media components such as icons, menus, video integration, and navigation were all found to be accessible and user-friendly.

By combining the average percentages from both validation processes—93.3% for material and 91.3% for media—the overall average feasibility rating is 92.3%. This result strongly supports the conclusion that the Android-based interactive learning application is both pedagogically valid and technically robust. It is therefore deemed ready for implementation in vocational education contexts,

particularly for Grade X students in computer and telecommunication network engineering subjects.

3.4 Student Response Results

In addition to expert validation, end-user feedback was collected through a structured student response questionnaire. This instrument was distributed to students of Grade X in the Computer and Telecommunication Network Engineering program at SMK Negeri 1 Sijunjung who used the application during the trial implementation.

The questionnaire evaluated three core dimensions: application design, content presentation, and perceived learning benefits. Students responded using a 5-point Likert scale ranging from Strongly Disagree to Strongly Agree. The summary of their responses is presented in Table 3:

Table 6. Summary of Student Response Evaluation

Aspect	Percentage	Category
Application Design	88.02%	Highly Feasible
Content Presentation	88.89%	Highly Feasible
Perceived Benefits	89.03%	Highly Feasible
Overall Average	**88.52%**	**Highly Feasible**

As shown in Table 3, all evaluated aspects received scores above 88%. The Application Design aspect, which encompasses visual appeal, menu organization, and ease of use, scored 88.02%. The Content Presentation dimension, which includes clarity, media use, and alignment with learning outcomes, received 88.89%. The highest score was recorded in the Perceived Benefits dimension at 89.03%, indicating strong motivational and cognitive impacts on learners.

The overall average score of 88.52% places the application in the Highly Feasible category. These results suggest that the application not only meets the technical and pedagogical criteria but also engages students effectively. Students reported that the application increased their motivation, enhanced their understanding, and allowed them to review materials independently outside of class. These findings align with prior studies indicating that digital learning media with interactive and visual components significantly enhance student engagement and learning outcomes in vocational and technical education [26]–[29].

3.5 Discussion

The results of this study indicate that the development of Android-based interactive learning media for the Basic Computer and Telecommunication

Network Engineering subject is both technically feasible and pedagogically appropriate. High validation scores from subject-matter experts and media experts confirm strong alignment with the curriculum, as well as adherence to usability and instructional design principles.

From the content standpoint, the material experts awarded an average validity score of 93.3%, reflecting the application's strong coherence with the national Learning Outcomes (CP) and Learning Objectives (TP). The instructional materials were evaluated as accurate, systematically structured, and suitable for conveying complex concepts such as network business processes and emerging telecommunications technologies. This confirms the importance of contextual and domain-specific learning media in vocational education as previously emphasized [30], [31].

The media experts also provided a high validity score of 91.3%, indicating that the technical aspects, including user interface, layout consistency, and multimedia integration, met the expected quality standards. The inclusion of images, videos, and interactive assessments effectively supported cognitive processing by combining visual and verbal channels in accordance with multimedia learning principles [32], [33].

In addition, student feedback yielded an average score of 88.52%, categorized as "Highly Feasible." This suggests that the application was well-received by its target users and contributed positively to student motivation and engagement. Learners reported that the design was attractive and easy to navigate, the content was understandable, and the quizzes enhanced their comprehension and retention of the subject matter. These findings are consistent with prior studies on the effectiveness of mobile learning applications in increasing learner autonomy and motivation [34]–[38].

Furthermore, the inclusion of real-time quizzes with automated feedback fulfills the requirements of formative assessment, which is essential for self-monitoring and continuous improvement in learning [39][40]. The application's ability to deliver feedback promptly enables learners to identify their strengths and weaknesses, facilitating a more reflective and independent learning process.

From a technological perspective, the use of the Flutter framework enabled the application to function optimally across Android devices with varying screen sizes and system capabilities. This aspect is crucial for ensuring accessibility and inclusivity, especially in vocational schools where students often rely on personal mobile devices for learning [41].

Despite these strengths, the study acknowledges some limitations. The application currently lacks teacher-facing analytics tools to monitor student progress in real time. Future iterations could incorporate learning analytics

dashboards to support data-driven decision-making by educators. Additionally, while the application functions offline, future versions may benefit from optional online features such as collaborative modules, cloud-based updates, or integration with learning management systems.

In conclusion, the Android-based interactive learning media developed in this study is a valid and feasible educational tool that aligns well with curriculum standards and responds effectively to students' learning needs. Its implementation may support digital transformation in vocational education and promote independent learning in line with the goals of Industry 4.0 [22].

4. Conclusion

This study successfully developed and validated an Android-based interactive learning media application tailored to the Basic Computer and Telecommunication Network Engineering course for Grade X students at SMK Negeri 1 Sijunjung. Built using the ADDIE model and the Flutter framework, the application incorporates instructional materials, multimedia resources, and quiz-based evaluations aligned with national curriculum standards (CP and TP). The validation results confirmed the application's high level of feasibility and effectiveness, with average scores of 93.3% from material experts, 91.3% from media experts, and 88.52% from student responses—all classified as "Highly Feasible."

The media proved successful in enhancing student engagement and learning motivation through its interactive features and user-friendly design. By integrating text, images, video, and real-time assessment, the application provided an accessible and comprehensive learning experience suitable for vocational education settings.

However, the study also identified several limitations. First, the application does not yet include a teacher dashboard or analytics tools to monitor student progress. Second, the evaluation was limited to a single institution, which may restrict generalizability. Furthermore, the application's content is currently limited to specific topics in Semester 1 of the course, leaving room for content expansion.

Future research should focus on scaling the application to broader educational contexts, incorporating adaptive learning features, and integrating cloud-based data storage for performance tracking. Additional development could also explore interoperability with existing learning management systems (LMS) and the inclusion of collaborative learning tools to support peer-to-peer interaction. These advancements would further enhance the application's pedagogical impact and contribute to the broader digital transformation of vocational education in the era of Industry 4.0.

Author's declaration

Author contribution

Fadilla was responsible for the research design, data collection, and application development. **Efrizon** contributed to the supervision of the research process and provided guidance in instructional media validation. **Mahesi Agni Zaus** assisted in the technical development and testing of the Android-based application. **Vera Irma Delianti** contributed to the analysis of student responses and the preparation of the manuscript.

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Competing interest

The authors declare no competing financial or non-financial interests related to this study.

Ethical clearance

All procedures performed in this study involving human participants were reviewed and approved by the relevant ethics committee. Prior informed consent was obtained from all participants and school authorities involved in the research.

AI statement

AI tools were used solely to assist with language refinement and formatting. The research design, data analysis, and interpretation of results were conducted entirely by the authors.

Publisher's and Journal's note

Universitas Negeri Padang as the publisher and Editor of Jurnal Vokasi Informatika state that there is no conflict of interest towards this article publication.

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