

## HEURISTIC METHOD IN NON – ROUTINE WORD PROBLEMS AND MATHEMATICS PERFORMANCE

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### Abstract

The main objective of this study was to find out the effect of Heuristic method in learning non-routine word problems. The study utilized the one group pretest – posttest experimental design to find the difference in the performance of students who were exposed to the use of Heuristic method in learning mathematics. Using t-test, result of this study turned out that students under study performed better in their posttest after the experimentation was conducted.

**Keywords:** Heuristics, Heuristic Method, Mathematics Performance, Academic Achievement

### INTRODUCTION

Mathematics is fundamental for many professions, especially science, technology, and engineering. (Li, 2019). Many are aware especially the public and educational communities of the continuing crisis in math education and the convergence of technologies for teaching and learning. (Peng, 2008). The teacher and his/her strategy used in teaching mathematics are very important in the learning process. Conventional teacher-led instruction remains dominant in most classrooms. Under such instruction, the teacher can rarely take care of all students. Many students may then continue to fall behind the standard of mathematics achievement and lose their interest in mathematics; they eventually give up on learning mathematics. (Yeh, 2019). Furthermore, in a teacher-led instruction, all the students are required to learn from the teacher in the same way at the same pace (Hanus et al. 2015), making each of them dependent to the teacher.

In the mathematical classrooms students' creativities and abilities are fostered through a variety of teaching methods and learning strategies. The role of teachers as the facilitators in a mathematical classroom is to instil students' confidence in presenting their mathematical solutions. Hoon (2012) observed that students' mathematical problem-solving abilities increase after the use of heuristic approaches. They were reported to engage profoundly in their learning and such active learning environment improved students' interest in solving mathematical problems as well as enabled them to respond creatively.

One method that will give the students freedom on how they can solve math problems on their own is the heuristic approach. Heuristics play important roles in problem-solving. When we are trying to solve a problem or make a decision, we often turn to mental shortcuts when we need a quick solution, and these are what we call heuristics. (<https://www.verywellmind.com/what-is-a-heuristic-2795235>).

Heuristics, or a heuristic technique, is any approach to problem solving that uses a practical method or various shortcuts in order to produce solutions that may not be optimal but are sufficient given a limited timeframe or deadline. Heuristics methods are intended to be flexible and are used for quick decisions, especially when finding an optimal solution is either impossible or impractical and when working with complex data. (Chen, 2021)

According to Mumford (2005), the term “heuristics” was first applied in the social sciences some 50 years ago. Initially, this term was used to refer to the strategies people employed to reduce the cognitive demand associated with certain decision-making tasks. These strategies involved, for example, “satisficing,” which refers to peoples' tendency to use readily available representations as a basis for framing decision tasks. “Means-end analysis” was the term coined to describe a strategy whereby people work backward from a given goal using trial and error to identify the operations needed for problem solving.

In the article of Hamad (2007), *Creativity: Method or Magic?* he stressed that Heuristics are usually contrasted with ‘algorithms’ in problem-solving. Solving a problem by an algorithm or fail-safe rule is supposed to yield an exact, reliable solution that works for every case. ‘Solving’ it by heuristics – by an unintegrated and incomplete set of suggestive ‘rules of thumb’ that work in some cases, but not in all, and not for fully understood or unified reasons – is just as uncreative as solving it by algorithm. However, many people have noticed that heuristic procedures occasionally lead to insights, sometimes through inductive generalization and analogy with cases in which heuristics succeed. Heuristics are the actual mental rules humans employ when making decisions such as choosing an action from a set of alternatives or deciding when to stop searching for a better option. A simple illustration is ‘one-reason decision making’ according to which individuals make choices based on the first relevant criterion that discriminates between the alternatives. (Flache, 2015).

Heuristic as a method of teaching is believed to help the performance of students in mathematics. Okechukwu (2014) in his study “Effects of Heuristic Method of Teaching on Students’ Achievement in Algebra” proved that heuristic can improve the performance of students in math when the results of the study show that the heuristic approach was superior to the conventional approach in fostering students’ achievement in linear algebra. This result can be supported by the study of Hoon (2012), “Learning Mathematics Using Heuristic Approach”, the findings showed that the students were able to engage heuristic approaches in solving mathematical problems. Their reflections in the reflective journals indicated that they had applied the relevant strategies of the approach to solve mathematics problems. The strategies included giving representation, making a calculated guess and going through the process.

### Statement of the Problem

The study aimed to find the difference in the mathematics performance of students who were exposed to heuristic method in learning mathematics.

Specifically, it sought to find the following;

1. determine the pretest performance of the group of students under study,
2. determine the posttest performance of the group of students under study after exposing to the use of Heuristic method, and
3. find out if there is a difference in the pretest and posttest performance of the students under study.

### Significance of the Study

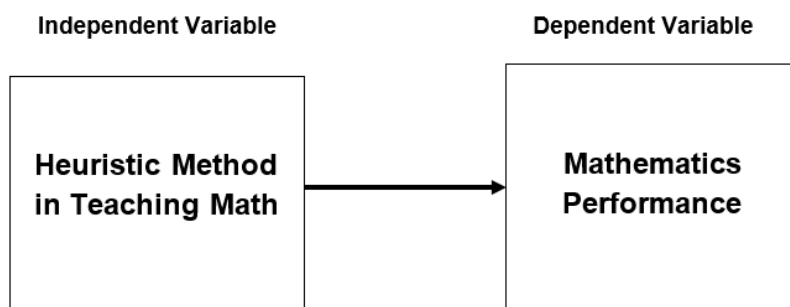
This study intended to find out how heuristic method will affect the mathematics performance of the subjects of study. The results of this study will be beneficial to both teachers and learners; the first, to determine areas for improvement in making learning process in a classroom setting be more meaningful, and to the students, to enjoy learning mathematics, to learn how solve problems using their own methods, and for them to love mathematics.

**To the Students.** Findings of this study are beneficial since they are the center of any classroom setting. They need to know what teaching strategy they would like best and would enjoy the most for a better performance.

**To the Teachers.** Findings of this study will give them ideas to determine how they can make their teaching more effective knowing other approaches to teaching that would assure that their students will have positive response.

**To future Researchers.** Findings of the study can be validated by conducting similar studies on related fields in the future.

### Conceptual Framework



**Fig 1: The Conceptual Framework of the Study**

Figure 1 presents the conceptual framework of the study being undertaken. It shows the independent variables – the approach to teaching mathematics subject, and how it will affect the mathematics performance of the students exposed to heuristic methods of teaching.

## Definition of Terms

The following terms are operationally defined for better understanding.

**Heuristic Method.** In this study, it refers to any approach in solving math problem that uses practical method. Students may use any method they think might help them solve the problem not using any math formula.

**Mathematics Performance.** In this study, it refers to the scores obtained by the subjects under study in their pretest and posttest.

**Posttest.** In this study, it refers to the test that will be administered after the conduct of experimentation.

**Pretest.** In this study, it refers to the 15 – item test that will be given before the actual experimentation begin. It is the same test given in the posttest.

## Scope and Delimitation of the Study

This study was conducted in Eastern Samar State University College of Education. The subjects of the study were limited to third year COEd students who took the subject Problem Solving and Mathematical Investigation.

## METHODOLOGY

This part presents the procedural techniques that were used in the conduct of the study. It discusses the research design, locale of the study, respondents of the study, sampling procedure, instrumentation, validation of research instrument, data gathering procedure, measurement of variables, and data analysis.

### Research Design

This study utilized the one group pretest – posttest experimental design. It will find the difference in the performance of students who will be exposed the use of Heuristic method in learning mathematics.

### Research Locale

The study will be conducted in Eastern Samar State University College of Education, Borongan Campus. It offers two programs, the BSEd and the BEEd, it is located in the northern part of the City at Barangay Maypangdan.

### Subjects of the Study

The subjects of this study were all the third-year COEd students who were enrolled in the subject during the second semester of School Year 2021 – 2022.

### Research Instrument

The study adopted a 15 – item test from the book *The Art of Problem Solving* by Camarista (2016) and was administered as the pretest and posttest before and after the actual experimentation.

### Statistical Treatment of Data

The mean was used to determine the average mathematics performance of the subjects under study. T - test was utilized to find if there was difference in the pretest and posttest scores of the subjects who were exposed to the heuristic methods in learning mathematics.

### Data Gathering Procedure

*Pre-Experimental Stage:* The pretest will administered to the subjects before the actual experimentation begin.

*Experimental Stage:* The group of students under study will be exposed to learning mathematics using the heuristic methods, the teaching approach used in the study.

*Post Experimental Stage:* After the experimentation, the posttest will be administered to every member of the group under study.

Data were evaluated and analyzed.

### Ethical Consideration

Before the conduct of the experiment, the researcher informed the students who will be the subjects that they will be part in a study. The researcher provided sufficient information and assurance for them to understand and to be fully informed about the study including the risks and benefits if they partake in this study. They were given freedom about whether or not to take part in the study without any pressure. Pretest and posttest scores are the only data needed from the students who will be subjected to the experiment.

## RESULTS AND DISCUSSION

This part presents, analyzes and interprets data gathered from the different experimental groups using the peer ratings and their achievement test. The results are presented according to the statement of the specific questions that directed the study.

**Table 1: Pretest and Posttest Performance of COEd Students**

Test	N	Mean	SD
Pretest	14	4.85	1.99
Posttest	14	9.21	2.29

Table 1 presents the mean of the pretest and posttest performance of the group under study. The mean of the posttest performance at 9.21 with a standard deviation of 2.29 is higher than the mean pretest performance of 4.85 with a standard deviation of 1.99. The posttest performance revealed a higher mean implying that learning took place.

The standard deviation of the pretest at 1.99 and posttest at 2.29 shows that scores obtained in both the pretest and posttest are not far from their respective mean implying that scores obtained in both test are almost similar or close to each of the other scores.

**Table 2: T-test between the mean Pretest and Posttest of COEd Students**

Tests	N	Mean	SD	Mean Difference	p	Interpretation
Pretest	14	4.85	1.99	4.36	0.003	significant
Posttest	14	9.21	2.29			

Table 2 shows the t-test result in the pretest and posttest performance of the group under study. With the mean pretest and posttest performance of 4.85 and 9.21 respectively, a mean difference of 4.36 is revealed.

From these results, it evidently show a significant difference at p value of 0.003 which is less than the 0.05 level of significance, hence we reject null hypothesis. This implies that the pretest and posttest performance of the group under study varies significantly.

With the p value less than 0.05 between the pretest and posttest scores, interpreted as having significant difference, further implies that the use of Heuristic approach did help the students improve their understanding and learning the concepts.

This result is in consonance with the findings of Al-Fayez (2012), Abonyi (2014), Hadjichristou (2015), and Singh, et., al, (2018), the findings of their studis indicated that the experimental group who were exposed to heuristic method of teaching performed better that those students who were taught traditionally. There were statistically significant differences in the post- test between the control and the experimental groups in favor of the experimental group.

But this result are in contrast with Abdulhamid (2020) Comparative Analysis of SMASSE and Heuristic Methods of Teaching Mathematics at Secondary School Level in Gombe State, where the findings showed that using Heuristic method approach did not make the performance of the subjects better in the class. The results indicated that students taught using the Heuristic approach obtained lower grades than the control group students indicating no significant difference in the students' performance.

## CONCLUSIONS AND RECOMMENDATIONS

This part presents the summary of the significant findings in the study, the conclusions that were derived from these findings and the corresponding recommendations made on the basis of the conclusions.

### Summary

This study was conducted to find out the how Heuristic method would help students learn concepts in mathematics particularly the third-year COEd students enrolled during the second semester of school year 2021 - 2022 at Eastern Samar State University Borongan Campus.

This study used the one group pretest – posttest experimental research design. It tried to find out the difference in the pretest and posttest performance of the single group under study.

The mean was used to determine the average mathematics performance of the subjects under study. T - test was used to find the difference in the pretest and posttest scores.

## Findings

Based on the results, the following findings were formulated;

1. The average of the pretest performance of the single group under study understandably low at 4.85, with a standard deviation of 1.99.
2. The average of the posttest performance of 9.21 with a standard deviation of 2.25 was higher than the pretest performance, implying that learning took place.
3. The t-test result between the pretest and posttest performance revealed a mean difference of 4.36 which implies that the pretest and posttest performance of the group under study varies significantly. The p value of 0.003 between the pretest and posttest scores is less than the significance level of 0.05 which implied that using heuristic approach in solving non-routine math problems improve the scores in the posttest.

## Conclusions

Based on the results, scores obtained in the pretest was considerably low presenting that students did not know any idea how non-routine problems are solved. The average of the posttest was higher compared to the pretest, showing that learning took place. Based on statistics, there was a significant difference in the pretest and posttest performance of the group under study.

## Recommendations

Based on the findings of the study, the following recommendations are presented:

1. Knowing one's students before starting the course is imperative to all teachers, this is to enable them to identify and employ the appropriate teaching method to be used.
2. Teachers may try to use heuristic method not only in math classes to help students learn better.
3. School administrator should send instructors and professors to seminars on new trends in education, strategies and approaches.
4. Future researchers may conduct a similar experiment to validate results of this study.

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