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Inquiry-Based Learning As A Strategy in Teaching Earth and Life Science Among Grade 11 Learners

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Abstract— The main concern of this study was to determine the effectiveness of using Inquiry-Based Learning as a strategy in teaching Earth and Life Science among Grade 11 learners. There were two groups consisting of (30) Grade 11 learners in each group. The control group was taught Earth and Life Science using the traditional method and the experimental group was taught using the Inquiry-Based Learning Approach. Frequency, percentage and t-test were used to analyze data at 0.05 level of significance. The results showed that both groups are equivalent on their prior knowledge in Earth and Life Science at the start of the study. T-test results also revealed that both the traditional method and the Inquiry-Based Learning Approach are effective in teaching Earth and Life Science among Grade 11 learners however those learners who were taught using Inquiry-Based Learning Approach obtained a significantly higher mean gain scores. These results led to the conclusion that integrating Inquiry-Based Learning Approach is more efficient and effective method of instruction in teaching Earth and Life Science than using the lecture method alone.

Keywords—Inquiry-Based Learning, Earth and Life Science, Senior High School Learners, Teaching Strategy

I. INTRODUCTION

In the advent of technology and fast-changing economy, everything evolves at a rapid speed. Lecture method has changed as well to meet the demands of the 21st-century learners. And as traditional teaching styles evolve with the emergence of differentiated instruction and different learning approaches, more and more teachers are adopting and adjusting their approach based on their student's learning styles. Every teacher has his/her teaching styles however no one teaching strategy applies to all types of learners thus teachers must be flexible enough and be sensitive to the needs of his/her learners.

Inquiry-based learning is a pedagogy that enables the learners in experiencing the processes of knowledge creation and learn through inquiry. It is a student-centered approach which allows learners to learn at their own pace. In this type of strategy, learners will develop their research skills and eventually will become life-long learners. It makes the learners' questions, ideas and observations being the center of the learning process. Inquiry-based learning could enhance student engagement, academic achievement, and development of higher-order thinking skills [1].

Various studies have been conducted on the effectiveness of employing inquiry-based learning to learners and it has shown that learners who were instructed through inquiry-based learning have higher score compared to those taught using the lecture method [2].

Teaching science education is not an easy task for a science teacher. It requires hard work, dedication, long study hours and mastery of the concepts to be presented.

In 2003, the Philippines participated in the Trends in International Mathematics and Science Study (TIMSS) together with the 44 countries focusing on Grade 8 students. The data gathered from 6,917 Grade 8 students from 137 schools in sixteen (16) regions were analyzed. Based on the results, the Philippines average score was significantly lower compared to the International Average of 474 however the Philippines average TIMSS score in 2003 was significantly higher by 32 points compared from the 1999 results of Grade 7 students. Majority of the students (90%) have a positive attitude towards learning science. Students having hands-on activities had a higher mean score compared to the one who experienced traditional science activities. The student's content area achievement revealed that students got the highest mean score for Environmental Science followed by Life Science and lowest for Chemistry and Physics.

In the current status of science education, teaching science subjects must incorporate contemporary teaching/learning methods which reduce the gap between the knowledge taught in school and those obtained from different

information sources [3]. With this, it is essential to look for an innovative teaching/learning methods and approaches that are more effective in science education and could increase the learners' participation and motivation making it fun and rewarding.

For these reasons, the researcher wanted to investigate the effectiveness of employing Inquiry-Based Learning strategy in teaching Earth and Life Science among Grade 11 learners.

II. RELATED WORK

Numerous research findings have shown that with the use of Inquiry-Based Learning learners increased their critical thinking skills, have higher levels of motivation and engagement and more retention on the content presented [4]. It also resulted to better development of learners' scientific ability compared to traditional method of teaching [5].

Employing inquiry-based science teaching could contribute learners' motivation regardless of the different learning styles they possess in learning science [6]. It was also revealed that Inquiry-Based Learning significantly increases the learners' science process skills and attitudes [7].

On the teachers' hindsight on Inquiry-Based Learning in science, the findings showed that there are several constraints in the implementation of Inquiry-Based Learning in classrooms namely time management, curriculum, learners' prior knowledge, motivation, physical classroom size, limited resources, good search engine as well as authentic and effective assessment [8].

It is also believed that learners being taught using inquiry-based method scored significantly higher, and there was a significant improvement in their achievement test and appropriate training for the teacher is required for better implementation of Inquiry-Based Learning in the classroom have been suggested [9].

In the context of holistic development, Inquiry-Based Learning develops not only the intellectual abilities of the learners but also their emotions, skills, and confidence [10] Furthermore, inquiry-based instruction is seen to be effective in the development of learners' prior knowledge and reading abilities and significantly associated to conceptual development [11] and developing activity set supported by guided activities anchored with the inquiry-based learning approach has significant effects in developing learner's critical thinking skills in the science subject [12].

On the other hand, metacognition also increases the effectiveness of inquiry-based science education. Metacognition along with disciplinary inquiry has a great effect in teaching scientific process and thoughts because students develop their critical thinking and are becoming more scientifically literate [13].

Based on the reported findings, Inquiry-Based Learning doesn't only benefit the learners but the teachers as well particularly in developing teacher self-efficacy and the openness of teacher towards Inquiry-Based Learning is the key in using it as the method of teaching in the classroom [14].

A. Research Questions

This study was conducted to determine the effectiveness of Inquiry-Based Learning Approach as a strategy in teaching Earth and Life science among Grade 11 learners. It aimed to answer the following questions:

1. Is there a significant difference in the mean pre-test scores of the control group and the experimental group in Earth and Life Science?
2. Is there a significant difference in the pre-test and posttest scores in Earth and Life Science under the experimental group?
3. Is there a significant difference in the pre-test and posttest scores in Earth and Life Science under the control group?
4. Is there a significant difference in the mean gain scores in Earth and Life Science between the experimental group and the control group?

III. METHODOLOGY

A. Research Design

This study employed the quasi-experimental research design on the effect of Inquiry-Based Learning in the academic performance of Grade 11 learners in Earth and Life Science. A set of pre-test and posttest questionnaires were used as the primary tool in data gathering and was given to both the experimental and control group.

B. Respondents

A total of sixty (60) Grade 11 learners from the two (2) sections in Bawing National High School, Sequel, General Santos City were asked to participate in the study. Two classes were used in the study. One class was designated as the control group, and the other class was the experimental group. The selection as to what group of learners constituted the experimental and control group made through tossing of coin wherein the two sections are intact so that both the experimental and control group have an equal chance of being selected. The head of the coin was the experimental group and the tail was the control group.

C. Data tools and procedures

This study used three (3) instruments namely the Table of Specifications (TOS), the Pretest and Posttest in Earth and Life Science and the Lesson Plans. The table of specifications in this study determined the content validity of the pretest and posttest administered to the Grade 11 learners. The pretest and posttest of this study adopted from the unified examination of the Division of General Santos City concerning the K-12 curriculum. The appropriateness of the instrument was checked based on the Table of Specifications (TOS). The thirty-five (35)

item test was distributed into 60% for easy questions, 30% for average questions and 10% for difficult questions.

The experimental group consisted of thirty (30) learners and the control group consisted of thirty (30) learners as well were given sixty (60) minutes to answer the pretest. The pretest consisted of thirty-five (35) multiple choice items. The test covered the following: Origin and Structure of the Earth which comprises the following content standard: Universe and Solar System, Earth and Earth Systems. Earth Materials and Processes which comprised the following content standard: Minerals and Rocks, Exogenic and Endogenic Processes, Deformation of the Crust and History of the Earth. After that, they were taught daily using the 5E Model of Inquiry-Based Science Instruction by Bybee et al. (2006) and using the traditional chalk and board method. The Earth and Life Science classes were done for 1 hour every day from 8:00 am until 9:00 am for the experimental group and 10:20 am to 11:20 am for the control group, Mondays to Fridays for 8 weeks and posttest of the same content and number as the pretest was administered after covering all the topics included in the study. The researchers documented the result for data analysis.

D. Data Analysis

Quantitave data were analyzed using the Statistical Package for Social Science (SPSS). Frequency, percentage and t-test were used to analyze data at 0.05 level of significance. The t-test for independent samples was used to determine the significant difference between the pre-test and posttest scores of the experimental and control group. The t-test for dependent samples was used to determine the significant difference between the pre-test and posttest scores of the experimental group. To determine if there was a significant difference between the pre-test and posttest scores of the control group, t-test for dependent samples was used and to determine if there was a significant difference between in the mean gain scores of the experimental and the control groups, t-test for independent samples was used. All tests were done at 0.05 level of significance.

IV. Results and Discussion

A. Performance of the Grade 11 Learners in Earth and Life Science at the Start of the Study

Table 1 Academic performance of Grade 11 Learners in Earth and Life Science at the Start of the Study

Performance in Earth and Life Science (based on pre-test scores)	Frequency	Percentage	Description
29-35	0	0%	Very Good
22-28	0	0%	Good
15-21	16	26.7%	Fair
8-14	37	61.6%	Poor
0-7	7	11.7%	Very Poor
Over-all Mean Score:		12.00	Poor

Table 1 shows the academic performance of Grade 11 learners at the start of the study. As shown, 37 of the Grade 11 learners got the score ranging from 8-14 in the pre-test wherein their Earth and Life Science academic performance is considered **Poor**. This was followed by 16 Grade 11 learners who got a scores ranging from 15-21 out of 35 correct answers. These learners' academic performance was considered **Fair**. There were 7 learners who got a scores ranging from 0-7 which is considered **Very Poor**. No learners got a scores ranging from 22-28 and 29-35 in the pre-test. The data being shown revealed that the Grade 11 learners had **Poor** academic performance in Earth and Life Science at the start of the study.

B. Difference in the Pre-test Mean Scores of the Control Group and the Experimental Group

Table 2 Difference in the Pre-test Mean Scores of the Control Group and the Experimental Group

Group	Pre-test Mean Score	t-value	*p*-value	Remarks
Control Group (Traditional method)	12.03	0.067	0.947	no significant difference
Experimental Group (Inquiry-Based)	11.97			

Table 2 presents the difference in the pre-test scores of the control and experimental group. It shows that the control group got a pre-test mean score of 12.03 while the experimental group obtained a pre-test mean score of 11.97. Based on the t-test for independent samples, the t-value is 0.067 and the *p*-value is 0.947. The result implies that at the onset of the study, both the control group and the experimental group have **poor level of performance** in Earth and Life Science thus there is no bias in the grouping of learners in the two groups.

C. Difference in the Pre-test and Posttest Scores in Earth and Life Science of the Experimental Group

Table 3 Difference in the Pre-test and Posttest Scores of the Experimental Group

Experimental Group	Mean	t-value	*p*-value	Remarks
Pre-test	11.97	10.307	0.000	with significant difference
Posttest	21.13			

Table 3 shows that the experimental group obtained a pre-test mean score of 11.97. The experimental group got a posttest mean score of 21.13 which is higher compared to the pre-test mean. Comparing the pre-test and the posttest mean scores using t-test, the obtained t-value is 10.307 and the *p*-value is 0.000. This means that the performance of the Grade 11 learners in Earth and Life Science had significantly improved when they were taught using the Inquiry-Based Learning Approach.

D. Difference in the Pre-test and Posttest Scores in Earth and Life Science of the Control Group

Table 4 Difference in the Pre-test and Posttest of the Control Group

Control Group (Traditional Method)	Mean	t-value	*p*-value	Remarks
Pre-test	12.03	6.951	0.000	with significant difference
Posttest	17.77			

Table 4 shows that the control group got a pre-test mean score of 12.03 at the start of the study. After being taught in Earth and Life Science employing the traditional method for eight weeks, the group got a posttest mean score of 17.77 higher than the pre-test mean score. Using t-test for dependent samples, the t-value is 6.951 and the *p*-value is .000. This means that there was also an improvement in the academic performance of Grade 11 learners in the control group compared to the experimental group.

E. Difference in the Mean Gain Scores in Earth and Life Science of the Control Group and the Experimental Group

Table 5 Difference in the Mean Gain Scores of the Control Group and the Experimental Group

Group	Mean Gain Score	t-value	*p*-value	Remarks
Control Group	5.73	2.831	0.006	with significant difference
Experimental Group	9.17			

The result in Table 5 shows that the control group obtained a mean gain score of 5.73. This is significantly lower than the mean gain score of the experimental group which is 9.17. Comparing the two mean gain scores using t-test, the resulting t- value of 2.831 yields a *p*- value of .006. It means that the experimental group had a greater improvement in learning Earth and Life Science than the control group. The higher mean gain score of the experimental group shows that the Grade 11 learners had better academic performance in Earth and Life Science.

V. CONLUSION AND FUTURE SCOPE

Based on the findings of the study, the Grade 11 learners have a **Poor** performance in Earth and Life Science at the start of the study (see Table 1). For this reason, a need for academic intervention is necessary to improve their performance.

The control group and the experimental group are equivalent in their initial knowledge of Earth and Life Science thus there was no bias in the grouping of subjects in this study (see Table 2).

The traditional method also helped the learners to understand Earth and Life Science but not as significant compared to those being taught using Inquiry-Based Learning Strategy (see Table 4).

The use of Inquiry-Based Approach helped the learners understand and learn better the concepts presented in Earth and Life Science (see Table 5).

This study then, implies the need of the school particularly the school head in providing support and training for the teachers in employing Inquiry-Based Learning Approach as a strategy in teaching Earth and Life Science. It can be integrated during the Learning Action Cell (LAC) and have someone demonstrate the said strategy to the teachers. The teachers must provide instructional materials and promote cooperative learning activities to their learners to make their class interesting. He/she must engage the learners to participate actively and must integrate the Inquiry-Based Learning strategy using the 5E learning method to enhance students' learning. Lastly, the future researchers may replicate this study using another learning areas particularly in Physical Science and other STEM track academic core subjects.

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