



Assessing the Impact of Project-Based Learning on Academic Performance: A Quantitative Study of University Students’ Perceptions

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Abstract

Project-Based Learning is considered an effective teaching strategy that improves pupils' academic engagement and learning outcomes by involving them in practical, real-world tasks. This quantitative study aimed to assess university students' perceptions regarding the impact of project-based learning on academic achievement. The primary objective was to assess undergraduate students' perceptions on the impact of project-based learning on their academic performance, while the secondary objective was to access the statistical association between project-based learning and academic performance. This research followed a quantitative approach and employing a descriptive survey design. Self-developed questionnaire is utilized to collect data from undergraduate students from the Education and Psychology departments of selected public universities in Islamabad. To analyze the data both descriptive and inferential statistical methods were used. The results showed that learners usually held positive opinions about PBL, reporting improved motivation, better understanding of content, and enhanced learning engagement. However, the statistical analysis revealed that the association between PBL and academic achievement was not significant. Although this, the positive perceptions propose that PBL holds educational value, and future research may explore its long-term impact and application across diverse academic settings.

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INTRODUCTION

The 21st century has observed quick technological and societal changes, demanding learners to adapt to new learning environments. To meet these developing educational preferences, educators have increasingly adopted Inquiry-based learning is an instructional approach that contains learners in real-world, interdisciplinary projects aimed at solving difficult problems. According to Barron and Darling-Hammond (2008), PBL fosters deeper learning by assimilating knowledge and encouraging collaboration. Thomas (2000) highlighted that students in PBL environments are assessed through practical tasks instead of traditional exams, promoting problem-solving and cooperation.

Constructivist approaches, such as PBL, let students to discover real-world issues, collaborate with peers, and improve independent learning skills. These approaches are mainly useful in transitioning from general to specialized coursework and have been linked to improved academic success.

Research has revealed that PBL can develop students' motivation, engagement, and understanding of content (Blumenfeld et al., 1991). Furthermore, PBL has been associated with the improvement of creative thinking and collaboration skills (Hmelo-Silver, 2004; Strobel & van Barneveld, 2009).

Although evidence supporting PBL's impact on academic outcomes, there remains limited research on how students themselves perceive its effectiveness. Given these benefits and the changing desires of modern learners, this study aims to evaluate university students' perceptions of the impact of project-based learning on their academic performance.

PROBLEM STATEMENT

While Project-Based Learning is known to improve pupil participation and academic performance, traditional teaching methods still overcome in many universities in Pakistan. There is insufficient evidence on how students perceive the impact of PBL on their academic success. This study aims to address this gap by assessing the perceptions of undergraduate students regarding the impact of project-based learning on their academic performance.

OBJECTIVES OF THE STUDY

This study has the following objectives;

- To assess undergraduate students' perceptions on the impact of project-based learning on their academic performance
- To examine the association between project-based learning and academic performance of undergraduate learners

RESEARCH QUESTIONS

The research questions of the study are;

1. What are the perceptions of undergraduate students regarding the impact of project-based learning on their academic performance?
2. Is there any significant association between project-based learning and undergraduate students' academic performance?

RESEARCH HYPOTHESES

H₀: There is no significant association between project-based learning and undergraduate students' academic performance.

LITERATURE REVIEW

Project-based learning is an instructional approach that engages students in challenging, real-world projects that help them apply and enhance their knowledge and abilities. In PBL

settings, learners actively explore and respond to real-world problems and difficulties rather than passively taking in knowledge from the teacher (Thomas, 2000).

PBL places more stress on cooperative inquiry, creativity, problem-solving, and the development of 21st-century skills like critical thinking and teamwork than traditional learning models, which prioritize rote memorization and solo academic assignments (Bell, 2010). By placing instruction in authentic settings, PBL helps students make the connection between theoretical thoughts and real-world applications (Larmer, Mergendoller & Boss, 2015).

PROJECT-BASED LEARNING

The learning based on project use in the classroom gives students the chance to work on actual world problems. Students are given a driven example in project based learning, where the task may "drive" them to the central idea of a given subject.

The task should involve students' productive inquiries, which involve their questioning, assessment making, and determination. A certain amount of project-based teaching is challenging, though, and some activities like straightforward information and practice that incorporate "already-learned information" do not encounter the requirements of project based learning.

The learning based on projects encourages pupils to take charge of their education. For instance, individuals are accountable for their own decisions, choices, and even solutions to the issues they met. The term "realism" describes the task's character, which calls for it to be realistic and the issues near the subjects it covers to be genuine for the pupils.

THE IMPACT OF PROJECT-BASED LEARNING ON ACADEMIC PERFORMANCE

Inquiry-Based Learning has been progressively recognized as an teaching approach that improves students' academic performance and cognitive engagement across various educational levels. Trustee (2024) conducted a study on secondary school learners, revealing that students perceived PBL as highly valuable in improving their academic success. The applicants reported greater motivation, better understanding of course content, and improved performance in assessments due to their involvement in real-world, collaborative projects. Although the study was limited to the secondary school level, the findings contribute meaningfully to the broader understanding of PBL's usefulness. These outcomes support with the current research focus on undergraduate students, supporting the argument that PBL can be an effective pedagogical tool in higher education as well. While Trustee's research did not address creative thinking specifically, it strengthens the positive impact of PBL on academic performance, which is one of the core constructs examined in this study. This connection provides a basis for further discovering how PBL also contributes to higher-order thinking skills, including creativity, mainly at the undergraduate level. The impact of Project-Based Learning on academic performance can be observed through several key dimensions, including improved understanding, improved motivation, and the improvement of essential academic capabilities.

IMPROVED UNDERSTANDING AND KNOWLEDGE RETENTION

Students who participate in project have a better knowledge of the material as they are required to put what they have learnt into practice. A research by Barron and Darling-Hammond (2008), establish that pupils engaged in PBL demonstrated better conceptual understanding and information retention than those in traditional settings. A strong academic record may influence from this increased understanding.

HIGHER ENGAGEMENT AND MOTIVATION

Students' motivation and concentration in learning is enhancing in project-based learning setting, and learner engagement is a important element of academic success. According to research by Blumenfeld et al. (1991), hands-on approach makes learning more interesting for learners, which may improve their academic performance.

In addition, a study by Boaler (2002) found that students in project-based learning environments were more involved and performed better on standardized tests than their classmates in outdated classrooms.

DEVELOPMENT OF KEY ABILITIES

Project-based learning is important for building critical capabilities required for succeeding academically. These abilities include self-control, effective communication, and critical thinking. It helps learners improve strong research and logical skills that are vigorous for academic success, according to research by Hmelo-Silver (2004). Additionally, developing these skills yields long-term benefits because they are applicable to a variety of academic fields and real-world situations.

META-ANALYTIC EVIDENCE

A growing number of meta-analyses quantitatively review how PBL affects academic performance across disciplines, areas, and educational levels. These studies reliably report moderate to large positive effects in favor of PBL over traditional instructional methods.

- A meta-analysis is conducted by Ayaz & Söylemez (2015) on 41 science education studies in Turkey (2002–2013) and found a mean result size of 0.997 (95 % CI; SE = 0.112), representing a moderate to strong effect of PBL on academic performance in science classes. Most studies (39 of 42) reported positive effects compared to conventional methods.
- Batdı, Topkaya & Jibril (2024) employed a mixed-method meta-analytic method combining quantitative and qualitative data across 26 studies. Their quantitative meta-analysis reported Hedges' $g = 0.83$ (range -0.02 to 1.68 ; $p < .05$), indicating a large effect on academic performance. The qualitative component acknowledged both positive and some negative student experiences but overall supported PBL's effectiveness
- Balemen & Keskin (2018) reviewed 48 science education studies and concluded the effect size of PBL was 1.063, indicating it is 86% more effective than traditional instruction in improving learning outcomes across subjects and educational levels.
- A comprehensive meta-analysis spanning 70 studies from 2010 to 2023 reported an average effect size ($d+$) of 0.652, demonstrating a consistent moderate-to-substantial enhancement of academic achievement associated with PBL across Another recent meta-analysis of 66 experimental/quasi-experimental studies produced 190 effect values, concluding that PBL meaningfully develops academic achievement, affective attitudes, and higher-order thinking skills. It also found that effectiveness was higher in Asia, especially Southeast Asia, in engineering/technology subjects, and when administered in small groups over 9–18 weeks.

Taken together, these meta-analyses affirm that PBL consistently yields large effect sizes ($ES \geq 0.8$) or moderate-to-large effects ($ES \approx 0.6-1.0$) on academic performance. Moderator analyses suggest that effect magnitude is influenced by factors including region, subject area, group size, duration of intervention, and educational level—with big effect sizes especially in engineering, technology, and STEM fields, as well as in Eastern and

Southeastern Asian contexts.

EMPIRICAL EVIDENCE

The valuable impact of Project-Based Learning (PBL) on students' academic performance across a range of academic levels and disciplines has been validated by many experiential studies.

To compare a standards-based Project-Based Learning (PBL) model with traditional classroom methods, Iwamoto et al. (2016) carried out an action research study with first-year undergraduate psychology students. On multiple-choice tests, the group that fully incorporated PBL and emphasized peer responsibility outperformed the control group by a substantial margin. On the other hand, a different PBL group that did not include the peer accountability component made no discernible progress. The researchers came to the conclusion that the enhancements in performance were caused by elements such as growth mindset, perceived control, and self-efficacy. Their results offer confidence to the notion that PBL can improve academic performance and suggest that motivational elements might also contribute to the development of creative thinking, a notion that is being explored in the current study of students' perceptions in the fields of psychology and education. The researchers came to the conclusion that the performance improvements were caused by elements such as growth mindset, perceived control, and self-efficacy. Their results lend credence to the notion that PBL can enhance academic performance and imply that motivational elements might also contribute to the development of creative thinking, a notion that is being investigated in the current study of students' perceptions in the fields of psychology and education.

- Chen and Yang (2019) conducted a meta-analysis to evaluate the effectiveness of PBL on academic achievement across different educational levels primary, secondary, and university. Their analysis showed that PBL led to better academic outcomes than traditional direct instruction. They found that involving students in meaningful project work and product creation improved both their understanding and retention of subject matter.

STUDENTS' PERCEPTIONS OF THE EFFECTIVENESS OF PROJECT-BASED LEARNING

Puangpunsi (2021) discovered learners' perceptions of Project-Based Learning in the setting of English language education, aiming on its role in improving academic achievements and developing 21st-century skills. The findings showed that students viewed PBL as an engaging and effective method that enhanced their interaction, collaboration, creativeness, and problem-solving skills. While the main stress was on language development, the study also highlighted the broader cognitive advantages of PBL, mainly in encouraging creative thinking and learner independence. These insights are significant to the current research, as they support the idea that PBL supports both academic performance and the attainment of essential capabilities needed in today's educational and professional environments. Additionally, Puangpunsi's focus on student perceptions offers a valuable basis for understanding how undergraduates across various disciplines experience PBL.

Gibbes and Carson (2014), using Activity Theory as an analytical framework, exposed university students' views on project-based learning. Their study stressed that project-based learning is applied across various disciplines in higher education. Thus, they highlighted the importance of assessing its outcomes, mainly through the lens of learners' experiences and perceptions.

Evaluating PBL's overall effectiveness as a teaching method in higher education requires an understanding of students' perspectives (Han & Bhattacharya, 2001). Students' engagement and the results they attain are directly influenced by their attitudes, beliefs, and perceived advantages or difficulties (Barron & Darling-Hammond, 2008). Studies constantly demonstrate that students, who frequently characterize it as more interesting, useful, and related than conventional lecture-based instruction (Blumenfeld et al., 1991; Kokotsaki et al., 2016).

This encouraging view is supported by recent empirical research in a variety of fields. Hasan and Khan's (2021) mixed-methods study looked at how business students at an Indian university felt about PBL. The results showed that students for its role in skill development, teamwork, and real-world learning valued PBL. Many participants said that by applying theoretical ideas to real-world situations, PBL tasks helped them understand them better and boost up their confidence in their skills and knowledge.

Similarly, Krajcik and Shin (2014) argue that students perceive PBL as a real approach that links learning with real-life contexts, which enhances their motivation and commitment. Since students frequently doubt the theoretical knowledge's practical applicability in higher education, this authenticity is crucial (Thomas, 2000). Similar results are commonly reported in STEM-related studies. Chen and Yang (2019), for instance, discovered that engineering students viewed PBL as a significant factor in their professional readiness since it reflects business procedures that call for teamwork, project management, and innovative problem-solving.

The literature does, however, also draw attention to issues that influence students' opinions. Concerns have been raised by some students regarding the uncertainty of open-ended projects, the unequal distribution of work among groups, and the heavier workload in comparison to traditional coursework (Han & Bhattacharya, 2001; Kokotsaki et al., 2016).

According to a 2003 study by Frank, Lavy, and Elata, Israeli engineering students acknowledged the value of PBL for skill development but also expressed stress as a result of ambiguous expectations and short deadlines.

RESEARCH DESIGN

This research employ a quantitative, descriptive survey design to assess students 'perceptions regarding the impact of project-based learning on learners academic achievement. The data were collected through a self-developed questionnaire from.

POPULATION

The target population of this study included undergraduate students enrolled in the Education and Psychology departments at six public universities in Islamabad, namely NUML university, Quaid Azam university, Comsat university, NUST, Air university and Islamic university. The estimated population was approximately 4000

SAMPLE AND SAMPLING TECHNIQUE

The researcher chose a sample size of 351 students, aiming to represent both male and female undergraduate students of Education and Psychology departments from 6 public universities in Islamabad. The researcher employed simple random sampling techniques. Simple random sampling is especially valuable in educational settings.

RESEARCH INSTRUMENTS

A self-constructed, structured five likert scale questionnaire is used as research instrument. The questionnaire comprises three main sections. The first part includes demographic information, such as gender, department, and name of university. Second part focused on PBL and it includes statements and third part is about statements for pbl impact on



creative thinking.

RELIABILITY OF QUESTIONNAIRES

To assess the reliability of the scale, the researcher conducted a pilot study and calculated reliability using Cronbach's Alpha in SPSS version 16.

Table 3.4 Reliability Statistics

Total No of Items	Cronbach Alpha Reliability
40	0.810

RESULTS AND DISCUSSIONS

RESULTS

Table 4.1 Percentage responses about students' perceptions regarding project-based learning.

S.No	ITEMS	Strongly disagree%	Disagree %	Neutral %	Agree %	Strongly agree %	Mean value
1.	The PBL project were well-designed and aligned with course objectives.	3.4	2.8	9.6	60.0	22.9	3.97
2.	The PBL approach allowed for flexibility and autonomy in learning	3.7	4.2	14.2	59.2	17.8	3.84
3.	The instructor provides clear guidance and support throughout the PBL process	2.0	8.5	11.1	57.5	20.8	3.87
4.	PBL enhanced my engagement and motivation in course.	1.4	6.2	14.4	65.7	11.6	3.80
5.	I found PBL more engaging than traditional lectures.	1.7	9.3	15.3	54.7	55.0	3.79
6.	PBL motivated me to learn more about the subject matter.	1.7	9.1	19.3	50.4	19.0	3.76
7.	PBL helped me developed a deeper	1.7	9.1	16.1	56.7	37.7	3.76



	understanding of course material.						
8.	PBL improved my ability to apply hypothetical concepts to real-world problems.	2.3	9.3	18.1	51.6	43.3	3.74
9.	PBL enhanced my creative thinking and problem solving skills.	1.1	5.9	17.0	56.7	18.7	3.86
10.	PBL encouraged me to work collaboratively with peers.	2.5	5.7	16.4	48.4	26.1	3.91
11.	PBL helped me develop effective communication skills.	2.3	2.8	19.5	56.7	18.1	3.86
12.	PBL fostered a sense of teamwork and shared responsibility.	2.5	4.5	22.1	48.7	21.5	3.83

Aggregate mean 3.83

Table 4.1 shows that students generally held positive perceptions of Project-Based Learning (PBL). High percentages of agreement across all items, along with an aggregate mean of 3.83, reflect satisfaction with aspects such as project alignment, instructor support, engagement, critical thinking, collaboration, and communication skills. Neutral and negative responses were minimal, suggesting strong overall approval of the PBL approach in enhancing academic experiences.

Table 4.2 Percentage responses about students' perceptions regarding the impact of project-based learning on their academic performance.

S. No	ITEMS	Strongly disagree%	Disagree %	Neutral %	Agree %	Strongly agree %	Mean value
1.	Engaging in real-world tasks has enhanced my ability to recall	.6	1.4	5.9	50.7	40.5	4.31



	information during exams.						
2.	The projects I worked on have deepened my understanding of the subject matter.	.6	2.0	5.1	50.1	41.6	4.31
3.	Real-world applications of course material have made learning more meaningful to me.	.8	1.1	4.8	48.7	43.9	4.34
4.	I understand complex topics better when learning through applied experiences.	.6	4.5		51.3	42.5	4.35
5.	My performance in assessments has improved because of hands-on learning experiences	.6	.6	5.9	50.4	41.9	4.33
6.	Engaging in real-world tasks has made me feel more prepared for exams and quizzes	.8	.6	3.7	43.3	49.0	4.42
7.	Practical tasks have improved my ability to complete academic work effectively.	1.4	1.1	4.8	48.2	43.9	4.33
8.	My GPA has improved as a result of engaging in hands-on	2.5	1.1	7.1	51.0	37.7	4.21



	activities.						
9.	Active learning has increased my interest in the subject matter.	.8	2.0	5.1	49.3	42.2	4.31
10.	I actively participate in class discussions more when practical tasks are involved	1.7	1.1	8.5	53.0	35.1	4.19
11.	I put more effort into my coursework when engaged in applied learning activities.	1.4	1.1	5.9	44.5	46.2	4.34
12.	Engaging in practical assignments has increased my sense of ownership over my academic success.	1.4	.8	4.0	47.3	45.9	4.36

Table 4.2 The overall mean score of 4.26 indicates a strongly positive perception among students regarding the impact of project-based learning on their academic performance and understanding. This suggests that integrating real-world tasks and hands-on activities significantly enhances learning outcomes, motivation, and student engagement.

TABLE 4.3 EXAMINE THE ASSOCIATION BETWEEN PROJECT-BASED LEARNING AND ACADEMIC PERFORMANCE OF UNDERGRADUATE STUDENTS

Academic performance	Project-based learning		
	Low	Moderate	High
	Percentages		
Low	27.3	63.6	9.1
Moderate	9.3	71.2	19.5
High	10.8	66.7	22.5

X² tab=9.488 X² cal=4.370 df= 4 Non-significant

Table 4.3 shows the association between project-based learning and academic performance and reveals that this association is statistically non-significant. The percentages show how different levels of project-based learning are distributed across students with varying academic performance. Among students with low academic performance, 63.6% had

moderate exposure to project-based learning, 27.3% had low exposure, and only 9.1% experienced high levels. In the moderate academic performance group, the majority (71.2%) also experienced moderate project-based learning, while 19.5% had high exposure and 9.3% had low exposure. Similarly, among students with high academic performance, 66.7% were exposed to moderate levels of project-based learning, 22.5% to high levels, and 10.8% to low levels. This overall pattern suggests that students, regardless of their academic performance, commonly experience moderate levels of project-based learning. Despite these variations in percentages, the chi-square test result indicates that the differences are not statistically significant. The calculated chi-square value (4.370) is less than the critical value (9.488) at 4 degrees of freedom. As a result, the null hypothesis of no significant association between hands on learning and academic.

DISCUSSION

Findings revealed that learners generally held positive views about PBL, noting its role in enhancing engagement, understanding of subject matter, and real-world application of knowledge. Many participants reported that working on real-life projects helped improve their creativity, motivation, communication, time management, and research skills.

The results align with previous research (e.g., Zhang & Ma, 2023; Han & Bhattacharya, 2001), confirming that PBL fosters active learning and academic improvement. Students appreciated the collaborative nature of PBL and noted increased confidence and responsibility. Interdisciplinary teamwork also promoted creative thinking, supporting Vygotsky's (1978) social learning theory.

High mean scores for academic performance (3.74–3.97) and creative thinking (4.18–4.37) reflected strong student satisfaction. Yet, Chi-square analysis showed no significant relationship between PBL exposure levels and learning outcomes. This may be due to limited variation in exposure or other influencing factors like instructor quality and project design.

CONCLUSION

This study concludes that university students perceive Problem-Based Learning as a useful method for improving academic achievement. Learners reported better understanding of course content, increased engagement, and enhanced learning through real-world application. The findings suggest that with proper project design, faculty support, and institutional resources, PBL can be a successful approach for strengthening academic outcomes in academic settings.

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