Guided discovery approach improves learners' test scores in Science

Gemma G. Pragale
La Paz National High School, Iloilo City, Philippines

ABSTRACT

This quasi-experimental research determined the effectiveness of guided discovery and conventional approaches on learners' test scores in Grade 8 Science at La Paz National High School, La Paz, Iloilo City during the school year 2017-2018.The research instrument used in this study was a researcher-made test which was validated, reliability tested and item analyzed. The statistical tools employed were the mean, standard deviation, Wilcoxon Signed Ranks test and Mann-Whitney U test using SPSS (Statistical Packages for Social Sciences). The statistical significance was set at 0.05. The results of the study showed that students have average science test score before using the guided discovery approach but after the intervention students attained above average test score in science. A significant difference was also noted in the students' post test scores. Hence, guided discovery approach is more effective in increasing students' test score in science compared to conventional approach.

***Keywords**:*
Science education
Guided Discovery Approach
Quasi-Experimental Research
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Introduction

The changing character of our increasingly scientific and technologically dependent society requires a science curriculum to match – one that will adequately prepare learners for life and work in the 21st century.

Science education aims to develop scientific literacy among learners that will prepare them to be informed and become participative citizens who are able to make judgments and decisions regarding applications of scientific knowledge that may have social, health, or environmental impacts (K to 12 Curriculum Guide Science, 2012).

As a whole, the K to 12 Science curriculum is learner-centered and inquiry-based, eemphasizing the use of evidence in constructing explanations. Concepts and skills in Life Sciences, Physics, Chemistry, and Earth Sciences are presented with increasing levels of complexity from one grade level to another (spiral progression) thus paving the way to deeper understanding of a few concepts. These concepts and skills are integrated rather than discipline based, stressing the connections across science topics and other disciplines as well as applications of concepts and thinking skills to real life.

According to the National Reading Panel Report (2000), vocabulary is a critical aspect of reading instruction. The larger a reader's vocabulary, the easier it is to comprehend the text. Lack of vocabulary knowledge can be particularly problematic for learners.

The challenge of teaching is to create experiences that involves the learner and support his own thinking explanation, evaluation and communication and application of the scientific models needed to make sense of these experiences. Hence,

constructivism is a theory that suggests that learners construct knowledge out of this experiences which is associated with pedagogical approaches that promotes learning by doing or active learning.

According to Afolabi and Akinbobola (2009), Constructivist teaching focuses on independent learning, creativity, critical thinking and problem solving. Constructivist teaching is based on the fact that skills and knowledge acquisition are not by passive receiving of information and rote learning but involves participation of the learners through knowledge construction, hands-on and minds on activities.

The teacher's role in constructivist teaching is to serve as facilitator of learning in which learners are encouraged to be responsible, autonomous and construct their own understanding of each of the scientific concept. The activities are learner centered, democratic and interactive.

Hence, the researcher in this study explored the use of guided discovery approach which is an example of constructivist learning to address the needs of her junior high school learners. The researcher observed that her Grade 8 students were unable to comprehend the science terms which had caused the low performance in science. The researcher tried guided discovery as a tool to address the alarming situation. Guided discovery approach encourages independence, makes learning more memorable and if analysis is done in groups it becomes a meaningful communicative task. It is important however, to understand that some learners are resistant to this approach.

It is on the foregoing premise that the researcher decided to conduct a study on the effect of guided discovery approach in teaching science to Grade 8 students at La Paz National High School, La Paz, Iloilo City. Specifically, it determined the pretest and posttest scores of the learners in science, the significant differences in the pretest and posttest scores using the guided discovery approach, the pretest and posttest scores of the learners in science using the conventional approach, the significant differences in the pretest and posttest scores of the learners in science using conventional approach, and the significant differences between the pretest and posttest scores of the learners in science using the guided-discovery approach and the conventional approach.

Methodology

This methodology presents the research design, respondents of the study, data-gathering procedure, research instrument, data analysis, and statistical tools used to determine the effectiveness of the guided discovery approach and conventional approach on learners' test scores in Science.

Research Design

This research made use of the pretest-posttest control group design using matched subjects. According to Fraenkel & Wallen, (2009), quasi-experimental design does not include the use of random assignment. Researchers who employ this design rely instead on other techniques to control (or at least reduce) threats to internal validity.

Respondents of the Study

The respondents of this study consisted of 88 Grade 8 junior high school students from La Paz National High School in two classes of the same teacher for school year 2017-2018. All the students had taken up the necessary topics/ lessons in their Science class during the first grading period as offered by the DepEd curriculum.

The data were obtained from 44 learners in the experimental group and 44 learners in the control group matched paired based on pretest scores in the researcher made test including topics for the first grading period. Data gathered were analyzed quantitatively through close examination of learners' responses in the test.

Research Instrument

The Grade 8 Science Unit Test was utilized to determine students' achievement in Science, a researcher-made test, it consist of 40 item multiple-choice questions. Some items were taken from the National Achievement Test (NAT).

The test covered the Grade 8 topics in module 1 of unit four (4) the Living Things and their environment. The Grade 8 Science Unit test had undergone validity testing. It was validated by experts in Science and assessment. The test had undergone pilot testing at which ensures the reliability of the test for the first grading period and was found reliable, KR20=0.83.

The GSUT (Grade 8 Science Unit Test) asks students for the "right" answer in each item. In order to investigate the effect of treatment on students' understanding of concepts only for the fourth grading period, Grade 8 Science Unit test was applied as a pre and posttests to all the respondents of this study. The first draft of the instrument was constructed and presented to the research consultant for corrections, revisions, and for improvement. The second draft was developed incorporating the corrections and suggestions given in the first draft and then presented again. After that, the researcher prepared several clear copies for validation. The validation of instrument was needed to ensure that the subjects would respond well to the test as it measured comprehensiveness of science topics. The instrument was presented again to the adviser for further verification and assessment.

Data Gathering Procedures

The researcher secured a permission to conduct the study from the Division Superintendent of Schools and the School Heads of La Paz National High School, La Paz, Iloilo City. The participants were assigned by the researcher as either experimental or control group. These were the two sections under her regular load.

The researcher taught the experimental group using guided discovery approach and control group received conventional approach and was carefully guided by the topics and lessons specification for implementation. Students were given a pretest to measure their initial knowledge and skills in the subject. The experimental group after the pre-test was exposed to different activities involving guided discovery. Guided discovery approach was taught using the guided discovery plan with the aid of guided students' activity sheets which includes the different science process skills and science vocabulary words related to the lesson. The teacher provides a student with guiding information for the first time. The teacher provides examples of a language item and helps the learners to find the rules themselves. The activity was given to students before and after the lesson. Conventional approach was taught using traditional teaching wherein most of the lesson were lecture method. The method of teaching is textbook centered, teacher dominant and exam-oriented.

The exposure lasted for six (6) weeks, from July 2, 2017 to August 4, 2017, after which both groups were given a posttest. Thereafter, the data were collected, processed, and subjected to pertinent statistical tools.

Data Analyses

Mean and standard deviation were used to determine the effect of guided discovery and conventional approach on the basis of their pretest and posttest scores. In order to find out the effect of guided discovery and conventional approach, the following scale and corresponding descriptions were used: 32.01 – 40.00 (Excellent), 24.01 – 32.00 (Above Average), 16.01 – 24.00 (Average), 8.01 – 16.00 (Below Average), 0.00 – 8.00 (Poor).

Wilcoxon-Signed Rank test was used to determine the difference in the pretest scores and the difference in the posttest scores using guided discovery approach and conventional approach. The Mann Whitney U test was used to determine the differences

in the pretest and posttest scores between groups. Data were analyzed using the Statistical Package for Social Sciences (SPSS) software.

Results and Discussion

The following presents the analyses and interpretation of the data gathered.

Pretest and Posttest Scores of the Learners in Science using Guided Discovery Approach

The table below shows that the students have below average science test score (M=14.11, SD=3.06) before using the guided discovery approach but after the intervention the learners attain an average test score in science (M=20.18, SD=5.27).

Table 2. Pretest and Posttest Scores of the learners in Science Using Guided Discovery Approach.

Category	Mean	Description
Pre-Test	14.11	Below Average
Post Test	20.18	Average

Note: 32.01-40.00 = excellent; 24.01-32.00 = above average; 16.01-24.00 = average; 8.01-16.00 = below average; 0.00-8.00 = poor

By providing students strategies to learn science vocabulary, it "can significantly support their understanding of and interest in the language of science" (Shook, et. al., 2011).

Differences in the Pretest and Posttest Scores of Learners in Science Using Guided Discovery Approach

The data reflects a significant difference in the learners' pretest and posttest scores using the guided discovery approach, z = -4.905, p = 0.000. This may imply that indeed, guided discovery approach is effective in increasing learners' achievement in science, with a mean gain of 6.07.

Table 2. Differences in Pretest and Posttest Scores of the Learners in Science using Guided Discovery Approach.

Category	Mean Rank	Sum of Ranks	PreExp/ PostExp	Remarks
Pre-test	8.50	59.50	-4.905*	Significant
Posttest	24.10	843.50		

*Note: *p<0.05, Significant*

Nelson and Stage (2007) stated that most students showed gains in their vocabulary knowledge from pre- to post-test.

Pretest and Posttest Scores of the Learners in Science Using Conventional Approach

The data shows that the learners have below average science test score before (M=12.52, SD=3.27) and after (M=16.48, SD=5.09) using the conventional approach in teaching science.

Table 3. Pretest and Posttest Scores of the Learners in Science Using Conventional Approach.

Category	Mean	Description
Pre- Test	12.52	Below Average
Post Test	16.48	Below Average

Note: 32.01-40.00=excellent; 24.01-32.00=above average; 16.01-24.00=average; 8.01-16.00=below average; 0.00-8.00=poor

The results of the study were due to the idea that science is composed of many concepts that are unfamiliar to students (Sjøberg, 2001). Science texts tend to deal with information that students may have been exposed to but "have never consciously analyzed or addressed" (Bravo, et. al., 2007).

Differences in the Pretest and Posttest Scores of Learners in Science Using Conventional Approach

The data reflects a significant difference in the learners' pretest and posttest scores using the conventional approach, z=-4.934, p=0.000. This means that the conventional approach is effective in increasing learners'

achievement in science with a mean gain of 3.96.

Table 4. Differences in Pretest and Posttest Scores of the Learners in Science using Conventional Approach.

Category	Mean Rank	Sum of Ranks	PreCont/ PostCont	Remarks
Pre-test	11.00	110.00	-4.394*	Significant
Posttest	25.33	836.00		

*Note: *p<0.05, Significant*

The results were supported by the study of Upadhyay & De Franco (2008) which stressed that in the control (direct instruction) group, there was a significant gain from pretest to posttest. However, when looking at longer retention of information, those students who learned from connected science showed a lower rate of loss than students who received direct instruction.

Differences between the Pretest and Posttest Scores of the Learners in Science Using the Guided-Discovery Approach and the Conventional Approach

Analysis of data reveals a significant difference in the learners' pretest scores using the guided discovery and conventional approach, z=-2.314, p=0.021. This may imply that indeed the guided discovery approach (M=14.11) is more effective in increasing learners' achievement in science when compared to the conventional approach (M=12.52).

Also, a significant difference was noted in the learners' posttest scores using the guided discovery and the conventional approach, z=-3.112, p=0.002. This also means that the guided discovery approach (M=20.18) is more effective in increasing learners' achievement in science compared to the conventional approach (M=16.48).

Other studies that included additional variables in addition to direct instruction included Nelson and Stage (2007) who added pre/activities for prior knowledge, word history, and word maps. Overall, because science vocabulary knowledge plays such a pivotal role in understanding wider scientific concepts it is important to clarify those as much as possible (Mamlok-Naaman, 2011). In order to increase science vocabulary knowledge, educators must develop specific instructional strategies for academic-specific informational words (Hiebert & Cervetti, 2011; Marzano & Pickering, 2005).

Table 6. Differences between Guided Discovery and Conventional Approach using the Pretest Scores and Posttest Scores.

Category	Mean Rank	Sum of Ranks	z-value	Remarks
Pre-test (Conventional)	50.76	2233.50	-2.314	Significant
Pre-test (Guided Discovery)	38.24	1682.50		
Posttest (Conventional)	52.95	2330.00	-3.112	Significant
Posttest (Guided Discovery)	36.05	1586.00		

*Note: *p <0.05, Significant*

Other studies that included additional variables in addition to direct instruction included Nelson and Stage (2007) who added pre/activities for prior knowledge, word history, and word maps. Overall, because science vocabulary knowledge plays such a pivotal role in understanding wider scientific concepts it is important to clarify those as much as possible (Mamlok-Naaman, 2011). In order to increase science vocabulary knowledge, educators must develop specific instructional strategies for academic-specific informational words (Hiebert & Cervetti, 2011; Marzano & Pickering, 2005).

Conclusions

Based on the findings of the study, the following conclusions were drawn:

Learners have increased their test score performance in science using the guided discovery approach. Also, learners have the same level of test score performance before

and after using the conventional approach in teaching science. Conventional approach is effective in increasing learners' test score in science. But, guided discovery approach is more effective in increasing learners' test score in science. Thus, the use of guided discovery approach in teaching and learning process greatly increased the test scores of the learners.

Recommendations

Based on the findings of the study, the following recommendations were drawn:

Learners in science classes should be responsive and participative especially when teachers use the guided discovery approach in teaching. Science teachers should adopt new trends and strategies in teaching science so as to instill in the learners a good science foundation. Science teachers need to exert extra effort to improve science instruction to meet the national standards. Science teachers have to consider the use of guided discovery approach as an effective strategy in teaching science concepts. Also, this is in response to the discovery learning of the K to 12 curriculum. School Heads and the head of the Science Department need to support science teachers in the delivery of instruction to further enhance science teaching and learning. They must encourage teachers in science to discover more pedagogy in enhancing learners' performance in science. The Department of Education officials may consider the guided discovery approach as a strategy in teaching not only science concepts but also in other disciplines. Also, to support science educators in attending seminars and trainings in enhancing their pedagogical-content knowledge in teaching science. Future researchers should look into other factors which affects learners' performance in science, especially guided discovery approach and other strategies in teaching science concepts in response to the k to 12 curriculum. Trainings, seminars, and workshops must be conducted for both learners and teachers to equip them with necessary skills in the implementation of innovative strategies. Teachers who strategically innovate to make learning easier and clearer should be properly compensated and recommended for recognition and awards. This research study may serve as a springboard for future researches and maybe replicated using other research designs, other instruments, or other variables to further support the present findings.

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