The Effects of Inquiry-based Approach on Pupils' Performance and Motivation in Science

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Abstract

This experimental study investigated the effects of Inquiry-based Approach on the performance and motivation in Science involving Grade 6 Pupils of Calatrava I Central School using the quasi-experimental research design. The 30 subjects of the control group were taught with Direct Instruction, and the 30 subjects of the experimental group were subjected to Inquiry-based Approach. The research instruments utilized were: Test on Science Content Standards, Test on Science Performance Standards; and the questionnaire on Pupils' Level of Motivation before and after the experimentation. The experiment was completed for five (5) weeks. The pre-test scores of both control and experimental groups were similar, but there appears a marked difference between their post-test scores as the control group obtained a rating of "high" compared to "very high" on the part of the experimental group. These results highlight the existence of that significant difference between the levels of performance of the control and experimental groups in the post-tests on Science Content and Performance Standards; and between their levels of motivation after the experimentation. In plain language, these results prove that the Inquiry-based Approach is more effective in improving the pupils' performance in Science Content and Performance Standards, and their motivation in Science compared to Direct Instruction. These results call for broadening the scope of this experimental research on other teaching strategies suitable in science courses or possibly extending its scope beyond the walls of Calatrava I Central School in Calatrava, Negros Occidental.

Keywords: Inquiry-based approach, performance and motivation, science education, experimentation/intervention

Bionotes:

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Introduction

Nature of the Problem

The learners' need to acquire the essential competencies of the 21st century has provided a new set of challenges to the teachers in innovating their teaching strategies to fulfill the transformation of the education system. The K to 12 Science Curriculum has recognized these demands to enable them to work collaboratively, communicate eloquently, and solve problems efficiently to flourish in complex societies. The Science curriculum has been designed around the three domains of learning Science: understanding and applying scientific knowledge, performing scientific processes and skills, and developing and demonstrating scientific attitudes and values. These overarching goals are reflected in the K to 12 Curriculum Guide Science of 2013.

However, the Philippine International Student Assessment (PISA) of 2018 shows the Philippines' declining score of 357 points in scientific literacy. The mean score of Filipino students falls within the lowly Proficiency Level 1a, which pales in comparison to a typical 15-year-old student from the Organization for Economic Cooperation and Development (OECD) countries obtaining Proficiency Level 3 and can draw upon moderately complex content knowledge to construct explanations of familiar phenomena. Sadly, the Philippines fared significantly lower in scientific literacy than all the ASEAN countries that participated in PISA 2018 (PISA 2018 National Report of the Philippines, 2019).

The scientific literacy and 21st Century skills can be cultivated using the Inquiry-based Approach, which aims to inculcate the scientific knowledge, skills, and values required to think systematically to answer questions and solve problems. Despite the extensive professional development efforts of the Department, some teachers have been reluctant to utilize this approach because of the challenges in the implementation in the elementary science education.

The researcher has been a constant advocate of the development of scientific literacy and has been compassionate on the difficulties encountered by other teachers, especially in the implementation of Inquiry-based Approach. It is in this context that this researcher decided to investigate the effects of Inquiry-based Approach on elementary pupils' performance and motivation, in the hope of inspiring his fellow teachers in upholding the ideals of 21st-century education.

Current State of Knowledge

The Inquiry-based Approach is a process-oriented instructional model that aims to teach students the skills, knowledge, and dispositions required for thinking systematically to answer important questions. Through participation, students also develop knowledge of academic content that includes an understanding of facts, principles, and concepts within a meaningful context- the solving of a problem (Kilbane & Milman, 2014).

Harlen and Qualter (2018) explain the outcome of children's investigations will depend on whether the inquiry skills are carried out 'in a scientific manner.' The

extent to which ideas become 'bigger' or more powerful depends both on the way ideas from previous experience are linked to new experience and on how the testing of a possible explanatory idea is carried out on the use of the inquiry skills.

The studies of Abdi (2014), Supasorn and Promarak (2015), and Duran and Dokme (2016) confirmed that students educated by Inquiry-based Approach have become more successful than students educated by traditional teaching methods as the approach enhances conceptual understanding and improves critical thinking skills.

Cairns and Areepattamannil (2019) concluded that a significant positive relationship exists between Inquiry-based science teaching and dispositions toward science. They emphasized that it is vital that students must comprehend science concepts and be able to use science process skills. Koksal and Berberoglu (2014) proved its positive on students' cognitive and affective aspects as it enhanced their understanding of the concepts and improved their attitudes toward science.

There have been numerous international studies on Inquiry-based Approach, but only a few kinds of are research implemented locally to confirm its appropriateness in elementary Science education to Filipino pupils. It is henceforth imperative to determine its effectiveness in enhancing pupils' achievement and motivation in Science.

Purpose Statement

The purpose of the study was to determine the effects of Inquiry-based Approach on the performance and motivation in Science of Grade 6 Pupils of Calatrava I Central School during the Third Quarter of School Year 2019-2020.

Specifically, the paper sought answers to the following questions:

1. What are the pretest and posttest scores of the control and experimental groups in Science Content and Performance Standards (SCPS)?

2. What are the levels of motivation of both control and experimental groups before and after the experimentation?

3. Is there a significant difference between the pretest and posttest scores of the control group in SCPS?

4. Is there a significant difference between the pretest and posttest scores of the experimental group in SCPS?

5. Is there a significant difference between the levels of motivation of the control group before and after the experimentation?

6. Is there a significant difference between the levels of motivation of the experimental group before and after the experimentation?

7. Is there a significant difference between the pretest scores of both control and experimental groups in SCPS?

8. Is there a significant difference between the posttest scores of both control and experimental groups in SCPS?

9. Is there a significant difference between the levels of motivation of both control and experimental groups before the experimentation?

10. Is there a significant difference between the levels of motivation of both control and experimental groups after the experimentation?

Hypotheses

In view of the aforementioned specific objectives, the following hypotheses are hereby set forth:

1. There is no significant difference between the pretest and posttest scores of the control group in SCPS.

2. There is no significant difference between the pretest and posttest scores of the experimental group SCPS.

3. There is no significant difference between the levels of motivation of the control group before and after the experimentation.

4. There is no significant difference between the levels of motivation of the experimental group before and after the experimentation.

5. There is no significant difference between the pretest scores of both control and experimental groups in SCPS.

6. There is no significant difference between the posttest scores of both control and experimental groups in SCPS.

7. There is no significant difference between the levels of motivation of both control and experimental groups before the experimentation.

8. There is no significant difference between the levels of motivation of both control and experimental groups after the experimentation.

Materials and Methods

Research Design

The study utilized the quasi-experimental research design which directly attempts to influence a particular variable and aims to establish the cause-and-effect relationships between these variables without random assignment of subjects. The researchers assigned the subjects to groups based on non-random criteria, and guided by Fraenkel et al. (2019), employed techniques to control or at least reduce threats to internal validity by using matched sampling method.

Subjects

The study involved 60 subjects, specifically: 30 pupils from Grade 6-Mahogany for the control group and 30 pupils from Grade 6-Acacia for the experimental group. There were 15 male pupils and 15 female pupils for each group. The subjects in each group were appropriately matched based on their average grades in Science during the First and Second Quarter.

Instrument

The researcher formulated three data-gathering instruments: the test on Science Content Standards (SCS), the test on Science Performance Standards (SPS), and the questionnaire on Pupils' Level of Motivation in Science before and after the experimentation.

The test on SCS consisted of forty items of multiple-choice type of questions was constructed based on the Table of Specifications with the contents of the Third Quarter. The posttest was an identical form of the pre-test on SCS since the interval between these tests was large.

The test on SPS allowed the researcher to directly observe and evaluate an individual's performance of a certain task and/or judges the finished product of that performance. It offered a way to measure abilities and skills that cannot be measured by paper-and-pencil tests (Ary et al., 2018). The test consisted of two performance tasks incorporating the contents of the Third Quarter. The performance tasks of the posttest were identical with the pre-test since the interval between these tests was large.

In the first task entitled Wind Turbine, the subjects individually designed and constructed a wind turbine to transfer and convert wind to electricity. In the second task entitled Simple Machine Project, the subjects designed and constructed simple machines as a group. Along this line, the researcher developed a rubric scale that lists the relevant criteria used in evaluating the performance or the product namely: Design and Materials, Construction, Scientific Procedure, Function, and Exposition. The scoring criteria and quality levels of this rubric were: Exemplary (4), Proficient (3), Developing (2), and Emerging (1). The total rating for each performance task was 20 points. The researcher evaluated the subjects' performance of the tasks individually.

The questionnaire on Pupils' Level of Motivation in Science was used to determine the level of motivation of the subjects before and after the experimentation. The questionnaire consisted of two parts. The first part of the instrument collected the information comprising the name, gender, and grade and section of the subjects. The second part contained fifteen statements intended to measure pupils' motivation in Science which addressed Science learning of the elementary pupils based on the factors of motivation in Science, namely: Self-efficacy, Active Learning, Achievement Goal, and Performance Goal. A Likert-scale was used to measure how the subjects feel on each of the statements.

These instruments used the criteria developed by Carter V. Good and Douglas B. Scates to evaluate the validity; and obtained a mean score of 4.56 for SCS, 4.58 for SPS, and 4.53 for the questionnaire on Pupils' Level of Motivation in Science.

Furthermore, after the validity was established these instruments were administered to other Grade 6 pupils in another school to evaluate the reliability. The internal consistency reliability for SCS was determined using Kuder-Richard Formula 21 and it obtained a reliability coefficient of 0.71 (reliable). Item Analysis was conducted for SCS. Cronbach's Alpha was used to determine the reliability of SPS, rated 0.81 (Good); and the questionnaire on Pupil's Level of Motivation in Science, rated 0.90 (Excellent).

Data Gathering Procedure

At the onset, the researcher secured the approval to conduct the study from the Schools Division Superintendent and the School Principals, respectively. After establishing the validity and reliability of the research instruments, the researcher administered the pre-test on SCS to all Grade 6 pupils of Calatrava I Central School. The test obtained the following information: Mean value of the five sections, a comparable mean value of the sections which were assigned to control and experimental groups, and the baseline information of the subjects' content knowledge in science.

On the second day, the subjects of both groups filled the questionnaire on Pupils' Level of Motivation in Science. Thereafter, the answers to the questionnaire were tallied and tabulated. The subjects of both groups performed the Test on SPS for two days. The researcher evaluated their performance using the rubric scale. The sum of two scores was then tallied and tabulated. The experiment was conducted after the instruments were administered.

These were some of the protocols strictly observed in the conduct of this experimentation.

Firstly, the Science teacher of the five sections in Grade 6 was responsible for teaching Science in both groups. The Grade 6 Science class of both groups was scheduled daily with a duration of 50 minutes. The control group was scheduled from 8:00 – 8:50 am followed by the experimental group from 9:00 – 9:50 am. The researcher organized the classroom with good ventilation and adequate lighting. The researcher utilized the same classroom for the control and experimental groups during the conduct of the study for the duration of five weeks.

Second, the researcher formulated two sets of lesson plans for the daily learning objectives of the Third Quarter based on the learning competencies of the Curriculum Guide for Grade 6 Science.: the first set incorporated the Direct Instruction for the control group, and the second set incorporated the Inquiry-based Approach for the experimental group.

Direct Instruction refers to the teaching strategies that are structured and directed by the teachers; the learning contents for the students are delivered by the teachers which are commonly observed in lecture. On the other hand, the principles

of Inquiry-based Approach are incorporated in 5E's Instructional Model which consists of five phases, namely: Engagement, Exploration, Explanation, Elaboration, and Evaluation.

After the experimentation, the posttest on SCS was administered to all Grade 6 pupils. The test papers were checked, and the scores were tallied and tabulated. The results of the pretest and posttest on SCS of the control and experimental groups were analyzed and interpreted. The same questionnaire on Pupils' Level of Motivation in Science was accomplished by the subjects of the study on the following day. The answers to the questionnaire were tallied and tabulated. The results of the level of pupils' motivation in Science in the pretest and posttest of both groups were analyzed and interpreted.

Finally, the posttest on SPS was conducted for the last two days. The researcher evaluated the performance of the two tasks and the scores were summarized and tabulated. The results of the pretest and posttest of both groups were then analyzed and interpreted.

Data Analysis

This study employed the following procedures to facilitate the data analysis:

1. Objective 1 employed the descriptive-analytical scheme, and the mean and standard deviation as statistical tools to determine the pretest and posttest scores of the control and experimental groups in SCPS.

2. Objective 2 employed the descriptive-analytical scheme, and the mean and standard deviation as statistical tools to determine the levels of motivation of both control and experimental groups before and after the experimentation.

3. Objective 3 employed the comparative analytical scheme, and the dependent t-test as the statistical tool to determine the difference, if any, between the pretest and posttest scores of the control group in SCPS.

4. Objective 4 employed the comparative analytical scheme, and the dependent t-test as the statistical tool to determine the difference, if any, between the pretest and posttest scores of the experimental group in SCPS.

5. Objective 5 employed the comparative analytical scheme, and the dependent t-test as the statistical tool to determine the difference, if any, between the levels of motivation before and after the intervention of the control group.

6. Objective 6 employed the comparative analytical scheme, and the dependent t-test as the statistical tool to determine the difference, if any, between the levels of motivation of the experimental group before and after the experimentation.

7. Objective 7 employed the comparative analytical scheme, and the independent t-test as the statistical tool to determine the difference, if any, between the pretest scores of both control and experimental groups in SCPS.

8. Objective 8 employed the comparative analytical scheme, and the independent t-test as the statistical tool to determine the difference, if any, between the posttest scores of both control and experimental groups in SCPS.

9. Objective 9 employed the comparative analytical scheme, and the independent t-test as the statistical tool to determine whether or not a significant difference exists between the levels of motivation of both control and experimental groups before the experimentation.

10. Objective 10 employed the comparative analytical scheme and the independent t-test as the statistical tool to determine whether or not a significant difference exists between the levels of motivation of both control and experimental groups after the experimentation

Ethical Considerations

The design and conduct of the study were in accordance with the recognized standards of research. The administrators of the institutions were informed about the research methodology, and prior approval for the conduct of the study was secured. The informed consent from the parents was obtained after they were oriented with the purpose and nature of the research. More importantly, the researcher implemented appropriate measures to protect the rights and welfare of the subjects of the study.

Results and Discussion

This section elaborates on the results of the study in accordance with the sequence of the objectives of the study.

Pretest Scores of the Control and Experimental Groups in SCPS

Table 1
Pretest Scores of Control and Experimental Groups in SCPS

	Groups	Mean	*sd*	Interpretation
SCS	Control	14.97	4.709	Low Level
	Experimental	15.93	3.695	Low Level
SPS	Control	15.40	2.908	Low Level
	Experimental	15.80	3.508	Low Level

Table 1 presents the pretest scores of both groups in SCS, with the control group obtaining a mean score of 14.97 and the experimental recording its mean score of 15.93. The pretest mean scores in SCS of both groups are both interpreted as "low level."

The same table shows the pretest scores of both groups in SPS, with the control group gaining a mean score of 15.40, while the experimental group attaining 15.80. Both pretest mean scores were interpreted as "low level."

Posttest Scores of the Control and Experimental Groups in SCPS

Table 2
Posttest Scores of the Control and Experimental Groups in SCPS

	Groups	Mean	*Sd*	Interpretation
SCS	Control	25.83	3.384	High Level
	Experimental	34.57	3.059	Very High Level
SPS	Control	29.23	3.126	High Level
	Experimental	35.30	3.030	Very High Level

The preceding table has thus far illustrated the posttest scores of both groups in SCS and SPS. When viewed closely, the control group registered a mean score of 25.83, interpreted as "high level" while the experimental group recorded a mean score of 34.57, interpreted as "very high level" in SCS. These findings convey that the subjects of both groups have acquired knowledge and comprehension of the content standards. The level of performance in the posttest of the experimental group was remarkably higher compared to that of the control group. This conforms to the study of Ramirez and Francisco (2017) which reported the posttest that the non-Inquiry-based Group remained in the low achieving level while the Inquiry-based Learning Group moved from the low achieving level to the high achieving level.

The same table shows the control group obtaining a posttest mean score of 29.23 interpreted as "high level" with the experimental group achieving a posttest mean score of 35.30 interpreted as "very high level" in SPS. This indicates that the subjects of both groups have further developed their skills and have demonstrated their understanding to achieve the performance standards. The experimental group performed better compared to the control group. This is in agreement with the study of Abdi (2014) in which the mean scores of the students taught science education using inquiry-based instruction were higher compared to those taught using traditional approach.

Levels of Pupils' Motivation of the Control and Experimental Groups before and after the Experimentation

Table 3
Levels of Pupils' Motivation of the Control and Experimental Groups before and after Experimentation

	Groups	Mean	*Sd*	Interpretation
Before	Control	3.35	0.375	Average Level
	Experimental	3.39	0.311	Average Level
After	Control	3.93	0.262	High Level
	Experimental	4.32	0.266	High Level

The previous table presents the level of motivation of both groups before and after the experimentation on the use of two teaching strategies. Before the conduct of experimentation, the control group obtained a mean score of 3.35 while the experimental group got a mean score of 3.39, which are all interpreted as "average." The result indicates that both groups were similar in their level of motivation in Science before the experimentation. This is in harmony with the study of Bilgin et al. (2015).

In reference to Table 4, the findings show the levels of pupils' motivation after the experiment was applied to both groups. The control group's level of motivation increased to 3.93 while that of the experimental group recorded an ascent of 4.32. Incidentally, both mean scores are interpreted as "high level." As expected, the experimental group obtained a higher mean score of their level of motivation compared to that of the control group. The study of Koksal and Berberoglu (2014) observed similar result which indicates that the experimental group of students improved their attitudes toward Science more than the control group students as a result of treatment.

A Comparative Analysis between the Pretest and Posttest Scores of the Control Group in SCPS

Table 4
Difference between the Pretest and Posttest Scores of the Control Group in SCPS

Control Group		Mean	T	*p*-value	Sig level	Interpretation
SCS	Pretest	14.97	-16.325	0.000	0.05	Significant
	Posttest	25.83				
SPS	Pretest	15.40	-45.013	0.000		Significant
	Posttest	29.23				

Table 4 depicts the comparative analysis between the pretest and posttest scores of the control group in SCS. It obtained a pretest mean score of 14.97 and a posttest mean score of 25.83. The dependent t-test revealed the t-value of -16.325, and the p-value of 0.000, interpreted as significant at 0.05 level. A significant difference was henceforth found between those twin tests. This result validates Abdi's (2014) findings that traditional approach, or in this case, direction instruction likewise increases pupils' level of achievement.

The same graphic in Table 4 displays the comparative analysis of pretest and posttest scores in SPS of the control group. It got a pretest mean score of 15.40 and posttest mean score of 29. The dependent t-test revealed the t-value of -45.013, and the p-value of 0.000, interpreted as significant at 0.05 level. It was henceforth found that a significant difference exists between those twin tests in SPS. The findings are in line with the previous study of Duran and Dokme (2016), which revealed a significant difference in the scores of the control group instructed through the traditional lecturing method.

A Comparative Analysis between the Pretest and Posttest Scores of the Experimental Group in SCPS

Table 5
Difference between the Pretest and Posttest Scores of the *Experimental Group in SCPS*

Experimental Group		Mean	T	*p*-value	Sig level	Interpretation
SCS	Pretest	15.93	-25.434	0.000	0.05	Significant
	Posttest	34.57				
SPS	Pretest	15.80	-34.281	0.000		Significant
	Posttest	35.30				

Table 5 illustrates the comparative analysis between the pretest and posttest scores of the experimental group in SCS. It obtained a pretest mean of 15.93, and a posttest mean of 34.57. The dependent t-test reported the t-value of -25.434, and the p-value of 0.000, interpreted as significant at 0.05 level. Therefore, a significant difference was found between the pretest and posttest scores of the experimental group. The result shows the group's marked improvement in the level of achievement in SCS. Moreover, it substantiates that common assumption that the inquiry-based approach promotes a deeper comprehension of science contents as it provides the subjects with learning opportunities to reinforce their existing knowledge, understand how it is generated and how they can utilize to construct new knowledge. This coincides with the study which verified that inquiry was an effective means of enhancing and retaining students' conceptual understanding (Supasom & Promarak, 2015).

Still in reference to Table 5, the graphic compares the pretest and posttest scores of the same group in SPS. The group recorded a pretest mean of 15.80 and posttest mean of 35.30. Subsequently, the dependent t-test revealed the t-value of -25.434, and the p-value of 0.000, interpreted as significant at 0.05 level. Henceforth, a significant difference has been found to exist between those twin tests on SPS involving the experimental group. The result shows the group's marked improvement in the level of achievement in Science Performance Standards, an outcome comparable to Prahani et al. (2016), which reported an increase in students' problem-solving skills after the implementation of guided inquiry model.

A Comparative Analysis between the Levels of Motivation of the Control Group before and after Experimentation

Table 6
Difference between the Levels of Motivation of the Control Group before and after Experimentation

Control Group	Mean	T	*p*-value	Sig level	Interpretation
Before	3.35	-9.337	0.000	0.05	Significant
After	3.93				

Table 6 presents a comparative analysis between the levels of motivation of the control group before and after the use of Direct Instruction. The control group got a mean of 3.35 before the conduct of the teaching strategy and a mean of 3.93 after the Direct Instruction was applied. The dependent t-test reported the t-value of -9.337 and the p-value of 0.000, interpreted as significant at 0.05 level. These figures indicate the existence of a significant difference between the levels of motivation of the control group before and after the Direct Instruction was used. This result shows a marked improvement in the level of motivation as a result of Direct Instruction applied in teaching Science. If at all, it proves that Direct Instruction helps develop the understanding of science concepts and application of skills directed by the teacher, which can promote self-efficacy and determination to acquire knowledge and skills. This coincides with the similar study of Bilgin et al. (2015), which showed that there was a statistically significant relationship between the scores obtained by the students of the control group in pre– and post-Self Efficacy Belief Scale (SEBS). The students of the control group obtained a higher post-SEBS score who were instructed through a use of traditional method.

A Comparative Analysis between the Levels of Motivation of the Experimental Group before and after Experimentation

Table 7
Difference between the Levels of Motivation of the Experimental Group before and after the Experimentation

Experimental Group	Mean	T	*p*-value	Sig level	Interpretation
Before	3.39	-11.680	0.000	0.05	Significant
After	4.32				

Table 7 presents the comparative analysis between the levels of motivation of the experimental group before and after the use of Inquiry-based Approach. The experimental group obtained a mean of 3.39 before the intervention and a mean of 4.32 after the intervention. The dependent t-test revealed the t-value of -11.680 and the p-value of 0.000, interpreted as significant at 0.05 level. A significant difference was henceforth found between the levels of motivation before and after the intervention of the experimental group.

The findings denote that the subjects of the experimental group who were instructed with Inquiry-based Approach have enhanced their level of motivation as a result of the intervention. In Inquiry-based Approach, the participants can improve their skills by investigating the problem and exploring the concepts independently or collaboratively which can promote their confidence and apply the skills to fulfill the learning goals. The outcome corroborates Koksal and Berberoglu (2014) who claimed that the experimental group have improved their attitudes toward Science.

A Comparative Analysis between the Pretest Scores of the Control and Experimental Groups in SCPS

Data gathered compared the pretest scores of both control and experimental groups in SCS and SPS. The pretest mean score on SCS obtained by the control group was 14.97, and the experimental group was 15.93. The independent t-test reported the t-value of -0.885 and the p-value of 0.380, interpreted to be not significant at 0.05 significance level. No significant difference was henceforth found between the pretest scores of both groups in SCS. Additionally, these data proved the homogeneity of groupings in terms of their mental ability and level of comprehension on Science concepts before the experiment. This is in agreement with the study of Njoroge et al. (2014) which reported that the mean scores of Group 1 and 2 were not statistically significantly different. This meant that the groups used in the study exuded comparable characteristics.

Still in reference to the same data, the result shows the control group obtaining a pretest mean of 15.40 with the experimental group getting 15.80 in SPS. The ensuing independent t-test revealed the t-value of -0.481 and the p-value of 0.632, interpreted to be not significant at 0.05 significance level. This paper therefore concluded that no significant difference exists between the pretests of both groups in SPS. Both control and experimental groups were appropriately matched in terms of their level of abilities, problem-solving, and process skills to accomplish the performance tasks before the experimentation. This is consistent with the investigation of Prahani et al. (2016) which reported that there is no difference of student's problem solving skills before implementation of the physics learning material through guided inquiry model in one class to another class.

A Comparative Analysis between the Posttest Scores of both Control and Experimental Groups in SCPS

Table 8
Difference between the Posttest Scores of both Control and Experimental Groups in SCPS

Posttests	Groups	Mean	t	*p*-value	Sig level	Interpretation
SCS	Control	25.83	-10.485	0.000	0.05	Significant
	Experimental	34.57				
SPS	Control	29.23	-7.632	0.000		Significant
	Experimental	35.30				

Table 8 compares the posttest scores of both groups in SCS. The control group attained a posttest mean of 25.83 while the experimental group got a posttest mean of 34.57. Subsequent independent t-test revealed the t-value of -10.485 and the p-value of 0.000, interpreted to be significant at 0.05 significance level. A significant difference was therefore found between those posttest scores in focus. These findings indicate that the subjects of the experimental group achieved higher results in the posttest in SCS compared to the subjects of the control group. The Inquiry-based Approach looks more effective in improving the pupils' achievement in SCS compared to Direct Instruction. It cultivates the pupils in building comprehension and critical thinking skills by facilitating them make their own connections about what they learned towards significant engagement, immersive exploration, and deeper understanding of the Science content. This concurs with the study of Njoroge et al. (2014), which reported that the Inquiry-based Approach produced a significant difference in students' achievement between students in the experimental and control groupings.

Still referring to Table 8, the graphic compares the posttest scores of both groups on SPS. The control group obtained a posttest mean of 29.23 while the experimental group recorded a mean of 35.30. The ensuring independent t-test reported the computed t-value of -7.632, and the p-value of 0.000, interpreted as significant at 0.05 level. This therefore proves the existence of a significant difference between the posttest scores of both groups in SPS. The experimental group performed better in the posttest compared to the control group. In plain wordings, the Inquiry-based Approach is more effective in improving pupils' performance in SPS compared to Direct Instruction. Additionally, it provides the pupils with opportunities to nurture their talents and problem-solving skills as it develops them on how to investigate independently, and it further promotes the process of questioning the concepts and deeper understanding of the process of accomplishing Science performance tasks or standards. This concurs with Prahani et al. (2016), which showed the implementation of the guided inquiry model was effective in improving student's problem-solving skills.

A Comparative Analysis between the Level of Motivation of both Control and Experimental Groups before Experimentation

The ensuing analysis of mean scores of 3.35 and 3.39 showed no significant difference between the levels of motivation of both control and experimental groups. This was validated by the t-value of -0.525 and the p-value 0.602, respectively. This result further shows that both groups have the same level of motivation before the experimentation. In plain wordings, subjects from both groups were similar in terms of their belief of their own ability to accomplish the science activities, their role in building new knowledge based on past experiences and understanding, their determination to comprehend concepts, and their fulfillment on the development of science process skills and 21st Century skills. Bilgin et al. (2015) corroborates these findings.

A Comparative Analysis between the Level of Motivation of both Control and Experimental Groups after Experimentation

Table 9
Difference between the Levels of Motivation for both Groups after Experimentation

Groups	Mean	T	*p*-value	Sig level	Interpretation
Control	3.93	-5.798	0.000	0.05	Significant
Experimental	4.32				

The preceding table aptly compares the level of motivation of both groups after the experimentation. The control group obtained a mean score of 3.93, and the experimental group got a mean of 4.32. The independent t-test shows the computed t-value of -5.798 and the p-value of 0.000, interpreted as significant at 0.05 significance level. In other words, a significant difference was found between the levels of motivation after the experimentation was carried out. Subjects belonging to the experimental group who were subjected to Inquiry-based Approach have increased motivation compared to the subjects of the control group subjected to Direct Instruction. The Inquiry-based Approach appears more effective in enhancing the pupils' motivation towards learning Science.

Conclusion

On hindsight, the purpose of the study was to determine the effects of Inquiry-based Approach on the performance and motivation in Science of Grade 6 pupils of Calatrava I Central School during the Third Quarter of the School Year 2019-2020. At the very outset, the homogeneity of groupings was established first prior to experimentation. A pretest proved that both control and experimental groups were appropriately matched and equivalent in terms of their knowledge and skills before the experimentation was carried out. The ensuing results show the experimental group subjected to Inquiry-based Approach as an intervention getting more success than their counterparts from the control group subjected to Direct Instruction. In other words, Inquiry-based Approach is more effective in improving pupils' achievement in SCPS compared to Direct Instruction. A point worth highlighting is that both experimental and control groups recorded the same level of motivation prior to experimentation. After the experimentation, however, the experimental group registered an increase in motivation compared to the control group. Simply put, that the Inquiry-based Approach appears more effective in enhancing the pupils' motivation towards learning Science. Future experimental research might attempt to broaden its scope on other teaching strategies suitable in science courses or possibly broaden its scope beyond the walls of Calatrava I Central School in Calatrava, Negros Occidental.

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