Project-Based Learning in Science on Students' Learning Involvement and Performance

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Abstract

This study would to determine the relationship and effects of project-based learning in science on students' involvement and performance. Specifically, it sought to identify the level of utilizing project-based learning, level of student learning involvement while utilizing project-based learning, and the level of students' performance.

The study adopted the descriptive approach and quantitative method. Simple random sampling was applied from a population of 100 students that served as respondents of this study. The instrument used in the study was a survey questionnaire-checklist and 50-items test. The questionnaire and test were research-made instrument devised to further explore effects of project-based learning in science on students' learning involvement and performance. In order to analyze and interpret the data gathered, weighted mean, standard deviation, Pearson r correlation and regression analysis were utilized in the study.

In addition, the study shows the relationship between project-based learning and students' learning involvement has no significant relationship. Thus, the researcher therefore concludes that the research hypothesis stating that there is no significant relationship between project-based learning and students' learning involvement is accepted. The second hypothesis results in a significant difference on students' performance before and after using project-based learning. Thus, the researcher therefore concludes that the research hypothesis stating that "There is no significant difference on students' performance before and after using project-based learning is rejected.

The school should may provide teachers with valuable insights into effective methods for teaching science in laboratory classrooms, encouraging interactive and collaborative learning to stimulate various student skills. The teachers should identify effective learning competencies by reinforcing the integration of project-based learning in science laboratory classrooms, promoting ongoing innovation in educational practices. For future researchers, it is highly suggested to explore new dimensions and inspiring contributions for the next generation.

Keywords: project-based learning; interactive learning; collaborative learning

1. Introduction

Project-based learning in science on students' learning involvement and performance holds great potential for improving student learning outcomes in various ways. PBL allows students to connect science

concepts with real-world applications, making the subject more relevant and meaningful to them. By working on authentic projects, students can see the practical implications of scientific knowledge and develop a deeper understanding of how it is applied in the real world.

Institutions of education are tasked with preparing students for success in the 21st century are designing and examining various academic environments to validate and amend antiquated pedagogical practices. Teaching for 21st century skills and creating environments should promote intrinsic motivation are two ways to meet the aims of the quality education.

In recent years, there are lot of approaches and methods on promoting effective teaching-learning processes. Nevertheless, amidst every change in educational pedagogy, school still ensure that the learners will be the top priority of the school. (Davis, 2016)

With regards to these changes, most of the schools adapted the outcome-based learning. In outcome-based learning, learning outcomes (knowledge, skills and competences) to be achieved by learners are in the focal point of the learning process. However, this kind of learning has a holistic approach to learning is lost. Learning can find itself reduced to something that is specific, measurable, and observable. As a result, outcomes are not yet widely recognized as a valid way of conceptualizing what learning is about.

On contrary, it has stated that there has been a growing interest in integrating project-based learning (PBL) in science classrooms as a means to enhance student learning outcomes. PBL is an instructional approach that involves students working on real-world projects, where they actively engage in solving complex problems, conducting research, and collaborating with peers.

The researcher conducts the study to determine the effects of project-based learning in science on students' learning involvement and performance.

1.1 Statement of the Problem

Specifically, it seeks to address the following research questions:

1. What is the level of utilizing project-based learning in terms of:
   - 1.1 collaborative;
   - 1.2 innovative;
   - 1.3 interactive;
   - 1.4 inquiry-based; and
   - 1.5 immersive?
2. What is the level of student learning involvement while utilizing project-based learning in terms of:
   - 2.1 personalized learning;
   - 2.2 learning participation;
   - 2.3 quality of work;
   - 2.4 completion of task; and
   - 2.5 initiative?
3. What is the level of students' performance in terms of:
   - 3.1 comprehension;
   - 3.2 problem solving;
   - 3.3 analytical;
   - 3.4 logical reasoning; and
   - 3.5 critical?
4. Is there a significant difference on students' performance before and after using project-based learning?
5. Is there a significant relationship between project-based learning and students' learning involvement?

2. Methodology

The study adopted the descriptive approach and quantitative method. Simple random sampling was applied from a population of 100 students that served as respondents of this study. The instrument used in the study was a survey questionnaire-checklist and 50-items test. The questionnaire and test were research-made instrument devised to further explore effects of project-based learning in science on students' learning involvement and performance. In order to analyze and interpret the data gathered, weighted mean, standard deviation, Pearson r correlation and regression analysis were utilized in the study.

3. Results and Discussion

This chapter enumerates the different results and discusses the results that were yielded from the treatment of the data that was gathered in this study.

Level of Project-Based Learning

The following table presents the results of project-based learning in terms of collaborative, innovative, interactive, inquiry-based and immersive.

Table 1. Level of project-based learning in terms of Collaborative

STATEMENTS	***MEAN***	***SD***	***REMARKS***
Allow group participation and collaboration among the learners while doing activities.	4.59	0.60	Strongly Agree
Let the students exchange information and allow brainstorming.	4.60	0.64	Strongly Agree
Gives ideas and feedback for the project of classmates and peers.	4.40	0.64	Strongly Agree
Gives opportunity to share learners' success.	4.43	0.61	Strongly Agree
Promotes opportunities for learners to distribute roles and responsibilities, monitor and regulate their group processes.	4.61	0.49	Strongly Agree
Weighted Mean	*4.52*		
SD	*0.24*		
Verbal Interpretation	*Very Great Extent*		

Table 1 illustrates the level of project-based learning in terms of Collaborative

Students strongly agree that utilizing project-based learning facilitate the distribution of roles and responsibilities among learner as well as monitoring, regulation of their group process (M=4.61, SD=0.49). Furthermore, collaboration among students and project-based learning forth the exchange of ideas and feedback among classmates' peers (M=4.40, SD=0.64).

The weighted mean of 4.52 and standard deviation of 0.24, it is evident that project-based learning is empowered students to become active, develop essential skills for lifelong learning.

This implies that project-based learning in science effectively empowers students to become active participants in their education and equips them with the skills necessary for success beyond the classroom.

This is why project-based learning is a form of learning that focuses on students. Students are actively involved in the learning process. Through this learning process, it will train students' thinking in dealing with problems. In PBL, students work collaboratively with others and reflect on what they have

learned. (Ravitz, J. 2020).

Table 2. Level of project-based learning in terms of Innovative

STATEMENTS	*MEAN*	*SD*	*REMARKS*
Emphasize real-world problem-solving and critical thinking.	4.81	0.39	Strongly Agree
Allow integration of various educational tools to make more successful project.	4.42	0.64	Strongly Agree
Cultivate resourcefulness and innovative thinking of the learners.	4.53	0.63	Strongly Agree
Engage students to different activities that foster discovery skills.	4.65	0.56	Strongly Agree
Encourage students to voice out new ideas regarding their lessons.	4.31	0.54	Strongly Agree
Weighted Mean	*4.55*		
SD	*0.29*		
Verbal Interpretation	*Very Great Extent*		

Table 2 demonstrates the level of project-based learning in terms of Innovative

Students strongly agree that utilizing project-based learning can emphasize the real-world problem solving and critical thinking (M=4.81, SD=0.39). Furthermore, encouraging students to voice out new ideas regarding lessons (M=4.31, SD=0.54).

The weighted mean of 4.55 and standard deviation of 0.29, it is evident that project-based learning is empowered students to innovate and improved the quality of learning.

This implies that project-based learning in science provides a stable and reliable method for fostering innovation and improving learning outcomes while also cultivating creativity, critical thinking, and engagement among students.

Table 3. Level of project-based learning in terms of Interactive

STATEMENTS	*MEAN*	*SD*	*REMARKS*
Centers student learning around a central question or problem and a meaningful outcome.	4.61	0.49	Strongly Agree
Connect with content areas text while increasing their knowledge of a topic.	4.68	0.55	Strongly Agree
Engage the students to engage and give them ownership over their own learning.	4.41	0.60	Strongly Agree
Combine different types of tools that allow the students to learn on their own.	4.55	0.59	Strongly Agree
Boost students' interest and motivation to learn.	4.63	0.51	Strongly Agree
Weighted Mean	*4.58*		
SD	*0.27*		
Verbal Interpretation	*Very Great Extent*		

Table 3 shows the level of project-based learning in terms of Interactive

Students strongly agree that utilizing project-based learning connect content areas text while increasing their knowledge of a topic (M=4.68, SD=0.55). Furthermore, engaging among the students to

engage and give them ownership over their own learning received the lowest mean score of responses with (M=4.41, SD=0.60).

The weighted mean of 4.58 and standard deviation of 0.27, it is evident that project-based learning in terms of interactive promotes active engagement and fostering meaningful learning experiences among learners.

This implies that project-based learning in science provides a stable and reliable method for enhancing student engagement and creating meaningful learning opportunities. The consistency of the reliability of this approach in encouraging active participation and deepening understanding among students.

Table 4. Level of project-based learning in terms of Inquiry-Based

STATEMENTS	***MEAN***	***SD***	***REMARKS***
Allow the students to explore their own knowledge and dig new information.	4.85	0.39	Strongly Agree
Provide appropriate resources that help the students on finding new ideas.	4.59	0.51	Strongly Agree
Let the students observe and analyze what is happening on their learning environment.	4.66	0.52	Strongly Agree
Allow the students to answer their own questions through experimentations and/or actual project presentation.	4.63	0.56	Strongly Agree
Help the students to develop questions related to the topic, make predictions, and hypothesize.	4.48	0.59	Strongly Agree
Weighted Mean	*4.64*		
SD	*0.18*		
Verbal Interpretation	*Very Great Extent*		

Table 4 proves the level of project-based learning in terms of Inquiry-Based

Students strongly a agree that utilizing project-based learning allows the students to explore their own knowledge and dig new information *(M=4.85, SD=0.39)*. Furthermore, helping the students to develop questions related to the topic, make predictions, and hypothesize (M=4.48, SD=0.59).

The weighted mean of 4.64 and standard deviation of 0.18, it is evident that project-based learning is effective in fostering deep understanding and critical thinking skills among learners.

This implies that project-based learning in science promotes essential skills and pedagogical tool to cultivate deep comprehension and critical thinking abilities of the students.

Table 5. Level of project-based learning in terms of Immersive

STATEMENTS	***MEAN***	***SD***	***REMARKS***
Engage students in a real scenario that helps them gaining more knowledge regarding their lessons.	4.70	0.48	Strongly Agree
Transports the learners and engages multiple senses.	4.71	0.52	Strongly Agree
Cultivate deep knowledge by developing learners' multiple intelligences.	4.42	0.54	Strongly Agree
Integrate technological tools and other instructional materials to improve learners' capabilities.	4.35	0.58	Strongly Agree

Establish immersive knowledge among students by involving them in exploring their own learning.	4.62	0.53	Strongly Agree
Weighted Mean	*4.56*		
SD	*0.29*		
Verbal Interpretation	*Very Great Extent*		

Table 5 displays the level of project-based learning in terms of Immersive

Students strongly agree that utilizing project-based learning transporting the learners and engaging multiple senses (M=4.71, SD=0.52). Furthermore, integrating technological tools and other instructional materials to improve learners' capabilities (M=4.35, SD=0.58).

The weighted mean of 4.56 and standard deviation of 0.29, it is evident that project-based learning in terms of immersive capturing learners' interest and fostering deep engagement with scientific concepts.

This implies that project-based learning in science engaging to enhance student learning outcomes in science. By incorporating hands-on, experiential activities that allow students to explore scientific concepts in depth, cultivate a deeper understanding and appreciation for science among students.

Table 6. Composite table of project-based learning

INDICATORS	***WM***	***SD***	***V.I.***
Collaborative	4.52	0.24	Very Great Extent
Innovative	4.55	0.29	Very Great Extent
Interactive	4.58	0.27	Very Great Extent
Inquiry-Based	4.64	0.18	Very Great Extent
Immersive	4.56	0.29	Very Great Extent
Overall Mean	*4.57*		
SD	*0.25*		
Verbal Interpretation	*Very Great Extent*		

Table 6 verifies the composite table of project-based learning

From the indicators, "*Inquiry-Based*" yielded the highest weighted mean score *(M=4.64, SD=0.18)* and was interpreted *to a very great extent*. This is followed by "*Interactive*" with a weighted mean score *(M=4.58, SD=0.27)* and was also interpreted *to a very great extent*. On the other hand, the indicator "*Collaborative*" received the lowest weighted mean score of responses with *(M=4.52, SD=0.24)* yet was also was also interpreted *to a very great extent*.

The level of project-based learning in science of the learners attained an overall mean score of 4.57 and a standard deviation of 0.25 and was interpreted *to a very great extent* among the respondents.

This implies that project-based learning in science is widely recognized as highly effective by the respondents. The high mean score suggests strong agreement among them regarding the positive impact of project-based learning on science education

Level of Students' Involvement

The following table presents the results of students' involvement in terms of personalized learning, learning participation, quality of work, completion of task, and initiative.

Table 7. Level of student learning involvement in terms of Personalized learning

STATEMENTS	***MEAN***	***SD***	***REMARKS***
Learn many ways on how to learn by their own.	4.79	0.41	Strongly Agree
Choose own format of educational content they	4.54	0.56	Strongly Agree

wanted and needed.			
Learn through own experiences and apply it to the real-life situations.	4.62	0.56	Strongly Agree
Make learning habits that is suitable for own understanding.	4.76	0.47	Strongly Agree
Learn how to be flexible in terms of gaining knowledge from different ways.	4.58	0.55	Strongly Agree
Weighted Mean	*4.66*		
SD	*0.21*		
Verbal Interpretation	*Very Great Extent*		

Table 7 exhibits the level of student learning involvement in terms of Personalized learning

Students strongly agree that students' learning involvement while utilizing project-based learning facilitate the learning styles on how the learners learned by their own (M=4.79, SD=0.41). Furthermore, choosing own format of educational content they wanted and needed (M=4.54, SD=0.56).

The weighted mean of 4.66 and standard deviation of 0.21, it is evident that the students' learning involvement in terms of personalized learning approaches have successfully engaged students to a significant degree, tailoring educational experiences to individual needs, preferences, and learning styles.

This implies that project-based learning in science students' involvement meets the diverse needs, preferences, and learning styles of students effectively.

Table 8. Level of student learning involvement in terms of Learning participation

STATEMENTS	***MEAN***	***SD***	***REMARKS***
Work with other peers and able to learn with them.	4.87	0.34	Strongly Agree
Use other people perspectives to gain new kinds of learning.	4.65	0.54	Strongly Agree
Open with the opinions and feedback of other classmates.	4.80	0.45	Strongly Agree
Participate with different classroom activities and will be able to learn with them.	4.72	0.49	Strongly Agree
Willingness to be corrected by other classmates and will be able to learn from it.	4.52	0.58	Strongly Agree
Weighted Mean	*4.71*		
SD	*0.24*		
Verbal Interpretation	*Very Great Extent*		

Table 8 verifies the level of student learning involvement in terms of Learning participation

Students strongly agree that working with peers and being able to learn with them enhances students' learning involvement while utilizing project-based learning (M=4.87, SD=0.34). Furthermore, willingness to be corrected by other classmates and will be able to learn from it (M=4.52, SD=0.58).

The weighted mean of 4.71 and standard deviation of 0.24, it is evident that students are actively participating in their learning experiences to a significant degree, contributing to discussions, and collaborating with peers.

This implies that project-based learning in science students' involvement actively engaging them with the material, encouraging questions, participation in discussions, and completion of assignments.

Table 9. Level of student learning involvement in terms of Quality of work

STATEMENTS	*MEAN*	*SD*	*REMARKS*
Set high but achievable learning objectives.	4.76	0.45	Strongly Agree
Organize everything and do planning ahead of time.	4.78	0.44	Strongly Agree
Finish works one at a time and do not leave things unfinished.	4.59	0.49	Strongly Agree
Allow self to continue learning and gain knowledge every day.	4.58	0.52	Strongly Agree
Avoid multi-tasking and do job effectively.	4.64	0.52	Strongly Agree
Weighted Mean	*4.68*		
SD	*0.25*		
Verbal Interpretation	*Very Great Extent*		

Table 9 presents the level of student learning involvement in terms of Quality of work

Students strongly agree that organizing everything and planning ahead of time while utilizing project-based learning enhances students' learning involvement (M=4.78, SD=0.44). Furthermore, allowing oneself to continue learning and gain knowledge every day (M=4.58, SD=0.52).

The weighted mean of 4.58 and standard deviation of 0.25, it is evident that the students were actively participating, comprehending, and applying knowledge effectively, which is likely to contribute positively to their academic performance and overall educational experience.

This implies that project-based learning in science students' involvement that students are not only actively involved in their learning but are also committed to producing work of high quality. This indicates that they are not merely going through the motions, but are genuinely invested in understanding the material and demonstrating their understanding through their work.

Table 10. Level of student learning involvement in terms of Completion of task

STATEMENTS	*MEAN*	*SD*	*REMARKS*
Commit to every deadline and work schedules.	4.71	0.46	Strongly Agree
Concentrate on giving a hundred percent on every work task.	4.68	0.49	Strongly Agree
Develop a healthy balance between study and personal life.	4.63	0.51	Strongly Agree
Set priorities, improve productivity and complete all the task given.	4.64	0.52	Strongly Agree
Show enthusiasm in doing every task and pass activities on time.	4.75	0.44	Strongly Agree
Weighted Mean	*4.68*		
SD	*0.22*		
Verbal Interpretation	*Very Great Extent*		

Table 10 illustrates the level of student learning involvement in terms of Completion of task

Students strongly agree that committing to every deadline and work schedules while utilizing project-based learning enhances students' learning involvement (M=4.71, SD=0.46). Furthermore, developing a healthy balance between study and personal life (M=4.63, SD=0.51).

The weighted mean of 4.68 and standard deviation of 0.22, it is evident that the students are highly motivated and engaged in their learning process, ensuring that they complete tasks with great effectiveness and efficiency.

This implies that project-based learning in science students' involvement that students are not only actively involved in their learning but also committed to meeting the requirements and deadlines set for them. It implies that they are capable of managing their time effectively and are motivated to achieve their academic goals.

Table 11. Level of student learning involvement in terms of Initiative

STATEMENTS	***MEAN***	***SD***	***REMARKS***
Take initiative when it comes to own learning.	4.68	0.51	Strongly Agree
Do something that will make own self knowledgeable and learn new things.	4.61	0.53	Strongly Agree
Productive and enthusiasm in terms of doing new kinds of learning.	4.69	0.49	Strongly Agree
Make own self available whenever there is an opportunity of learn.	4.50	0.56	Strongly Agree
Do not stop from asking, researching and inquiring about the things that still now know.	4.77	0.45	Strongly Agree
Weighted Mean	*4.65*		
SD	*0.27*		
Verbal Interpretation	*Very High*		

Table 11 demonstrates the level of student learning involvement in terms of Initiative

Students strongly agree not stopping from asking, researching and inquiring about the things that still now know while utilizing project-based learning enhances students' learning (M=4.77, SD=0.45). Furthermore, making own self available whenever there is an opportunity of learn (M=4.50, SD=0.56).

The weighted mean of 4.65 and standard deviation of 0.27, it is evident that students are highly self-motivated and driven to take ownership of their learning experiences and actively seeking out opportunities to expand their knowledge and skills.

This implies that project-based learning in science students' involvement that students are not just passive learners but are actively engaged in their education. They demonstrate a strong desire to learn and are willing to take initiative in their own learning process.

Table 12. Composite table of student learning involvement

INDICATORS	***WM***	***SD***	***V. I.***
Personalized learning	4.66	0.21	Very Great Extent
Learning participation	4.71	0.24	Very Great Extent
Quality of work	4.68	0.25	Very Great Extent
Completion of task	4.68	0.22	Very Great Extent
Initiative	4.65	0.27	Very Great Extent
Overall Mean	*4.68*		
SD	*0.24*		
Verbal Interpretation	*Very Great Extent*		

Table 12 shows the composite table of student learning involvement

From the indicators, "*Learning participation*" yielded the highest weighted mean score *(M=4.71, SD=0.24)* and was interpreted *to a very great extent*. This is followed by "*Quality of work" and "Completion of task*" with a weighted mean score *(M=4.68, SD=0.25, 0.22)* and was also interpreted *to a very great extent*. On the other hand, the indicator "*Initiative*" received the lowest weighted mean score of responses with

(M=4.65, SD=0.27) yet was also was also interpreted *to a very great extent*.

The weighted mean of 4.68 and standard deviation of 0.24, it is evident that project-based learning in science is effective and impactful instructional approach in science education. It fosters deeper understanding, critical thinking, and practical application of scientific concepts.

This implies that project-based learning in science students' involvement that the learning environment encourages and supports students in taking initiative.

Level of Students' Performance

The following table presents the results of students' performance in terms of comprehension, problem solving, analytical, logical reasoning, and critical.

Table 13. Level of students' performance in terms of Comprehension

Score	**Before**		**After**		**Descriptive Equivalent**
	F	**%**	**F**	**%**	
9 – 10	3	*3.00*	19	*19.00*	Outstanding
7 – 8	29	*29.00*	75	*75.00*	Very Satisfactory
5 – 6	56	*56.00*	6	*6.00*	Satisfactory
3 – 4	11	*11.00*	0	*0.00*	Fairly Satisfactory
1 – 2	1	*1.00*	0	*0.00*	Did not meet Expectation
Total	**100**	***100***	**100**	***100***	
Weighted Mean	*5.93*		*7.84*		
SD	*1.472*		*0.801*		
Verbal Interpretation	*Satisfactory*		*Very Satisfactory*		

Table 13 proves the level of students' performance before the project-based learning in terms of Comprehension. Out of total number of one hundred respondents *"5 to 6*" received the highest frequency of fifty-six (56) or 56.00% of the total population with descriptive equivalent of *Satisfactory*. The scores *"7 to 8"* received the frequency of twenty-nine (29) or 29.00% of the total population with descriptive equivalent of *Very Satisfactory***.** While the scores *"1 to 2"* received the lowest frequency of one (1) or 1.00% of the total population with descriptive equivalent of *Did not meet expectations*. With a *(Weighted Mean = 5.93, SD = 1.472)* it shows that the level of students' performance before he project-based learning in terms of Comprehension has a descriptive equivalent of *Satisfactory.*

The level of students' performance after the project-based learning in terms of Comprehension. Out of total number of one hundred respondents *"7 to 8*" received the highest frequency of seventy-five (75) or 75.00% of the total population with descriptive equivalent of *Very Satisfactory*. The scores *"9 to 10"* received the frequency of nineteen (19) or 19.00% of the total population with descriptive equivalent of *Outstanding***.** While the scores *"5 to 6"* received the lowest frequency of six (6) or 6.00% of the total population with descriptive equivalent of *Satisfactory*. With a *(Weighted Mean = 7.84, SD = 0.801)* it shows that the level of students' performance after the project-based learning in terms of Comprehension has a descriptive equivalent of *Very Satisfactory.*

This implies that project-based learning in science on students' performance is an effective instructional method for improving students' comprehension skills. It encourages active engagement, critical thinking, and deeper understanding of the material.

Table 14. Level of students' performance in terms of Problem solving

Score	**Before**	**After**	**Descriptive Equivalent**

	F	**%**	**F**	**%**	
9 – 10	1	*1.00*	16	*16.00*	Outstanding
7 – 8	19	*19.00*	73	*73.00*	Very Satisfactory
5 – 6	56	*56.00*	11	*11.00*	Satisfactory
3 – 4	21	*21.00*	0	*0.00*	Fairly Satisfactory
1 – 2	3	*3.00*	0	*0.00*	Did not meet Expectation
Total	**100**	***100***	**100**	***100***	
Weighted Mean	5.45		7.54		
SD	1.366		0.915		
Verbal Interpretation	*Satisfactory*		*Very Satisfactory*		

Table 14 displays the level of students' performance before the project-based learning in terms of Problem solving. Out of total number of one hundred respondents *"5 to 6*" received the highest frequency of fifty-six (56) or 56.00% of the total population with descriptive equivalent of *Satisfactory*. The scores *"3 to 4"* received the frequency of twenty-one (21) or 21.00% of the total population with descriptive equivalent of *Fairly Satisfactory***.** While the scores *"9 to 10"* received the lowest frequency of one (1) or 1.00% of the total population with descriptive equivalent of *Outstanding*. With a *(Weighted Mean = 5.45, SD = 1.366)* it shows that the level of students' performance before he project-based learning in terms of Problem solving has a descriptive equivalent of *Satisfactory.*

The level of students' performance after the project-based learning in terms of Problem solving. Out of total number of one hundred respondents *"7 to 8*" received the highest frequency of seventy-three (73) or 73.00% of the total population with descriptive equivalent of *Very Satisfactory*. The scores *"9 to 10"* received the frequency of sixteen (16) or 16.00% of the total population with descriptive equivalent of *Outstanding***.** While the scores *"5 to 6"* received the lowest frequency of eleven (11) or 11.00% of the total population with descriptive equivalent of *Satisfactory*. With a *(Weighted Mean = 7.54, SD = 0.915)* it shows that the level of students' performance after the project-based learning in terms of Problem solving has a descriptive equivalent of *Very Satisfactory.*

Table 15. Level of students' performance in terms of Analytical

Score	**Before**		**After**		**Descriptive Equivalent**
	F	**%**	**F**	**%**	
9 – 10	0	*0.00*	12	*12.00*	Outstanding
7 – 8	25	*25.00*	80	*80.00*	Very Satisfactory
5 – 6	53	*53.00*	8	*8.00*	Satisfactory
3 – 4	22	*22.00*	0	*0.00*	Fairly Satisfactory
1 – 2	0	*0.00*	0	*0.00*	Did not meet Expectation
Total	**100**	**100**	**100**	**100**	
Weighted Mean	5.50		7.55		
SD	1.314		0.809		
Verbal Interpretation	*Satisfactory*		*Very Satisfactory*		

Table 15 explains the level of students' performance before the project-based learning in terms of Analytical. Out of total number of one hundred respondents *"5 to 6*" received the highest frequency of fifty-three (53) or 53.00% of the total population with descriptive equivalent of *Satisfactory*. The scores *"7 to 8"*

received the frequency of twenty-five (25) or 25.00% of the total population with descriptive equivalent of *Very Satisfactory***.** While the scores *"3 to 4"* received the lowest frequency of twenty-two (22) or 22.00% of the total population with descriptive equivalent of *Fairly Satisfactory*. With a *(Weighted Mean = 5.50, SD = 1.314)* it shows that the level of students' performance before the project-based learning in terms of Analytical has a descriptive equivalent of *Satisfactory.*

The level of students' performance after the project-based learning in terms of Analytical. Out of total number of one hundred respondents *"7 to 8*" received the highest frequency of eighty (80) or 80.00% of the total population with descriptive equivalent of *Very Satisfactory*. The scores *"9 to 10"* received the frequency of twelve (12) or 12.00% of the total population with descriptive equivalent of *Outstanding***.** While the scores *"5 to 6"* received the lowest frequency of eight (8) or 8.00% of the total population with descriptive equivalent of *Satisfactory*. With a *(Weighted Mean = 7.55, SD = 0.809)* it shows that the level of students' performance after the project-based learning in terms of Analytical has a descriptive equivalent of *Very Satisfactory.*

This implies that the project-based learning in science on students' performance in terms of analytical is effective instructional method for developing students' analytical skills. Analytical skills are crucial in various academic and professional contexts, including problem-solving, decision-making, and critical thinking. Therefore, educators should consider incorporating more project-based learning activities into their teaching practices to help students develop and refine these essential skills.

Results show that the plans for organization of project-based and inquiry-based learning activities in the science learning had efficiencies 89.05/78.79 of project-based learning. The plans for organization of project-based learning activities had effectiveness indices 0.6774.

Table 16. Level of students' performance in terms of Logical reasoning

Score	**Before**		**After**		**Descriptive Equivalent**
	F	**%**	**F**	**%**	
9 – 10	1	*1.00*	14	*14.00*	Outstanding
7 – 8	19	*19.00*	70	*70.00*	Very Satisfactory
5 – 6	63	*63.00*	16	*16.00*	Satisfactory
3 – 4	16	*16.00*	0	*0.00*	Fairly Satisfactory
1 – 2	1	*1.00*	0	*0.00*	Did not meet Expectation
Total	**100**	**100**	**100**	**100**	
Weighted Mean	5.53		7.47		
SD	1.298		0.989		
Verbal Interpretation	*Satisfactory*		*Very Satisfactory*		

Table 16 exhibits the level of students' performance before the project-based learning in terms of Logical reasoning. Out of total number of one hundred respondents *"5 to 6*" received the highest frequency of sixty-three (63) or 63.00% of the total population with descriptive equivalent of *Satisfactory*. The scores *"7 to 8"* received the frequency of nineteen (19) or 19.00% of the total population with descriptive equivalent of *Very Satisfactory***.** While the scores *"1 to 2" and 9 o 10"* received the lowest frequency of one (1) or 1.00% of the total population with descriptive equivalent of *Did not meet expectations and Outstanding*. With a *(Weighted Mean = 5.53, SD = 1.298)* it shows that the level of students' performance before the project-based learning in terms of Logical reasoning has a descriptive equivalent of *Satisfactory.*

The level of students' performance after the project-based learning in terms of logical reasoning. Out of total number of one hundred respondents *"7 to 8*" received the highest frequency of seventy (70) or 70.00% of the total population with descriptive equivalent of *Very Satisfactory*. The scores *"5 to 6"* received

the frequency of sixteen (16) or 16.00% of the total population with descriptive equivalent of *Satisfactory***.** While the scores *"9 to 10"* received the lowest frequency of fourteen (14) or 14.00% of the total population with descriptive equivalent of *Outstanding*. With a *(Weighted Mean = 7.47, SD = 0.989)* it shows that the level of students' performance after the project-based learning in terms of Logical reasoning has a descriptive equivalent of *Very Satisfactory.*

This implies that the project-based learning in science on students' performance in terms of logical reasoning is effective instructional method for developing students' logical reasoning skills. Logical reasoning is essential in various academic and professional contexts, including problem-solving, analysis, and decision-making. Therefore, educators should consider incorporating more project-based learning activities into their teaching practices to help students develop and refine these critical skills.

Table 17. Level of students' performance in terms of Critical.

Score	**Before**		**After**		**Descriptive Equivalent**
	F	**%**	**F**	**%**	
9 – 10	0	*0.00*	19	*19.00*	Outstanding
7 – 8	34	*34.00*	70	*70.00*	Very Satisfactory
5 – 6	47	*47.00*	11	*11.00*	Satisfactory
3 – 4	19	*19.00*	0	*0.00*	Fairly Satisfactory
1 – 2	0	*0.00*	0	*0.00*	Did not meet Expectation
Total	**100**	**100**	**100**	**100**	
Weighted Mean	5.73		7.65		
SD	1.427		0.978		
Verbal Interpretation	*Satisfactory*		*Very Satisfactory*		

Table 17 verifies the level of students' performance before the project-based learning in terms of Critical. Out of total number of one hundred respondents *"5 to 6*" received the highest frequency of forty-seven (47) or 47.00% of the total population with descriptive equivalent of *Satisfactory*. The scores *"7 to 8"* received the frequency of thirty-four (34) or 34.00% of the total population with descriptive equivalent of *Very Satisfactory***.** While the scores *"3 to 4"* received the lowest frequency of nineteen (19) or 19.00% of the total population with descriptive equivalent of *Fairly Satisfactory*. With a *(Weighted Mean = 5.73, SD = 1.427)* it shows that the level of students' performance before he project-based learning in terms of Critical has a descriptive equivalent of *Satisfactory.*

The level of students' performance after the project-based learning in terms of Critical. Out of total number of one hundred respondents *"7 to 8*" received the highest frequency of seventy (70) or 70.00% of the total population with descriptive equivalent of *Very Satisfactory*. The scores *"9 to 10"* received the frequency of nineteen (19) or 19.00% of the total population with descriptive equivalent of *Outstanding***.** While the scores *"5 to 6"* received the lowest frequency of eleven (11) or 11.00% of the total population with descriptive equivalent of *Satisfactory*. With a *(Weighted Mean = 7.65, SD = 0.978* it shows that the level of students' performance after the project-based learning in terms of Critical has a descriptive equivalent of *Very Satisfactory.*

This implies that the project-based learning in science on students' performance in terms of critical is effective instructional method for developing students' critical thinking abilities students demonstrated strong critical thinking abilities after engaging in project-based learning. As evidenced by their high level of initiative, active participation, and completion of tasks to a very great extent

Table 18. Level of students' performance before and after using project-based learning

Score	Before		After		Descriptive Equivalent
	F	%	F	%	
41 – 50	0	*0.00*	16	*16.00*	Outstanding
31 – 40	14	*14.00*	84	*84.00*	Very Satisfactory
21 – 30	86	*86.00*	0	*0.00*	Satisfactory
11 – 20	0	*0.00*	0	*0.00*	Fairly Satisfactory
1 – 10	0	*0.00*	0	*0.00*	Did not meet Expectation
Total	**100**	**100**	**100**	**100**	
Weighted Mean	28.14		38.05		
SD	1.995		2.883		
Verbal Interpretation	*Satisfactory*		*Very Satisfactory*		

Table 18 presents the level of students' performance before using project-based learning. Out of total number of one hundred respondents *"21 to 30*" received the highest frequency of eighty-six (86) or 86.00% of the total population with descriptive equivalent of *Satisfactory*. While the scores *"31 to 40"* received the lowest frequency of fourteen (14) or 14.00% of the total population with descriptive equivalent of *Very Satisfactory*. With a *(Weighted Mean = 28.14, SD = 1.995)* it shows that the level of students' performance before using project-based learning has a descriptive equivalent of *Satisfactory.*

The level of students' performance after using project-based learning. Out of total number of one hundred respondents *"31 to 40*" received the highest frequency of eighty-four (84) or 84.00% of the total population with descriptive equivalent of *Very Satisfactory*. While the scores *"41 to 50"* received the lowest frequency of sixteen (16) or 16.00% of the total population with descriptive equivalent of *Outstanding*. With a *(Weighted Mean = 38.05, SD = 2.883* it shows that the level of students' performance after using project-based learning has a descriptive equivalent of *Very Satisfactory.*

This implies that the project-based learning in science effectively enhances students' performance that promotes deep understanding, critical thinking, and application of knowledge. It is impactful instructional approach for enhancing students' performance and fostering their overall development.

Test of Difference between the students' performance before and after using project-based learning

Table 19. Test of Difference between the students' performance before and after using project-based learning

Project-based Learning	**Before**		**After**		Mean Difference	95% Confidence Interval of Difference		**t**	**Df**	**Sig (2-tailed)**
	Mn	**SD**	**Mn**	**SD**		**L**	**U**			
Performance	28.14	1.96	38.05	2.88	9.91	1.35	1.47	28.27	198	0.000

*Legend: *Significant at 0.05*

Shown in Table 20 is the test of difference between the students' performance before and after using project-based learning mean scores of the two groups. Data obtained through a paired t-test indicated that the increase in the scores is significant ($p < 0.05$).

This implies that the students performed better in the after using project-based learning. Their level of learning involvement and performance has significantly improved from satisfactory to very satisfactory.

Significant relationship between the integration of project-based learning in science on students' learning involvement and performance.

Table 20. Significant relationship between the integration of project-based learning in science on students' learning involvement and performance.

		Personalized learning	Learning participation	Quality of work	Completion of task	Initiative
Collaborative	Pearson Correlation	.132**	.084*	.032*	.155	.127*
	Sig. (2-tailed)	.000	.003	.021	.537	.011
	N	99	99	99	99	99
	Strength	*Very Weak*	*Very Weak*	*Very Weak*	*Very Weak*	*Very Weak*
	Analysis	*Significant*	*Significant*	*Significant*	*NS*	*Significant*
Innovative	Pearson Correlation	.505*	.171*	.168*	.144*	.007*
	Sig. (2-tailed)	.000	.000	.001	.033	.000
	N	99	99	99	99	99
	Strength	*Moderate*	*Very Weak*	*Very Weak*	*Very Weak*	*Very Weak*
	Analysis	*Significant*	*Significant*	*Significant*	*Significant*	*Significant*
Interactive	Pearson Correlation	.120*	.375*	.271*	.111	.506*
	Sig. (2-tailed)	.000	.000	.026	.343	.000
	N	99	99	99	99	99
	Strength	*Very Weak*	*Weak*	*Very Weak*	*Very Weak*	*Very Weak*
	Analysis	*Significant*	*Significant*	*Significant*	*NS*	*Significant*
Inquiry-Based	Pearson Correlation	.309*	.003*	.187*	.076	.033*
	Sig. (2-tailed)	.017	.000	.001	.183	.001
	N	20	20	20	20	20
	Strength	*Weak*	*Very Weak*	*Very Weak*	*Very Weak*	*Very Weak*
	Analysis	*Significant*	*Significant*	*Significant*	*NS*	*Significant*
Immersive	Pearson Correlation	.002**	.063*	.175*	.207	.054*
	Sig. (2-tailed)	.001	.010	.034	.782	.026
	N	99	99	99	99	99
	Strength	*Very Weak*	*Very Weak*	*Very Weak*	*Very Weak*	*Very Weak*
	Analysis	*Significant*	*Significant*	*Significant*	*NS*	*Significant*

Table 19 presents the significant relationship between the project-based learning in science on students' learning involvement and performance.

The *Collaborative, Innovative, Interactive, Inquiry-Based and Immersive* of the project-based learning in science on students' learning and involvement was observed to have a significant relationship to the Personalized learning, Learning participation, Quality of work and Initiative of student learning involvement. This is based on the computed r values obtained from the tests with very weak to strong moderate relationship. Furthermore, the p-values obtained were less than the significance alpha 0.05, hence there is a significance.

This implies that the significant relationship between the collaborative, innovative, interactive, inquiry-based, and immersive aspects of project-based learning in science and various aspects of students' learning and involvement, such as personalized learning, learning participation, quality of work, and initiative,

suggests that integrating these elements into classroom practices can lead to more engaged and effective learning experiences.

This implies that when educators focus on incorporating collaborative, interactive, and inquiry-based methods in project-based learning, students are more likely to participate actively, produce high-quality work, and take initiative in their learning. The significant relationship also implies that personalized learning experiences, tailored to students' individual needs and interests, are better facilitated through these project-based approaches.

4. Conclusion and Recommendation

On the basis of the foregoing findings, the following conclusions were drawn.

The study shows the relationship between project-based learning and students' learning involvement has no significant relationship. Thus, the researcher therefore concludes that the research hypothesis stating that There is no significant relationship between project-based learning and students' learning involvement is accepted. The second hypothesis results in a significant difference on students' performance before and after using project-based learning. Thus, the researcher therefore concludes that the research hypothesis stating that "There is no significant difference on students' performance before and after using project-based learning is rejected.

Based on the drawn conclusions resulted to the following recommendations:

1. Recommend offering students a thorough understanding of the impacts of integrating project-based learning in science laboratories. Equip them with skills to manage their learning and discover quality education individually.
2. Suggest providing teachers with valuable insights into effective methods for teaching science in laboratory classrooms, encouraging interactive and collaborative learning to stimulate various student skills.
3. Recommend aiding the school in identifying effective learning competencies by reinforcing the integration of project-based learning in science laboratory classrooms, promoting ongoing innovation in educational practices.

Reference:

Ravitz, J. (2020). Beyond changing culture in small high schools: Reform models and changing instruction with project-based learning. Peabody Journal of Education, 85(3), 290-312. doi:10.1080/0161956X.2010.491432