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Examining the Impact of Project-Based Learning on Students' Academic Performance

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Abstract: *In contemporary education, the traditional teaching techniques do not particularly involve students in active learning and training but instead fail to produce the necessary skills like critical thinking, problem-solving, and group work. Project-Based Learning (PBL) is an instructional approach that is student-oriented and requires students to learn real-world issues by working on practical projects, hence motivating them to participate actively, understand, and apply knowledge. This research project aimed at analyzing how Project-Based Learning influences the academic success, motivation, and interest of students. In particular, the analysis was supposed to identify whether students learning under PBL achieve higher academic scores as compared to those learning under the conventional lecture-based techniques. These objectives were accomplished using a true experimental research design. The population was comprised of all the students who were enrolled at the sampled secondary school and a sample of 60 randomly divided students was used to form two groups, with 30 students in the experimental group where they would be taught the PBL and 30 students in the control group where they would be taught the conventional instruction. The two groups were also evaluated based on pre-tests and post-tests to determine academic performance. To analyze the data, descriptive statistics (mean and standard deviation) and inferential statistics (independent sample t-test and gain score analysis) were applied to identify the performance between both groups and the significance of the difference. The results have shown that the experimental group scored significantly higher in post-test scores and mean gain than the control group. This shows that Project-Based Learning improves the learning experience of students both in terms of academic performance, their interest, and motivation better than the traditional approaches. On these findings it can be advised that schools should incorporate PBL in their instruction, offer training and resources to teachers, promote collaborative and student centred activity and tracking the project milestones to guarantee effective learning.*

Introduction

Education is critical in molding individual and making them ready to overcome the demands of the

contemporary society. In the modern world where everything evolves at a fast rate, students should not just learn, they need to think critically, have the ability to solve problems, know how to work in teams, and be creative. The conventional instructions that have been based mostly on lectures and memorization of things taught usually cannot satisfy these requirements. These methods restrict active involvement of students and give less chances to meaningful learning experience.

To overcome these difficulties, teachers have been embracing student-based teaching techniques that promote active learning. Project-Based Learning (PBL) is one of such approaches. Project-Based Learning is an educational approach where students learn through working on real-life issues and significant projects throughout a long time. Students do not receive information passively, but they actively research on matters, share ideas with others, and report on their findings. This will also promote better comprehension as well as long term knowledge retention.

Project-Based Learning is in line with the constructivist learning theory which accentuates that learners build knowledge by experience and interaction. Projects also help students to relate theories to their practice and learn in a more relevant and interesting way. Additionally, PBL leads to the development of the required life skills, including collaboration, communication, time management, and self-directed learning.

Academic performance is one of the major measures of learning achievements. Educational institutions and schools always want efficient teaching strategies that enhance the performance of students. Although the conventional teaching strategies can be used to impart simple knowledge, it is unlikely that higher-order thinking skills will be promoted. Project-Based Learning, in its turn, could be used to improve academic performance because it facilitates active learning and increased learning.

Project-Based Learning is a well-known concept; nevertheless, its application in most of the classrooms is still scarce. Teachers can be challenged by a lack of training, a lack of time, and/or the lack of resources. Also, experimental evidence is required to find out the significance of PBL on academic success in comparison to traditional methods of teaching, especially in the local school setting.

The discrepancy between theory and practice is one of the key issues in the education field. Most of the students learn by memorizing what they learn in their exams but they cannot use them in practical life. Project-Based Learning assists in eliminating this gap by involving students in work that simulates challenges in the real world. Projects help students to know how to use what they have learned in books to solve practical problems to prepare them better to attend college and work in the future.

Project-Based Learning in contemporary classrooms often incorporates online tools in the form of presentations, online research, multimedia creation and collaborating tools. This assimilation boosts the digital literacy of students and equips them with a technologically oriented world. Through technology in collecting information, data analysis, and presentation of results, the students are equipped with skills that can make them succeed in the academic environment and in their professional careers.

This research is, therefore, expected to experimentally test the effectiveness of Project-Based Learning on academic performance of students. The study aims at giving evidence by comparing performance of students using PBL approach to that of traditional approach in order to assist teachers, administration and policymakers in enhancing teaching skills and performance.

Problem of the statement

The goal of education systems is to enhance the academic performance of students and even equip them with the skills required in the contemporary society. Nevertheless, it is widely observed that a good number of the classroom still sticks to the traditional method of teaching which entails the use of lectures where the teacher focuses more on imparting information that is based on memorization, but

not a true understanding. In these environments, students tend to be passive learners with little chance to engage in learning, which may decrease the motivation, decrease the ability to solve problems and lead to poor knowledge retention. Consequently, a large number of students fail to be able to translate theoretical knowledge into practical life which points to a disconnect between theoretical knowledge taught in the classroom and real life.

Project-Based Learning (PBL) is a student-centered model, which encourages active learning with the help of real-life projects, teamwork, and investigation. It is not widely implemented, though it can lead to better understanding, engagement, and academic performance because of inadequate training, time, resource use, and uncertainty regarding its effectiveness. The local educational setting lacks experimental data to establish whether PBL can significantly improve academic performance of students as opposed to conventional practices. Consequently, this paper aims at filling this gap as it tries to explicitly test the effect of Project-Based Learning on student academic performance.

Research Objectives

- To examine the effect of Project-Based Learning on students' academic achievement.
- To compare the academic performance of students taught through Project-Based Learning and traditional teaching methods.

Research Questions

- Does Project-Based Learning improve students' academic achievement?
- Is there a significant difference in achievement between students taught through Project-Based Learning and those taught through traditional methods?

Research Hypothesis

Research Hypothesis (H$_1$)

Students taught through Project-Based Learning achieve significantly higher academic performance than those taught through traditional teaching methods.

Significance of the Study

The study is valuable because it focuses on the effects of Project-Based Learning (PBL) on the academic achievement of students and provides the practical evidence concerning the efficiency of student-centred teaching methods. The study helps to make the conclusion whether active learning methods can improve the knowledge of students, retain the knowledge and improve the overall performance.

The researchers will prove to be helpful to the teachers because they will give them the information about how to apply the teaching strategies which can bring student engagement, participation and motivation. It is expected that the engaged students of the project work have deeper knowledge, critical thinking skills, creativity, and problem-solving skills. It is a set of skills that are essential in life-long learning and can hardly be properly trained with the help of memorization.

In schools, the study may provide data that can be employed in developing the education program and schedule. Schools can apply the findings to introduce Project-Based Learning into the classroom environment, schedule teacher education workshops, and allocate the resources that will enable interactive learning.

The study can also be beneficial to policymakers and curriculum developers since it presents evidence that the current instructional techniques can be used to improve learning. This information may be utilized to make choices guided by the reforms in the educational systems, the policies of teaching and evaluation techniques that would promote effective learning and would not lead to memorization.

The study highlights to the students the Importance of having positive experience in learning that will not only enhance academic performance but also other important aspects of life such as team work,

communication, time management and independent learning. The competencies prepare the students to college studies, professions and feasibility.

Delimitation of the study

- The study is limited to secondary school students.
- Only one subject area was selected for instruction.
- The experiment was conducted over a limited period of time.

Literature review

1. Project-Based Learning.

Project-Based Learning is a student-centered form of instruction entailing the learning process by participating in real life projects. It focuses on questioning, teamwork and solving problems. Students are engaged in projects where they are required to explore questions, collect information and offer solutions. This is a participatory approach that promotes active engagement and learners gaining a better grasp of subject matter.

PBL is the methodology which reverses the direction of the teacher-centered learning to the student-centered learning. Teachers in this setting play the role of facilitator where they guide the students instead of providing information. This method will encourage students to be responsible and own the learning.

2. Theoretical Basics of Project-Based Learning.

Project-Based Learning is based on constructivist learning theory that assumes that learners construct knowledge by experience and contacts. Students will learn better when they actively participate in the content as opposed to passively receiving information.

Constructivist theorists underline the fact that learning is realized in the process of exploration, discussion and reflection. The following principles are supported by PBL: students are able to investigate real-life issues, cooperate with each other, and evaluate the experiences of learning. Through this, the students get to attain meaningful understanding as opposed to memorization of facts.

3. Academic Achievement and Project-Based Learning.

Project-Based Learning has positive effects on academic performance. Students who have been involved in working on projects are more likely to exhibit excellent conceptual knowledge, creativity in solving problems, and higher test scores than their counterparts who are taught in a conventional manner.

According to the research, PBL improves knowledge retention since students put learning into practice. The learners will remember and comprehend the material better when they relate a theoretical knowledge with a real-life situation. This is a greater learning that leads to better academic performance.

4. The Traditional Teaching vs. Project-Based Learning.

Common teaching techniques, in a traditional setting, will include lectures, taking notes and memorizing. Although such a method can be an effective means of providing information, it is not necessarily the one that encourages critical thinking or active involvement. Students can develop as passive learners and depend on teachers to get information instead of searching concepts.

On the contrary, Project-Based Learning promotes teamwork and interaction. Learners collaborate in groups, brainstorm, and solve problems. This participative learning facilitates critical thinking, creativity and communication. Comparison of the two techniques has revealed that PBL results in increased student engagement and better learning outcomes.

5. The project-based learning has a role to play in the development of 21st-century skills.

The 21 st -century skills that are being developed within modern education are critical thinking, collaboration, communication and creativity. Project-Based Learning helps to develop these skills as it gives students a chance to collaborate in groups, share their ideas and solve complicated tasks.

Project work enables students to learn how to manage time, distribute responsibility, and be critical of information. These are the skills necessary to succeed in higher learning and even in the future. Thus, PBL does not only enhance academic success but also equips the students with the reality of the world.

6. Difficulties with the Implementation of Project-Based Learning.

Project-Based Learning has its advantages, it may prove difficult to implement. Educators might need to be trained on how to create successful projects as well as how to facilitate shared learning. Also, there can be a lack of time in classrooms and excessive numbers in classes, which will complicate the observation of group activities.

Another factor that can influence the use of PBL is the availability of resources. Successful work on the project requires access to materials, technology, and supportive infrastructure. Nevertheless, these difficulties can be overcome with the help of planning and assistance.

7. PBL and Knowledge Retention

Project-Based Learning is improved knowledge retention. Students engaged in hands-on activities and real-world applications tend to remember concepts longer than those who learn through memorization. Active involvement in the learning process strengthens understanding and helps students connect new knowledge with prior experiences, leading to long-term retention.

8. PBL in Diverse Learning Environments

PBL has been found effective across diverse classrooms, including mixed-ability groups. It allows students with different learning styles to participate actively by using their strengths, whether visual, verbal, or hands-on. This inclusivity helps reduce achievement gaps and promotes equitable learning opportunities for all students.

9. Project-Based Learning and Student Motivation

Project-Based Learning significantly increases student motivation by making learning meaningful and relevant to real-life situations. When students work on authentic projects, they feel a sense of ownership over their learning, which enhances intrinsic motivation. Increased motivation leads to greater persistence, improved task completion, and better academic outcomes. Motivated learners are more likely to explore concepts deeply and take responsibility for their progress.

Research Gap

Despite the advantages of Project-Based learning some studies mention, there is a lack of experimental studies in the local educational context that directly compares PBL with conventional teaching approaches. Moreover, differences in classroom settings and student groups demand the context-specific research. The proposed research will address this gap by conducting experimental research on the effects of Project-Based Learning on academic achievement of students.

Research Design

This study employed experimental research design where, the impact of Project-Based Learning (PBL) on academic performance of students was established. This design will allow one to establish a controlled comparison of two groups of people, an experimental group, which will be taught using Project-Based Learning and a control group, which will be taught using a regular lecture-based teaching approach. In order to be fair and minimize the bias, the students were selected randomly to these groups, hence, at the start of the study, there was a similarity of the groups. The two groups also had a pre-test that assessed the level of their knowledge prior to the teaching intervention and after test that

assessed the level of their academic success after the teaching intervention. The content and the time and teacher engagement in both groups did not differ, and the only variation in the study was the teaching approach which allowed the isolation of the effects of Project-Based Learning in the research. The reason why the researcher opted to use the experimental design is that it will enable the researcher to establish the cause and effect relationship that exists between the teaching method and the academic performance without the intervention of the external variables, which are likely to influence the results. This design will provide simple, reliable and valid results of whether Project-Based Learning can enhance academic performance of students compared to traditional methods basing on the pre-test and post-test results.

Population of the study

The study participants were 60 secondary school students of the sampled school who were studying in Grade 9. The students were close in age, background, and learning conditions and this was a way of ensuring uniformity in the teaching and learning conditions that the study was conducted. The respondents were separated into two categories 30 students in the experimental group were taught through Project-Based Learning and 30 students in the control group were taught through instructional methods that used lectures. The sample had a good attendance and all subjects took part in the classroom activities, thus they were fit to study the effect of the methods used in teaching academic performance.

Sample of the Study

The population of 60 students was taken as a sample and participated in this experimental study. The subjects had to be in the grade level chosen, must have a similar academic background and willingness to take part in the study. These requirements made sure that the students were in a good position to compare the impact of the Project-Based Learning and the traditional instructional strategies on academic performance. These students were separated in two equal groups to provide the fair comparison of the methods of teaching. The experimental group was divided into 30 individuals where Project-Based Learning would be practiced and the control group (30 individuals) was taught in the traditional lecture-based environment. The similarity between both groups in the aspects of academic background, curriculum, and classroom setting assisted in making sure that the difference in the academic achievement could be ascribed to the teaching method, and not any external factor. The number of students in the experimental and control groups was selected and assigned randomly through the application of a random sampling approach. This approach guaranteed all students within the population an equal opportunity to be selected into either group thus minimizing the chances of selection bias. Random assignment helped to maximise the comparability of the two groups as students with different abilities and characteristics were evenly distributed. Consequently, the research design increased the validity and reliability of the experimental design and the study was capable of generating more precise and generalized results on the effects of Project-Based Learning on the academic achievement of students.

Research Instruments

It was also conducted as a pre-test to the experimental and control group to determine the level of knowledge that students had before the intervention in order to draw a comparison. This was done to make sure that any difference in post test scores could be blamed on the teaching approach and not prior knowledge. A post-test was implemented after the instructional period to measure the academic performance of the students and the effect of the Project-Based Learning versus the traditional teaching methods. The tests were both objective and short-answer questions on the content taught during the

study. This combination gave the opportunity to evaluate also factual knowledge and the possibility to use concepts in practical situation. Also, the lesson plans were done in either of the teaching methods to standardize teaching and to have uniformity in providing the teaching content. The lesson plans directed the teachers to use Project-Based Learning as the experimental and traditional lectures as a control group giving equal chances to all students to get similar instruction in terms of topics, learning goals, and time distribution. All these tools presented valid and credible information to analyse the impact of the teaching methods on the academic performance of the students.

Data Collection

The data collection process for this study began with obtaining permission from the school administration to conduct the research and implement the teaching intervention. Once approval was granted, the 60 selected students were divided into the experimental and control groups. To establish a baseline for comparison, a pre-test was administered to both groups to assess their prior knowledge of the subject matter. Following the pre-test, the experimental group was taught using Project-Based Learning, where students engaged in real-world projects, collaborated with peers, and presented their findings. Meanwhile, the control group received instruction through the traditional lecture method, involving teacher-led explanations and note-taking. The teaching intervention was carried out over a period of four weeks, ensuring that both groups received instruction on the same content and learning objectives. At the end of the instructional period, a post-test was administered to both groups to evaluate their academic achievement. All test scores were carefully recorded for further analysis, allowing a comparison of learning outcomes between students taught through Project-Based Learning and those taught using traditional methods.

Data Analysis

Data analysis is the process of organizing, summarizing, and interpreting the collected data to draw meaningful conclusions related to the research objectives. In this study, data were collected through pre-tests and post-tests administered to both the experimental group (taught using Project-Based Learning) and the control group (taught using traditional methods).

Results

Statistical Analysis Tables

Table 1: Pre-Test Scores of Control and Experimental Groups

Group.	N	Mean	Standard Deviation
Control Group.	30	49.20	6.10
Experimental Group	30	48.75	5.95

The pre-test results indicate that the control group had a mean score of 49.20, while the experimental group had a mean score of 48.75. The difference between these mean scores is minimal, showing that both groups had nearly the same level of prior knowledge before the teaching intervention began. This similarity is important because it confirms that the groups were equivalent at the start of the study.

The standard deviation values (6.10 for the control group and 5.95 for the experimental group) are also close, indicating that the spread of scores within each group was similar. This suggests that students in both groups had comparable academic abilities and learning variations before the experiment.

Overall, the pre-test results demonstrate that any differences observed in the post-test are likely due to the teaching methods rather than pre-existing differences between the groups. This strengthens the internal validity of the study.

In data analysis involved calculating the mean scores and standard deviations for both groups. The mean provided the average performance of students, while the standard deviation indicated the variation or consistency of the scores within each group. By comparing the pre-test and post-test scores, it was possible to assess the improvement in academic achievement resulting from the teaching methods

Table 2: Post-Test Scores of Control and Experimental Groups

Group	N	Mean	Standard Deviation
Control Group.	30	56.40	6.25
Experimental Group.	30	68.90	5.80

The post-test results show a clear difference between the academic performance of the two groups. The control group achieved a mean score of 56.40, while the experimental group achieved a significantly higher mean score of 68.90. This substantial difference suggests that students who were taught using Project-Based Learning developed a better understanding of the subject matter compared to those taught through traditional lecture methods.

The improvement in the experimental group's performance indicates that Project-Based Learning enhanced students' engagement, comprehension, and retention of knowledge. By actively participating in projects, students were able to apply concepts, collaborate with peers, and develop deeper understanding, which contributed to their higher scores.

The standard deviation values (6.25 for the control group and 5.80 for the experimental group) show that the scores in both groups were fairly consistent. The slightly lower standard deviation in the experimental group suggests that the benefits of Project-Based Learning were experienced by most students, not just a few high performers.

Table 3: Independent Sample t-Test for Post-Test Scores

Variable	t-value	df	p- value	Level of
Post- Test scores	7.85	58	0.000	$p < 0.05$

The calculated t-value (7.85) is significant at $p < 0.05$, indicating a statistically significant difference between the academic achievement of the experimental and control groups. Therefore, the improvement in the experimental group is not due to chance.

Independent sample t-test was applied to determine whether the difference in post-test scores between the experimental and control groups was statistically significant. This test helped evaluate whether Project-Based Learning had a measurable impact on academic achievement compared to traditional teaching. A significance level of $p < 0.05$ was used to decide if the observed differences were meaningful and not due to chance. In this research hypothesis (H_1) was accepted, indicating that Project-Based Learning positively influences students' academic achievement.

Table 4: Mean Gain Scores Comparison

Group	Pre-Test Mean	Post – Test Mean.	Mean
Control Group.	49.20	56.40	7.20
Experimental Group.	48.75	68.90	20.15

The mean gain scores provide insight into the amount of improvement shown by each group from pre-test to post-test. The control group showed a mean gain of 7.20 points, indicating some improvement through traditional teaching methods. However, the experimental group demonstrated a much larger mean gain of 20.15 points.

This significant difference in gain scores highlights the effectiveness of Project-Based Learning in promoting academic growth. The large improvement suggests that PBL not only helped students understand the content better but also enhanced their ability to apply knowledge and retain

information.

The comparison clearly shows that while traditional teaching may lead to modest improvement, Project-Based Learning results in substantially greater academic progress. This finding reinforces the value of active learning strategies in improving student outcomes. The statistical analysis of post-test scores revealed a significant difference between the experimental and control groups at the 0.05 level of significance ($p < 0.05$). The experimental group achieved higher mean scores and greater improvement compared to the control group taught through traditional lecture methods. This significant difference indicates that the improvement in academic achievement was not due to chance but was the result of the Project-Based Learning approach.

Research hypothesis (H_1): Students taught through Project-Based Learning achieve significantly higher academic performance than those taught through traditional teaching methods.

Discussion

The findings of this study indicate that Project-Based Learning (PBL) significantly improves students' academic achievement compared to traditional teaching methods. Students in the experimental group showed higher post-test scores, suggesting that active participation, real-life project work, and collaborative learning enhanced understanding and retention of knowledge (Yusof & Manza, 2024). PBL also increased motivation and engagement, allowing students to develop critical thinking and problem-solving skills alongside academic performance (Sánchez et al., 2024; Abenes et al., 2024). These results support the idea that student-centered, active learning approaches are more effective in improving learning outcomes than conventional lecture-based methods.

Conclusion

Project-Based Learning (PBL) has a significant positive impact on students' academic achievement. The experimental group, taught through PBL, showed higher post-test scores and greater mean gains compared to the control group taught through traditional lecture methods. Active, student-centered learning strategies enhance comprehension, retention, and application of knowledge.

Project-Based Learning not only improved academic performance but also increased students' motivation, engagement, and collaboration skills. Students actively participated in projects, applied theoretical concepts to real-world problems, and developed critical thinking and problem-solving abilities. These outcomes suggest that PBL supports holistic learning and equips students with essential 21st-century skills that go beyond academic knowledge.

The study highlights the Importanc" of integrating Project-Based Learning into educational practice, providing adequate teacher training, resources, and structured guidance to ensure successful implementation. In conclusion, PBL is an effective instructional strategy that enhances learning outcomes, fosters independent learning, and prepares students for future academic and professional challenges.

Recommendation

- Implement Project-Based Learning regularly in classrooms to improve academic achievement, as students in the experimental group performed better than those taught traditionally.
- Provide teachers with training and support to design and manage PBL activities effectively, ensuring higher learning outcomes.
- Encourage teamwork and peer collaboration through projects, since students engaged in group work showed better understanding and performance.
- Supply necessary materials, digital tools, and workspace to facilitate projects, as adequate resources help students fully participate and improve results.

- Allow students to plan, execute, and present their projects independently, promoting active participation and self-directed learning that enhances academic achievement.

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