

Development of Android-Based Project-Based Learning Media to Enhance Students' Entrepreneurial Skills

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ABSTRACT

Entrepreneurship education at the higher education level often faces challenges in bridging theoretical knowledge with practical application. Students frequently lack the necessary skills to implement entrepreneurial concepts in real-life contexts. This study aimed to develop an Android-based learning media using a Project-Based Learning (PjBL) approach to enhance students' entrepreneurial skills. The study employed a Research and Development (R&D) method using the ADDIE model, which includes five phases: Analysis, Design, Development, Implementation, and Evaluation. The product was evaluated through expert validation (content and media), small and large group practicality tests, and effectiveness testing using the N-Gain formula. The developed learning media was rated as *very valid* by experts, with a material validation score of 90.6 and a media validation score of 77.9. The practicality test showed a high level of usability with an average score of 80.45%, categorized as *very practical*. The effectiveness test produced an N-Gain score of 0.5788, indicating a *moderate* level of effectiveness in improving entrepreneurial skills. The findings suggest that the Android-based PjBL learning media effectively supports students in understanding and applying entrepreneurial concepts through real-world projects. Its integration of mobile technology with experiential learning offers a flexible and engaging alternative to conventional instruction. This study contributes an innovative, technology-integrated instructional model that enhances entrepreneurship education by fostering practical skill development among university students in the digital era.

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1. INTRODUCTION

In recent years, higher education institutions in Indonesia have made significant efforts to improve graduate employability and foster entrepreneurial mindsets. One such initiative is the implementation of the Merdeka Belajar – Kampus Merdeka (MBKM) curriculum by Muhammadiyah University of Metro, particularly within the Economic Education study program. A key component of this curriculum is the

integration of entrepreneurship education to equip students with the necessary knowledge, skills, and experiences to become independent entrepreneurs. This initiative aligns with national goals to reduce graduate unemployment and promote self-sufficiency through entrepreneurial ventures (Pratiwi, 2023; Sari, Suryana, Bentri, & Ridwan, 2023).

The MBKM curriculum emphasizes experiential learning approaches, and one of the most effective models for this purpose is Project-Based Learning (PjBL). The PjBL model facilitates active student engagement by allowing learners to work on real-life business projects, thus fostering entrepreneurial competencies such as opportunity identification, strategic planning, business execution, and problem-solving (Fajra & Novalinda, 2020; Rohm et al., 2021). The primary goal of the entrepreneurship program within the MBKM framework is to help students acquire both the mindset and skill set necessary for successful business development. This involves cultivating creativity, innovation, risk-taking, and the ability to create and implement viable business models.

In today's digital era, especially in the 21st-century globalized education landscape, entrepreneurship education must also integrate technological competencies. The Technological Pedagogical Content Knowledge (TPACK) framework has been widely recognized as a valuable tool in supporting meaningful and interactive teaching (Hasanah, Meviana, & Setyawan, 2025; Haniefa & Samsudin, 2023). Given the pervasive use of smartphones, especially in Indonesia—where the average daily screen time reached 5.7 hours in 2021—leveraging mobile technology for educational purposes presents a significant opportunity (Basuki et al., 2022; Rizvi & Nabi, 2021; Sujarwoto, Saputri, & Yumarni, 2023). Integrating Information and Communication Technology (ICT) in learning can enhance clarity, speed of information delivery, and visualization of abstract concepts, all of which are crucial in entrepreneurship education.

Despite these innovations, many students remain disengaged with entrepreneurship courses. Observations indicate that students often lack interest in entrepreneurship topics and struggle to apply theoretical concepts in practical contexts. Traditional lecture-based and discussion-based pedagogies are insufficient for providing students with real-world entrepreneurial experiences (Kabeyi, 2019; Widiastuti, 2021). Consequently, students may understand theories but lack the practical skills required to plan, execute, and manage business ventures effectively. They also face difficulties in solving real-life business problems, identifying opportunities, making strategic decisions, or recovering from entrepreneurial failures (Muhammad & Zulfikar, 2024; Usman, Djaha, & Farida Tuati, 2024).

Moreover, entrepreneurship is not merely about selling products or services—it is about identifying customer needs and offering innovative solutions. A viable business idea should fulfill a need or solve a problem faced by potential customers. This requires students to possess both critical thinking and creative problem-solving abilities (Kabeyi, 2019; Ragil Adiyatma et al., 2023). Therefore, entrepreneurship education must move beyond the classroom and engage students directly with real-world challenges. Hands-on learning experiences are essential for cultivating the entrepreneurial skills necessary for success in today's competitive job market.

Given these challenges, the Project-Based Learning (PjBL) model emerges as a promising solution. PjBL encourages students to engage in real or simulated business projects, which helps them develop entrepreneurial thinking, teamwork, communication, and problem-solving skills (Fajra & Novalinda, 2020; Rohm et al., 2021; Hendrawati, 2017). At the same time, the rapid development of technology provides opportunities to create more interactive and engaging learning media. One such innovation is the use of Android-based applications as learning tools to support PjBL. These apps offer flexibility, accessibility, and interactivity, enabling students to learn anytime and anywhere using their smartphones.

Integrating Android apps with PjBL not only makes learning more efficient and personalized, but it also fosters collaborative learning environments that are conducive to developing entrepreneurial competencies (Fitri et al., 2024; Iskandar, 2023). Students can interact with content, collaborate on projects, and apply entrepreneurial concepts in practical settings. PjBL has also been shown to improve students' critical thinking skills, creativity, self-regulation, motivation, and attitudes toward entrepreneurship

(Nurhidayah et al., 2021; Diana et al., 2021; Azzahra et al., 2023; Wati et al., 2022; Agustin, 2022; Kurniawati et al., 2021; Adhimah, 2022; Alshammary & Alhalafawy, 2023).

Although prior studies have implemented PjBL in entrepreneurship education to enhance student outcomes, many have not utilized mobile applications to their full potential. For instance, while projects have been used to improve student literacy, motivation, creativity, and critical thinking (Chen et al., 2022; Khairat, 2020; Kartono, 2022; Kumar, 2021; Damayanti et al., 2019; Kamal & Khusna, 2023), they often lack integration with Android-based platforms that can further support flexible, mobile learning (Ruslan, Bilad, Noh, & Sufian, 2021).

The novelty of the current approach lies in the development of Android-based PjBL learning media specifically for entrepreneurship education in Economic Education programs. This integration combines the advantages of mobile technology with the experiential strengths of PjBL, providing a more engaging and contextually relevant learning experience. By involving students in hands-on projects and equipping them with tools that mirror real-world business practices, this model is expected to significantly enhance their entrepreneurial abilities.

In summary, Project-Based Learning supported by Android applications represents a modern, practical solution for entrepreneurship education in higher education. It enables students to develop entrepreneurial mindsets and business skills, bridge the gap between theory and practice, and prepare for the complex demands of the workforce. This study aims to design and implement an Android-based PjBL learning media to support entrepreneurship learning in the Economic Education program. It is anticipated that this innovation will contribute significantly to improving students' entrepreneurial competencies and their ability to apply theoretical concepts in real-world settings.

2. METHODS

This study employs a Research and Development (R&D) approach, which is designed to produce new educational products or enhance existing ones. The purpose of R&D is not only to generate practical solutions but also to ensure that the resulting product is valid, effective, and applicable in real educational settings.

To guide the development process, this research adopts the ADDIE model, an instructional design framework that consists of five systematic phases: Analysis, Design, Development, Implementation, and Evaluation (Rahmayani et al., 2022). The ADDIE model is widely recognized for its structured yet flexible methodology, allowing for iterative improvements at each stage of product development.

In this study, the ADDIE model has been adapted to suit the specific context of developing an Android-based learning media for entrepreneurship education. Each phase of the ADDIE model is outlined and modified as shown in Figure 1, which illustrates the sequence and components of the development process implemented in this research.

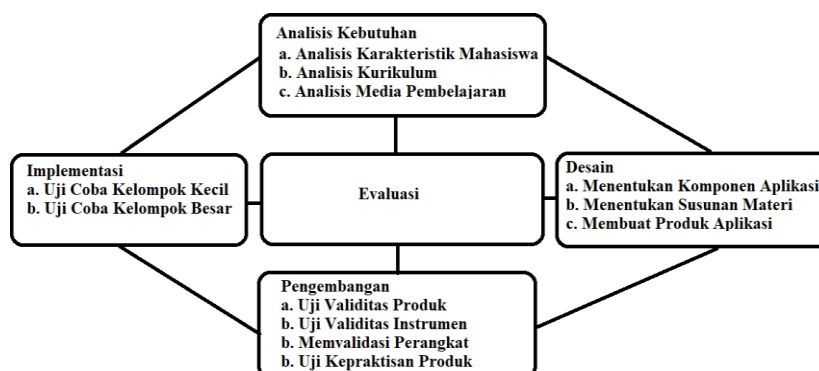


Figure 1. ADDIE Development Model

This study applies the ADDIE development model—Analysis, Design, Development, Implementation, and Evaluation—to create Android-based learning media grounded in the Project-Based Learning (PjBL) approach. The first phase, Analysis, involved identifying learning challenges and gaps in the existing entrepreneurship teaching materials. This needs analysis provides a foundation for designing instructional materials aligned with student needs and learning objectives.

In the Design phase, the insights gained were used to structure the content and user interface of the Android application, ensuring alignment with entrepreneurship learning goals and the principles of PjBL. The Development phase included creating a prototype and validating it through expert review. Media and content validation was conducted by a media expert, an entrepreneurship subject matter expert, and a PjBL practitioner using a 4-point Likert scale. Validation ensured the product met standards for content accuracy, media functionality, and instructional effectiveness (Ahorsu et al., 2022; Ilmuyyah et al., 2021).

Several research instruments were used, including a validation sheet, an entrepreneurial skills observation rubric (covering business planning, product creation, and marketing), and a student response questionnaire assessing practicality. A pre-test and post-test were also administered to measure knowledge gains, though the study primarily focused on practical skill development.

The participants were fourth-semester students in the Economic Education Study Program, selected via purposive sampling. These students had prior exposure to entrepreneurial theory through the Merdeka Belajar – Kampus Merdeka curriculum and had access to Android devices. Initial product testing was conducted with a small group of 11 students to assess practicality. The media’s reliability and effectiveness were evaluated using predetermined criteria categorized into five levels of feasibility, as summarized in the evaluation table provided.

Table 1. Criteria for Assessing the Reliability and Usefulness of Learning Media

Score Range (%)	Category	Description
81 – 100	Very Feasible	The learning media are highly reliable and very suitable for use.
61 – 80	Feasible	The learning media are reliable and suitable for use.
41 – 60	Moderately Feasible	The learning media are fairly reliable and usable with revisions.
21 – 40	Less Feasible	The learning media are less reliable and require major improvements.
0 – 20	Not Feasible	The learning media are not reliable and unsuitable for use.

The fourth stage of the ADDIE model is Implementation, during which the developed learning media were applied in the context of entrepreneurship learning. A total of 60 students from the Economic Education Study Program participated in this stage. The sample size aligns with Sugiyono’s (2017) recommendation that a reasonable sample in educational research typically ranges from 30 to 500 participants.

The final stage, Evaluation, was conducted continuously throughout the previous phases to ensure that the developed product met the intended educational objectives. This stage involved both formative and summative evaluations to assess the effectiveness and practicality of the Android-based learning media. To analyze the effectiveness, an independent sample t-test was employed to compare student performance between the experimental and control groups. Additionally, an N-Gain test was used to measure the improvement in students’ entrepreneurial skills before and after using the learning media.

The N-Gain score reflects the magnitude of learning gains, with higher scores indicating that the media effectively enhanced students’ entrepreneurial competencies. Conversely, lower N-Gain scores suggest that the media had minimal impact on skill development. The evaluation was guided by established N-Gain interpretation criteria (Utami et al., 2020), which are summarized in the following

table to illustrate the level of effectiveness of the Android-based PjBL learning media in improving entrepreneurial skills.

Table 2. Criteria for N-Gain Scores

N-Gain Score (g)	Category
$g > 0.7$	High
$0.3 \leq g \leq 0.7$	Moderate
$g < 0.3$	Low

The assessment of students' entrepreneurial skills was conducted using a set of statements and indicators that reflected key competencies in entrepreneurship. To evaluate the improvement in students' theoretical understanding, pre-test and post-test assessments were administered before and after the learning intervention. Meanwhile, practical entrepreneurial skills were measured through the implementation of real-world projects, such as business simulations, product development, and digital marketing activities. These projects provided opportunities for students to apply entrepreneurial concepts in authentic contexts. The assessment employed a rubric-based evaluation, which included indicators such as independence, creativity, responsibility, problem-solving, and sales ability, to comprehensively measure students' entrepreneurial performance and growth.

3. FINDINGS AND DISCUSSION

This development study resulted in a valid and practical learning product in the form of an Android-based Project-Based Learning (PjBL) application, designed to support the enhancement of students' entrepreneurial skills. The following section presents the results and discussion of the learning media development process, which was carried out using the ADDIE instructional design model.

3.1 Stage Analysis

Based on interviews conducted with lecturers of the entrepreneurship course in the Economic Education Study Program at Muhammadiyah University of Metro, it was found that the current learning process utilizes digital media in the form of e-books as the primary source of theoretical material. While these e-books are considered helpful in presenting systematic and concise theoretical content, further analysis revealed that they remain general in nature and do not explicitly provide technical guidance for implementing entrepreneurship practices. In particular, for project-based assignments, students lack structured and detailed instructions on how to conduct practical tasks involving business planning, execution, and evaluation.

The absence of concrete guidance on entrepreneurial practices has led to low levels of student engagement in entrepreneurial activities. Students reported feeling confused and unsure where to begin when assigned practical tasks, such as developing products, determining marketing strategies, or preparing simple financial reports. The lack of step-by-step instructional support in the current e-books makes it difficult for students to translate theoretical concepts into real-life practice. Ideally, entrepreneurship learning should encourage students to train directly, experiment, and develop contextual business ideas through experiential learning.

Interviews with students further revealed a strong demand for learning media that not only delivers theory but also includes technical instructions for conducting entrepreneurial practices. Students expressed the need for offline-accessible media, such as downloadable applications, interactive e-books, or digital modules in PDF format, due to internet connectivity issues and limited data quotas in their residential areas. Therefore, offline-compatible media becomes a critical alternative to ensure accessibility and inclusivity in learning.

Students also emphasized that the ideal learning media should provide visual and instructive content, including illustrated practice guides, flowcharts of entrepreneurial steps, business simulations,

and real-world project examples. While project-based tasks have helped students better understand how the business world operates, they expressed concern over the lack of media that offers clear, detailed, and achievable task instruments to support these projects during their entrepreneurship practice.

These findings highlight that students, as active learners, require media that is not only informative but also applicable and action-oriented. Instructional media significantly influences student understanding and engagement (Siregar, Panjaitan, Girsang, & Dabukke, 2019). Students tend to comprehend better when learning is grounded in direct experience, and thus need media that provides realistic, hands-on guidance. In this context, the need for project-based learning (PjBL) media becomes increasingly relevant. PjBL has been shown to effectively develop students' entrepreneurial skills through a learning-by-doing approach. Unfortunately, the current learning media—such as static e-books—do not fully meet these demands. The integration of visual and audio-visual tools in learning is essential for enhancing student participation and reducing learning barriers (Ezeh, Anidi, & Nwokolo, 2021).

From a pedagogical perspective, these conditions reveal an imbalance between theoretical and practical approaches in entrepreneurship education. Although lecturers have taken steps to enhance learning resources by providing e-books, there is a lack of supporting instructional media that enables students to carry out entrepreneurship practices independently and in a structured manner. Instructional media should serve as a bridge to foster critical thinking, motivate students, and stimulate engagement—all of which are crucial for achieving learning competencies (Arifiyana, 2024).

Therefore, future learning media development must integrate detailed project-based task components, covering the full process—from business idea planning and implementation, to documentation and final evaluation.

In summary, the analysis of media needs and student characteristics in entrepreneurship learning identifies three key issues that must be addressed:

1. Current learning media lack systematic, practical guidance for entrepreneurship implementation.
2. Students require offline-accessible media to overcome technical barriers such as internet limitations.
3. As active and contextual learners, students demand the development of interactive, applicable, and inclusive project-based media with detailed guidance.

3.2 Design Stage

The design stage is a critical phase in the development of Android-based learning media, as it lays the foundation for all aspects of the media's content, structure, appearance, and functionality. During this stage, every component is systematically planned to align with the learning objectives and instructional needs of the course.

The first step in the design phase involved organizing and structuring the learning materials in accordance with the Semester Learning Plan (RPS) for the Entrepreneurship course. The content was developed based on predetermined learning outcomes and indicators, ensuring that each section had a clear purpose. The material focused on core entrepreneurial competencies, including business planning, market analysis, marketing strategies, and business evaluation. To enhance clarity and accessibility, the content was designed to be concise, communicative, and student-friendly, and was supplemented with relevant video materials to support visual learning.

Next, the design phase included the development of project-based learning (PjBL) task models, which formed the core instructional approach. These tasks were carefully structured to guide students through a gradual, continuous process of entrepreneurial practice. The activities were sequenced in logical and realistic stages, starting from identifying business ideas, preparing business proposals, and implementing small-scale ventures, to compiling business reports and delivering presentations. Each

task included detailed implementation instructions, worksheets, and clear assessment criteria to help students follow the process efficiently and understand the expectations of their instructors.

In terms of visual and structural design, the media was developed with an emphasis on user-friendly interface and accessibility. This began with the creation of visually engaging elements such as an application cover page that reflects the entrepreneurial spirit. The interface was designed to be simple, functional, and intuitive, allowing students to easily navigate the content. The main menu provided access to essential components, including Usage Instructions, Material Summaries, Project Guides, Worksheets, and Self-Evaluation Tools. All features were developed to be fully accessible offline, acknowledging the challenges students may face in areas with limited internet connectivity.

With this structured design approach, the Android-based learning media was developed not only as a tool for theoretical understanding but also as a practical guide for implementing entrepreneurial projects. This aligns with prior research emphasizing the importance of integrating structured and interactive design elements to enhance the effectiveness of digital learning tools (Afriyani et al., 2023; Pharmadi & Zola, 2021). The integration of content, project-based assignments, and an engaging visual interface is expected to create a contextual, applicable, and meaningful learning experience.

The application's home screen features the title of the project-based learning media and an "Open" button, which serves as the entry point to all application content. As shown in Table 1, the home screen includes two primary elements: the application title and the navigation button. The title explicitly indicates that the media adopts a project-based learning approach, serving not only as a visual identity but also as a pedagogical statement. It signals the application's aim to equip students with practical business skills. The "Open" button is designed with a simple and intuitive interface, making it easy for users to begin engaging with the content.

Each project in the application includes a sub-menu with four main sections: Market Research, Business Planning, Product Development, and Marketing Mix. These sections share a consistent layout and include components such as Learning Objectives, Material Summaries, Project Instructions, Tools and Materials Lists, Task Formats, Practice Questions, and Bibliographies. The design of this sub-menu ensures that students are guided systematically through each stage of the learning process. The inclusion of specific, measurable learning outcomes in each project helps students clearly understand the goals of the learning activities.

The Project Tasks menu was also designed to facilitate structured and practical learning experiences. It includes key components such as equipment preparation, materials lists, step-by-step project instructions, video links for additional explanations, and submission links for project deliverables. The Tools and Materials section ensures that students prepare all necessary resources before starting the project, allowing the implementation process to run smoothly and according to plan. The step-by-step instructions are written in a clear and systematic manner to support students in completing each project efficiently.

Additionally, video tutorials are provided to enrich students' understanding by offering visual and auditory explanations of key concepts and processes. These videos enhance students' ability to comprehend complex tasks, aligning with findings that multimedia resources can significantly improve student learning outcomes (Afriyani et al., 2023). To streamline the assessment and submission process, the application includes direct links to online platforms where students can submit their project tasks. This feature allows instructors to easily document, monitor, and evaluate student work.

In summary, the design phase plays a central role in ensuring the Android-based learning media is instructionally effective, visually engaging, and technically accessible. The integration of clearly defined content, structured project tasks, multimedia resources, and an intuitive interface contributes to a comprehensive learning environment. This design is expected to bridge the gap between theory and practice, allowing students to engage in authentic, hands-on entrepreneurship education that is both flexible and accessible, even in low-connectivity settings.

3.3 Development Stages

After the Android-based learning media utilizing the Project-Based Learning (PjBL) approach was fully designed, the process continued to the development stage. This stage involved several key activities, including product validation, instrument validation, and practicality testing. The product validation was conducted by a panel of experts to ensure the quality and appropriateness of the media content and design. Specifically, validation was carried out by two subject matter experts and two media experts, each evaluating the product based on predetermined criteria.

The results of the material and media expert validations are summarized in Table 3, which presents the assessment outcomes related to the validity and feasibility of the developed learning media.

Table 3. Material and Media Expert Validation Scores

No	Validator Types	Average Score
1	Subject Matter Expert Validation	90.6
2	Media Expert Validation	77.9

Based on the results presented in Table 3, the material validation by subject matter experts achieved an average score of 90.6, indicating that the content delivered in the entrepreneurship learning application is very valid and can be used without revision. Meanwhile, the media validation conducted by media experts received an average score of 77.9, suggesting that the application is valid, but may benefit from minor revisions to enhance its overall quality.

The feedback from the media validation highlighted that the learning content aligns well with the learning objectives and covers essential aspects of entrepreneurship, such as business planning, financial management, marketing strategies, and risk analysis. However, to ensure the material is more comprehensive and relevant to current trends, it is recommended to incorporate contemporary topics such as digital startups, e-commerce, and social entrepreneurship.

Additionally, the inclusion of real-world case studies and project-based assignments is advised to enhance students' practical understanding. The learning materials should not be limited to text but should also include videos, infographics, and animations to improve engagement and cater to different learning styles. Furthermore, it is essential to integrate the development of soft skills, such as leadership and communication, which are crucial for entrepreneurial success. A well-defined assessment rubric should also be provided to measure students' achievement of learning outcomes systematically.

3.4 Implementation Stage

The research's implementation stage involved two trial phases: a small group trial and a large group trial. The purpose of these trials was to evaluate the effectiveness and quality of the Android-based learning media developed using the Project-Based Learning (PjBL) model. This research aimed to produce an innovative and applicable learning tool that enhances students' entrepreneurial skills through experiential learning.

The small group trial was conducted with eleven students selected based on their alignment with the target user profile, particularly those who had prior exposure to entrepreneurship learning. The main objective of this initial trial was to collect feedback on several key aspects, including the clarity of the instructional material, the visual and functional design of the interface, the ease of navigation, and the integration of PjBL principles within the application.





Following the trial, participants completed a questionnaire to assess the practicality of the Android-based learning media. The results of this practicality test for the small group are detailed in Table 4, providing insight into the initial user experience and the usability of the application.

Table 4. Practicality test results of a small group

Respondents	Scores from Respondents	Maximum Score	Percentage	Criteria
11	80.45	100	80.45	Very Practical

The results of the small group trial, as shown in Table 4, indicate that the application was generally considered practical by students. They found the learning media easy to access, the content systematically presented, and the project activity instructions sufficiently clear. However, several improvements were suggested, including correcting typographical errors, enhancing color contrast for visual comfort, and adding navigation icons to simplify access to submenus. Feedback from the 11 respondents also highlighted minor issues such as inconsistent font use, incorrect capitalization, and misplaced icon buttons. These insights served as the basis for product refinement before proceeding to large-scale testing. Overall, students found the application helpful and engaging, particularly in supporting their understanding of entrepreneurship projects.

Table 5. Improvements After Expert Validation and Practicality Test

No	Before	After
1	 <p>There is error typos and errors use letter capital .</p>	 <p>Writing Already revised</p>
2	 <p>Use font that is not The same with the other parts .</p>	 <p>Use font already standardized .</p>

<p>3</p>		
	<p>Election color QR too much striking .</p>	<p>Color QR neutral and aligned with color background.</p>
<p>4</p>		
	<p>There is no icon for back to sub chapter.</p>	<p>There is icon for back to the sub-chapter menu .</p>
<p>5</p>		
	<p>There is an error with icon</p>	<p>Objective icon already revised, go to the sub-chapter menu product businessman.</p>

Based on the results in Table 5, several improvements were made to enhance the quality and usability of the Android-based learning media. Initially, issues such as typographical errors and the incorrect use of capital letters were identified. These were corrected, resulting in cleaner, more readable text. The previously inconsistent fonts were standardized to ensure a more professional and cohesive appearance. Additionally, the QR code, which had been visually distracting due to its bright color, was redesigned in a neutral tone that blends better with the background, maintaining reader focus. A new navigation icon was added to help users return to specific sub-chapters easily. The direction of an existing icon was also corrected to ensure it links directly to the appropriate content, such as the entrepreneurial products section. These refinements significantly improved the readability, navigation, and overall user experience, making the media more comfortable and engaging for students.

Following these revisions, the second trial phase was conducted with a larger group to obtain more representative data on the effectiveness of the learning media in enhancing students' entrepreneurial skills. This large-group trial involved 60 students from the Economic Education Study Program, selected to reflect diverse backgrounds and varying levels of ability. Data collection was carried out using a questionnaire focused on evaluating the students' responses to the project-based tasks developed within the application. The results of this trial are presented in Table 6.

Table 6. Questionnaire results on the practicality of the big group

No	Indicator	Average Score	Criteria
1	App cover view is interesting	81.8%	Very Practical
2	background color used in accordance	87.3%	Very Practical
3	Presentation material interesting	76.4%	Practical
4	Exercises interesting	76.4%	Practical
5	Language used is easy understood	81.8%	Very Practical
6	Video and Audio presented can played	89%	Very Practical
7	Placement images, audio, and video are not bother other aspects	76.4%	Practical
8	Clarity instruction use application	83.6%	Very Practical
9	Features in the application support activity learning based on project	81.8%	Very Practical
10	Knob navigation is functioning with Good	81.8%	Very Practical
11	Application increases my understanding about entrepreneurship	80%	Very Practical
12	Application helps in compile business plan in a way systematic .	78%	Practical
13	Application help understand entrepreneurship through project real.	80%	Very Practical
14	Assigned tasks and projects in the application are challenging and rewarding.	83.6%	Very Practical
15	Application push For think creative in entrepreneurship.	76.4%	Practical
16	Learning model based on implemented projects in application in accordance with the need.	80%	Very Practical
17	Application increases skills Work the same and communication	76.3%	Practical
18	Media can used in a way repetitive and independent	81.8%	Very Practical
19	The application helps in compiling business plan	74.5%	Practical
20	The application gives an outlook on practical management in managing business.	81.8%	Very Practical
Average Percentage of Practicality		80.45%	Very Practical

Practicality data were obtained from the responses of 60 students in the Economic Education Study Program through a structured questionnaire. Based on the analysis, the highest-rated statement was "The video and audio can be played properly", which received an average score of 89%. This reflects the importance of multimedia integration, as every module is supported by video content to enhance students' understanding of the material. The second-highest score was 87.3%, for the statement "The background colors used are appropriate", indicating that the visual design of the application – specifically the use of harmonious color schemes – was effective in making the content both engaging and easy to read.

Another highly rated statement was "The tasks and projects assigned are challenging and useful," with a score of 83.6%, showing that students found the project-based tasks both realistic and beneficial for building entrepreneurial experience and life skills. However, the lowest score, at 74.5%, came from the statement "This application helps me prepare a business plan systematically." This suggests the need for clearer instructions or additional support tools to guide students in drafting structured business plans.

Overall, the practicality score across all questionnaire items was 80.45%, placing the application in the “very practical” category.

The large-group trial also demonstrated a notable improvement in students’ understanding of entrepreneurial concepts, active engagement in learning, and their ability to develop actionable business plans. Students not only grasped theoretical content but were also able to apply it through tasks such as business proposal writing, marketing planning, and small-scale business simulations. The Android-based application was considered highly beneficial due to its flexibility, interactivity, and alignment with the digital habits of modern learners.

Table 7. Results of N-Gain Analysis on Learning Media Effectiveness

Indicator	Score	Category
N Gain Score	0.578813559	Moderately Effective
N Gain Score (%)	57.88135593	Moderate

Based on the calculations presented in Table 7, the N-gain score obtained was 0.5788, or 57.88%, placing it in the moderate effectiveness category. This indicates that the Android-based learning media, developed using the Project-Based Learning (PjBL) approach, effectively contributed to improving students' learning outcomes in entrepreneurship. Although the improvement is not at the highest level, the results demonstrate a positive impact on students’ understanding of entrepreneurial concepts after using the application.

The moderate classification suggests that the media provided meaningful support in achieving the intended learning objectives. Students were better able to grasp entrepreneurship material compared to before using the media. This implies that the content design, instructional approach, and presentation format were appropriately aligned with students' learning needs and characteristics. Nonetheless, the findings also indicate opportunities for further development, such as enhancing interactivity, updating content to reflect current entrepreneurship trends, and integrating more authentic, real-world projects.

Overall, the N-gain results reinforce the conclusion that the developed learning media is feasible, effective, and appropriate for use in higher education entrepreneurship instruction.

The implementation of the media further confirms that the Project-Based Learning approach embedded in digital learning tools can positively impact the development of students’ entrepreneurial skills. Its application in entrepreneurship courses led to improved competencies in areas such as digital marketing, content creation, and product promotion via social media platforms (Pancawati, 2023). Active student involvement in real projects fostered critical thinking, creativity, and independence, which align with the fundamental principles of PjBL—contextual and collaborative learning.

The application successfully balanced theoretical understanding and practical application, while also supporting the development of essential soft skills like leadership, communication, and decision-making. Interactive features, including learning videos, project-based assignments, quizzes, and structured assessment rubrics, were shown to enhance both student motivation and the achievement of entrepreneurial competencies.

User satisfaction questionnaires revealed that most students found the application highly beneficial for deepening their understanding of entrepreneurship and providing a more engaging and enjoyable learning experience.

In conclusion, the Android-based learning media developed in this study is proven to be effective and practical as a teaching tool for entrepreneurship education. Beyond improving theoretical comprehension, it also encourages students to become actively involved in the planning and execution of innovative business ideas. Based on the implementation outcomes, it is recommended that the application be continuously refined and expanded, including the addition of real-world case studies and access to online discussion forums to facilitate peer collaboration and knowledge sharing among users.

Discussion

This research presents the development of an Android-based learning media using the Project-Based Learning (PjBL) approach as an innovative strategy to improve students' entrepreneurial skills. The study was motivated by the real-world challenges in entrepreneurship education at the tertiary level, which still relies heavily on conventional, theory-oriented teaching methods. These traditional approaches often fail to adequately prepare students for practical business implementation. By integrating Android technology, the developed learning media aims to actively engage students in real-life projects, deepen their understanding of business concepts, and enhance practical skills such as market analysis, business planning, small-scale business operations, and business evaluation.

The findings indicate that the developed media is highly valid and practical. The material expert validation scored 90.6, suggesting that the content is very suitable and requires no major revisions. The media expert validation scored 77.9, indicating the application is valid with only minor revisions. In terms of practicality, both small and large group trials yielded an average score of 80.45%, categorizing the application as very practical. Additionally, the N-gain score of 57.88% places the application in the moderate effectiveness category, showing a notable improvement in students' entrepreneurial understanding and practical abilities.

Several factors contributed to these positive outcomes. These include students' genuine need for applicable and accessible learning media, the use of Android technology which supports flexibility and ease of access, and the integration of PjBL, which emphasizes hands-on, real-world learning. The media also includes interactive features such as learning videos, step-by-step project guides, and a visually appealing interface. Revisions based on small group feedback—such as improved navigation, visual consistency, and content formatting—also contributed to better user experience and enhanced learning outcomes.

Despite its strengths, the media has some limitations. Its effectiveness remains moderate, indicating room for improvement, particularly in guiding students through systematic business plan development. Furthermore, the absence of features such as online discussion forums limits peer-to-peer interaction, which could further enhance collaborative learning. Additionally, the study was limited to a single university, so broader generalization requires caution.

These findings are consistent with previous research showing that the integration of PjBL and digital technology increases student engagement and learning performance. Teza and Astuti (2024) found that PjBL significantly improved students' academic achievement through experiential learning. Similarly, Widyastuti et al. (2024) highlighted that PjBL enhances critical and creative thinking. The use of digital learning media has also been proven to positively influence student interest and achievement (Munfarijah, 2023; Muchlasin et al., 2024; Nursyam, 2019). In higher education, e-learning platforms have been shown to significantly improve student motivation (Suwastika, 2018).

The novelty of this research lies in combining the PjBL model with a mobile Android platform to create an entrepreneurship learning media that is practical, interactive, and aligned with students' digital habits. By offering features such as video tutorials, project-based tasks, and visual tools, the application bridges the gap between theory and practice. It promotes the development of critical entrepreneurial competencies, including problem-solving, decision-making, collaboration, and creativity.

The implications are substantial. For higher education institutions, this media provides an alternative, practice-oriented approach to entrepreneurship education. For educators, it offers a tool to deliver more engaging and comprehensive instruction. For students, it encourages active involvement in real business projects, building readiness for entrepreneurship in the real world. Future development may include integration with online communities, more advanced case studies, and expanded testing across larger and more diverse populations.

In conclusion, this Android-based PjBL learning media represents not only an innovation in entrepreneurship education but also a practical contribution to preparing students for the demands of a dynamic, competitive, and digital business environment.

4. CONCLUSION

Based on the research findings, the Android-based learning media employing the Project-Based Learning (PjBL) model proved to be effective in improving students' entrepreneurial skills. Validation by content and media experts confirmed that the media was both valid and practical, while trials with small and large student groups demonstrated positive user responses and enhanced learning engagement. The N-gain score of 57.88% indicates that the application was moderately effective in helping students understand entrepreneurship concepts, develop structured business plans, and become more active, creative, and collaborative in executing entrepreneurial projects. These outcomes highlight that the media successfully meets students' needs for technology-integrated, experience-based learning. However, this study also has limitations, including the need to deepen business plan content and add interactive features such as online discussion forums to facilitate peer collaboration. Furthermore, as the trials were limited to one institution, broader testing across multiple study programs and universities is necessary to enhance generalizability. Future research is recommended to explore the integration of advanced technologies such as artificial intelligence (AI) for adaptive learning and gamification to increase student motivation, ultimately fostering a more dynamic, contextual, and relevant entrepreneurship learning ecosystem aligned with the demands of the modern digital economy.

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