Original Research Article

AN ENTREPRENEURIAL SKILLS MODEL FOR PROJECT-BASED LEARNING IN PROGRAMMING

ABSTRACT

This research aims to: 1) analyse the development needs of the Project Based-Learning based Entrepreneurial Skills Programming model; 2) design a model that supports the integration of entrepreneurial skills into programming learning; 3) assess the validity of the Project Based-Learning based Entrepreneurial Skills Programming model; 4) pilot the model to evaluate the effectiveness of teaching and developing entrepreneurial skills; 5) examine the effectiveness of the Entrepreneurial Skills Programming model; and 6) identify student responses to the Entrepreneurial Skills Programming model. These skills are important to equip students with relevant and appropriate abilities for the dynamic world of work and rapid technological development. The method used is Research and Development (R&D) with a 4D development model approach: Define, Design, Develop, and Disseminate. Data were collected through literature studies, field surveys, and in-depth interviews with stakeholders. The research stages included needs identification, model design, prototype development, and model dissemination. The validity and reliability of the instruments were tested using the Validity Coefficient (Va) and percentage of agreement (PA). The results showed that the developed entrepreneurship model was effective in improving students' entrepreneurial skills, evidenced by the significant improvement in students' learning outcomes and their positive response to the model. The model is considered to add value and increase students' enthusiasm in learning. This confirms the importance of integrating entrepreneurial skills in programming learning to prepare students for the challenges of today's world of work.

Keywords: *Entrepreneurial Skills Model, Project-Based Learning, Programming Learning.*

INTRODUCTION

The digital era necessitates the incorporation of essential entrepreneurial abilities, particularly in the field of programming instruction, within higher education. This shift in paradigm results in a more thorough education of pupils, not just as employees but also as adaptable creators of new ideas. The growing requirement for proficient programmers in emerging technologies necessitates the use of inventive educational methods like Project-Based Learning (PjBL), which has proven to be beneficial in imparting programming and entrepreneurial abilities.

Prior studies have underscored the need of fostering entrepreneurial abilities in school to enhance the competitiveness and employment prospects of graduates. PjBL is regarded as an instructional framework that integrates entrepreneurial principles into the instruction of technology and programming. Haq (2022), Wardana et al. (2020), and Gieure et al. (2019) have conducted research that elucidates the correlation between entrepreneurial abilities, education, and entrepreneurial goals.

The research methodology consisted of a thorough examination of existing literature and a practical investigation of how Project-based Learning (PjBL) is implemented in educational settings. This study investigates the influence of Project-based Learning (PjBL) on the instruction of entrepreneurship and technology. It specifically references the research conducted by Yustina et al. (2020), Uyen et al. (2023), and Roslina et al. (2022), which emphasized the efficacy of PjBL in fostering critical and creative abilities.

Based on the analysis and literature evaluation, this project has developed a Project-based Learning (PjBL) paradigm that incorporates entrepreneurial abilities into programming instruction. Research conducted by Budhtranon et al. (2022) and Ferrandiz et al. (2018) demonstrates that incorporating entrepreneurial skills into education can enhance motivation and improve learning results.

The resultant PjBL model possesses the capacity to equip students with important abilities for the digital era. Studies conducted by Atmojo et al. (2022) and Sajidan et al. (2021) provide evidence that incorporating entrepreneurial skills into education enhances entrepreneurial preparedness. This concept is anticipated to serve as a potent tool for seamlessly incorporating Entrepreneurial and Programming abilities into the educational curriculum. These factors prompted the development of a research strategy centered on extensively investigating and evaluating the model. Hence, the researcher is keen on formulating it into a pedagogical framework as described in the dissertation titled "Entrepreneurial Skills Model in Project-Based Learning Programming".

According to the research article, the ESP-PjBL Model has been evaluated for its efficacy and feasibility, but the discussion lacks specific quantitative data and statistical analysis to support the claims made about the model's effectiveness. However, the limited trial of the model in small group testing showed positive results in terms of student engagement and learning outcomes. While the feasibility evaluation briefly mentions difficulties in terms of time and resources, the study did not provide a comprehensive understanding of how these challenges were addressed or mitigated. The conclusion could benefit from explicit alignment with broader educational goals, and it would be valuable to discuss the potential long-term impact and sustainability of the model. Additionally, the model's potential for sustained success over time and how it prepares students for future challenges beyond immediate learning outcomes should be explored. The model's ability to address diverse learning styles, backgrounds, and abilities should also be delved into. Reflecting on the limitations and strengths of the research methodology used in the study can enhance the transparency of the research process.

The ESP-PjBL Model contributes to achieving the university's educational objectives and broader societal needs by integrating entrepreneurial skills into programming learning, thereby preparing students for the challenges of the digital era and the dynamic world of work. The model has been shown to be effective in improving students' entrepreneurial skills, as evidenced by the significant improvement in students' learning outcomes and their positive response to the model. The integration of entrepreneurial skills in programming learning is essential to equip students with relevant abilities for the rapidly evolving technological landscape and to enhance their competitiveness and employment prospects. The model's feasibility and adaptability to varying student abilities further support its potential to contribute to the university's educational objectives and broader societal needs. However, the specific alignment of the model with the university's educational objectives and broader societal needs could be further elaborated to provide a comprehensive understanding of its impact.

METHOD

This study employs the Research and Development (R&D) approach utilizing the 4D development paradigm, encompassing the Define, Design, Develop, and Disseminate phases. The objective is to develop a pedagogical framework that combines entrepreneurial competencies with Project-Based Learning in the context of programming education. The processes encompassed in this process include conducting a needs analysis, designing a model based on a thorough study of existing literature and incorporating feedback from stakeholders, developing a prototype, and disseminating the model for subsequent deployment and evaluation. Practically, the research and development process guarantees that the produced model is both groundbreaking and efficacious, addressing the present educational requirements. This technique facilitates the establishment of a flexible learning environment, in which entrepreneurial skills are seamlessly integrated into the programming curriculum, aiming to cultivate graduates who are well-prepared for the ever-changing dynamics of the labor market.

Research Instrument

The research technique comprises a set of systematic tools designed to assess several facets of the "Entrepreneurial Skills in Project-Based Learning" paradigm. These instruments consist of a needs analysis that evaluates the appropriateness of existing learning methods for the acquisition of entrepreneurial skills, a model design that incorporates Project-Based Learning, and an evaluation of the model's validity, practicality, and effectiveness through expert feedback and field testing. Student responses were further gathered to assess the influence of the model on their enthusiasm and disposition towards learning. The purpose of this entire procedure is to guarantee that the model created is both unique and capable of being used and effective in actual educational settings.

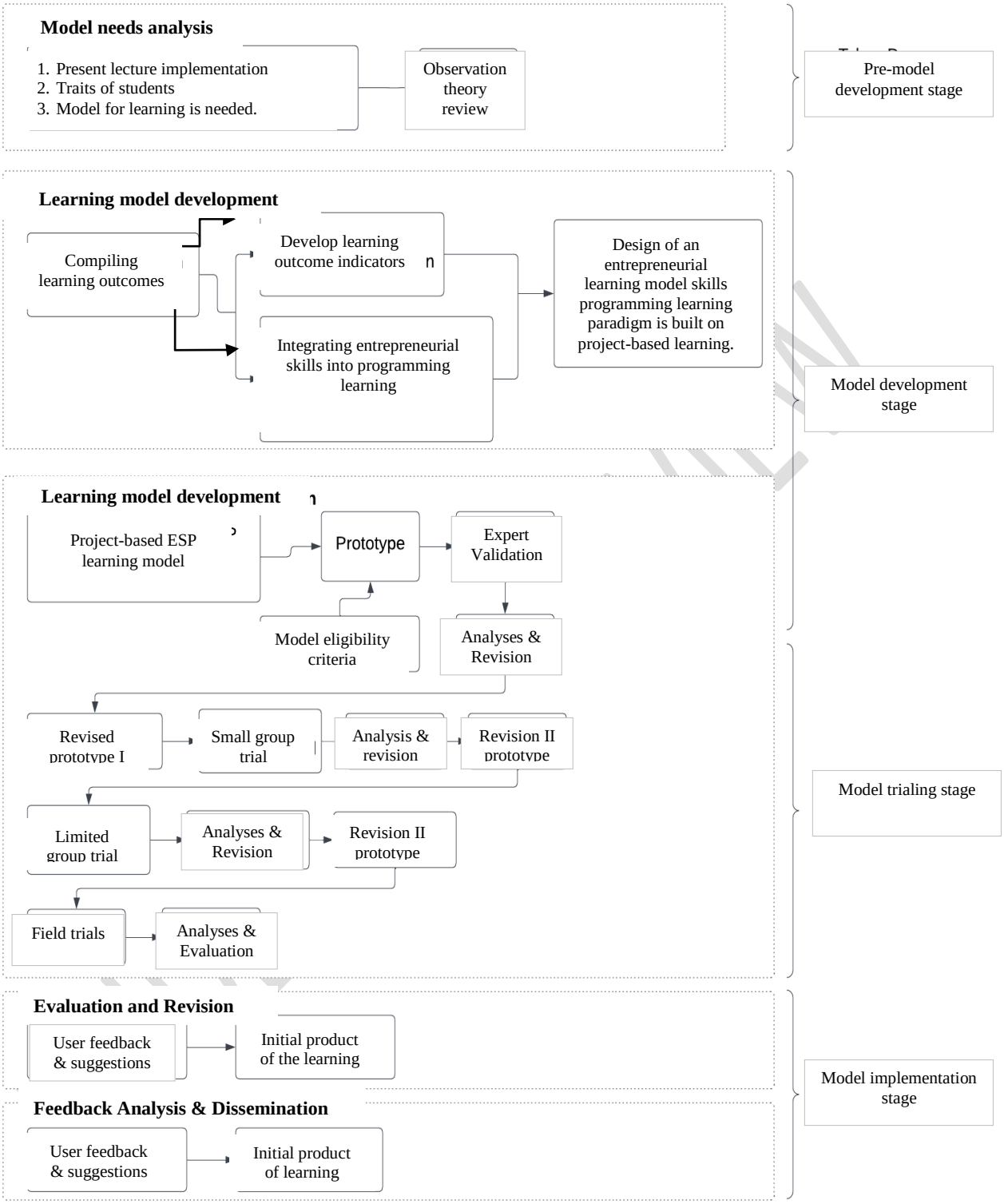

Figure 1. Research Procedure

RESEARCH RESULTS AND DISCUSSION

Research Results

Model Needs Analysis Results

The subsequent findings pertain to the research conducted on the Needs Analysis of Entrepreneurial Skills Model in Project-Based Learning-based Programming learning within the Informatics

Engineering Department. This research utilizes the data gathered from the initial investigation to develop an Entrepreneurial Skills Model in Project-Based Learning-based Programming learning. The model is specifically tailored to meet the needs and conditions of Informatics Engineering Students at Universitas Handayani Makassar. The matrix displaying the outcomes of the preliminary evaluation for this inquiry may be observed in Table 1.

Table 1. Results of Needs Analysis Assessment of Programming Learning

No	Aspects	Average (%)	Category
1	Learning Implementation	89 %	Excellent
2	Students' learning requirements Project-Based Learning in Programming	87 %	Excellent

Model Design Analysis Results

a. Learning Model Validation Results

This table presents a summary of the model evaluation conducted by three validators, resulting in an average score of 0.93. This score falls within the highly valid range and suggests that the model is reliable. However, there are some areas for improvement that can be addressed with further notes. The data regarding the model assessment findings from three validators may be found in Appendix C.8 on page 263. Additionally, Table 2 below provides a summary of the validators' assessment of the learning model.

Table 2. ESP-PjBL Model Validation Results

No	Aspects	Average	Criteria
1	Problem Identification	0.95	Very Valid
2	Determination of Product Type	0.92	Very Valid
3	Purpose of Product Development	0.96	Very Valid
4	Model Structure and Components	0.95	Very Valid
5	Model Completeness	0.93	Very Valid
6	Syntax	0.96	Very Valid
7	Social System	0.95	Very Valid
8	Reaction Principle	0.95	Very Valid
9	Support System	1	Very Valid
10	Instructional Impact	0.95	Very Valid
11	Accompanying Impact	0.95	Very Valid
V Average		0.94	Very Valid

Source: Analysed results in appendix C.8 on page 263

b. Learning Device Validation Results

Data on the results of validation of learning devices are presented in appendix B.18 page 251, while a summary of the results of the validator's assessment of learning devices is presented in table 3.

Table 3. Learning Device Validation Results

No	Learning Devices	V Average	Criteria
1	Lesson Plan (RPS)	0.90	Very Valid
2	Learning Module	0.92	Very Valid
V Average		0.91	Very Valid

Source: analysis results in appendix B.18 page 251

Model Validity Test Analysis Results

a. ESP-PjBL Learning Model Book Validation Results

The assessment data provided by the three validators may be found in appendix C.2 on page 256. The summary of assessments from the validators is displayed in table 4 below:

Table 4. ESP-PjBL Model Book Validation Results

No	Aspects	V Average	Criteria
1	Cover Eligibility	0.93	Very Valid
2	Appropriateness of Guide Content	0.92	Very Valid
3	Presentation	0.95	Very Valid
4	Language	0.78	Very Valid

V Average	0.90	Very Valid

Source: analysis results in appendix C.2 page 25

b. Results of ESP-PjBL Model Book Revision

The results of the revisions made can be seen in table 5 below:

Table 5. PjBL= ESP Model Book Revision

PjBL= ESP Model Book Revision	
Before Revision	Revised
Applying Entrepreneurial Skills	Integrating Entrepreneurial Skills in Programming Projects
Requires revision and comprehensive incorporation of Case Studies	Analysis of the Implementation of an Entrepreneurial Skills Model in a Programming Project
The assessment and evaluation of programming learning should include a more detailed examination of how to assess the entrepreneurial components and their incorporation into the project.	Expanding on the evaluation of entrepreneurial elements in programming projects through the use of Entrepreneurial Assessment.

Source: Analyze the test results for practicality of the model.

The effectiveness and applicability of the entrepreneurial skills model in Project-Based Learning (PjBL)-based programming learning may be evaluated by considering many aspects that measure its usefulness. The effectiveness of the ESP-PjBL model is demonstrated by the measure of how well the syntax of the learning model is implemented.

Table 6: Results of Observations of the Implementation of the ESP-PjBL Model in the Small Group Test (Limited Trial)

Phase	Evaluator			Average
	1	2	3	
Inquire	3.67	3.67	3.67	3.67
Planning	3.67	3.67	3.67	3.67
Scheduling	4	3.5	3.5	3.67
Monitoring	4	3.67	3.67	3.78
Assessing Results	4	3.5	4	3.83
Evaluating	3.67	4	3.67	3.78
Average of Each Validator	3.8	3.6	3.7	3.73

Source: Results of Analysis in appendix C.9 on page 264

Analysis of Model Effectiveness Results

a. Results of individual trials (Readability Test)

Lecturers and students of Informatics Engineering at Handayani University Makassar participated in individual trials to assess the clarity and comprehensibility of the ESP-PjBL model prototype and its accompanying learning tools.

b. Findings from Limited Trial of Small Group

A restricted experiment was undertaken, comprising three evaluators and 20 students from the Informatics Engineering Study Programme at Universitas Handayani Makassar. The objective of this trial was to directly and realistically assess whether the ESP-PjBL model fulfilled the specified criteria for practicality. The outcomes of the model's feasibility trial in this limited cohort encompassed the execution of the learning model's syntax, student engagement in learning activities, and student reactions to the used instructional approaches.

Table 7. Results of Observations of the Implementation of the ESP-PjBL Model in the Small Group Test (Limited Trial)

Fase	Evaluator			Average
	1	2	3	
Inquire	3.67	3.67	3.67	3.67
Planning	3.67	3.67	3.67	3.67
Scheduling	4	3.5	3.5	3.67

Fase	Evaluator			Average
Monitoring	4	3.67	3.67	3.78
Assessing Results	4	3.5	4	3.83
Evaluating	3.67	4	3.67	3.78
Average of Each Validator	3.8	3.6	3.7	3.73

Source: Results of Analysis in appendix C.9 on page 264

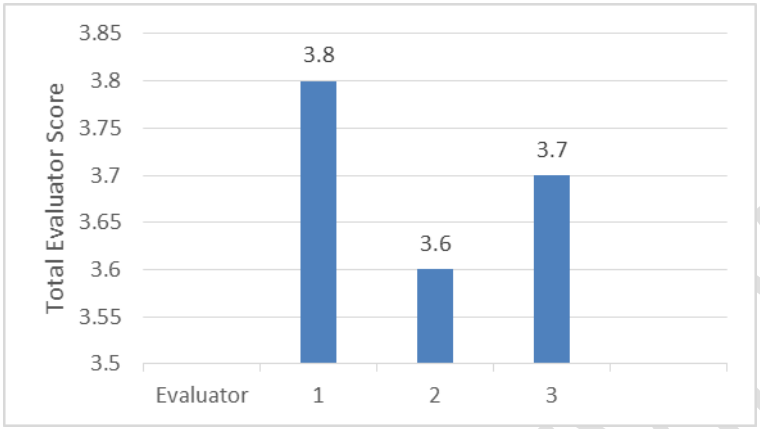

Figure 2. Observational findings from the limited trial of the ESP-PjBL model in small group testing.

Table 8. Results of Student Activity in Learning in the Limited Test

No	Responded Aspects	Meeting to-					Average	%
		1	2	3	4	5		
1	Introduction	20	20	20	20	20	20	100
2	Core Activity	18	19	19	20	20	19	95
3	Student Behaviour	16	17	18	19	20	18	91
4	Conclusion	20	20	20	20	20	20	100
Average		18	19	19	19	20	19	96

Source: Results of Analysis in appendix C.9 on page 264

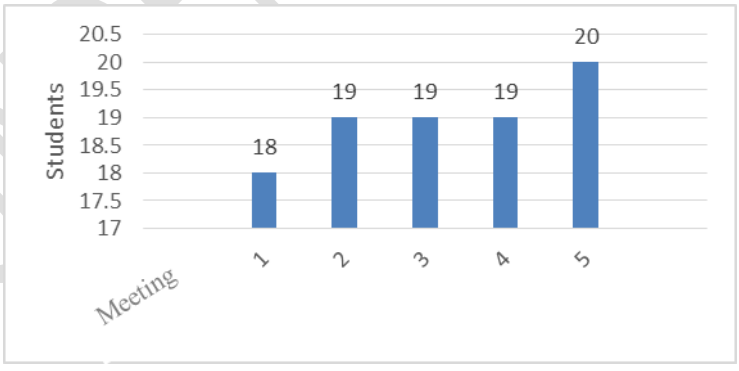

Figure 3. Results of student activity in learning in the limited trial

Figure 4. Cover of the ESP-PjBL Model Book

Figure 5. Cover of the ESP-PjBL-based Teaching Module Handbook

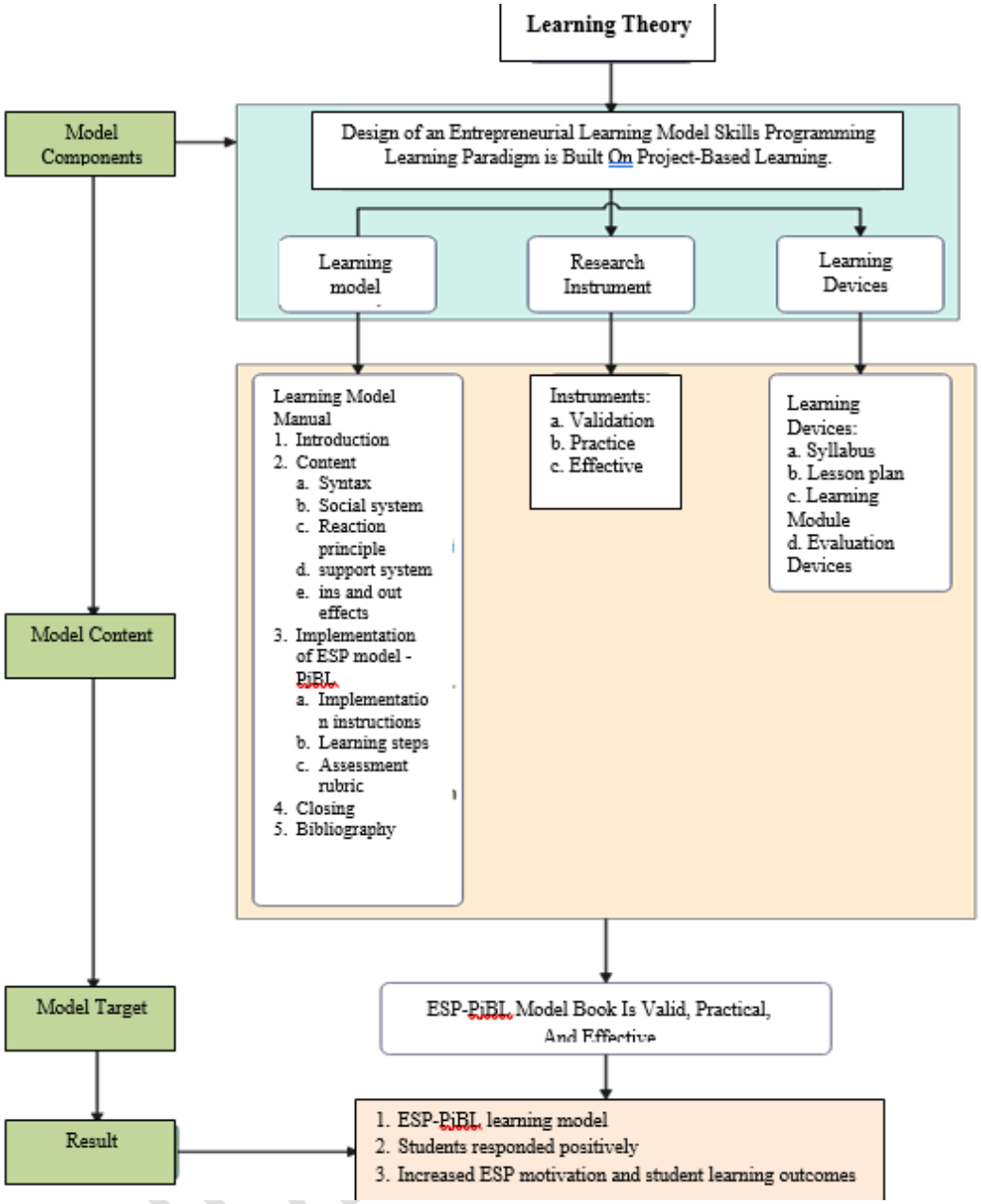

Figure 6. Learning Theory

Results of Student Response Analysis

a. Student Response to Learning

The results of the analysis of student responses to learning using the ESP-PjBL model are shown in table 9 below:

Table 9. Student Response to Limited Trial Learning

No	Aspects Responded	Responds				Average
		STS	TS	S	SS	
1	Curiosity about the process of acquiring knowledge	0	0	9	6	85
2	Simplicity of the learning process	0	0	8	7	87
3	Assessing the teaching quality during the learning process	0	0	6	9	92
4	Lecture activities	0	0	6	9	91
Average		0	0	7	8	89

Source: Results of Analysis in appendix C.11 on page 268

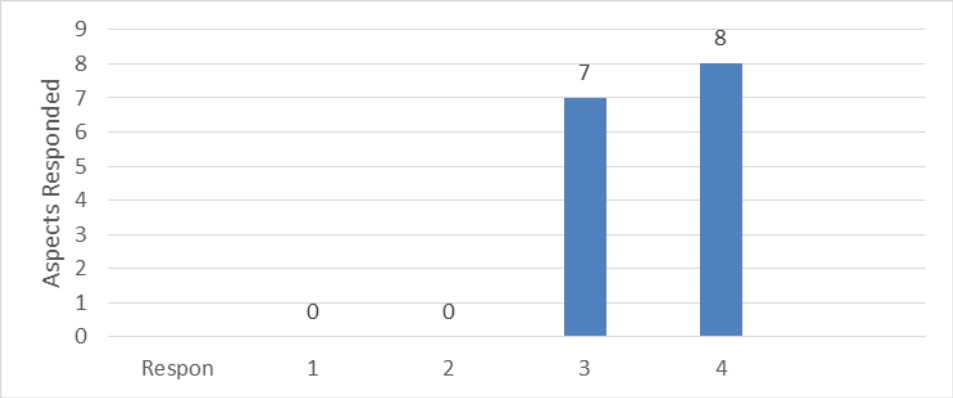

Figure 7. Student response results on limited trial learning

b. Attainment of Student Learning Objectives

The findings of this efficacy assessment, which includes the comparison of scores before and after the test, are displayed in Figure 8 below. By analysing these results visually, we can gain a deeper comprehension of how the ESP-PjBL model contributes to enhancing student learning outcomes.

Figure 8. Effectiveness Test of Pre Test and Post Test of Student Learning Outcomes

Discussion

Assessment of the ESP-PjBL Model's Validity

This research enhances the credibility of the ESP-PjBL Model, which combines entrepreneurial skills with programming instruction. Backed by relevant research, this methodology has been demonstrated to enhance students' inclination towards entrepreneurship and their belief in their own abilities. The research findings validate the efficacy of this strategy in equipping students for the digital era through the integration of programming and entrepreneurship principles.

Multiple studies demonstrate that integrating programming instruction with entrepreneurship education via project-based approaches like hackathons enhances the applicability of the ESP-PjBL Model. Therefore, this model effectively showcases its ability to cultivate the practical skills necessary for students to thrive in the technology-driven professional environment.

Evaluation of the Feasibility of the ESP-PjBL Model

This study confirms the feasibility of the ESP-PjBL Model, which emphasises the utilisation of entrepreneurial abilities in project-based programming education. Prior research conducted by Jones et al. (2020) and Cuadros & Alvarado (2018) substantiates this approach by demonstrating a rise in entrepreneurial self-efficacy and entrepreneurial abilities as a result of project-based learning. The paradigm supports the seamless integration of programming and entrepreneurship principles, fostering active and collaborative learning while honing crucial practical skills for students.

The ESP-PjBL paradigm enables adaptability to varying student abilities and gives tools that aid in teaching and assessment. Although the model presents difficulties in terms of time and resources, it remains feasible and exhibits significant promise in educating students in the digital era. The model places focus on active learning and the cultivation of crucial skills for achieving professional success.

CONCLUSION

1. The needs analysis indicates that the implementation of the Entrepreneurial abilities Model is necessary to enhance students' entrepreneurial abilities within the framework of Project-Based Learning-based Programming education. Traditional education is currently considered insufficient in equipping students to confront the demands of an ever-changing professional landscape.
2. The design of the created Entrepreneurial Skills model has considered crucial factors, including material requirements, methodologies, media, and learning evaluation. This strategy is specifically developed to effectively incorporate entrepreneurial skills into the programming learning process at Handayani University Makassar.
3. The Entrepreneurial Skills methodology has been verified by experts. This suggests that the model possesses strong credibility and reliability for implementation in the context of Programming education at Handayani University Makassar.
4. The created Entrepreneurial Skills model has a significant degree of usefulness. This is demonstrated by the utilisation of this paradigm in the process of learning Programming, which results in a notable enhancement of students' Entrepreneurial skills.
5. The implementation of the Entrepreneurial Skills Model in Project-Based Learning for programming education has been demonstrated to be highly beneficial in enhancing students' entrepreneurial abilities. This is evidenced by the substantial enhancement in student learning outcomes following the implementation of this methodology.
6. Students exhibited a favourable response towards the Entrepreneurial Skills Model in Project-Based Learning-based Programming instruction. This model is deemed valuable and enhances their interest and excitement in their study.

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