

Effects of Teaching Strategies and Instructional Materials on the Pupil's Mastery Level in Statistics and Probability for Grade VI

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Abstract: *The primary aim of this study is to determine the effects of the strategies, instructional materials used by the teachers in teaching statistics and probability and the problems encountered by the pupils in the mastery of statistics and probability. The respondents of this study are 265 grade six pupils of Bulan North and Bulan South District composed of 6 big schools 3 in Bulan North and 3 in Bulan South. The number of respondents was determined using Slovin's Formula. To determine the mastery level of the pupils they were given 30-item test 10 items for statistics and 20 items for probability based on the content area of statistics and probability. The pupils were given questionnaire to determine the strategies, instructional materials used by their teachers and the problems they encountered in teaching and learning statistics and probability. Selected pupils in San Francisco Elementary School were asked about the effects of the strategies and instructional materials used in learning statistics and probability. Findings revealed that the mastery level of the pupils in statistics and probability belongs to low level specifically the content area in probability. The strategies used by the teachers were lecture/exposition method, collaborative approach, discovery approach, problem-based approach, differentiated instruction, contextualization or localization and some used game-based approach and none used computer-aided instruction. The commonly used instructional materials were chalk and board, textbooks and workbooks. The pupils encountered many different problems in learning and the most common problems are difficulties in understanding word problems in solving routine and non-routine problems and the class disruption due to some extra-curricular activities and calamities or bad weather. There are different effects of teaching strategies and instructional materials used by the teachers. Pupils learned in the strategies which are interesting to them and find difficulties in learning word problems. The following recommendations are made based from the conclusion. Teachers must encourage applying different strategies specifically the computer-aided instruction and game-based approach in teaching probability. Also, teachers must not stop using different instructional materials and be creative in teaching. Teachers must focus also in giving problem solving routine and non-routine. Parents should encourage their children to give time in studying lessons and enhance their reading comprehension in order for them to understand different word problems. The researcher designs a sample of module which uses a computer-aided instruction to enhance the pupil's interest in learning statistics and probability. This research may be a guide to other researchers who may conduct another study parallel to this study in other school, district or division in a broader scope.*

Keywords: Effects of Teaching Strategies, Instructional Materials

1. Introduction

At the international level, the growing concern about improving the quality of statistics education is evident in the current reform efforts geared towards statistics and probability teaching-learning process such as books and technology resources. In 2007 the American Statistical Association published Guidelines for Assessment and Instruction in Statistics Education for Pre K-12 Education (GAISE) that outlined a curriculum framework for achieving statistical literacy. The framework consists of two dimensions – components of statistical problem solving and developmental levels of statistical understanding. The four components of statistical problem solving are consistent with the NCTM Standards for Data Analysis and Probability. These components include: formulating questions, collecting data, analyzing data and interpreting results (Metz 2017).

Implementing the new curriculum, the k-12 program in 2012 was a challenging solution to uplift the quality of education in our country. In 2013, it was enacted by the Senate and House of Representatives of the Philippines in Congress assembled known as the “Enhanced Basic Education Act of 2013”. In this act, it is stated in section 5, the Curriculum Development, that the new curriculum shall use spiral progression approach to ensure mastery of knowledge and skills after each level and the curriculum shall use pedagogical approaches that are constructivist, inquiry-based, reflective, collaborative and integrative. The

curriculum shall be flexible enough to enable and allow schools to localize, indigenize and enhance the same based on their respective educational and social contexts. The production and development of locally produced teaching materials shall be encouraged and approval of these materials shall devolve to the regional and division education units.

Mathematics as one of the major subjects of this curriculum has five content areas; Numbers and Number Sense, Measurement, Patterns and Algebra, Geometry, and Statistics and Probability. In the spiral approach, Statistics and Probability was already introduced in elementary level. Teaching Statistics and Probability in elementary from grade 1-3 focus on data collection and presentation in tables, pictographs and bar graphs and outcomes. From grade 4-6, bar graphs, line graphs, and pie graphs and simple experiment and experimental probability.

The necessity of the teaching of Statistics and Probability in the elementary level is being pointed out by many researchers. According to Mendoza and Swift (1981), the teaching of Statistics and Probability in schools is taking place for the following reasons: 1. Utility (The right knowledge of statistics helps in the elaboration, introduction and evaluation of information and reaching the right decisions), 2. Future studies (The knowledge of the probabilities and statistics not only cultivates the mathematic thought, develops the calculating and outlining abilities but is indispensable tool to almost all scientific branches), 3.

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Aesthetics (The aesthetics factor contributes the student to estimate the probabilities and statistics as much in the theoretical level as in using them in sciences, in technology and in different social phenomena and with various ways and means of teaching, to discover the beauty of mathematics' science).

Those reasons are also the purpose of k-12 program that will develop productive and responsible citizens equipped with the essential competencies, skills and values for both life-long learning and employment. The question raised is how the teachers could agree with teaching something they do not master. Statistic and Probability as one of the content area in mathematics gains a negative response by teachers in elementary and secondary level (Kazemi 2013).

Statistics refers to the process by which numerical data are collected and eventually presented in a usable and understandable form. In most instances the numerical information in its original form would be difficult to interpret. For this reason, the information is usually organized, summarized and presented in a form that can be more readily interpreted. Frequently this is accomplished by reducing the numerical data to a table or graph or by reporting one number, such as average to represent an entire set of numbers. Statistics is important not only for communication, it also provides a basis for decision making, numerical presentations of weather information, the stock market, political polls, business transactions, census data, government operations and many other types of data (Popular Science 2006).

Probability is a mathematician's way of describing the likelihood that a certain event will take place. Probability theory enable to determine probable characteristics of a sample drawn from a population whose characteristics are known. It also provides the basis for part of the related science of statistics. Statistical inference is an extension of probability theory. Statistics and Probability are two related but separate academic disciplines. Statistical analysis often uses probability distribution, and the two topics are often studied together. However, probability theory contains much that is of mostly of mathematical interest and not directly relevant to statistics. Moreover, many topics in statistics are independent of probability theory.

Teaching and learning statistical concepts are the focus of several studies conducted by community of mathematics and statistics educators. Some of the most important results indicate a strong relationship between the theory and practice of teachers and therefore, a strong relationship between those practices and the ones established by the pupils involved in learning process. Some researchers work on the levels of literacy proposed by Shamos (1995) and assumed by Gal (2002). The progression of this levels range from cultural to functional and functional to scientific. The first level, 'cultural', refers to a grasp of basic terminology commonly used in the media to convey information about science. The second level, 'functional', requires that the people are able to converse, read and write coherently, in addition to the abilities required for the cultural level. The most advanced level, 'scientific', requires some understanding of the overall scientific enterprise, coupled

with an understanding of scientific and investigative processes (Gal, 2002).

Some results of studies, focusing on elementary and high school teachers, agree concerning the identification of difficulties or even the lack of statistical knowledge in the teachers which suggest on the need for initial and continuing training in statistics. The teacher is basically regarded as the forerunner of the curriculum, and thus, efforts geared towards improvement of the quality of statistics education rely heavily upon efforts to improve the quality of teacher training and preparation (Reston & Bersalis). From a global perspective, two reform movements have been affecting the teaching and learning of statistics in all educational levels; namely: the reforms focused on content and pedagogy that advocate the shift of focus from computation and procedures to statistical thinking and reasoning; and the reforms in the area of assessment as a tool to improve student learning, focusing on better alignment of instruction with important learning goals and assessment (Garfield and Gal, 1999).

Moreover, for most countries, although the teaching of statistics in the primary and secondary level is part of the mathematics curriculum, several studies have established that mathematics teachers frequently lack specific training and preparation in statistics education (Batanero, Godino and Roa, 2004). In the Philippines, teachers in elementary level really lack the training and preparation in teaching statistics and probability since most of them are not major in mathematics. Though they have basic lesson in statistics and probability in college, mostly they do not understand many of the basic statistical concepts they have studied. Before K-12 started, in the old curriculum there is no statistics and probability in the elementary level. These new competency gives additional challenge to elementary teachers since these is new to them. Statistics and probability added as new learning competency is taught in the fourth quarter of the school year and there is a possibility that the topic may not be reached by the teachers for some reasons that the researcher also encounter in teaching secondary level. The researcher gains the idea on how elementary teachers teach statistics and probability and wants to know the strategies and instructional materials they use, and to determine the mastery level of the grade 6 pupils in statistics and probability. These motivated the researcher to choose this study.

2. Statement of the Problem

This study aims to determine the effects of teaching strategies and instructional materials on the mastery level in statistics and probability of the grade six pupils of Bulan District, for the S.Y 2019-2020. Specifically, the study aims to answer the following questions:

- 1) What is the mastery level of the pupils in Statistics and Probability along the following:
 - Data collection
 - Probability of an event
 - Prediction and outcomes
- 2) What are the different strategies used by the teachers in teaching statistics and probability?

- 3) What instructional materials are used by the teachers in teaching statistics and probability?
- 4) What are the problems encountered by the pupils in learning statistics and probability?
- 5) What are the effects of the teaching strategies and instructional materials used by the teachers on the mastery level in Statistics and Probability of the Grade VI pupils?
- 6) A computer-aided learning module in probability is hereby proposed based from the results of the study.

3. Methodology

This study determined the effects on the mastery level of the grade 6 pupils of the strategies and instructional materials used in teaching of statistics and probability of the Public Elementary School Teachers in the Municipality of Bulan and the problems encountered by the pupils in learning.

The descriptive method of research was employed in the study. This method tried to describe present conditions, events or systems based on impressions or reactions of respondents (Downie and Heath 1984). The aim of descriptive research is to verify formulated hypothesis that refer to the present situation in order to expound it. Moreover, this method allows a flexible approach, thus, when important new issues and questions arise during the duration of the study, further investigation maybe conducted.

A questionnaire checklist, interview, observation and test paper was used in gathering the needed data. The data in turn were subjected to appropriate statistical treatment for analysis and interpretation.

The Sample

Grade 6 pupils in the big school of Bulan District were the respondents of these study. Random sampling was employed to identify the samples of the pupils. The number of pupils was determined using Slovin's formula in the two districts.

Table 1: Respondents

Name of School	Number of Pupils
Bulan North Central School-A	65
Bulan North Central School-B	47
Bulan South Central School	69
Alberto De Castro Elementary School	34
San Francisco Elementary School	32
San Vicente Elementary School	18
Total	265

The table shows name of schools per number of pupils. Bulan North Central School-A with 65 pupils, Bulan North Central School-B with 47 pupils, Bulan South Central School with 69 pupils, Alberto De Castro Elementary School with 34 pupils, San Francisco Elementary School with 32 pupils and San Vicente Elementary School with 18 pupils. There were also 32 pupils interviewed on the effects of teaching strategies and instructional materials on the mastery level. Those were the pupils of San Francisco Elementary School because they were the school that used game-based approach, lecture method, problem-based approach and collaborative approach. This school is also

adjacent to the researcher's barangay and pupils were easier to identify.

These schools were chosen as the respondent schools since they were the big and performing schools in Bulan District and some of the teachers were master teacher and possibly they were the only schools that were able to reach the content area in statistics and probability.

The Instrument

The main instrument that was used in gathering the needed data was test paper to evaluate the level of mastery on different competency in statistics and probability, a questionnaire checklist, interview and observation is used to determine the strategies and instructional material used in teaching of statistics and probability. The main instrument that was used was subjected for a dry-run conducted on March 6, 2020 in Lapinig Elementary School one of the performing school in Magallanes District to determine its validity and to ensure the reliability of the test. The test was administered on March 9-10 which is the second week of March since the topic is covered on the fourth grading period.

The instrument was made based on the content area and competency on statistics and probability. On the table of specification, 10 items were made for statistics and 20 items for probability. There were more questions in probability because there were more topics or content area in probability. The questionnaire was made to determine the assessment of the pupils on teaching strategies and teaching materials used by their teachers and the problems encountered in learning statistics and probability.

4. Data Gathering Procedure

Before the conduct of the study, the researcher asked permission from the Superintendent and the Principals of Bulan Public Elementary Schools. Upon approval, the researcher administered the distribution of the test paper and questionnaire checklist to the respondents on March 9-10, 2020. Before the pupils answer the test and put a check mark on the questionnaire checklist, instruction and explanation was given by the researcher for each strategies and instructional materials. They were requested to answer honestly. The respondents were given enough time to finish it. Interview on selected 32 pupils of San Francisco Elementary School was also conducted to determine the effects of the strategies and instructional materials on the mastery of the subject which was done for one week. The responses were tallied to check the effectivity of the instrument and rechecked for statistical interpretation.

Data Analysis Procedures

The collected data were tabulated, analyzed and interpreted with the use of appropriate statistical measures and techniques. Frequency count and percentage were the statistical measures used to determine what strategies and instructional materials were commonly used by the teachers and the problems encountered by the pupils in learning statistics and probability.

The level of mastery of the pupils on statistics and probability was also determined through percentage of the pupils who got the correct answer in each item per competency which is the bases for making module. The result was interpreted using the following scale from National Education Testing and Research Center (NETRC).

Mastery Level Descriptive Equivalent

0% - 4% - Absolutely No Mastery

5% - 14% - Very Low Mastery

15% - 34% - Low Mastery

35% - 65% - Average Mastery

66% - 84% - Moving Towards Mastery

85% - 95% - Closely Approaching Mastery

96% - 100% - Mastered

5. Results and Discussions

5.1 Findings

Based from the data gathered, the following findings were revealed:

- 1) The mastery level of grade 6 pupils on data collection, the average rating is 49.18 which is average mastery.
- 2) The mastery level of grade 6 pupils on probability of an event, the average rating is 33.94 which is low mastery.
- 3) The mastery level of grade 6 pupils on prediction and outcomes, the average rating is 22.18 which is very low mastery.
- 4) The most common strategies used by the teachers are lecture/exposition method, collaborative approach, differentiated instruction, contextualization or localization and problem-based approach. Some teachers used game-based approach and discovery approach. No teachers used computer-aided instruction and inquiry-based approach.
- 5) The commonly used instructional materials used by the teachers were chalk and board and textbooks and workbooks. No teachers used computer, tv or projector as instructional materials.
- 6) Among the problems encountered by the pupils were difficulties in understanding word problems in solving routine and non-routine problem and class disruption due to some extra-curricular activities and calamities or bad weathers which are the major problems. Other problems of the pupils are lack skills in using compass and protractor in constructing pie graph, have limited or lack of materials like ruler, compass and protractor, have low numeracy skills like multiplying, dividing, simplifying fractions percent and angle measure and have difficulties in organizing data using frequency table.
- 7) The effects of the strategies and instructional materials used by the teacher on the mastery level, 100% did not learn in problem-based approach, 81.25% did not learn in lecture method and using textbooks, 68.75% learned in collaborative approach in making pie graph using compass and protractor and 65.62% learned in game-based approach using spinner, dice and unbiased coins.

5.2 Conclusions

Based on the findings of the study, the researcher arrived at the following conclusions:

- 1) The mastery level of the grade 6 pupils in statistics is average.
- 2) The mastery level of the grade 6 pupils in probability is low.
- 3) Most of the teachers are not using computer-aided instruction which is now one of the methods encouraged by the Department of Education to be used in teaching.
- 4) The instructional materials that were usually used by the teacher chalk and board, textbooks and workbooks.
- 5) The pupils encountered different problems in learning statistics and probability that could affect their performance.
- 6) Pupils learned more when the strategies and instructional materials used enhance their interest, and they do not learn when they find the lesson difficult specially in solving problems.
- 7) An instructional material or learning module that use computer aided-instruction in teaching probability is hereby proposed.

6. Recommendations

Based from the conclusions, the following recommendations are made:

- 1) Teachers must encourage applying different strategies to increase the level of performance and the knowledge of pupils in statistics and probability.
- 2) Teachers must continue to develop their teaching strategies using innovative method and instructional materials to become 21st century teachers.
- 3) Teachers must attend training and seminars to enhance their teaching styles and approaches.
- 4) Parents should encourage their children to give time studying the lessons and provide them the materials needed in learning.
- 5) School heads should provide their teachers materials like computer and projector that can be used as instructional materials.
- 6) A sample learning module that can be used in teaching was designed to develop the interest of the pupils in learning.
- 7) Researchers may conduct another study parallel to present study in other schools, district, or division in a broader scope.

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