Journal of Information Systems Engineering and Management
2025, 10(4)
e-ISSN: 2468-4376
https://www.jisem-journal.com/

Research Article

The Impact of Mobile App-Based Project-Based Learning on Transformation Entrepreneurship Education: Case studies Universities in Indonesia.

Munawaroh*, Lina Susilowati[2], Cahyo Tri Atmojo[3], Kumoro Asto Lenggono[4]
[1,2,3]*Economic Education Department, PGRI University, Jombang, East Java,Indonesia* [4]*Department of Public Health Sciences, Faculty of Sports Sciences, State University of Malang,*
Corresponding author:
Munawaroh, 3Economic Education Department, PGRI University, Jombang, East Java,Indonesia. Email: Munawaroh.stkipjb@gmail.com
Jl. Pattimura III No.20, Sengon, Kec. Jombang, Kabupaten Jombang,East Java, Indonesia 61418

ARTICLE INFO

Received: 30 Dec 2024

Revised: 19 Feb 2025

Accepted: 27 Feb 2025

ABSTRACT

The urgency of this research is motivated by the lack of critical thinking skills of students in solving problems of Entrepreneurship material. Critical thinking skills can be defined as the ability to think reflectively and have an explanation in decision making by considering indicators of interpretation, analysis, evaluation and inference. The learning model that can develop students' critical thinking skills is the Project Based Learning (PjBL) model. PjBL is a Learning Model where students are asked to think critically and scientifically, and also requires students to learn independently.PjBL is a learning model that requires students to learn independently, and can plan and implement their own learning or collaborate with lecturers and students. Mobile Apps is software in the form of applications developed using computerized programs to be embedded in mobile devices such as smartphones. The advantages of mobile Apps make it easy for students to collect information related to Entrepreneurship material, establish long-distance communication between lecturers and students, train students in digital-based business processes, Research Objectives to explain the influence of the PjBL model based on Mobile Apps on entrepreneurship courses on learning styles, learning motivation. learning achievement. critical thinking skills and to explain the direct and indirect influence of learning styles, learning motivation, learning achievement through the PjBL model based on Mobile Apps on critical thinking skills. And to determine the effectiveness of the PjBL Model based on Mobile Apps on entrepreneurship courses. To achieve these goals, a survey will be conducted and with an instrument in the form of a questionnaire for the variables: PjBL Mobile App, learning style, level of learning motivation, learning achievement, critical thinking skills. While the analysis used is quantitative analysis with Path analysis and a quantitative approach.The results of the study showed that there was a direct and indirect influence between the variables of PjBL Mobile Apps, learning style, learning motivation, learning achievement and critical thinking skills in entrepreneurship courses.

Keywords: Effectiveness1; Contextual Teaching Learning; 2Project Based Learning Model; Mobile Apps;3 Entrepreneurship4

Journal of Information Systems Engineering and Management
2025, 10(4)
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1. INTRODUCTION

The development of information technology in the world of education is very rapid. Entrepreneurship education in Higher Education is carried out through a learning process that is inseparable from information technology, considering the many important aspects carried out by Higher Education in organizing entrepreneurship education. Mobile Apps have become a potential for innovation and disruption in the last decade.

Moral responsibility needs to be used as a starting point for the importance of learning development strategies to improve Entrepreneurship in students. Unemployment is theoretically caused by the low entrepreneurial spirit of higher education graduates who are alienated amidst the problems of society and the nation. Entrepreneurship education in Higher Education is indeed very relevant to the issue of the quality of human resources that we need in the Industrial Era 4.0. the importance of creative, innovative and competitive human resources.

The first step that needs to be addressed is to improve entrepreneurship learning, because it has a very important role in instilling an entrepreneurial spirit. Through entrepreneurship learning, a person's cognitive, affective and psychomotor entrepreneurship can be improved. By choosing the right method and media, entrepreneurship learning will be interesting, not boring and easy to understand, so that it will motivate students to learn entrepreneurship.

Mobile technology can enhance mobile learning by creating connected learning experiences. However, research on acceptance and learning in recent decades has shown the importance of integrating classroom and field teaching, which is a key feature of learning schools. The PjBL learning model based on mobile apps is a learning concept that uses technology that makes the internet a database and applications can be accessed with computers or smartphones [1].

The Project Based Learning Learning Model has its own appeal for learning purposes, because it can accustom students to providing information, explaining processes, explaining various complex concepts, teaching skills, shortening or extending time, and influencing attitudes. So that it will help students to carry out the learning process to achieve learning goals. The main objective of project-based learning is to eliminate the gap between educational activities at universities and actual needs [2].

Project-based learning is a learning model that requires teachers or students to develop a guiding question. Given that each student has a different learning style, project-based learning provides students to explore content (material) using various methods that are meaningful to them, and to conduct experiments collaboratively. This allows students to ultimately be able to answer guiding questions [3].

Lecturers must master competencies and have good abilities in planning and implementing the learning process so that the teaching and learning process can be directed at the desired goals. The interaction between students and educators is a determinant of student success in learning. According to [4] educators who have high professionalism will always establish good interactions with their students and always motivate them to learn in order to achieve success in learning.

The use of mobile as an alternative learning media in the digital era[5] Project Based Learning based on Mobile Apps is one of the learning strategies that can improve and develop student motivation. The use of Mobile Apps can improve student learning motivation [6].

Motivational factors such as teaching strategies and learning motivation also affect student learning achievement. Positive interactions from learning experiences strengthen motivation and inspire students to react to challenges around them [7],[8]. The Project Based Learning (PjBL) model is a learning model that helps students gain

knowledge through their own experiences and collaboration with the process in the learning process [9]. Technology-based Project Based Learning (PjBL) learning can improve student learning outcomes [10]. The Project Based Learning (PjBL) model can increase motivation from within students in learning [11]. A good learning process will affect the high motivation of students. The application of project-based learning has an effect on achievement motivation [12].

Project-based learning (PjBL) has an impact on students' creativity and critical thinking skills [13]. Furthermore, project-based learning according to [14] is a learning method that can improve thinking skills, such as creative thinking, reflective thinking, communication skills and cooperation.

While the problems of this study are: 1) does the PJBL Mobile Application affect learning styles 2) does the PJBL Mobile Application affect learning motivation. 3) does the PJBL Mobile application affect learning achievement. 4) does the Learning Style Application affect critical thinking skills. 5) does the Learning Motivation Application affect thinking skills. 6) does the Learning Achievement Application affect critical thinking skills. 7) does the Learning Style Application affect learning motivation. 8) does Learning Motivation affect Achievement. 9) does the Influence of Learning Style on Achievement. 10) Does the PjBL Mobile Application affect Critical Thinking skills.

While the objectives of this study are: 1) to explain whether the PJBL Mobile application has an effect on learning styles 2) to explain whether the PJBL Mobile application has an effect on learning motivation. 3) to explain whether the PJBL Mobile application has an effect on learning achievement. 4) to explain whether the Learning Style application has an effect on critical thinking skills. 5) to explain whether the learning motivation application has an effect on thinking skills. 6) to explain whether the learning achievement application has an effect on critical thinking skills. 7) to explain whether the Learning Style application has an effect on learning motivation. 8) to explain whether Learning Motivation has an effect on Achievement. 9). To explain whether the Influence of Learning Style has an effect on Learning Achievement. 10) to explain whether the PjBL Mobile application has an effect on Critical Thinking skills

This study has several novelties that distinguish it from previous studies, including: 1) Integration of Project-Based Learning with Mobile Applications in Entrepreneurship Learning: although PjBL and mobile technology have been widely applied in education, this study specifically examines the integration of both methods in entrepreneurship courses. The focus on entrepreneurship provides new insights into how PjBL based on mobile applications can be used to develop students' entrepreneurial skills more effectively. 2) Influence on Several Psychological Variables (Learning Style, Motivation, Achievement, and Critical Thinking) This study comprehensively examines the influence of the use of mobile applications in PjBL on various psychological aspects of students, namely learning styles, motivation, achievement, and critical thinking skills. Most previous studies have focused more on one or two variables, so this study provides a more holistic picture of their influence. 3) Implementation of More Flexible and Personal Methods: By considering the diversity of student learning styles, the use of mobile applications in PjBL can provide more flexible learning and can be adjusted to the needs of each student. This is an innovation in the approach to entrepreneurship learning that is more personal and relevant to current technological developments.

2. LITERATURE REVIEW

a. Project-Based Learning (PjBL) in Entrepreneurship Education

Project Based Learning(PjBL) is a learning approach that uses real-world problem-based projects or assignments to facilitate learning. In the context of entrepreneurship, PjBL helps students learn through real-world experiences,

such as designing a business plan or running a small business simulation. Mergel (2020) stated that PjBL is very effective in developing practical skills and critical thinking, which are essential in the world of entrepreneurship.

b. Mobile Appcations Learning

The use of mobile applications in education, especially in entrepreneurship learning, allows students to access information and learning materials anytime and anywhere. Bower et al. (2021) stated that mobile applications can increase flexibility in learning and provide a more personalized learning experience, which can support students' diverse learning styles.

c. Student Learning Styles

Learning style is the way a person absorbs, processes, and remembers information. The Felder-Silverman model states that each student has a different learning style, such as visual, auditory, or kinesthetic. In the context of CTL and PjBL, a mobile application-based approach can accommodate the various learning styles of students, so they can learn in a way that is more in line with their preferences.

d. Motivation to Learn in Entrepreneurship

Learning motivation plays an important role in learning success. Ryan & Deci (2020) in the Self-Determination Theory theory suggests that intrinsic motivation (motivation that comes from within) is more effective in increasing student engagement and learning achievement. Relevant and real-world learning, as applied in PjBL, can increase students' intrinsic motivation to learn entrepreneurship.

e. Critical Thinking Skills in Entrepreneurship Learning

Critical thinking skills are the ability to analyze, evaluate, and make decisions based on available information. In entrepreneurship learning, this ability is very important to solve complex problems. Ennis (2022) emphasized that PjBL can improve students' critical thinking skills because they are faced with real problems that require proper analysis and decisions.

In order to improve the effectiveness of entrepreneurship learning in higher education, the Project-Based Learning (PjBL) model based on Mobile Apps has been proven to help students develop their learning styles, learning motivation, and critical thinking skills. This approach is not only relevant and interesting for students, but also connects theory with real-world practice, so that students are better prepared to face the challenges of entrepreneurship in the professional world.

3. METHODOLOGY

This study uses a survey model with a quantitative approach. which aims to explain the analysis of the Mobile Apps-based PjBL learning model that influences Learning Styles, Learning Motivation, Learning Achievement and Critical Thinking Skills in Entrepreneurship Learning. The research variables consist of exogenous variables, namely the use of the E-PJBL model and endogenous variables of Learning Styles, Learning Motivation, Learning Achievement and Critical Thinking Skills.The population of this study consists of four universities with the following details:1)students of PGRI Jombang University with research subjects of 50 students, 2) PGRI Mpu Sindok Nganjuk students totaling 30 students, 3) Nusantara PGRI Kediri University students totaling 20 students, 4) and PGRI Wiranegara Pasuruhan University totaling 20 students, so that the total population is 120 students. Data collection methods using

observation, interviews and questionnaires. Data analysis test using Path Analysis. With the aim of explainingThere is a direct and indirect influence between the variables of PjBL Mobile Apps, learning style, learning motivation, learning achievement and critical thinking skills in entrepreneurship courses.

To explain the direct and indirect influence between variables in this study, it can be written as follows:

$Y= \alpha 0+ \beta 1X1 +\beta 2X2 + \beta 3X3 + \beta 4X4 + \varepsilon$.....(1)

The above model in this study can be seen through the following equation:

LGB = $\beta 1$PjBL Mobile + $\varepsilon 1$ ..... (1)

LMB = β_1PjBL Mobile + $\beta 2$ GB + $\varepsilon 1$ ..... (2)

LP = β_1PjBL Mobile + $\beta 2$ GB + $\beta 3$ MB + $\varepsilon 1$ .....(3)

LKBK = β_1PjBL Mobile + $\beta 2$ GB + $\beta 3$ MB + $\beta 4$P + $\varepsilon 1$ .....(4)

Information:

PjBL Mobile = Project Based Learning Mobile

GB = Learning Style

MB = Learning Motivation

P = Achievement

KBK = Critical Thinking Ability

$\alpha 0$ = Intercept/Constant

$\beta 1$, $\beta 2$, $\beta 3$ = Regression Coefficients

ε = Error term

Path analysis method is a statistical analysis tool used to analyze causal relationship patterns between variables with the aim of determining the direct and indirect effects, either simultaneously or partially, of several causal variables on a result variable (Muhidin and Abdurahman, 2007). When conducting path analysis, a path is first formed which can be seen from the square root formed from the value of the Determination Coefficient (R-Square). After these stages are carried out, each variable formed into the path analysis must have a significant direct effect on the dependent variable. If one of the variables tested does not meet the requirements, the variable is eliminated from the path analysis test.

Journal of Information Systems Engineering and Management
2025, 10(4)
e-ISSN: 2468-4376
https://www.jisem-journal.com/

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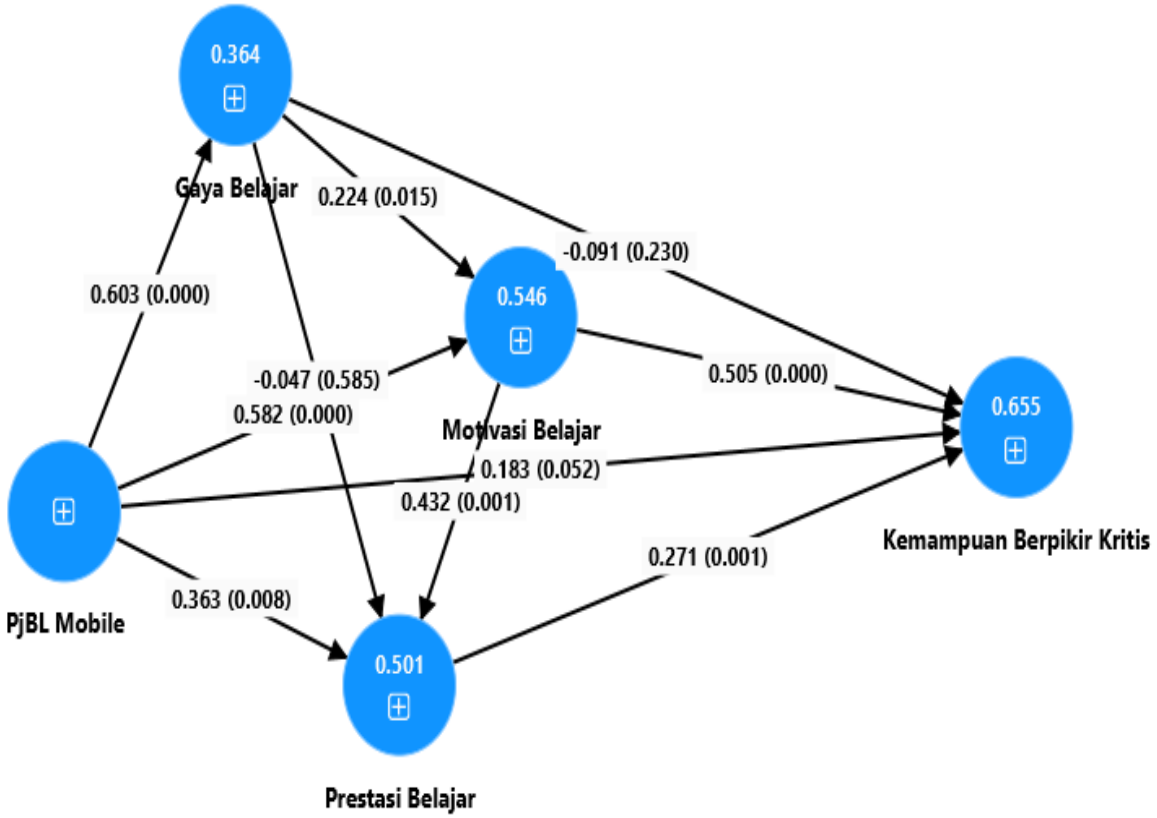
Path analysis in this study can be described as follows:



The following table 1 shows the value of the Determination Coefficient/ R-Square/ R2:

4. RESULTS

Table 1. Determination Coefficient (R-Square)

	R-square	R-square adjusted
Learning Styles	0.364	0.358
Critical Thinking Skills	0.655	0.643
Motivation to learn	0.546	0.539
Learning achievement	0.501	0.488

Table 1 shows the R square value, as in regression analysis, R square shows the suitability of the model/Goodness of Fit Model.The R-square (R2) value is a number that indicates how well the independent variables in a statistical model explain the variation in the dependent variable. The R2 value ranges from 0 to 1, where the closer it is to 1, the better the model.According to[15]The R-Square value is categorized as strong if it is more than 0.67, moderate if it is more than 0.33 but less than 0.67, and weak if it is more than 0.19 but less than 0.33. Based on table 46 above, the R-

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2025, 10(4)
e-ISSN: 2468-4376
https://www.jisem-journal.com/

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square value of the learning style variable is 0.364, the critical thinking ability variable is 0.655, the learning motivation variable is 0.546 and the R-Square of learning achievement is 0.501. Overall hThe R-square result shows a value of more than 0.33 but less than 0.67 so it is said to be moderate.

The following table shows 2 values of the Path coefficient, Average, Standard Deviation, calculated t value, sig t/ P-Values which show the direct effect on the variables used in the study:

Table 2. Path Coefficients, Mean, STDEV, T-Values, P-Values

	Original sample (O)	Sample mean (M)	Standard deviation (STDEV)	T statistics (|O/STDEV|)	P values
Learning Style -> Critical Thinking Skills	-0.091	-0.087	0.076	1,202	0.230
Learning Style -> Learning Motivation	0.224	0.228	0.091	2,449	0.015
Learning Style -> Learning Achievement	-0.047	-0.043	0.087	0.546	0.585
Learning Motivation -> Critical Thinking Skills	0.505	0.497	0.104	4,847	0,000
Learning Motivation -> Learning Achievement	0.432	0.425	0.132	3,262	0.001
PjBL Mobile -> Learning Style	0.603	0.594	0.061	9,845	0,000
PjBL Mobile -> Critical Thinking Skills	0.183	0.186	0.094	1,951	0.052
PjBL Mobile -> Learning Motivation	0.582	0.574	0.076	7,692	0,000
PjBL Mobile -> Learning Achievement	0.363	0.362	0.135	2,683	0.008
Learning Achievement -> Critical Thinking Skills	0.271	0.270	0.078	3,496	0.001

Table 2 shows that Hypothesis: H1 = The influence of Mobile Apps-based PjBL on Learning Style is significant indicated by a pvalue of 0.000 <0.05 with a coefficient value of 0.603 with a positive direction. Hypothesis H2 = The influence of Mobile Apps-based PjBL on Learning Motivation is significant indicated by a Pvalue of 0.000 <0.05 with a coefficient value of 0.582 with a positive direction. Hypothesis H3 = The influence of Mobile Apps-based PjBL on Achievement is significant indicated by a Pvalue of 0.008 <0.05 with a coefficient value of 0.363 with a positive direction. Hypothesis H4 = The influence of Learning Style on Critical Thinking Ability is not significant indicated by a P value of 0.230> 0.05 with a coefficient value of 0.091 with a negative direction. Hypothesis H5 = The Influence of Learning Motivation on Critical Thinking Ability is significant, indicated by a Pvalue of 0.000 <0.05 with a coefficient value of 0.505 with a positive direction. Hypothesis H6 = The Influence of Achievement on Critical Thinking Ability is significant, indicated by a Pvalue of 0.001 <0.05 with a coefficient value of 0.271 with a positive

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direction. Hypothesis H7 = The Influence of Learning Style on Learning Motivation is significant, indicated by a Pvalue of 0.015 <0.05. Hypothesis H8 = The Influence of Learning Motivation on Achievement is significant, indicated by a Pvalue of 0.001 <0.05 with a coefficient value of 0.224. Hypothesis H9 = The Influence of Learning Style on Achievement is not significant, indicated by a Pvalue of 0.585 >0.05 with a coefficient value of 0.047 with a negative direction. Hypothesis H10 = The influence of Mobile Apps-based PjBL on Critical Thinking Skills is not significant, as indicated by a Pvalue of 0.052 > 0.05 with a coefficient value of 0.183 in a positive direction.

Table 3 Path Coefficients, Mean, STDEV, T-Values, P-Values

	Original sample (O)	Sample mean (M)	Standard deviation (STDEV)	T statistics (|O/STDEV|)	P values
Gaya Belajar -> Motivasi Belajar -> Prestasi Belajar	0,097	0,096	0,048	1,999	0,046
PjBL Mobile -> Motivasi Belajar -> Kemampuan Berpikir Kritis	0,294	0,285	0,069	4,250	0,000
PjBL Mobile -> Gaya Belajar -> Kemampuan Berpikir Kritis	-0,055	-0,051	0,045	1,215	0,225
PjBL Mobile -> Gaya Belajar -> Motivasi Belajar	0,135	0,135	0,056	2,425	0,016
PjBL Mobile -> Motivasi Belajar -> Prestasi Belajar	0,252	0,244	0,083	3,031	0,003
PjBL Mobile -> Gaya Belajar -> Prestasi Belajar	-0,029	-0,024	0,051	0,555	0,579
Gaya Belajar -> Motivasi Belajar -> Prestasi Belajar -> Kemampuan Berpikir Kritis	0,026	0,026	0,016	1,590	0,113
PjBL Mobile -> Gaya Belajar -> Motivasi Belajar -> Prestasi Belajar	0,058	0,057	0,030	1,960	0,051
PjBL Mobile -> Gaya Belajar -> Motivasi Belajar -> Kemampuan Berpikir Kritis	0,068	0,068	0,033	2,069	0,039
PjBL Mobile -> Motivasi Belajar -> Prestasi Belajar -> Kemampuan Berpikir Kritis	0,068	0,066	0,030	2,265	0,024
PjBL Mobile -> Gaya Belajar -> Prestasi Belajar -> Kemampuan Berpikir Kritis	-0,008	-0,007	0,015	0,516	0,606
Gaya Belajar -> Prestasi Belajar -> Kemampuan Berpikir Kritis	-0,013	-0,013	0,025	0,505	0,614
Gaya Belajar -> Motivasi Belajar -> Kemampuan Berpikir Kritis	0,113	0,115	0,055	2,056	0,040
Motivasi Belajar -> Prestasi Belajar -> Kemampuan Berpikir Kritis	0,117	0,115	0,052	2,266	0,024
PjBL Mobile -> Gaya Belajar -> Motivasi Belajar -> Prestasi Belajar -> Kemampuan Berpikir Kritis	0,016	0,016	0,010	1,552	0,121
PjBL Mobile -> Prestasi Belajar -> Kemampuan Berpikir Kritis	0,098	0,098	0,048	2,061	0,040

5. RESEARCH DISCUSSION

The results of the study revealed that through Mobile Apps-based PjBL, students are facilitated in finding solutions by organizing problems, namely by sorting out a problem then grouping the problems in detail and combining one problem with another so that students are able to think. solve problems in an organized manner and continue by

preparing the necessary facts. Furthermore, students will analyze the existing problems and existing facts so as to find an outline in compiling arguments. However, what is seen from the initial problem is that students are sometimes confused in understanding the problems presented. Therefore, the problems presented should not be problems stated as questions, but problems that actually occur related to entrepreneurial problems.

Project-Based Learning Model mobile Apps is a learning model that can improve learning outcomes, retention, interpersonal skills and better thinking skills by students. Therefore, this learning model can be used as an alternative learning model to improve students' critical thinking skills.

The results of the study showed that there was a direct and indirect influence between the variables of PjBL Mobile Apps, learning style, learning motivation and critical thinking skills. The results of the study showed that there was a direct influence of learning motivation on students' critical thinking skills. This is in line with the results of the study[31]which states that there is a relationship between motivation and critical ability. Research[32]shows that the influence of learning motivation on critical thinking skills is 51.2%. Motivation that focuses on achievement has a close relationship with critical thinking skills.[33]. Mobile Apps-based PjBl does not directly affect critical thinking skills, but indirectly affects critical thinking skills through intervening variables of learning style, learning motivation and learning achievement. This is in line with research[34]which shows that project-based learning improves student achievement. According to[35]stated that Web-based PjBL learning can improve student learning outcomes. Project-based learning is effective in improving learning outcomes/achievement and self-efficacy.[36]. Project-based learning can help students optimize creativity and critical thinking by starting learning with important questions, working together, making plans, and developing project completion schedules.[37]. Research result[38]shows that students' critical thinking skills can be improved through project-based learning by considering learning motivation factors and learning styles.

Based on the results obtained, several main findings can be identified and discussed as follows:

The Influence of Mobile Apps-based PjBL on Learning Styles (H1): The results of the study showed that Mobile Apps-based PjBL had a significant influence on students' learning styles, with a p-value of 0.000 which is smaller than 0.05 and a positive coefficient of 0.603. This indicates that the implementation of mobile application-based PjBL can improve students' learning styles positively. This is in accordance with the theory that the use of technology in learning can facilitate students to be more active in learning and more easily adjust their learning styles in a more flexible way.

The Influence of Mobile Apps-based PjBL on Learning Motivation (H2): This finding also shows a significant influence between Mobile Apps-based PjBL and students' learning motivation (p-value 0.000 < 0.05 and coefficient 0.582). A positive coefficient value indicates that the more often students use mobile applications in PjBL-based learning, the higher their level of learning motivation. This shows that mobile applications can increase students' interest and enthusiasm in following the learning process, which supports the results of previous studies showing that digital technology can increase student motivation.

The Influence of Mobile Apps-based PjBL on Achievement (H3): The influence of Mobile Apps-based PjBL on students' academic achievement was also found to be significant, with a p-value of 0.008 < 0.05 and a coefficient of

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2025, 10(4)
e-ISSN: 2468-4376
https://www.jisem-journal.com/

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0.363. Although the influence is smaller compared to learning styles and motivation, this finding still shows that the use of mobile applications in PjBL-based learning can contribute to improving students' academic achievement. This may be due to increased student understanding supported by more interactive and interesting learning media.

Influence of Learning Style on Critical Thinking Ability (H4): The results of the study showed that learning styles did not have a significant effect on critical thinking skills, with a p-value of 0.230 > 0.05. Although the coefficient is negative (0.091), this relationship is not strong enough to be considered significant. This may indicate that although learning styles affect the way students absorb information, other more dominant factors, such as motivation and active learning strategies, may play a greater role in developing students' critical thinking skills.

The Influence of Learning Motivation on Critical Thinking Ability (H5): On the other hand, learning motivation is proven to have a significant influence on critical thinking skills (p-value 0.000 < 0.05, coefficient 0.505). This shows that motivated students tend to be more able to develop critical thinking skills. This study supports the theory that motivation is a key factor in facilitating students' critical thinking processes, because motivated students are more likely to try to solve problems in a more analytical and creative way.

Influence of Achievement on Critical Thinking Ability (H6): The findings also show that academic achievement has a significant effect on critical thinking skills (p-value 0.001 < 0.05, coefficient 0.271). Higher achievement may indicate that students have a deeper understanding of the material being studied, which then supports the development of critical thinking skills. Students who perform well are more likely to apply their critical thinking skills in solving more complex problems.

The Influence of Learning Style on Learning Motivation (H7): Learning style is proven to have a significant effect on learning motivation (p-value 0.015 < 0.05), with a positive coefficient indicating that appropriate learning style can increase student motivation. An active learning style, for example, allows students to be more involved in learning, which in turn can increase their motivation to learn.

The Influence of Learning Motivation on Achievement (H8): Learning motivation has a significant influence on academic achievement (p-value 0.001 < 0.05, coefficient 0.224). This shows that students who have high motivation are more likely to achieve good academic results. Motivation can affect the extent to which students try to learn and how they face challenges in the learning process.

The Influence of Learning Style on Achievement (H9): Learning style does not have a significant effect on student achievement (p-value 0.585 > 0.05). Although there is a negative relationship with a coefficient of 0.047, this result indicates that learning style does not directly affect academic outcomes. Other factors, such as motivation and achievement that are more often associated with the ability to achieve better results, may play a greater role.

The Influence of Mobile Apps-based PjBL on Critical Thinking Skills (H10): The effect of Mobile Apps-based PjBL on critical thinking skills is not significant (p-value 0.052 > 0.05). Although the coefficient is positive (0.183), the p-value greater than 0.05 indicates that the use of mobile applications in PjBL-based learning does not have a significant impact on improving students' critical thinking skills.

Overall, the results of this study indicate that Mobile Apps-based PjBL has a significant impact on students' learning styles, learning motivation, and achievement. However, the influence on critical thinking skills is more limited and not always significant, either through learning styles or mobile applications. Other factors such as learning motivation and academic achievement play a greater role in developing students' critical thinking skills. These findings provide important insights for the development of technology-based learning models to improve the quality of education.

6. CONCLUSION

Project-Based Learning Model mobile Apps is a learning model that can improve learning outcomes, retention, interpersonal skills and better thinking skills by students. Therefore, this learning model can be used as an alternative learning model to improve students' critical thinking skills.

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