

# Mathematical Investigations Skills of Senior High School Students

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**Abstract:** *The main purpose of this study is to find out the level readiness of the public senior high school students in conducting mathematical investigation along general mathematics and probability and statistics, likewise, performance level and its difficulties. This research used descriptive method in order to gather factual and relevant data as it also used teacher made test and questionnaire checklist for finding the performance level and the level of readiness of the senior high school students as the main data-gathering instrument. The data collected were statistically treated using weighted mean, frequency count, percentage-test. The findings revealed that out of 71 Senior High School Students belongs to beginning in general mathematics and 86 SHS did not meet the expectation in statistics and probability. They were belongs to low performance. Out of 142 Senior High School Students only 5 of them got the highest performance level in general mathematics, 10 were belongs to the proficient, 13 were approaching to proficient. Moreover, 45 belong to developing and 71 belong to beginning. And 3 among 142 SHS students performed advanced, 9 performed proficient and 12 performed approaching proficient. Furthermore, 32 of the students performed developing and 86 performed beginning. The result of the statistics and probability was low performance level. The investigation skills of Senior high school in general mathematics along formulation of questions with an overall weighted mean of 3.48, under testing with overall WM of 3.42, under refinement of questions with overall WM of 3.47, under proving with overall WM of 2.28 and for communicating skills with overall WM of 2.95. The investigation skills of Senior high school in statistics and Probability along formulation of questions with an overall weighted mean of 2.16, under testing with overall WM of 2.46, under refinement of questions with overall WM of 3.41, under proving with overall WM of 2.34 and for communicating skills with overall WM of 3.61. The most difficulty encountered by the students along the identified variables are cited – the 1<sup>st</sup> difficulty is when the students are not knowledgeable about making of mathematical investigation wherein 140 students out of 142. The students are not knowledgeable about making of mathematical Investigation. Students are not aware about making a Mathematical Investigation and its implication to the Mathematics world. It recommends developing training design to address the needs of the senior high school in conducting mathematical investigation that focus on general mathematics and probability and statistics. Development and validation of format of mathematical investigation to inform senior high school students in conducting it. Similar study about conducting study of mathematical investigation in other branches of Mathematics for the enhancement of mathematical skills of the senior high school students. Research parallel to this may also be conducted in other subjects and on wider scope.*

**Keywords:** Mathematical Investigations Skills

## 1. Introduction

Mathematics took an important role in life, not just for our self but also to others. Mathematics makes a huge effect on all of our lives. Just think of the things that would be possible without mathematics. Mathematics helps us do everyday tasks like cooking, cleaning and shopping. Mathematics helps us complete these tasks without completely messing up on doing it. You need mathematics for cooking because you need to measure things such as cups of flour, etc. You need mathematics to go shopping to ensure that you are getting all of your change back and getting ripped off.

Modern society requires from everyone a reasonable fluency in mathematics. It is especially important to be able to interpret information framed in mathematical language (numerical and graphical) and to think mathematically (seeking patterns and relationships and reasoning). However, mathematics is usually regarded as a most difficult subject. Students frequently view it just as doing computations and getting the correct answers. They tend to assume a dualist view in which things are either right or wrong. In many countries, including Portugal, the evaluations of students' learning, attitudes and views about mathematics are considered unsatisfactory — by all sorts of criteria (Neves e Serrazina, 2016; Ponte, 2014; Ramalho, 2014).

At the base of these difficulties it is the social filter role played by mathematics teaching and the subsequent emphasis on mastery of basic concepts and procedures. In

general, mathematics teaching pays little attention to the more advanced aspects of mathematical activity such as the formulation and resolution of problems, the formulation and testing of conjectures, the pursuit of investigations and mathematical proofs, and the argumentation and critique of results. While these are fundamental and current themes of mathematics education expressed in many curriculum documents across the world (APM, 1988; Cockcroft, 1982; NCR, 1989; NCTM, 1989) they still find very little emphasis in classroom practice, both in our country and elsewhere (Lerman, 1989; Silver, 1993).

Mathematical investigations, based on open-ended problem solving tasks, are important from the educational point of view (Ernest, 1991; Mason, 1991). In fact, in our perspective, they: (1) are indispensable to provide a complete view of mathematics, since they are an essential part of mathematical activity; (2) stimulate the sort of student involvement required for significant learning; (3) provide multiple entry points for students at different ability levels; (5) stimulate a holistic mode of thought, relating many topics, an essential condition for significant mathematical reasoning.

Article XIV, Section 2 of the 1987 Constitution of the Philippines states that the State shall establish, maintain and support a complete, adequate and integrated system relevant to the needs of the people and the society. This stipulation in the country's highest law is one of the legal bases of the Republic Act 10533, also known as the Enhanced Basic Education Act of 2013 which paved the way for upgrading the 10 – year basic education to a 12 – year program. It

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introduced Senior High School which is from Grade 11 to Grade 12 in the country (Lazaro, 2013). Senior High School students have to take two compulsory Mathematics subjects in Grade 11. These subjects are General Mathematics which is offered in the first semester, and Statistics and Probability, offered in second semester.

The common feeling that more attention should be paid to understanding what is involved in doing mathematical investigations in the classroom brought together a small group of teachers and teacher's educators. Mathematical Investigation intends to contribute to furthering knowledge about innovative learning situations in mathematics classrooms. It is double sided, involving curriculum development (collecting information about the potential value of given types of activities in different school grades and acquiring experience in the preparation and evaluation of classroom tasks) and also research on teaching (studying the decisions, dilemmas, difficulties, etc. that teachers face in conducting these kinds of activities).

Gallanosa National High School is presently offering Senior High School and also focuses on Science and Technology Engineering and Mathematics Strand of which they found very difficult to conduct Mathematical Investigation because learners did not know the mathematical concepts and skills, the scientific technological exploration of the solution to the given problem, transformation where student engage into thinking, talking and exploring and logical deduction. These are all dilemmas that the teacher may encounter through the years since the senior high school started. That is why the researcher opted to study about the Mathematical Investigation for us to help learners especially STEM students enhance and be ready for the improvement of mathematical investigation skills and numerical ability.

### Statement of the Problem

This study aimed to determine the Mathematical Investigation Skills of Senior high School students in Science and Technology Engineering and Mathematics (STEM) of Gallanosa National High School for school year 2019-2020. Specifically, it sought answer to the following questions:

- 1) What is the performance level of Senior High School students in a) General mathematics and b) Statistics and Probability?
- 2) What are the investigation skills of Senior High School students in General Mathematics along:
  - a) Formulations of questions,
  - b) Testing,
  - c) Refinement of questions,
  - d) Proving, and
  - e) Communicating results?
- 3) What are the investigation skills of the students in Statistics and Probability along the identified variables?
- 4) What are the difficulties encountered by the students in developing their investigation skills in General Mathematics and Statistics and Probability?
- 5) What training design may be proposed based on the results of the study?

## 2. Methodology

### 2.1 Research Design

The study determined the mathematical investigation skills of senior high school students in Science and Technology Engineering and Mathematics (STEM) of Gallanosa National High School for school year 2019-2020.

The researcher used the descriptive method of quantitative research in order to determine the performance level in general mathematics and probability and statistics of Senior High School students at Gallanosa National High School on mathematical investigations. The instruments used in this study are the teacher made test and questionnaire checklist to gather appropriate data. The researcher used a sample size of 142 STEM students from Senior High School. It composed of 71 from grade 11 and 12 SHS of Gallanosa National High School. The statistical tools used were frequency count, percentage, ranking and weighted Mean.

### The Sample

This study covered Grade 11 and 12 Senior High School students of Gallanosa National High School, for the school year 2019-2020. The researcher used a purposive sample size of 220 from a population. The researcher purposively selected 142 senior high school students as the primary respondents of the study who would provide intensive data to the research study.

**Table 1:** The Respondents

Grade Level	F	%
Grade 11	71	50%
Grade 12	71	50%
Total	142	100

### The Instrument

The instrument used in this study was questionnaire and teacher-made test. The proponent conducted survey among selected respondents from senior high school at Gallanosa National High School using a questionnaire regarding the topic to deduce and collect answers that would suffice the data needed for the completion of the study.

The researcher seek permission from the office of the Schools Division Superintendent for the conduct of pilot testing her instrument to the grade 11 and 12 students of Gallanosa National High School and for the conduct of validity and reliability and the dry run of her instrument to the grade 11 and 12 GASS students of Holy Spirit Academy of Irosin and for the implementation of the said study to Senior High School students.

### Data Collection Procedures

To gather the data needed in this study, the following procedures were done by the researcher:

Primarily, the researcher asked permission from the Schools Division Superintendent of Sorsogon province. Upon approval of the letter the researcher preceded to the Principal of the Gallanosa National High School and the grade eleven and twelve mathematics teachers of the aforementioned school to seek approval of the administration of pre-test. The

letters were duly signed by the researcher’s adviser and the dean of Sorsogon State College Graduate Studies before these were distributed.

Upon approval of the request, the researcher prepared and validated the teacher-made test through a dry-run to determine the student’s performance on general mathematics and probability and statistics and determine the mathematical skills formulation of questions, testing, refinement of questions, proving and, communicating results. The researcher personally transported the test materials to the respective school on October, 2019. With the assistance of each mathematics teachers, the researcher administered the pretest. The tests only lasted for one hour. After the collection of the tests, answers were checked and scored. The results of the test were subjected to tabulation, analysis and interpretation to determine the performance level of the students.

Moreover, it also aided with structure interview to validate the data from the survey with the use of the interview schedule. During the interview, the researcher recorded the responses of the teacher respondents using an audio recorder to validate the indicators used in the survey questionnaire.

After the finalization of the survey questionnaire, it was conducted to some teachers of the researcher in Gallanosa National High School. It was found out that there were lacking thoughts in some of the indicators under mathematical skills and assessment for learning. The researcher conducted unstructured interview to the teachers to gather data about the performance of the learners and some ways to create mathematical test for the learners and make them support to the research and it was transcribed by the researcher. Finally, towards December 2019 the retrieval rate was 99.9%.

**Data Analysis Procedures**

The data gathered were statistically treated using appropriate statistical formula. These were checked, analyzed, validated, and interpreted.

The frequency and percentage were used in presenting the performance level of the senior high school students in General Mathematics and Statistics and Probability. Also, to interpret the performance level, the researcher aligned the scale from DepEd Order No. 73, s.2012 for proficiency level of the pupils, to wit:

Scale	Description
90% - above	Advanced
85% - 89%	Proficient
80% - 84%	Approaching Proficiency
75% - 79%	Developing
74% and below	Beginning

The weighted mean was used to determine the investigation skills of the respondents in General Mathematics and Statistics and Probability along formulation of questions, testing, refinement of questions, proving and, communicating results. The scale below was adopted in order to interpret the extent:

Scale	Descriptor
4.50 – 5.00	Very much evident
3.50 – 4.49	Much evident
2.50 – 3.49	Evident
1.50 – 2.49	Less evident
1.00 – 1.49	Least evident

The frequency and ranking were utilized in presenting the difficulties encountered by the senior high school students in conducting the investigation skills.

Problem 3, the researcher used rank to determine the difficulties encountered by the students along the identified variables.

**Results and Discussions**

**3. Findings**

The findings revealed the following:

- 1) Out of 142 Senior High School Students, only 5 of them got the highest performance level in general mathematics, 10 were belongs to the proficient, 13 were approaching to proficient. Moreover, 45 belong to developing and 71 belong to beginning. And 3 among 142 SHS students performed advanced, 9 performed proficient and 12 performed approaching proficient. Furthermore, 32 of the students performed developing and 86 performed beginning. The result of the statistics and probability was low performance level.
- 2) The investigation skills of Senior high school in general mathematics along formulation of questions with an overall weighted mean of 3.48, under testing with overall WM of 3.42, under refinement of questions with overall WM of 3.47, under proving with overall WM of 2.28 and for communicating skills with overall WM of 2.95.
- 3) The investigation skills of Senior high school in statistics and Probability along formulation of questions with an overall weighted mean of 2.16, under testing with overall WM of 2.46, under refinement of questions with overall WM of 3.41, under proving with overall WM of 2.34 and for communicating skills with overall WM of 3.61.
- 4) The most difficulty encountered by the students along the identified variables are cited – the 1<sup>st</sup> difficulty is when the students are not knowledgeable about making of mathematical investigation wherein 140 students out of 142.
- 5) A Proposed Training on Improving the Mathematical Investigation Skills for Senior High School students was designed.

**4. Conclusions**

Based on the findings, the following conclusions are drawn:

- 1) The senior high school students have developing performance level in General Mathematics whereas they have beginning performance level in Statistics and Probability.
- 2) The senior high school students shown evident investigation skills in General Mathematics along formulation of questions, testing, refinement of



questions, and communicating results but less evident skills in proving.

- 3) The senior high school students manifested less evident investigation skills in Statistics and Probability along formulation of questions, testing, and proving. However, it was evident in refinement of questions and much evident in communicating results.
- 4) The problems encountered by the students are lack of knowledge about making of mathematical Investigation and not aware about making a Mathematical Investigation and its implication to the Mathematics world.
- 5) The training matrix was designed to improve the mathematical investigation skills of senior high school students.

## 5. Recommendations

Based from the conclusions of the study, the following recommendations are made:

- 1) The students may be exposed to various teaching strategies in order to improve the performance level. also, the teachers may attend seminars and training in latest trends in mathematics teaching.
- 2) The students may be provided with appropriate instruction in conducting mathematical investigation in order to hone their skills in doing it.
- 3) The teachers may attend various seminar and workshops on conducted mathematical investigation so as to deliver the proper way of doing it.
- 4) The problems encountered by the students in conducting mathematical investigation be addressed and given utmost solution.
- 5) The training matrix may be submitted to the Division Office for implementation and if found feasible, be adopted.
- 6) Research parallel to this may also be conducted in other subjects and on wider scope.

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