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Original Research Article

TEACHER'S TEACHING METHODS AND STUDENT'S ACADEMIC PERFORMANCE IN SCIENCE: BASIS FOR TEACHER'S IN –SERVICE TRAINING PROGRAM

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Abstract

The study was conducted to determine if the strategies being used by science teachers are beneficial in achieving positive outcome in science among the learners. Utilizing descriptive-correlational research design, the study was participated by science teachers and students from a secondary education school in Cavite. Results revealed that the teachers generally use teacher-centered, student-centered, and student-teacher interactive methods with high extent. While their students perform satisfactorily in their science subject, it was found out that the high extent of use of the teacher-centered, student-centered, and student-teacher interactive methods has no significant relationship to their performance in science. The teachers have identified three major problems in utilizing the different methods in teaching science: applying knowledge and content of the subject matter following the spiral progression approach; applying various teaching strategies to develop learners' performance and attitude towards the subject matter; and designing appropriate assessment strategies. To address problems identified by the teachers, an in-service training program has been developed wherein the expected output is a teaching demonstration using a well-crafted lesson plan showing an application of the concepts tackled therein.

Keywords: Science teaching, Spiral model, Basic education, Science education

INTRODUCTION

Science plays an important role in the lives of millions of people throughout the globe. It has changed the trends of human history and has been a contributory factor in shaping the destination of the nation. Science has not only accelerated the face of material progress, it also enables man to enter to a new phase, the age of electronics and wonders of atomic era. According to Lisama (2011), the role of science plays in man's life beyond doubt. He needs a working knowledge of science to find meaning to events that takes place in his body and his environment. Furthermore, man needs science to cope with new development and discoveries.

In view of the fact that every person should have sufficient knowledge in science, it has been integrated in the school curriculum both in basic and higher education; hence, the field science education. Science education aims to instill science content and process with people who are not conventionally considered part of the scientific community. The learners may be children, college students, or adults within the public. The field of science education includes work in science content, science process (The scientific method), some social science, and some teaching pedagogy.

The standards for science education provide expectations for the development of understanding for students through the entire course of their K-12 education and beyond. The traditional subjects included in the standards are physical, life, earth, environmental, and human sciences. There are actually three fields of science education. These are biology education, chemistry education, and physics education. The knowledge content and process in these fields are expected to enable learners to examine the structure and behavior of the physical and natural world through observation and experiment.

Teachers have a very respectable position in the society. Being a teacher is to be a change agent

transforming ideas into ideals and ideals into institutions which may spread the light of knowledge and wisdom into eternity. A competent and committed teacher is in demand for today's revolutionary era. Teacher commitment has been identified as one of the most crucial factors for the success of the education and school. Being a competent and committed teacher means being able to use the appropriate teaching strategy for his or her learners. It is a fact that students come from different backgrounds and have varied experiences and abilities. The use of appropriate teaching strategy is manifested if these concerns are properly addressed. Likewise, the use of appropriate teaching strategy makes the learning experience worthwhile and enjoyable for the learners. This can be attested by good academic outcomes being shown by the students through their performance and written output.

In the Philippine setting, several reforms have been made towards providing greater opportunities for students to realize that science principles studied in class are relevant to everyday life. Through proper classroom instruction, the learners are expected to integrate local and relevant technologies and their environmental impact with science concepts. At present, the school curriculum in science can be summarized as learner-based, multidisciplinary to some EXTENT, and relevant to national developmental goals. It is flexible to suit the separate needs of the college-bound and the students who would drop out of secondary schools in different communities. The curriculum includes the core textbook, which introduces the basic concepts and its relevant applications, and supplementary materials, both theoretical and applied. These features of science education in the Philippine curriculum are quite promising and ideal for the learners. Nevertheless, this can only be properly delivered to the learners if the teachers, as the major source of knowledge in the classroom, will, of course, utilize the suitable teaching strategy. In this study, the strategy of teachers in science teaching will be explored. It will be found out if these strategies indeed aid the learners in achieving positive outcome in science.

The primary purpose of teaching at any level of education is to bring a fundamental change in the learner (Tebabal & Kahssay, 2013). To facilitate the process of knowledge transmission, teachers should apply appropriate teaching methods that best suit specific objectives and level exit outcomes. In the traditional period, many teaching practitioners widely applied teacher-centered methods to impart knowledge to learners comparative to student-centered methods. Until today, questions about the effectiveness of teaching methods on student learning have consistently raised considerable interest in the thematic field of educational research (Hightower et al., 2013). In this study, the strategy of teachers in science teaching will be explored. It will be found out if these strategies indeed aid the learners in achieving positive outcome in science.

Statement of the Purpose

The major focus of the study was to determine if the strategies being used by science teachers are beneficial in achieving positive outcome in science among the learners. Specifically, it aimed to answer the following questions:

What is the participants' extent of utilization about the following teaching methods?

a. Student centered;
b. Teacher centered; and
c. Student-teacher interactive method?

2. What is the level of academic performance of the students in Science?
3. What significant relationship exists between the extent of use of teaching methods and academic performance?
4. What problems are encountered by the teachers in the utilization of different methods of teaching?
5. Based from the findings, what in-service training program may be proposed to improve teacher's teaching method and student's academic performance.

METHODOLOGY

Research Design

Descriptive-correlational research design was used in the study. In here, the students' performance in science was determined based on the teaching methods being employed by their teachers. The performance of each class was compared with one another to resort to a training program that would aim to address issues relating to teaching methodologies in science in order to subsequently increase students' performance in the said subject.

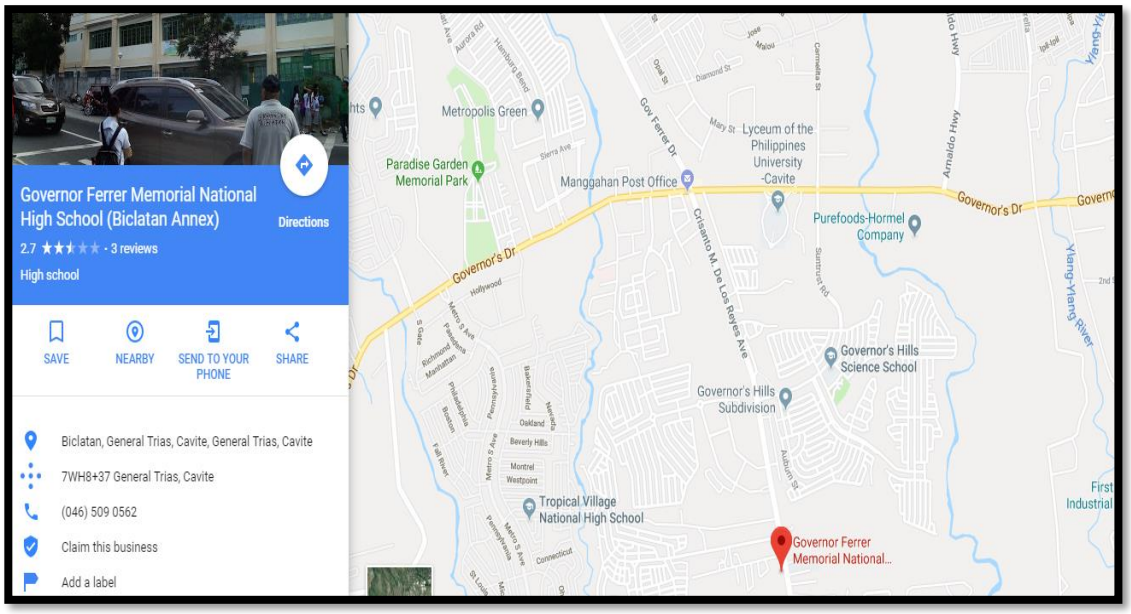
Locale of the Study

The study was conducted in Governor Ferrer Memorial National High School – Biclatan Annex. The school is located at Biclatan, City of General Trias, Cavite along Crisanto M. delos Reyes Ave (Figure-2). It is currently under the direct supervision of the newly established City Schools Division of General Trias.

As per records, the school was founded in 1968 with Lucio Nocon Community High School as its initial name. With a student population of more than 3,000, the school is catering seven barangays of the city. The school does not only offer quality instruction amongst its students. It likewise serves as a channel for the students to avail health and guidance and counseling services, which are necessary for their growth and development.

Having been surrounded with various commercial and business establishments and other types of institutions, Governor Ferrer Memorial National High School – Biclatan Annex has established linkages which

effectively aid it in delivering the necessary kinds of services its students deserve.



Source: Google Maps

Figure-2: Location map of Governor Ferrer Memorial National High School – Biclatan Annex

Participants of the Study

The teachers, regardless of their field of specialization, who are handling science subjects in Governor Ferrero Memorial National High School-Biclatan Annex were invited to be the participants of the study. Their approval to participate in the study was first sought before administering the questionnaire.

Samples and Sampling Technique Used

This study involved nine teachers in secondary level who are handling science and 20 percent of each section from Grade Seven to Ten in Governor Ferrer Memorial National High School – Biclatan Annex during the school year 2018 -2019.

Convenience sampling was used to identify the teachers who participated in the study. Random sampling, on the other hand, was used to determine the students whose grades in science were used in the study. In doing so, all willing science teachers in Governor Ferrer Memorial National High School- Biclatan Annex were automatically included to participate in the study.

Research Instrument

A researcher-made questionnaire anchoring on the theoretical framework of the study was used in the research. The questionnaire was composed of relevant statements that endeavored to assess teachers' extent of using different methods in handling their science class.

The devised questionnaires had been be pre-tested before it was finally utilized in the actual data gathering procedure to ensure its validity and reliability to the study.

The following instruments were used:

1. **Questionnaire.** It contains the assessment of respondents on their teaching method used in Science. The questionnaire consists of the Student- Centered Methods, Teacher- Centered Methods and Teacher-Student Interactive Methods

Scoring Guide for the Effectiveness of Teacher's teaching Strategies

Numerical weight	Numerical Range of scores	Response Scale	Descriptive Level
5	4.50- 5.00	Always	Very High Extent
4	3.50- 4.49	Often	High Extent
3	2.50- 3.49	Sometimes	Moderately High Extent
2	1.50- 2.49	Rarely	Low Extent
1	1.00- 1.49	Almost Never	Very Low Extent

The descriptive levels are explained below:

a. **Very High Extent**– When the teacher's teaching strategies are effective 95 % to student's academic achievement in Science

b**. High Extent** – When the teacher's teaching strategies are effective 90 % to academic achievement in Science

c. **Moderately High Extent** - When the teacher's teaching strategies are effective 85 % to academic achievement in Science

d. **Low Extent** - When the teacher's teaching strategies are effective 80 % to academic achievement in Science

e. **Very Low Extent** – When the teacher's teaching strategies are not effective 75 % to academic achievement in Science **Procedure**

A letter of request addressed to the school head from which the participants was secured to ask for permission for the conduct of this research in their respective school. Upon their approval, appropriate coordination was made with the participants.

To describe the participants' teaching method, they were asked to answer the prepared questionnaire. The participants were informed that the completed questionnaire would be collected one week after its distribution, so they would have ample time to read its content and supply the needed information.

To determine the participants' students' performance in science, their performance during the first and second quarter was reviewed and noted.

As soon as the questionnaires had been collected, the raw data were arranged and then encoded in a prepared database ready for statistical analysis.

Statistical Analysis

The following statistical tools were used to analyze the data gathered in the Study.

1**. Frequency and Percentage Distribution** – Used to determine the percentage for data on profile.

2. Weighted mean – Used to get the average or central value

3. **Standard Deviation** - Measures the dispersion of a dataset relative to its mean and is calculated as the square root of the variance. It is calculated as the square root of variance by determining the variation between each data point relative to the mean.

4. **Pearson R Correlation**– This was used in determining the significance of relationship of the variables.

RESULTS AND DISCUSSION:

This chapter presents the result of the thorough analysis done on the data obtained from this study. It shows the extent of teachers' use of different teaching methods and their students' academic performance. The problems encountered by teachers in teaching science were also identified in this chapter as well as a proposed solution to address each.

Teachers' Extent of Use of Different Teaching Methods

Teaching method is a set of principles, concepts, and techniques that enable learners to learn the subject matter being taught by their teacher. These are determined partly on subject matter to be taught and partly by the nature of the learner. For a particular teaching method to be appropriate and efficient it has to be in relation with the characteristic of the learner and the type of learning it is supposed to bring about (de Young, 2015). In this study, the teachers' extent of using different teaching methods in their science class was determined. Specifically, these teaching methods are the following: teacher-centered, student-centered, and teacher-student interaction methods. The succeeding tables (Tables 1, 2, and 3) show the participants' extent of using the abovementioned methods in conducting their science class.

Table-1: Science teachers' extent of use of student-centered method

Statement	Weighted Mean	Descriptive Level	Rank
I engage my students in **the hard, messy work of learning.**	2.22	Low Extent	11
I teach students how to think, solve problems, evaluate evidence, analyze arguments, generate hypotheses.	2.67	Moderate Extent	10
I encourage students to reflect on what they are learning and how they are learning it.	4.33	High Extent	2.5
I include assignment components in which students reflect, analyze and critique what they are learning and how they are learning it.	3.67	High Extent	7
I let students set assignment deadlines within a given time window.	2.78	Moderately Extent	9
I recognize that students can learn from and with each other.	4.22	High Extent	4.5
I establish a classroom that develops structures that promote shared commitments to learning.	4.33	High Extent	2.5
I challenge student assumptions about learning and encourage my students to accept responsibility for decisions they make about learning; like how they study for exams, when they do assigned reading, whether they revise their writing or check their answers	4.22	High Extent	4.5
I encourage students to learn on their own to give them independence and make their own decisions.	4.78	High Extent	1
I make students aware of themselves as learners and to make learning skills something students want to develop.	3.11	Moderately High Extent	8
I devote less time for lecturing to give more time for student discussion.	4.00	High Extent	6

Overall weighted mean = 3.67 (High Extent) SD = 2.65

Table-1 shows the extent on how the teachers use the student-centered method in teaching science. With an overall weighted mean of 3.67, findings show that the participants use this method at a high extent. Nevertheless, the varying responses in the table imply that they use the method in different means. With the highest mean of 4.78 (high extent), the data show that the teachers use the student-centered method in terms of encouraging them to learn on their own to give them independence and make their own decisions. On the other hand, the teachers are less likely to use this method by engaging their students in the hard and messy work of learning. Through the student-centered method, students are encouraged to direct their own learning and to work with other students on research projects and assignments that are both culturally and socially relevant to them. Students become self-confident, self-directed, and proactive. The teacher's primary role is to coach and facilitate student learning and overall comprehension of material, and to measure student learning through both formal and informal forms of assessment, like group projects, student portfolios, and class participation. In the student-centered classroom, teaching and assessment are connected because student learning is continuously measured during teacher instruction. According to Teach Thought Staff (2017), teaching strategies under this method include case study, laboratory experiments, brain storming, group presentation, role play, and group discussions.

According to Monte mayor (2018), the student-center method of teaching is the method prescribed by the Department of Education (DepEd) to be used in each classroom in the basic education institutions nationwide. This is because of DepEd's aim of instilling among its learners the 21st Century skills that they should know as learn for them to cope with the dynamic environment they are dwelling in. In response to this, teachers are expected to be adept enough in using this method and be able to craft lesson plans that are perfected towards promoting a learner-centered approach.

Table-2: Science teachers' extent of use of teacher-centered method

Statement	Weighted Mean	Descriptive Level	Rank
I prefer more theoretical methods of teaching concepts to my students	3.89	High extent	6.5
I tend to maximize my class hours on delivering the necessary information and concepts that my students have to learn.	3.89	High extent	6.5
I direct all classroom activities to ensure that my students do not an important topic.	3.78	High extent	8
I generally formulate the rules and policies that guide students' actions and behaviors in my classroom.	4.44	High extent	1.5
I usually do the talking in my classroom while my students listen and take note of the information I am feeding them.	4.00	High extent	4.5
I engage my students of memorization while I do the questioning, reviewing, and discussion of the topics.	3.56	High extent	9
I directly manage the pace and sequence of knowledge sharing in the classroom.	4.00	High extent	4.5
I value the information that my students may get from the topics more than their engagements on the subject matter.	4.11	High extent	3
I give my students less responsibility in my classroom since I serve as the major source of instruction.	3.44	Moderately High Extent	10
I use teaching aids to gain and retain my students' attention.	4.44	High extent	1.5

General weighted mean = 3.96 (High Extent) SD = 2.51

In terms of using the teacher-centered method, findings (Table 2) show that the participants generally use it with high extent, as shown by the general weighted mean (3.96) and the almost consistent 'high extent' rating of the participants in the statements presented above. It is likewise interesting to note that the teachers' top practices in connection to using the teacher-centered method are formulating the rules and policies that guide students' actions and behaviors in my classroom (Weighted Mean = 4.44, high extent) and using teaching aids to gain and retain students' attention (Weighted Mean = 4.44, high extent). The least rated practice in using teacher-centered method, however, is giving students less responsibility in my classroom since I serve as the major source of instruction (Weighted Mean = 4.44, high extent). According to de Young (2015), teacher-centered methods are also known as the traditional methods of teaching. In here, teachers are the main authority figure while the students are viewed as "empty vessels" who passively receive knowledge from their teachers through lectures and direct instruction, with an end goal of positive results from testing and assessment. In this style, teaching and assessment are viewed as two separate entities; student learning is measured through objectively scored tests and assessments.

While student-centered method is the one that is being prescribed by the Department Education to be used in every classroom, many teachers still cling to the traditional method, as what is exemplified by the above results. While learner-centered approach allows learners to learn important communicative and collaborative skills through group work, it is not found to be effective for students who prefer to work alone (Rom, 2018). Saputra (2015) also added that instead of using the learner-centered approach, teachers utilize the teacher-centered method to ensure that orderly is maintained in the classroom and that the students do not miss any detail in the subject matter being tackled.

Student-teacher interactive method involves not the teacher and the student in the learning process. Unlike a traditional teaching method oriented on the teacher whose main function is to assist learners and facilitate, interactive learning focuses on students' needs, abilities, and interests. While in a traditional approach, the teacher is the center of the learning process and learners are passive and only receive information, in an interactive system, the teacher and the learner swap their traditional roles enabling the learner to actively engage in the learning process and be the center of the classroom. Based on his knowledge and experience, learners categorize, analyze, assume opinions, acquire new skills, and develop their attitudes towards facts and events (Dgebuadze & Giordze, 2017). According to The Room 241 Team of Concordia University (2017), student-teacher interactive method includes the following strategies: think, pair, and share; buzz sessions; brainstorming; and Q&A sessions.

Table-3: Science teachers' extent of use of student-teacher interactive method

Statement	Weighted Mean	Descriptive Level	Rank
I encourage two-way communication between me and my students in my class.	4.44	High Extent	1.5
I tend to provide some information for my students while they will be the ones to process it through some activities.	4.44	High Extent	1.5
I minimize lecturing by peppering students with questions, asking the next question in a way that guides the conversation toward a learning outcome that was desired from the beginning.	4.11	High Extent	6
I allow students to ask me questions which enables me to answer in such a way as to post another question immediately but also drive the next student question in a certain direction.	4.22	High Extent	4.5
I start my class by showing something that would provoke discussion and exchange of ideas in class.	3.78	High Extent	8
I pepper my students with questions, always asking the next question in a way that guides the conversation toward a learning outcome that was desired from the beginning.	4.00	High Extent	7
I tend to give instructions to my students that would allow them to have hands-on experience on the topic being tackled.	4.33	High Extent	3
I make each class more of a conversation with my students while ensuring that they meet the learning outcome for that session.	4.22	Moderately High Extent	4.5

General weighted mean = 4.19 SD= 2.66

The participants' extent of using student-teacher interactive method is found to be similar to their extent of using the teacher-centered method (Table 3). The participants generally use this method with high extent (General Weighted Mean = 4.19, high extent) with encouraging two-way communication between me and my students in my class (Weighted Mean = 4.44, high extent) and providing some information to students to enable them to process it through some activities (Weighted Mean = 4.44, high extent). The least practiced strategy in this method is starting the class by showing something that would provoke discussion and exchange of ideas (Weighted Mean = 3.78, high extent).

Table-4: Ranking of the teaching methods in terms of the teachers' extent of use

Method	Weighted Mean	Descriptive Level	Rank
Student-Centered Methods	3.666	High extent	3
Teacher-Centered Methods	3.955	High extent	2
Teacher-Student Interactive Methods	4.192	High extent	1

Summing up the findings in Tables-1, 2, and 3, Table-4 shows the ranking in the teaching methods in terms of the teacher's extent of use. It is shown that teacher-student interactive method is the most widely used method while the least widely used is the student-centered method. This simply implies that while the Department of Education advocates the use of the student-centered method in classroom instruction, the participants still find the vital role of the teacher in catalyzing learning among the learners. With the student-teacher interactive method, students learn to collaboratively work with other students and develop their critical thinking skills. At the same time, teachers can ensure that they minimize the details that they might miss regarding the content of the subject matter they are tackling to their students. Also, they can maintain order in the classroom while the class is going on.

Students' Level of Performance in Science

In the current basic education curriculum being implemented by the Department of Education, the spiral approach is being used in the teaching of science and mathematics. Smith (2016) cited that spiral curriculum is an approach to education that introduces key concepts to students at a young age and covers these concepts repeatedly, with increasing degrees of complexity. This approach is also known as a "spaced" or "distributed" approach. It contrasts with "blocked" or "massed" curricula, which do not introduce difficult concepts until the student has reached a higher level of education.

In the result below (Table-4), the academic performance of the students in science, summarized as mean grade per class, is presented after being handled by their respective teachers using the spiral approach.

Table-5: Students' level of performance in science

Teacher	Mean Grade	SD	Interpretation
A	81	4.6	Satisfactory
B	82	5.2	Satisfactory
C	82	4.85	Satisfactory
D	82	4.22	Satisfactory
E	81	3.21	Satisfactory
F	82	4.43	Satisfactory
G	82	4.82	Satisfactory
H	81	3.52	Satisfactory
I	81	3.88	Satisfactory
Overall Mean	82	0.49	Satisfactory

Based on how the result was presented in Table-5, the mean grade of all the students handled by each teacher was computed to determine their general performance in science. Data show that all classes generally performed satisfactorily in their science subject under the instruction of their respective science teachers using the spiral approach. These findings, however, imply high variation in the grade of each class member as shown by the standard deviation value.

The satisfactory performance of the students in their science class suggests that there are still a lot that must be done to improve their literacy in the said subject. As cited by Akhareem and Hossain (2012), the quality of students is considered a determinant of quality education. According to them, an institution promotes high quality of education if majority of its students can achieve outstanding performance in each subject area. The performance of the students, however, is influenced by the school environment, teachers, and the curriculum (Arnon & Reichel, 2017).

Relationship between the Teachers' Extent of Use of Different Teaching Methods and their Students' Level of Performance in Science

The poor academic performance by majority of the students in various subject areas is basically linked to the application of ineffective teaching methods by teachers to impact knowledge to learners and therefore, teachers need to be conversant with numerous teaching strategies (Adunola, 2014). In view of this notion, this part of the study attempted to determine if the extent of use of different teaching methods in science significantly relates to the academic performance of the students in the research locale.

Table-6: Relationship between the teachers' extent of use of different teaching methods and their students' level of performance in science

Teaching Method	R-value	P-value*	Decision
Student-centered	0.227	0.82	No Significant Relationship
Teacher-centered	0.303	0.34	No Significant Relationship
Student-teacher Interactive Method	0.617	0.14	No Significant Relationship

*significant if $\alpha = 0.05$

In this study, the claim of Adunola (2014) has been negated. Table-6 shows that the extent of use of different teaching methods has no relationship to how well the students perform in the science class. The R-values imply that the extent of use of the three teaching methods possibly have a direct relationship to the students' academic performance. This means that the students' academic performance in science may increase if the teachers use the teaching methods at a higher extent. Nevertheless, the p-values, which are all greater than five percent falsifies this possible relationship. This clearly claims that aside from the teaching method, there are some other factors that influence students' performance in their science subject. Majo (2016) identified other factors that should be taken into consideration, which include number of teachers, adequacy of learning materials, and students' attitude towards their science subject. Considering this claim then suggests that the participants may also review if the learning materials being used in their class are relevant and sufficient. They should also ensure that they execute strategies that would sustain their students' interest in class regardless of the teaching method they are utilizing.

Problems Encountered by Teachers in Utilizing the Different Methods of Teaching

The problems encountered by the teachers in utilizing the different teaching methods, i.e., teacher-

centered, student-centered, and student-teacher interactive methods, were also identified in the study. This was done to identify some schemes and measures that can be instrumental in enhancing the students' academic performance in science by empowering their teachers as facilitators of learning. Table-7 summarizes the major problems encountered by the teachers. They have identified three major problems: applying knowledge and content of the subject matter following the spiral progression approach; applying various teaching strategies to develop learners' performance and attitude towards the subject matter; and designing appropriate assessment strategies.

Table-7: Problems encountered by teachers in utilizing the different methods of teaching

Problems Encountered	Rank
Applying knowledge and content of the subject matter following the spiral progression approach	1
Applying various teaching strategies to develop learners' performance and attitude towards the subject matter	2
Designing appropriate assessment strategies	3

Based from the results (Table-7), applying knowledge and content of the subject matter following the spiral progression approach is the most perceived problem by the teacher participants. According to them, they have insufficient training on using this approach. Likewise, they also believe that there is unequal distribution of teacher specialists per branch field and per quarter. According to Dig-dino (2018), as cited by Montemayor (2018), there is no need for teacher specialists in the junior high school if the spiral approach will be properly followed. Thus, the said problem can be addressed if the teachers will be adequately adept on utilizing the spiral approach and be familiar on the contents of the topics designed by the curriculum guides in science across grade levels.

The second identified problem is on applying various teaching strategies to develop learners' performance and attitude towards the subject matter. This finding concurs with the claim of Majo (2016) which states that students' attitude towards science influences their academic performance in the said subject area. In this connection, science teachers should be knowledgeable of strategies in class that can more effectively positivize their learners' attitude towards their subject.

On designing appropriate assessment strategies for the learners is another problem identified by the research participants. According to them, they do not find their learners' mastery of the topic evident with the assessment strategies they use. Likewise, they observed that many students hardly reach the standards set by the assessment tool they use in class, which is supported by their poor academic performance. According to Hamlin (2016), an assessment tool should be useful, targeted, and sustainable. Mentioning these, teachers are anticipated to be knowledgeable enough of different and appropriate assessment tools that would fit the needs and personality of the learners and, as well, extract the accurate information pertaining to their progress in class.

Proposed Program towards Enhancing Students' Level of Performance in Science

The data gathered in this study entail that teachers generally utilize a variety of teaching methods, which are student-centered, teacher-centered, and student-teacher interaction. Nevertheless, they appear to prefer methods which still employ teachers as the key players in the classroom. Amidst the situation, the teachers still perceive some problems in teaching science. This includes applying knowledge and content of the subject matter following the spiral progression approach, applying various teaching strategies to develop learners' performance and attitude towards the subject matter, and designing appropriate assessment strategies. This therefore results to students' performance which generally remains just satisfactory, which is anticipated to be outstanding. To address the problems encountered by teachers with the aim of improving students' academic performance in science, an in-service training (INSET) program is hereby formulated in the study (Table 8).

As shown in Table 8, the proposed INSET program will generally aim to enable teachers to utilize various teaching strategies across the different methods (teacher-centered, student-centered, and student-teacher interactive methods) to ensure that the students' achievement in science will be improved. Likewise, the program endeavors to identify and standardize valid assessment tools appropriate in determining students' learning for a given learning competency in science. The program targets to enable the teachers to try the other practices that they seldom apply under each teaching method.

These practices include the following:

Student-centered Method

Teaching students how to think, solve problems, evaluate evidence, analyze arguments, and generate hypotheses

Letting students set assignment deadlines within a given time window

Engaging students in the hard and messy work of learning

Teacher-centered Method

Giving students less responsibility in the classroom since the teacher serves as the source of instruction

Since the Department of Education highly prescribes the use of student-centered method despite being the least utilized teaching method by the participants, greater emphasis will be accrued to it.

The INSET program will be held year-round to ensure continuity of learning among the teachers and provide a series of monitoring and evaluation with regard to the progress of the program. It will be ensured that the set activities will not interrupt classes hence; proper scheduling of activities should be done. It will focus on three areas of concern: teaching strategies using the spiral approach, motivational activities for learners, and assessment methods in science teaching. With this program, teachers are expected to gain a better understanding of the spiral approach in teaching science and be able to apply it to improve their students' academic performance in science. Students' academic performance does not rely alone on the method used by the teacher. The teacher should likewise promote a motivating learning environment while using an appropriate assessment tool for each activity in class. Hence, it is likewise anticipated that through the designed program, the teachers will be more adept on various motivating activities and assessment methods in teaching.

The expected outputs in this program are lesson plans developed by the teachers that apply the spiral approach in teaching science while applying the student-centered approach. Through this, the students' academic performance is expected to consequently upgrade from satisfactory to very satisfactory rating. This, of course, will be derived using appropriate assessment tools that are carefully aligned with the learning competencies set in each grade level.

Table-8: Proposed INSET program for the science teachers

Area	Objectives	Activities	Timeframe	Person Involved	Source of Fund	Expected Outcome	Success Indicator
Applying knowledge and content of the subject matter following the spiral progression approach	Define spiral approach in teaching science Propose a lesson plan utilizing the spiral approach Execute the proposed lesson plan in a teaching demonstration	Conduct in-service training for teachers Regular provision of technical assistance by the learning leaders Conduct of regular learning action cell (LAC) sessions Participation in various seminars and conferences concerning pedagogy	Year-round	School Head Master Teachers Teachers	School MOOE Personal Fund	Teacher's clear and operational knowledge on spiral approach Crafted lesson plan properly integrating the spiral approach Students' better academic performance in science	80% of teacher's crafted lessons employ student-centered method
Applying various teaching strategies to develop learners' performance and attitude towards the subject matter	Identify different motivational strategies in science teaching across grade levels Propose a lesson plan with emphasis on motivating students' participation and learning in a science class Execute the					Teacher's improved skill on promoting a motivating leaning environment for the learners	At least 80% of the learners obtain very satisfactory rating in their science class performance

	proposed lesson plan in a teaching demonstration						
Designing appropriate assessment strategies	Identify assessment methods in science teaching across grade levels Propose a lesson plan with emphasis on using appropriate and valid assessment methods in a science class Execute the proposed lesson plan in a teaching demonstration					A more appropriate and valid assessment tool for each task in science Better academic performance in science	80% of teachers' crafted lesson plans utilize valid assessment tools aligned to the learning competencies and responsive to the students' intellectual and developmental capacity

CONCLUSIONS

In light of the results found in the study, the following conclusions are formulated:

The teachers generally use teacher-centered, student-centered, and student-teacher interactive methods with high extent in teaching science.

The students perform satisfactorily in their science subject.

The teachers' high extent of use of the teacher-centered, student-centered, and student-teacher interactive methods has no significant relationship to the students' satisfactory performance in science.

The teachers have identified three major problems in utilizing the different methods in teaching science: applying knowledge and content of the subject matter following the spiral progression approach; applying various teaching strategies to develop learners' performance and attitude towards the subject matter; and designing appropriate assessment strategies.

To address problems identified by the teachers, an in-service training program has been developed wherein the expected output is a teaching demonstration using a well-crafted lesson plan showing an application of the concepts tackled therein.

RECOMMENDATIONS

Based from the identified limitations and findings of the study, the following are hereby recommended:

Aside from conducting and in-service training for teacher, the school leaders should likewise a provide a regular technical assistance and learning action cell (LAC) sessions to their teachers to ensure that they are properly practicing the spiral approach in their respective classes.

A similar research may be conducted determining the relationship of teaching method to the academic performance of students n other learning areas.

Further research studies may be conducted to explore other factors that affect the academic performance of students in science.

An intervention program may be developed for the students with the aim of improving their academic performance.

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