UTILIZATION OF INQUIRY-BASED APPROACHES IN TEACHING SCIENCE AND ITS EFFECT TO LEARNERS' PERFORMANCE IN GOVERNOR FELICIANO LEVISTE MEMORIAL NATIONAL HIGH SCHOOL

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ABSTRACT

Inquiry-based approaches is one of the five pedagogical approaches prescribed by the K to 12 Basic Education Curriculum. It aimed to ascertain the effectiveness of inquiry-based approaches utilized in teaching Science and its effect on the performance of Grade 10 learners in Governor Feliciano Leviste Memorial National High School at Lemery District, Division of Batangas and was assessed by the teacher and learner-respondents in Academic Year 2018-2019. The study employed descriptive method of research and utilized questionnaire as the main data gathering tool. This study employed 312 Grade 10 learners and 28 science teachers as respondents. Weighted mean, t-test and Pearson's coefficient of correlation were used in the statistical treatment of data. Findings revealed that there were significant differences in the assessments of the teachers and the learners on the utilization of inquiry-based approaches in teaching Science. Moreover, significant relationships of inquiry-based approaches on the performance of learners was observed in understanding and applying scientific knowledge and performing scientific processes and skills while insignificant relationship was reflected on demonstrating scientific attitude and values. Therefore, an action plan was proposed to strengthen and enhance the utilization of inquiry-based approaches in teaching Science which aimed to improve the learners' performance on the existing three domains of learning Science.

Keywords: Inquiry-based, pedagogical approaches, descriptive method, action plan, Philippines

INTRODUCTION

The dynamic changes in the present educational system has brought a lot of implications to the teaching- learning situation. With the implementation of The Enhanced Basic Education Act of 2013 or the K-to-12 Act, established a "universal kindergarten" and introduced Grades 11 and 12 to high school education in public and private schools (Burgonio, 2013 & Republic Act No. 10533, 2013). Until this law's enactment, the Philippines was the only country in Asia and one of only three countries worldwide, together with Angola and Djibouti, with a 10-year pre-university cycle This institutionalizes a system that defies traditional 10-year basic education cycle and truly imbues youth with the skills needed to pursue their dream. Also, pursuant to Republic Act No. 10612 (n.d.) Sec.2 which states that it is important for the State to provide quality science and mathematics teachers at the secondary level, which would encourage more students to pursue careers in science and technology since it is essential for national development and progress. Teachers as deemed by the K to 12 Curriculum need to outcast from the stereotype mode of teaching and take large leaps toward meaningful and applicable knowledge. Science teachers should be equipped and aimed with purposive skills and knowledge in teaching methodologies to further incorporate

appreciation of the lesson. As facilitators of learning, they are charged with the great responsibility and challenge at the same time of incorporating and developing skills and values to the learners that they will need to cope with the demands of today's world. But questions and concerns emerged as time passes by. There is no such thing as one size that fits all. However, there are some pedagogical approaches that can be harnessed to make these things come into reality which is supported by inquiry-based teaching. Curricula reforms involving incorporation of inquiry-based teaching and learning strategy in secondary school science education was implemented around the world according to Akuma & Callaghan (2018). In relation to this, K to 12 Science curriculum was designed around the three domains of learning Science: understanding and applying scientific knowledge in local setting as well as global context whenever possible, performing scientific processes and skills, and developing and demonstrating scientific attitudes and values (Gemelo, 2016). In order to attain these goals, there is a need to facilitate and develop sound educational pedagogy especially the utilization of effective teaching approaches. The idea of inquiry-based approaches is link with the shared responsibility of students and educators in promoting concrete learning experiences. Based on the foregoing premises, the utilization of inquiry-based approaches and how it affects the performance of learners became the basis to pursue this study. It aimed to assess the present status of the above-mentioned approaches in terms of science teaching improvement and successful learning development that may create interest and enthusiasm to both the teachers and learners in the long run.

OBJECTIVES OF THE STUDY

The study was conducted to ascertain the utilization of inquiry-based approaches in the teaching of Science and its effect on the performance of Grade 10 learners in Governor Feliciano Leviste Memorial National High School at Lemery District, Division of Batangas. Also, this study aimed to sought answers to the succeeding objectives: 1) determine effectiveness of teaching strategies under inquiry-based approaches in teaching Science using audio-visual media; demonstration; differentiated instruction; experiment; and question formulation technique. 2) determine the effect on the performance of learners in the domains of learning Science namely: understanding and applying scientific knowledge; performing scientific processes and skills; and demonstrating scientific attitude and values; 3) test the significant difference on the assessment between teacher and learner-respondents regarding the effectiveness of strategies under inquiry-based approaches in teaching Science; 4) test significant relationship between inquiry-based approaches and performance of the learners on domains of learning science; and 5) propose action plan in the utilization of the inquiry-based approaches in Science to enhance and improve furtherly learners' performance.

METHODOLOGY

The study utilized descriptive method of research to find out the effect of inquiry-based approaches in terms of strategies on the performance of Grade 10 learners. This involved a total population of 312 Grade 10 learners enrolled in Governor Feliciano Leviste Memorial National High School and 28 Junior High School Science teachers. Grade 10 learners were randomly selected as respondents, using the sampling procedure by Slovin's formula at five percent margin of error. As for the teacher-respondents, purposive sampling was used because all science teachers were involved. The main data gathering instrument used was a survey questionnaire that focused mainly on inquiry-based approaches in teaching Science. It was made out of the researcher's intensive review of the related literature and studies gathered coupled with books read and online sources. The questionnaire consisted of two parts. Part I covered the strategies used in inquiry-based approaches and Part II included the effects on learners' performance.

The researcher intensively read books, journal, and published theses and surfed over the internet to gather ideas and concepts closely related to the study. Those concepts were used as guide in creating the items needed in the questionnaire. The items were carefully examined to guarantee that it will fit the statement of the problem. The researcher asked the permission from the school heads to validate the questionnaire. The ambiguous terms were changed. It was handed down again to the adviser for final review, then it was finalized and multiplied for distribution to the respondents. In order to analyze and interpret responses, the researcher applied weighted mean, t-test and pearson's coefficient of correlation in the statistical treatment of the data.

RESULTS AND DISCUSSION

1.Strategies used in Inquiry-Based Approaches

1.1 Audio–visual media. Table 1 reflects the use of audio-visual media in teaching Science as viewed by teachers (T) and learners (L). The average weighted mean of 4.79 as composite (C) data suggested that audio-visual media were utilized at a very great extent.

Table 1
Utilization of Audio–Visual Media

Indicators	T	L	C	VI
1. Increases the curiosity and sustain it in lesson presentation	4.93	4.88	4.91	VGE
2. Provides access about newest trends in science	4.87	4.79	4.83	VGE
3. Gets easily the attention of the participants	4.93	4.64	4.78	VGE
4. Integrates new materials and technology in the lesson	4.93	4.59	4.76	VGE
5. Motivates learners to present information in accurate and reliable way	4.67	4.71	4.69	VGE
Average Weighted Mean	**4.87**	**4.72**	**4.79**	**VGE**

This was supported by the weighted mean of 4.91 to a very great extent which claimed that it increased the curiosity and provided access about newest trend in science. Last was the motivation to learners to present information in accurate and reliable way with a mean of 4.69. This was supported by the fact that ICT like audio-visual media for developing inquiry-based science education allowed students to develop more active work styles, improved attitudes towards science, better conceptual and theoretical understanding, improved reasoning, better modelling capabilities and improved teamwork, along with improvements in other abilities. (Rocha Fernandes, Rodrigues, & Ferreira, 2019).

1.2 Demonstration. The assessment of demonstration strategy in teaching science is presented in Table 2. The average weighted mean of 3.47 confirmed that demonstration as strategy was utilized to a moderate extent. Making it easier to explain or put things in perspective and becoming unidirectional and more actively involved in the lesson were the last two indicators with weighted means of 3.16 and 3.07, respectively.

Table 2
Utilization of Demonstration

Indicators	T	L	C	VI
1. Captures much attention in the class	4.03	4.14	4.09	GE
2. Makes it easier to learn the topic than lecture	3.65	4	3.83	GE
3. Gives opportunities to manipulate objects	3.33	3.13	3.23	ME
4. Makes it easier to explain or put things in perspective	3.3	3.02	3.16	ME
5. Becomes unidirectional and more actively involved in the lesson	3.13	3.01	3.07	ME
Average Weighted Mean	**3.49**	**3.46**	**3.47**	**GE**

The findings implied that the trend in Science nowadays was not the typical memorization of facts and principles but rather for the learners to acquire sufficient skills and attitudes that would enable them to cope with the changing world.

1.3 Differentiated instruction. Table 3 shows the utilization of differentiated instruction in teaching science as perceived by the teachers and learners.

Table 3
Utilization of Differentiated Instruction

Indicators	T	L	C	VI
1. Enables learners to engage in meaningful discussions and learn from one another	4.93	4.46	4.70	VGE
2. Develops differentiated lessons that meet every learners' needs	4.7	4.33	4.51	VGE
3. Provides materials that reflect a variety of cultures and home settings	4.5	4.3	4.4	GE
4. Uses rubrics that match and extend learners' varied skills levels	4.0	3.91	3.96	GE
5. Uses different activities which all learners work with the same important understandings and skills	3.77	3.73	3.75	GE
Average Weighted Mean	**4.38**	**4.15**	**4.26**	**GE**

The data revealed that the teachers utilized to a great extent the differentiated instruction in teaching Science which was reflected in the average weighted mean of 4.26. This was further strengthened by the idea of enabling learners to engage in meaningful discussions and learn from one another and developing differentiated lessons that meet every learner's needs.

1.4 Experiment. The extent to which experiment was evaluated by teachers and learners as strategy in teaching science was presented in Table 4.

Table 4
Utilization of Experiment

Indicators	T	L	C	VI
1. Develops a streamlined process for answering questions and collecting data	4.67	4.72	4.69	VGE
2. Requires safety precautions when activity needs to take place in a laboratory	4.87	4.33	4.60	VGE
3. Reads instructions clearly that explain the experiment and the student's role	4.97	4.21	4.59	VGE
4. Encourages learners to make hypothesis about the outcome of the experiment	4.73	4.41	4.57	VGE
5. Guides learners to follow procedures in a systematic way	4.63	4.15	4.39	GE
Average Weighted Mean	**4.77**	**4.36**	**4.57**	**VGE**

The average weighted mean of 4.57 showed that experiment as a strategy in teaching Science was utilized to a very great extent. This finding was strengthened by the revelation of the teachers that they were able to develop a streamlined process for answering questions and collecting data supported by the highest weighted mean of 4.69 at a very great extent level and the disclosure that inquiry-related curiosity was associated with their inquiry abilities, and that the association was mediated by their inquiry-related laboratory engagement (Wu, Kuo, Wu, Jen, & Hsu, 2018) which is the heart of experimentation in Science teaching.

1.5 Question formulation technique. Table 5 manifests the extent of utilization of question formulation technique as perceived by both group of respondents in teaching science.

Table 5
Utilization of Question Formulation Technique

Indicators	T	L	C	VI
1. Ensures the development of high order thinking skill	4.67	4.59	4.63	VGE
2. Facilitates the construction of meaning of questions given	4.7	4.36	4.53	VGE
3. Sharpens the rational power and reasoning ability of learners	4.97	4.04	4.5	VGE
4. Draws out information from learner's experiences and perspectives	4.37	4.14	4.25	GE
5. Enhances the thinking and reasoning ability to come up with realistic solutions	4.47	3.58	4.02	GE
Average Weighted Mean	**4.64**	**4.14**	**4.39**	**GE**

Teachers utilized question formulation technique in teaching Science backed up with average weighted mean of 4.39 to a great extent. This was substantiated by highest weighted mean of 4.63 with the disclosure of the teachers that they ensure the development of higher order thinking skill (HOTS) at very great extent. This means that it posed an assurance in developing HOTS. It was worthy to note that teachers were able to sharpen the rational power and reasoning ability of the learners. This finding implied that it helped learners to transform abstract ideas into concrete ones through development of their reasoning skills.

2. Performance of Learners in the Domains of Learning Science

2.1 Understanding and applying scientific knowledge. The performance of learners in understanding and applying scientific knowledge in Science as assessed by the teachers and learners is presented in Table 6.

Table 6
Performance of Learners in Understanding and Applying Scientific Knowledge

Indicators	T	L	C	VI
1. Find a variety of ways in which they can externally represent their thinking about the topic and arrive at sound and concluding solutions to assigned task	4.67	4.32	4.50	VS
2. See how transferable the new knowledge to real life contexts	4.63	4.31	4.47	S
3. Consider the reasoning used to support their own views and perspectives	4.6	4.23	4.42	S
4. Reinforce concepts taught to deepen understandings about the lesson tackled	4.17	4.6	4.39	S
5. 5.Explain formulated findings through evaluatin and analysis of the data that they collected	4.03	4.1	4.07	S
Average Weighted Mean	**4.42**	**4.31**	**4.37**	**S**

It can be observed that performance of learners in understanding and applying scientific knowledge were satisfactorily assessed as reflected by average weighted mean of 4.37. Moreover, it revealed that learners find a variety of ways in which they can externally represent their thinking about the topic and arrive at sound and concluding solutions to assigned task with a weighted mean of 4.50 and jived with the findings of Oliveira (2010) whereas, student-centered questions prompted longer and more articulated student responses, and encouraged students to conduct authentic investigations. Explaining formulated findings through evaluation and analysis of the data collected, which obtained the lowest mean of 4.47.

2.2 Performing scientific processes and skills. Table 7 shows the extent of the performance of learners in scientific processes and skills in Science as assessed by the two

group of respondents. The average weighted mean of 4.13 revealed that the performance of learners in performing scientific processes and skills was satisfactorily assessed.

Table 7
Performance of Learners in Scientific Processes and Skills

Indicators	T	L	C	VI
1. Gather information using their senses	4.73	4.42	4.58	VS
2. Handle and manipulate materials with care for safety and efficiency	4.47	4.16	4.32	S
3. Look what is to change or be changed when different observations or measurement are made	4.20	4.33	4.27	S
4. Organize data and draw out conclusions from it	4.17	3.85	4.01	S
5. Make "educated guess" based data or information collected regarding an object or phenomena	3.53	3.46	3.50	S
Average Weighted Mean	**4.22**	**4.04**	**4.13**	**S**

First were the learners using their senses to gather information to a very satisfactory level with the highest weighted mean of 4.58. It was followed with weighted means of 4.32 and 4.27 whereas perception that learners looked what was to change or be changed when different observations or measurement were made and handled and manipulated materials with care for safety and efficiency was rated. This conforms with the concept that interpretations of assessment outcomes were largely focused on the demonstration of general science process skills. (Talanquet, Tomanek, & Novodvorsky, 2013) Making "educated guess" based data or information collected regarding an object or phenomena placed last.

2.3 Demonstrating Scientific Attitude and Values. Table 8 manifests the two groups of respondent's perception in terms of demonstrating scientific attitude and values in Science.

Table 8
Performance of Learners in Demonstrating Scientific Attitude and Values

Indicators	T	L	C	VI
1. Challenge formulated conclusion via seeking of further evidence	4.2	4.24	4.22	S
2. Expect challenges on every conclusion and treat every problem with fairness and objectivity	4.03	4.2	4.11	S
3. Review willing fully what they have done in order to consider how it might have been improved	4.2	4.0	4.1	S
4. Realize changes in ideas when better option comes to improve gathered evidence	4.27	3.9	4.08	S
5. Seek spontaneously for alternative ideas rather than accepting the first one which fits the evidence	4.13	3.95	4.04	S
Average Weighted Mean	**4.16**	**4.06**	**4.11**	**S**

Learner-respondents together with the teacher-respondents concurred satisfactorily as deemed by the average weighted mean of 4.11 the performance of learners in demonstrating scientific attitude and values. Among the indicators presented, learners challenging formulated conclusion via seeking of further evidence and expecting challenges on every conclusion and treating every problem with fairness and objectivity with weighted means of 4.22 and 4.11, respectively were verbally interpreted satisfactorily. This was strengthened

by the study of Bernardo, Limjap, Prudente, & Roleda (2008) that the use of grades as feedback in the higher grades, and positive effects and attitudes were the teaching practices that led to low student achievement levels in science. The last indicator that obtained the weighted mean of 4.04 showed satisfactory level wherein learners sought spontaneously for alternative ideas rather than accepting the first one which fitted the evidence.

3. Significant Difference on the Assessment Between Teachers and Learners-Respondents Regarding the Effectiveness of Strategies Under Inquiry-Based Approaches in Teaching Science.

Table 9 manifests the difference on the both group of respondents' assessments on the effectiveness of strategies under inquiry-based approaches in teaching Science

Table 9
Comparison on the Assessment of the Two Group of Respondents on the Effectiveness of Strategies Under Inquiry-Based Approaches in Teaching Science

Variables	AWM	Df	Ct	Tv	Decision
Teachers	4.43				
Learners	4.17	4	3.07	2.78	Rejected

*alpha level<0.05

The posited null hypothesis on the area of comparison was rejected as reflected by the computed t-value (Ct) of 3.07 which was significantly higher compared to the tabular value (Tv) of 2.78 at four degrees of freedom using 0.05 as alpha level. Hence, the data findings implied that the inquiry-based approaches in teaching Science was viewed differently as reflected by the assessment of the teachers and learners. This means that both respondents had their own perception regarding the utilization of inquiry-based approaches.

4. Significant Relationships of Inquiry-based Approaches on the Performance of Learners in the Three Domains of Learning Science.

Table 10 shows the test result on the relationships between the inquiry-based approaches in teaching and the performance of learners in the three domains of learning Science.

Table 10
Relationships of Inquiry-based Approaches in Teaching and the Performance of Learners in the Three Domains of Learning Science

Domains of Learning Science	AWM	Df	Cr	CV	Decision on H_o
1. Understanding and Applying Scientific Knowledge	4.53	8	0.809	0.707	Rejected
2. Performing Scientific Processes and Skills	4.40	8	0.752	0.707	Rejected
3. Demonstrating Scientific Attitude and Values	4.11	8	0.451	0.707	Accepted

*alpha level<0.05

As gleaned on the table, there were significant relationships that existed between the perception of teachers and learners regarding the utilization of inquiry-based approaches and performance of learners in understanding and applying scientific knowledge and performing scientific processes and skills. These were sustained by the computed correlations of 0.809 and 0.752 which was significantly higher the critical value of 0.707 using eight degrees of freedom at 0.05 level of significance thus, the null hypotheses on areas of relationship was rejected. This finding implied that learners' ability to acquire knowledge, processes, and skills in Science were largely depended on the teacher's utilization of inquiry-based approaches. On the other hand, there was no significant relationship on demonstrating scientific attitude and values as supported by the computed correlation of 0.451 which did not meet the tabular value of 0.707 using eight degrees of freedom at 0.05 alpha level, thus, led to the acceptance of hypothesis. This means that the attitude and values of learners toward Science and the utilization of inquiry-based approaches was assessed similarly by the teachers and learners.

This suggested how important the incorporation of values in teaching science was.

5. Proposed Action Plan

With the radical changes imposed in the current curriculum framework, there is a need for proposed action plan to further enhance the utilization of the inquiry-based approaches in Science for improved learners' performance. In order to update and improve teacher's utilization and competence of inquiry-based approaches in teaching Science, there is a need to provide seminars and workshops, and continued professional growth and development for effective utilization and maximization of teaching strategies. Also, the infusion of new technology and preparation of contextualized Daily Lesson Logs (DLLs) and activities may upgrade teaching style as well as having science learning center that shows newest trend in teaching Science. Conducting scheduled classroom observations and demonstration teaching activities in using inquiry-based approaches can also be done. With regard to the improvement of learners' performance in the three domains of learning Science, providing them with varied, localized, and appropriate learning activities and allowing them to organize and participate in Science fairs and alike activities while making use of interactive programs and software in the advent of technology is indeed a great supplement to remediate and enrich their current status. In addition to that, allowing learners to work individually, by pairs, or by group and emphasizing real-life applications in a science activity to value connections between real and abstract ideas, and foster genuine trust and cooperation among each other may help them gain more insights and better learning atmosphere.

CONCLUSION

Based from the results and discussion, the following conclusions were formulated:

1. Utilization of different teaching strategies under inquiry-based approaches are assessed to a great extent. Science teachers give value to the learners' divergent ways of seeking information and facilitated learning using their first-hand knowledge and experience.
2. The three domains of learning Science are assessed satisfactorily by the teachers and learners themselves. The inquiry-based approaches largely help science teachers to improve the learning insights and experiences of their learners.
3. Teachers and learners assess significantly different the effectiveness of strategies under inquiry-based approaches in teaching Science.
4. The teachers' utilization of inquiry-based approaches has significant relationships on the learners' performance in terms of understanding and applying scientific knowledge and performing scientific processes and skills, but no significant relationship on demonstrating scientific attitude and values.
5. A proposed action plan is recommended to further improve and enrich the utilization of inquiry-based approaches in teaching Science towards better achievement of learners' performance in the three domains of learning Science

RECOMMENDATION

The following recommendations were offered by the researcher:

1. Science teachers may continue the development of technical and professional competence in the light of inquiry-based approaches.
2. The school may initiate and develop a varied matrix of learning activities in Science to enhance the learners' performance and ensure total implementation of different teaching strategies under inquiry-based approaches.
3. School heads may conduct scheduled classroom observations and modeled teaching demonstrations to clearly picture

out and gain insight regarding its proper usage.

4. The proposed action plan may be examined, evaluated and executed to further improve and enrich the utilization of inquiry-based approaches and achievement of learners' performance in the three domains of learning Science.

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