Pak. j. life soc. Sci. (2025), 23(1): 7940-7951 E-ISSN: 2221-7630;P-ISSN: 1727-4915

Pakistan Journal of Life and Social Sciences

www.pjlss.edu.pk

https://doi.org/10.57239/PJLSS-2025-23.1.00615

RESEARCH ARTICLE

Project-Based Learning in Foundation of Education Course: Impact On First-Year College Student Outcomes

Jincheng Ji[1], Panidnad Chulerk[2], Supinda Lertlit[3], Haoming Zhang[4]

[1,2,3] Suryadhep Teachers College, Rangsit University, Thailand

[4] Education Factor, Nanchang Institute of Technology, China

ARTICLE INFO

Received: Jan 7, 2025

Accepted: Mar 21, 2025

Keywords

Project-Based Learning

Grades

Attitudes

Learning Processes

Foundation Of Education Course

First-Year College Students

***Corresponding Author:**

panidnad.c@rsu.ac.th

ABSTRACT

This study examined Project-Based Learning (PBL) impact on first-year college students in a Foundation of Education course. Employing a comprehensive tracking analysis, the research delves into the academic, attitudinal, and cognitive dimensions of students' experiences with PBL. The primary objectives are to examine the effect of PBL on students' grades, attitudes toward learning, and the learning processes engaged during the Foundation of Education course. Using a mixed-methods approach, 120 students (60 experimental, 60 control) were tracked over four months. Assessments included exams, surveys, and behavioral checklists. After a four-month teaching period, students' grades were evaluated through final exams, their learning attitudes were evaluated through survey questionnaires, and their learning processes were evaluated through behavioral checklists using observation methods. PBL can improve the academic performance of first-year college students in basic education courses. After testing, the average score of the experimental group (82.767) was higher than the average score of the control group (79.083). The questionnaire data showed that all items received high rankings, indicating student satisfaction with the researchers' methods. The behavioral checklist revealed that students tended to exhibit collaboration and self-regulation behaviors during the learning process. This research demonstrates PBL's positive effects on first-year learning, providing insights for educators in higher education.

INTRODUCTION

As educational concepts evolve and societal demands shift, traditional classroom teaching models are increasingly perceived as inadequate. Consequently, scholars are exploring innovative pedagogical approaches to enhance teaching effectiveness and student learning experiences (Loyens et al., 2023). Among these, Project-Based Learning (PBL) has garnered significant attention in recent years.

PBL is a student-centered methodology that utilizes projects as a vehicle for active participation, independent exploration, and practical application through collaborative problem-solving. It aims to cultivate students' innovation, problem-solving, and teamwork skills. Compared to conventional instruction, PBL emphasizes student initiative and practical abilities, demonstrating enhanced adaptability and sustainability (Almazroui, 2023).

This research focuses on a Foundation of Education course within higher education, recognizing the unique challenges and opportunities inherent in preparing future educators. By concentrating on this specific domain, the study seeks to offer insights tailored to its distinctive requirements and objectives (Gravett & Van der Merwe, 2023).

To comprehensively assess the transformative impact of PBL, this study employs a tracking analysis methodology. Unlike static assessments, this approach provides a dynamic and continuous perspective on the learning journey. By monitoring student experiences throughout the Foundation of Education course, the research aims to capture their evolving nature.

Specifically, this study aims to address the following objectives:

To determine whether PBL improves the academic performance (grades) of college students in Foundation of Education course.

To examine the impact of PBL on college students' learning attitudes towards Foundation of Education course.

To identify the learning approaches college students' favor when engaging in Foundation of Education course under the guidance of PBL.

By focusing on a Foundation of Education course and utilizing a tracking analysis, this study intends to contribute nuanced insights to the ongoing discourse on innovative teaching methodologies. The findings will inform educators, administrators, and policymakers about the potential benefits and challenges associated with integrating PBL, ultimately promoting evidence-based instructional practices that enrich the educational experiences of aspiring educators.

LITERATURE REVIEW

Project-Based Learning (PBL)

Project-based learning (PBL) is a student-centered pedagogical approach that utilizes projects as the foundation for learning. Its core principle involves guiding students to actively participate, explore, and apply knowledge through collaborative problem-solving, thereby enhancing their innovation, problem-solving, and teamwork abilities. This teaching model emphasizes student initiative and practical skills, fostering adaptability and sustainability while promoting student interest and motivation, encouraging active engagement in learning (Kokotsaki, Menzies, & Wiggins, 2016).

In PBL, students are tasked with completing project objectives through independent critical thinking and practical exploration, acquiring relevant knowledge and skills. Simultaneously, PBL emphasizes collaborative interaction, encouraging students to work together to accomplish project goals. Within this framework, the teacher's role shifts from knowledge transmitter to guide and facilitator, empowering students to discover and resolve problems through practical experience (Condliffe, 2017).

To optimize student learning and achievement, PBL implementation typically follows a structured sequence of steps, derived from expert literature and recommendations:

Initiating with Essential Questions: In PBL, educators guide students to explore and solve problems by posing essential questions. These foundational inquiries necessitate independent thinking and hands-on exploration, fostering an environment that stimulates creativity, problem identification, and solution development. Students not only acquire pertinent knowledge and skills but also cultivate self-directed learning, problem exploration, and resolution capabilities - crucial objectives within PBL (Miller & Krajcik, 2019).

Developing a Project Plan: Formulating a comprehensive project plan is pivotal in PBL. This plan delineates project objectives, content, task distribution, timelines, and evaluation criteria, serving as a roadmap for students. Effective project planning enables educators to guide students, ensuring project excellence and efficacy while fostering teamwork and organizational skills (Scarbrough et al., 2004).

Creating a Schedule: Schedule development involves outlining project milestones, deadlines, and task allocation. A well-designed schedule guides educators and students, facilitating time management and in-depth project exploration while enhancing organizational and time-management skills. It also promotes accountability and collaboration (Gary, 2015).

Monitoring Student Progress: Effective monitoring of group projects requires meticulous planning and preparation, preventing common group work issues. While experienced students may require less oversight, consistent monitoring is essential for providing feedback and intervening when necessary (Zhang, Shi & Zhang, 2023).

Assessing Outcomes: PBL incorporates diverse active learning opportunities, enabling authentic embedded evaluation. By demonstrating evolving mastery of content and problem-solving skills,

students create continuous evaluation opportunities integrated within the teaching process (Sukackė et al., 2022).

Evaluating the Learning Experience: PBL necessitates evaluating various facets of student achievement, emphasizing both the final outcome and the process of task execution. Students acquire content knowledge, collaboration, and problem-solving skills throughout project implementation (Aldabbus, 2018).

Foundation of Education Course

The Foundation of Education course is a vital component of university education, designed to help students understand educational theory and practice, laying the groundwork for future educational endeavors. In PBL research, this course has been widely used to explore PBL effectiveness. As a highly theoretical course, it emphasizes the integration of educational theory and practice. It guides students to apply relevant theories to analyze educational issues and synthesize experiences, enabling mastery of basic educational science theories (Crookes & Lehner, 1998). This curriculum aims to update educational perspectives, establish sound teaching and learning principles, and cultivate a professional outlook.

Students develop professional ethics and skills in curriculum planning, implementation, and evaluation, as well as teaching and curriculum management. They also learn moral education principles and independently conduct moral education in schools. By teaching the Foundation of Education course, students are encouraged to appreciate the educational profession, enhance educational science literacy, master foundational theories, develop educational skills, and become competent educators (Andersen & Ponti, 2014).

Reinforcement of PBL and a Foundation of Education Course

The followings are the relationship between Problem-Based Learning (PBL) and a Foundation of Education course which is deeply intertwined, as PBL can serve as a practical application of many foundational educational theories and principles.

Philosophical Underpinnings: Foundations of education often explore philosophies like constructivism, progressivism, and pragmatism. PBL aligns strongly with these philosophies. Constructivism emphasizes that learners actively construct their own knowledge, which is precisely what PBL encourages. Progressivism focuses on learning through experience and problem-solving, which are core components of PBL. Therefore, a foundation of education course will give the theoretical background, that supports the practical application of PBL (Jumaat, Tasir, Halim & Ashari, 2017).

Learning Theories: Foundations courses delve into various learning theories, such as cognitive, social, and behavioral theories. PBL applies cognitive theories by engaging students in critical thinking, problem-solving, and knowledge application. It also incorporates social theories through collaborative group work. A foundation of education course will teach students the different learning theories, that PBL is rooted in (Neo & Fadilla, 2024).

Educational Psychology: Understanding how students learn, their motivations, and their developmental stages is crucial in education. Foundations courses cover these aspects of educational psychology. PBL provides a context for applying this knowledge by requiring teachers to design problems that are developmentally appropriate and engaging (Zajda, 2023).

Curriculum and Instruction: Foundations courses examine curriculum design and instructional strategies. PBL is a specific instructional strategy that can be analyzed and evaluated within the broader context of curriculum development. A foundation of education course will teach the student how to create curriculum, and PBL is a method for delivering that curriculum (Korkmaz & Kalaycı, 2019).

Sociocultural Context: Foundations courses often address the influence of social and cultural factors on education. PBL can be used to explore real-world problems that are relevant to students' sociocultural contexts, fostering a deeper understanding of these issues (Mishra, 2023).

PBL reinforces Foundation of Education, it serves as a powerful reinforcement of the principles taught in Foundations of Education courses. A core tenet of many foundational educational

philosophies is active learning, and PBL directly embodies this by engaging students in the process of constructing knowledge rather than passively receiving it. Furthermore, PBL actively cultivates essential skills like critical thinking and problem-solving, which are universally recognized as crucial outcomes for a comprehensive education. By requiring students to work collaboratively, PBL also strengthens their collaboration and communication abilities, skills that are indispensable for success in both academic and professional environments. Perhaps most importantly, PBL bridges the gap between theoretical knowledge and practical application by connecting learning to real-world problems. In essence, a Foundations of Education course provides the theoretical framework, while PBL offers a practical method for implementing those theories in the classroom (Tursynkulova, Madiyarov, Sultanbek & Duysebayeva, 2023).

METHODOLOGY

This study employed a mixed-methods approach to investigate the impact of a multi-step Problem-Based Learning (PBL) model on college students' grades, attitudes, and learning processes. An experimental design, utilizing both quantitative and qualitative data collection, was implemented. Cluster sampling (Sedgwick, P. 2014) was used to select 120 students from two Foundation of Education course classes at a Chinese university, dividing them into an experimental group and a control group, each consisting of 60 students. Over a four-month period, the experimental group engaged in the PBL learning strategy for their Foundation of Education course, while the control group received instruction through traditional learning methods. Throughout this period, researchers employed behavioral check observation methods (Kong, S. T., & Stocco, C. S. 2022) to track and observe the students in the experimental group, generating a qualitative learning process observation record. Following the four-month period, quantitative data on academic performance was gathered through the collection of educational course exam scores from both groups. Additionally, a survey questionnaire was developed and administered to the 60 students in the experimental group to collect quantitative data regarding their attitudes and satisfaction with the PBL approach.

RESULTS

Based on the study's findings, the following summarizes the key outcomes:

1. PBL can improve the grades of college students in Foundation of Education courses

The data from the final exam strongly suggests that PBL positively impacts the academic performance of college students enrolled in Foundation of Education courses. Specifically, the experimental group, which utilized PBL, demonstrated significantly higher test scores compared to the control group, which received traditional instruction. This outcome, as detailed in Table 1, provides quantitative evidence supporting the claim that PBL is an effective strategy for enhancing student achievement in this subject area.

Table 1 Frequency Analysis Results of Final Exam Scores

Frequency Analysis Results of Final Exam Scores			
The grades of final exam	**Score interval**	**Experimental group frequency and percentage (n=60)**	**Control group frequency and percentage (n=60)**
	<60	0 (0%)	2 (3.33%)
	60-69	8 (13.33%)	10 (16.67%)
	70-79	10 (16.67%)	18 (30%)
	80-89	24 (40%)	23 (38.33%)
	>90	18 (30%)	7 (11.67%)

Table 1 presents the distribution of student scores across different ranges for both the experimental and control groups. Notably, the experimental group's scores clustered predominantly in the higher ranges. Specifically, 24 students (40%) achieved scores between 80 and 89, while 18 students (30%) scored above 90. This significantly contrasts with the control group, where 23 students (38.33%) scored between 80 and 89, and only 7 students scored above 90. This data demonstrates that the experimental group had a substantially higher concentration of students achieving high scores on the final exam.

Conversely, the experimental group exhibited a lower concentration of students in the lower score ranges. Notably, no students (0%) in the experimental group scored below 60, and only 8 students (13.33%) scored between 60 and 69. This is significantly lower than the control group, which had 2 students (3.33%) scoring below 60 and 10 students (16.67%) scoring between 60 and 69. Therefore, the experimental group had fewer students in the low score ranges of the final exam.

In summary, the data from Table 1 clearly indicates that students in the experimental group, who utilized PBL, achieved higher scores on the final exam compared to students in the control group, who received traditional instruction.

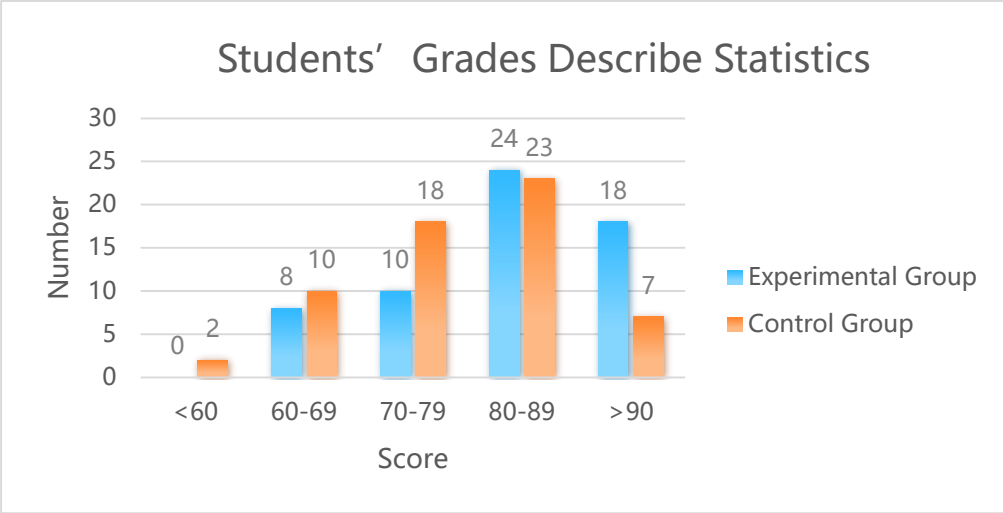

Figure 1: Students' Grades Describe Statistics

Figure 1 visually represents the distribution of student scores across different ranges for both the experimental and control groups, using a bar chart for clearer comparison. The chart effectively illustrates the disparity in student performance between the two groups. As depicted, the experimental group demonstrates a higher concentration of students within the higher score ranges (80-89 and above 90) compared to the control group. Conversely, the experimental group exhibits a lower number of students in the middle and lower score ranges (below 60, 60-69, and 70-79) compared to the control group. This visual representation reinforces the quantitative data, highlighting the positive impact of PBL on student achievement.

Table 2 T-test analysis results

T-test analysis results				
	Subgroup (Mean±SD)		t	p
	Control group (n=60)	Experimental group (n=60)		
Final exam	79.083±9.017	82.767±9.945	-2.125	0.036*
* p<0.05 ** p<0.01				

From Table 2, an independent samples t-test was conducted to analyze the differences in final exam scores between the control and experimental groups. The results revealed a statistically significant difference ($t = -2.125$, $p = 0.036$), indicating that the groups performed differently. Specifically, the average final exam score of the control group (79.08) was significantly lower than that of the experimental group (82.77). This confirms that the experimental group, utilizing PBL, achieved significantly higher final exam scores.

2. PBL positively impacts student satisfaction; students expressed satisfaction with it.

The survey questionnaire, designed to assess student satisfaction with PBL, comprised 10 questions, utilizing a combination of single-choice and multiple-choice formats. The single-choice questions employed a 5-point Likert scale (Likert, 1932), where 1 represented "Strongly Disagree," 2 "Disagree," 3 "Neutral," 4 "Agree," and 5 "Strongly Agree." Eight of the questions (1, 2, 3, 5, 6, 7, 8, and 10) were single-choice, and the distribution of student responses for each option within these questions is presented in the following table.

Table 3 Statistics of the number of people selected for each option

Question No.	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1	0	0	4	15	41
2	0	0	0	6	54
3	0	0	2	19	39
5	0	0	6	17	37
6	0	0	5	12	43
7	0	0	5	18	37
8	0	0	2	17	41
10	0	0	19	14	27

Table 3 reveals that student responses predominantly fell within the "Neutral," "Agree," and "Strongly Agree" categories. Notably, the "Disagree" and "Strongly Disagree" options were not selected by any respondents. A detailed breakdown of the single-choice question results, including specific descriptions and statistical data, is provided in Table 4.

Table 4 Descriptive statistics for single item selection

Item	Validity Samples	Min.	Max.	Mean	Level
1.The teacher is timely and correct guidance for students. (Teacher)	60	3.00	5.00	4.62	Very high
2. The teacher is approachable and willing to help me. (Teacher)	60	4.00	5.00	4.90	Very high
3.The teacher is open to questions and discussion. (Teacher)	60	3.00	5.00	4.62	Very high
5. Project-based learning helped me develop critical thinking skills. (PBL)	60	3.00	5.00	4.52	Very high
6.Project-based learning improved my collaboration skills. (PBL)	60	3.00	5.00	4.63	Very high
7. Project-based learning increased my interest in the course material. (PBL)	60	3.00	5.00	4.53	Very high
8. Project-based learning is helpful for my learning in Foundation of Education course. (PBL)	60	3.00	5.00	4.65	Very high
10. I satisfied with the project-based learning experience in the Foundation of Education course. (Summary)	60	3.00	5.00	4.13	High

Based on the analysis of Table 4, the single-choice questions can be categorized into three distinct areas: teacher-related questions (1, 2, and 3), PBL-related questions (5, 6, 7, and 8), and a summary question (10). Applying Best's (1981) rating scale, the average responses for questions 1, 2, 3, 5, 6, 7, and 8 fall within the "Very High" category, while question 10 falls within the "High" category. This clearly demonstrates that respondents consistently rated their experiences with both the teachers and the PBL method at a high level or above, indicating a positive overall perception.

Table 5 Pearson related T-values

Question No.	1	2	3	5	6	7	8	10
1	1							
2	0.155	1						
3	0.208	-0.03	1					

5	-0.005	0.091	-0.005	1				
6	0.025	-0.106	0.171	0.683**	1			
7	0.011	-0.069	0.106	0.751**	0.685**	1		
8	0.099	-0.215	-0.003	0.497**	0.501**	0.629**	1	
10	-0.03	-0.077	0.037	0.829**	0.760**	0.829**	0.703**	1
* p<0.05 ** p<0.01								

Table 5 presents the results of a correlation analysis, which utilized Pearson's correlation coefficient to examine the relationships between seven single-choice questions (1, 2, 3, 5, 6, 7, 8, and 10). The analysis revealed no statistically significant correlations between these items. The calculated correlation coefficients (0.155, 0.208, -0.005, 0.025, 0.011, 0.099, and -0.030) were all close to zero, and the corresponding p-values were all greater than 0.05. This indicates that the responses to these seven single-choice questions were independent of each other, suggesting that students' perceptions on one aspect of the PBL experience did not significantly influence their perceptions on other aspects.

Table 6 Linear regression analysis results

	Non-standardized Coefficient		**Standardized Coefficient**	**t**	**p**	**Collinearity Diagnosis**	
	B	**SE**	**Beta**			**VIF**	**TOL**
Constant	-2.263	1.035	-	-2.187	0.033*	-	-
Question 1	-0.084	0.079	-0.059	-1.064	0.292	1.115	0.897
Question 2	-0.019	0.166	-0.007	-0.114	0.91	1.194	0.837
Question 3	-0.014	0.088	-0.009	-0.159	0.874	1.139	0.878
Question 5	0.485	0.116	0.376	4.182	0.000**	2.928	0.342
Question 6	0.289	0.11	0.211	2.629	0.011*	2.327	0.43
Question 7	0.316	0.126	0.235	2.513	0.015*	3.172	0.315
Question 8	0.426	0.114	0.267	3.731	0.000**	1.853	0.54
R^2	0.856						
Adjust R^2	0.837						
F	F (7,52) = 44.316, p =0.000						
Dependent variable: Question 10							
* p<0.05 ** p<0.01							

Table 6 presents the results of a linear regression analysis, which examined the relationship between seven independent variables (single-choice questions 1, 2, 3, 5, 6, 7, and 8) and a dependent variable (question 10). The regression model, represented by the formula: question 10 = -2.263 - 0.084*question 1 - 0.019*question 2 - 0.014*question 3 + 0.485*question 5 + 0.289*question 6 + 0.316*question 7 + 0.426*question 8, demonstrated a strong fit, with an R-squared value of 0.856. This indicates that the independent variables explain 85.6% of the variance in question 10.

The model also passed the F-test (F = 44.316, p < 0.001), confirming its statistical significance. Further analysis of the individual regression coefficients revealed the following:

Questions 1, 2, and 3 (teacher-related) showed no significant impact on question 10 ($p > 0.05$).

Questions 5, 6, 7, and 8 (PBL-related) demonstrated significant positive impacts on question 10 ($p < 0.05$ or $p < 0.01$).

Specifically:

Question 5 (PBL) had a significant positive impact ($t = 4.182$, $p < 0.001$).

Question 6 (PBL) had a significant positive impact ($t = 2.629$, $p = 0.011$).

Question 7 (PBL) had a significant positive impact ($t = 2.513$, $p = 0.015$).

Question 8 (PBL) had a significant positive impact ($t = 3.731$, $p < 0.001$).

These findings indicate that while teacher-related questions did not significantly influence overall student satisfaction (question 10), PBL-related questions had a substantial positive impact. Therefore, the data supports the conclusion that students expressed satisfaction with the PBL approach.

3. PBL can enhance students' interest in learning and make a significant contribution to their collaboration skills.

Questions four and nine of the survey questionnaire were multiple-choice, designed to gather qualitative insights into the impact of Problem-Based Learning (PBL) on students' learning attitudes and processes. Question four, "How has project-based learning influenced your attitude towards learning in the Foundation of Education course? (Select all that apply)," aimed to understand the attitudinal changes resulting from PBL. Question nine, "How did project-based learning contribute to your learning process? (Select all that apply)," focused on the perceived contributions of PBL to students' learning experiences. Statistical analyses of the responses to these two questions are presented in Tables 7 and 8.

Table 7 Summary of Response and Popularity Rates for Question 4

Summary of Response and Popularity Rates for Question 4			
Option	Response		Popularity rate (n=60)
	n	Response rate	
Increased motivation	48	25.806%	80.000%
Enhanced engagement	54	29.032%	90.000%
Improved interest in the subject matter	56	30.108%	93.333%
Boosted confidence in academic abilities	28	15.054%	46.667%
No significant impact	0	0.000%	0.000%
Total	186	100%	310.000%

Table 7 summarizes the response and popularity rates for each option in question 4, a multiple-choice question. Notably, the option "Improved interest in the subject matter" had the highest response rate (30.108%) and penetration rate (93.333%). This indicates that a significant majority of students believe that PBL significantly enhanced their interest in the subject, which subsequently influenced their learning attitudes in the Foundation of Education course.

Table 8 Summary of Response and Popularity Rates for Question 9

Summary of Response and Popularity Rates for Question 9			
Option	Response		Popularity rate (n=60)
	n	Response rate	
Encouraged active participation	46	19.247%	76.667%
Facilitated hands-on learning	44	18.410%	73.333%
Strengthened collaboration skills	57	23.849%	95.000%
Improved problem-solving abilities	53	22.176%	88.333%
Enhanced creativity	39	16.318%	65.000%

Summary of Response and Popularity Rates for Question 9			
Option	Response		Popularity rate (n=60)
	n	Response rate	
Total	239	100%	398.333%

Table 8 demonstrates that, in question 9, the option "Strengthened collaboration skills" received the highest response rate (23.849%) and penetration rate (95.000%). This data strongly suggests that the majority of students perceived that Problem-Based Learning (PBL) significantly contributed to the enhancement of their collaborative skills during the learning process.

Collaboration and self-regulation are the primary learning behaviors exhibited by students during the Problem-Based Learning (PBL) process.

An operational definition of student behavior within Problem-Based Learning (PBL) provides a framework for educators to objectively observe and measure student actions, thereby assessing engagement, collaboration, and progress. In this context, student behavior encompasses specific, observable, and measurable actions, including:

Engagement: Active participation in project tasks and discussions, demonstrated by contributing ideas, asking relevant questions, and providing constructive feedback; exhibiting curiosity and enthusiasm by seeking information and learning opportunities.

Collaboration: Effective teamwork, evidenced by sharing responsibilities, negotiating roles, respecting diverse perspectives, communicating constructively, actively listening, and building upon peers' ideas.

Project Management: Efficient planning and organization of tasks, indicated by creating and adhering to project timelines, setting clear goals, and adapting plans as necessary; effective resource management, including time, materials, and technology.

Creativity and Innovation: Generation of original ideas and solutions, showcased through brainstorming, prototype development, and experimentation; willingness to propose novel approaches and embrace unconventional ideas.

Self-Regulation: Monitoring and evaluating personal performance, reflected in self-assessment, reflection, and strategy adjustments; actively seeking and utilizing feedback from peers and instructors.

Perseverance and Resilience: Maintaining focus and effort despite challenges, demonstrated by overcoming obstacles and working towards project goals; exhibiting adaptability and flexibility in response to changing requirements.

To track these behaviors, researchers conducted a four-month behavioral check and observation of 60 students in the experimental group, who were participating in a weekly Foundation of Education course using PBL. These students were divided into six groups of ten. The frequency of observed PBL behaviors within these groups was then recorded.

Table 9 Statistics of student behavior verification records

Behavior	Groups						Mean
	1	2	3	4	5	6	
Engagement	59	55	48	47	52	41	50.33
Collaboration	57	58	60	53	50	48	54.33
Project Management	8	14	10	9	21	13	12.5
Creativity and Innovation	34	19	14	27	14	24	20
Self-Regulation	52	57	51	54	49	58	53.5

Table 9 clearly indicates that "Collaboration" and "Self-Regulation" have the highest mean values (54.33 and 53.5, respectively) among the observed behaviors. This strongly suggests that students participating in Problem-Based Learning (PBL) are most frequently engaging in collaborative activities and demonstrating self-regulatory behaviors.

DISCUSSION

This study confirms that Project-Based Learning (PBL) is an effective and suitable method for enhancing college students' grades, attitudes, and learning processes in Foundation of Education courses.

1. Impact on Academic Performance (Objective 1)

The final exam results clearly demonstrated that the experimental group, utilizing PBL, significantly outperformed the control group, which employed traditional teaching methods. This indicates that PBL effectively improves academic performance in Foundation of Education courses.

While traditional teaching methods have historically dominated theoretical courses like Foundation of Education, concerns about the impact of innovative models on student learning outcomes persisted. However, the study's findings show that PBL not only maintains but also significantly enhances academic achievement. This encourages educators to confidently adopt innovative teaching practices.

2. Impact on Student Satisfaction and Learning Processes (Objective 2)

The survey results revealed a positive correlation between PBL implementation and student satisfaction. Specifically, PBL-related questions significantly influenced overall satisfaction, whereas teacher-related questions did not. This indicates that students are highly satisfied with PBL-guided education curricula.

Multiple-choice questions further highlighted that students perceive PBL as enhancing their learning interest and significantly strengthening their collaborative skills. This validates PBL as a student-centered approach, where students take ownership of their learning, with teachers acting as facilitators.

Students reported that PBL's primary impact on their learning attitude was its ability to inspire interest and promote active learning. Moreover, they experienced a notable improvement in their teamwork abilities during PBL implementation.

3. Impact on Learning Behaviors (Objective 3)

Analysis of observational data revealed that students engaged in self-regulation and collaboration most frequently during PBL activities in the Foundation of Education course.

Behavioral checklists from the experimental group demonstrated a high prevalence of self-regulation and teamwork behaviors. This confirms that PBL significantly promotes teamwork, as it emphasizes collaboration and the division of labor. Furthermore, self-regulation is crucial for students to effectively participate in team activities and complete their assigned tasks.

CONCLUSION AND RECOMMENDATIONS

This study, utilizing a mixed-methods approach, investigated the impact of Problem-Based Learning (PBL) on the academic performance, attitudes, and learning processes of college students in Foundation of Education courses. Employing both quantitative and qualitative data collection, the study addressed three primary objectives: 1) to determine if PBL improves student grades, 2) to assess PBL's impact on student learning attitudes, and 3) to identify student learning preferences within a PBL framework.

The final exam results confirmed that PBL significantly enhances student academic performance. Survey questionnaire data revealed high student satisfaction with PBL. Behavioral checklists indicated that students predominantly engage in self-regulation and teamwork during PBL activities.

Based on these findings, the following recommendations are made:

Expand PBL Research: Future studies should explore PBL's effectiveness in diverse course areas and utilize larger sample sizes to enhance generalizability.

Foster Collaboration: Implement team-building activities and collaborative tools to promote effective teamwork and enhance student engagement. Establishing a supportive learning environment is crucial (Kavanagh, Farrow, Bernhard, Guillotte & Dean, 2024).

Integrate Reflective Practices: Incorporate regular reflective exercises within the PBL framework to encourage students to analyze their learning experiences and develop self-awareness. This can positively impact self-regulation skills (Crawford, Arellano Carmona & Kumar, 2024).

Accommodate Diverse Learning Styles: Design PBL projects with varied tasks and roles to cater to diverse learning preferences, ensuring all students can contribute effectively.

Promote Student Autonomy: Empower students by allowing them to take ownership of their learning through project selection, design, and execution. This fosters intrinsic motivation and a sense of responsibility (Wijnia et al., 2024).

Conduct Longitudinal Studies: Track the long-term impact of PBL on students' academic and professional journeys to provide insights into its lasting benefits.

By implementing these recommendations, educational institutions can optimize PBL's effectiveness, leading to improved student outcomes and a more engaging learning experience.

IMPLICATIONS FOR EDUCATION

There are several significant implications for education stemming from this research. This research strongly advocates for a significant shift in educational practices towards student-centered learning models, particularly Problem-Based Learning (PBL). The study's findings reveal that PBL not only enhances academic performance but also fosters crucial skills like collaboration and self-regulation, while significantly increasing student satisfaction. Educators should prioritize designing curricula that empower students through autonomy and active participation, moving away from traditional teacher-centered approaches.

Furthermore, the emphasis on collaborative learning necessitates the integration of teamwork activities, fostering communication and problem-solving skills. To effectively implement PBL, institutions must invest in comprehensive teacher training and professional development, ensuring educators are equipped to design engaging projects and facilitate student-led learning. Assessment practices should also evolve to reflect the goals of PBL, focusing on evaluating critical thinking and collaborative skills. Ultimately, this research underscores the importance of creating engaging and relevant learning experiences that connect to real-world problems, fostering positive learning attitudes and equipping students with the skills necessary for success.

In essence, this research provides valuable insights into how PBL can transform educational practices, leading to improved student outcomes and a more engaging learning experience.

REFERENCES

Aldabbus, S. (2018). Project-based learning: Implementation & challenges. International Journal of Education, Learning and Development, 6(3), 71-79.

Almazroui, K. M. (2023). Project-based learning for 21st-century skills: An overview and case study of moral education in the UAE. The Social Studies, 114(3), 125-136.

Andersen, R., & Ponti, M. (2014). Participatory pedagogy in an open educational course: challenges and opportunities. Distance education, 35(2), 234-249.

Condliffe, B. (2017). Project-Based Learning: A Literature Review. Working Paper. MDRC.

Crawford, L. K., Arellano Carmona, K., & Kumar, R. (2024). Examining the Impact of Project-Based Learning on Students' Self-Reported and Actual Learning Outcomes. Pedagogy in Health Promotion, 23733799241234065.

Crookes, G., & Lehner, A. (1998). Aspects of process in an ESL critical pedagogy teacher Foundation of Education course. Tesol Quarterly, 32(2), 319-328.

Fleming, D. S. (2000). A Teacher's Guide to Project-Based Learning. Scarecrow Education, Attn: Sales Department, 15200 NBN Way, PO Box 191, Blue Ridge Summit, PA 17214.

Gary, K. (2015). Project-based learning. Computer, 48(9), 98-100.

Gravett, S., & van der Merwe, D. (2023). Learning-centered lesson design and learning about teaching in a pre-service teacher Foundation of Education course. Cogent Education, 10(1), 2202123.

Jumaat, N. F., Tasir, Z., Halim, N. D. A., & Ashari, Z. M. (2017). Project-based learning from constructivism point of view. Advanced Science Letters, 23(8), 7904-7906.

Kavanagh, S. S., Farrow, J., Bernhard, T., Guillotte, A., & Dean, C. P. (2024). Practicing inquiry: Investigating how coaches support teachers to lead inquiries in project-based learning classrooms. Teaching and Teacher Education, 144, 104575.

Kokotsaki, D., Menzies, V., & Wiggins, A. (2016). Project-based learning: A review of the literature. Improving schools, 19(3), 267-277.

Kong, S. T., & Stocco, C. S. (2022). Teaching study skills to college students using checklist training. Behavioral Interventions, 37(4), 1149-1165.

Korkmaz, G., & Kalaycı, N. (2019). Theoretical foundations of project-based curricula in higher education. Cukurova University Faculty of Education Journal, 48(1), 236-274.

Loyens, S. M., Van Meerten, J. E., Schaap, L., & Wijnia, L. (2023). Situating higher-order, critical, and critical-analytic thinking in problem-and project-based learning environments: A systematic review. Educational Psychology Review, 35(2), 39.

Miller, E. C., & Krajcik, J. S. (2019). Promoting deep learning through project-based learning: A design problem. Disciplinary and interdisciplinary science education research, 1(1), 7.

Mishra, N. R. (2023). Constructivist approach to learning: An analysis of pedagogical models of social constructivist learning theory. Journal of research and development, 6(01), 22-29.

Neo, M., & Fadilla, A. N. (2024). Enhancing student project-based learning experiences within a constructivist learning environment. In EDULEARN24 Proceedings (pp. 1159-1164). IATED.

Scarbrough, H., Bresnen, M., Edelman, L. F., Laurent, S., Newell, S., & Swan, J. (2004). The processes of project-based learning: An exploratory study. Management learning, 35(4), 491-506.

Sedgwick, P. (2014). Cluster sampling. Bmj, 348.

Sukackė, V., Guerra, A. O. P. D. C., Ellinger, D., Carlos, V., Petronienė, S., Gaižiūnienė, L., ... & Brose, A. (2022). Towards active evidence-based learning in engineering education: A systematic literature review of PBL, PjBL, and CBL. Sustainability, 14(21), 13955.

Tursynkulova, E., Madiyarov, N., Sultanbek, T., & Duysebayeva, P. (2023, December). The effect of problem-based learning on cognitive skills in solving geometric construction problems: a case study in Kazakhstan. In Frontiers in Education (Vol. 8, p. 1284305). Frontiers Media SA.

Wijnia, L., Noordzij, G., Arends, L. R., Rikers, R. M., & Loyens, S. M. (2024). The effects of problem-based, project-based, and case-based learning on students' motivation: A meta-analysis. Educational Psychology Review, 36(1), 29.

Zajda, J. (2023). The use of social constructivism to improve learning and performance. In Globalisation and Inclusive Schooling: Engaging Motivational Environments (pp. 55-70). Cham: Springer Nature Switzerland.

Zhang, R., Shi, J., & Zhang, J. (2023). Research on the quality of collaboration in project-based learning based on group awareness. Sustainability, 15(15), 11901.