INSTABRIGHT e-GAZETTE
ISSN: 2704-3010
Volume V, Issue II
November 2023
Available online at https://www.instabrightgazette.com

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DESIGN THINKING METHOD TOWARDS IMPROVED HIGHER ORDER THINKING SKILLS OF STUDENTS IN SOLVING PROBLEM

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ABSTRACT

The study aimed to determine the significant relationship between Design Thinking Method and Improved Higher Order Thinking Skills of Grade 8 Students in Problem Solving.

Specifically, it sought to find the pre-test scores of the respondents in thinking skills test in terms of analyzing, evaluating, and creating; the post-test scores of the respondents in thinking skills test in term of analyzing, evaluating, and creating; and to find out if there is a significant difference between the pre-test and post-test scores of the respondents in thinking skills test in terms of analyzing, evaluating, and creating.

This study used the pre-experimental method of research that involved pre-testing, application of treatment then post-testing of the respondents that were measured using the pre-post rubrics. The respondents of the study were Grade 8 students of Prudencia D. Fule Memorial National High School who were enrolled during the S.Y 2018-2019.

The data gathered were subjected to statistical treatment and analyses. To answer the problem, the researchers used the mean and standard deviation for descriptive data. The researchers also used the matched t-test for inferential data.

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INSTABRIGHT e-GAZETTE
ISSN: 2704-3010
Volume V, Issue II
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Available online at https://www.instabrightgazette.com

The results of the study revealed that the post-test scores of the higher order thinking skills test such as analyzing, evaluating, and creating are higher than their pre-test scores. The pre-test scores of the higher order thinking skills test belong in the developing level of proficiency. On the other hand, the mean post-test scores belong in the approaching proficiency level. Lastly, the significant difference was obtained between the pre-test and post-test scores of the respondents in higher order thinking skills.

Based on the findings of this study, it can be concluded that there is a significant difference between the pre-test and post-test score of the respondents in thinking skills test in terms of analyzing, evaluating and creating.

Definition of Terms

The following terms are defined operationally for the purpose of the study.

Analyzing. It is used in the study as how students break down those big concepts and problems into smaller for their understanding so that they can answer the problems easier. It is also means of understanding the concepts into simplest way.

Brainstorming. It is used by the teachers to know the reasons why such problem arises within the student's learning. It is used as one of the method in design thinking that allows the students to generate ideas or prior knowledge in a particular problem.

Creating. It is used in the study as the ability of the students to put all together the knowledge they've learn to form a valuable idea.

Creative ideas. The way the students think creatively to come up with a unique solution to solve a specific problem. It is also used in the study where in students are allowing to formulate

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ISSN: 2704-3010
Volume V, Issue II
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different ideas that suites with the needed demands of the problem as well as for the teachers to make an innovative way of teaching a lesson.

Design thinking methods. It is used as a process in creating new and innovative ideas to solve problems.

Evaluating. It is how students' make a judgment based on their understanding of the problem. It is used in the study for the students to be sensitive in learning and make opinions/solutions that are based on the result in their analyzing.

Group analysis. It is a method used by the teacher to have students' collaboration about the problem. Collaboration as a group will be easier for the students to create different ideas with regards to the problem. And it is more convenient for the teacher to teach because working as a group makes the lesson easier to teach.

Higher order thinking skills. Those skills are being measured by the researcher. It includes the analyzing, evaluating and creating skills of the students. These skills, as a whole, will be a target of the researcher from the student's improvement in learning using the method of design thinking.

Innovation. It is used by the teachers to come up with a new and effective method in teaching. It is not written in the lesson plan but the teacher used it to help the students to acquire knowledge needed for the problem solving.

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Introduction

The needs of today's learners evolve fast as the day goes by. At the same time, teachers must stretch to their limits to keep up with the changing demands of times. Teachers understand their students like no one else. It is their opportunity and their responsibility to design a new method and improved solutions for the challenges that they encounter everyday in their classroom. As Einstein said, "We can't solve problems by using the same kind of thinking we used when we created them." Method used by others might not work to some so teachers must think and design for new methods that will respond to the different needs of their students.

Design Thinking is one of the methods that can respond to different complex problems, but what is Design Thinking? It is design methodology that provides problem-based approach to the problem solving. According to the study of Tornali (2013), in its simplest form, Design Thinking is a process that is applicable to all walks of life, of creating new and innovative ideas to solve problems; it is not limited to a specific industry or area of expertise. It can also be effective in education, if students are working on a problem in Mathematics. With the help of design thinking, students can learn how to interpret information they have learned, to analyze the given problem, to evaluate and to create different solutions and ideas. In the process, students higher order thinking skills are used.

According to Revised Bloom's Taxonomy (2001), higher order thinking skills were composed of *analyze, evaluate and create*. These three (3) thinking skills are essential in solving problems in Mathematics because students need to analyze the problem and apply many Mathematical skills and concepts in their decision making. They also need to create a unique solution to the given problem. Problem solving is not just a simple situation to be solved; it involves the higher order thinking skills of the students.

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ISSN: 2704-3010
Volume V, Issue II
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Available online at https://www.instabrightgazette.com

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Research Instrument

The instrument used by the researchers to gather the essential information for the study from the respondents was the pre-test and post-test to determine the cause-and-effect relationship between the variables and the researchers also used a prepared lesson plan.

The researchers made four (4) sets of lesson plans for the four consecutive lessons. The detailed lesson plans were based in the Kto12 Curriculum. The pre-test and post-test used in this study was made by the researchers and the researchers used modified standardized questionnaires as a reference.

The pre-test and post-test used in this research was consisted of twenty (20) problem solving tests. Each item corresponds to 9 points that is based on the formulated rubric.

The test instruments used were subjected to a content validation by five mathematics professors and researchers' thesis adviser, for correction, revision, and improvement of the pre-test and post-test.

Research Procedure

To carry out the study, the researcher asked permission from the principal, to formally conduct an instruction to the science section in grade 8 with regards to Design Thinking Method at Prudencia D. Fule Memorial National High School during the first quarter, school year 2018-2019.

Upon the approval of the principal, the researchers also asked permission to math teacher coordinator to assign them. Afterwards, through the help of other teachers, researchers personally approached the respondents and asked a help for their research by means of cooperating. The researchers gave the pre-test to determine how the students analyze, evaluate and create a problem in mathematics before they taught the experimental group using design

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INSTABRIGHT e-GAZETTE
ISSN: 2704-3010
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thinking method such as group analysis, brainstorming, innovation, and creative ideas. During an activity, the researchers used the collaborative learning strategy for group analysis by dividing them into twelve groups. Each group was given word problems to be accomplished and then rewarded for every correct answer. Moreover, as they worked in groups, they were collecting ideas and suggestions with their group members through brainstorming. In addition, throughout the discussion, the researchers tend to innovate through generating other examples aside from those written in the lesson plan due to the varied level of understanding of the students. Lastly, the researchers let the students use their unique way of solving the given problem by means of their creative ideas.

The researchers made four (4) sets of detailed lesson plans for the four consecutive lessons. The researchers also looked some sample problems from the internet and from books as guide in order to make a test. The test was constructed based on the needed data as explicitly stated in the statement of the problem to establish the validity of the test.

After the four consecutive discussions using the Design Thinking Method and also with the use of prepared detailed lesson plan, the researchers administered the post-test to determine if the higher order thinking skills of the students were improved. The papers were checked by the researchers, and the scores were tallied and analyzed. All information was organized, synthesized, and presented quantitatively to answer the specific problems presented.

Statistical Treatment

The collected data were classified, tabulated, and encoded for analysis. The data gathered were subjected to statistical treatment and analyses.

To answer the problem posted in the study, the researchers used mean and standard deviation for descriptive data. The researchers also used the matched t-test for inferential data. It was used since t-test was probably the most widely used statistical test for comparison of two

INSTABRIGHT e-GAZETTE
ISSN: 2704-3010
Volume V, Issue II
November 2023
Available online at https://www.instabrightgazette.com

means, the pre-test mean score and post-test mean score, of the same sample. Matched t-test was used to analyze the data to improve the higher order thinking skills of the students especially in problem solving through teaching mathematics using design thinking method.

PRESENTATION, ANALYSIS AND INTERPRETATION OF DATA

This chapter is a presentation of the results of the study. The analysis and presentation of the data are discussed according to the problems presented so that conclusions and any recommendation may be drawn from the study.

Part I. Frequency of the Pre-test Scores of the Respondents in Higher Order Thinking Skills

Table 1. Frequency of the Pre-test Score of the Respondents in Higher Order Thinking Skills in terms of Analyzing

Scale	Pre-test	
	f	%
90-100	1	2
85-89	4	11
80-84	6	17
75-79	19	53
74 and below	6	17

Legend: 90 and above: Advanced 85-89: Proficient 80-84: Approaching Proficient 75-79: Developing 74 and below: Beginning

Table 1 revealed that out of thirty-six (36) students, the highest frequency is nineteen (19) with a total of fifty-three percent (53%) which means that most of the students got a score ranging from 75-79 while the lowest frequency is one (1) with a total of two percent (2%) which

INSTABRIGHT e-GAZETTE
ISSN: 2704-3010
Volume V, Issue II
November 2023
Available online at https://www.instabrightgazette.com

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means that only one student got a score ranging from 90-100. The majority of the respondents are in the developing level of proficiency.

Table 2. Frequency of the Pre-test Score of the Respondents in Higher Order Thinking Skills in terms of Evaluating

Scale	Pre-test	
	f	%
90-100	0	0
85-89	4	11
80-84	3	8
75-79	18	50
74 and below	11	31

Legend: 90 and above: Advanced 85-89: Proficient 80-84: Approaching Proficient 75-79: Developing 74 and below: Beginning

Table 2 revealed that out of thirty-six (36) students, the highest frequency is eighteen (18) with a total of fifty (50%) which means that most of the students got a score ranging from 75-79 while the lowest frequency is three (3) with a total of eight percent (8%) which means that eight students got a score ranging from 90-100. The majority of the respondents are in the developing level of proficiency.

Table 3. Frequency of the Pre-test Score of the Respondents in Higher Order Thinking Skills in terms of Creating

Scale	Pre-test	
	f	%
90-100	1	2
85-89	3	10
80-84	4	11
75-79	21	59
74 and below	7	18

Legend: 90 and above: Advanced 85-89: Proficient 80-84: Approaching Proficient 75-79: Developing 74 and below: Beginning

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INSTABRIGHT e-GAZETTE
ISSN: 2704-3010
Volume V, Issue II
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Table 3 revealed that out of thirty-six (36) students, the highest frequency is twenty-one (21) with a total of fifty-nine percent (59%) which means that most of the students got a score ranging from 75-79 while the lowest frequency is one (1) with a total of one percent (1%) which means that only one student got a score ranging from 90-100. The majority of the respondents are in the developing level of proficiency.

Part II. Frequency of the Post-test Scores of the Respondents in Higher Order Thinking Skills

Table 4. Frequency of the Post-test Score of the Respondents in Higher Order Thinking Skills in terms of Analyzing

Scale	Post-test	
	f	%
90-100	9	25
85-89	4	11
80-84	17	47
75-79	6	17
74 and below	0	0

Legend: 90 and above: Advanced 85-89: Proficient 80-84: Approaching Proficient 75-79: Developing 74 and below: Beginning

Table 4 revealed that out of thirty-six (36) students, the highest frequency is seventeen (17) with a total of forty-seven percent (47%) which means that most of the students got a score ranging from 80-84 while the lowest frequency is four (4) with a total of eleven percent (11%) which means that four students got a score ranging from 85-89. The majority of the respondents are in the approaching level of proficiency.

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ISSN: 2704-3010
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Table 5. Frequency of the Post-test Score of the Respondents in Higher Order Thinking Skills in terms of Evaluating

Scale	Post-test	
	f	%
90-100	4	11
85-89	9	25
80-84	12	33
75-79	11	31
74 and below	0	0

Legend: 90 and above: Advanced 85-89: Proficient 80-84: Approaching Proficient 75-79: Developing 74 and below: Beginning

Table 5 revealed that out of thirty-six (36) students, the highest frequency is twelve (12) with a total of thirty-three percent (33%) which means that most of the students got a score ranging from 75-79 while the lowest frequency is four (4) with a total of eleven (11%) which means that four students got a score ranging from 85-89. The majority of the respondents are in the developing level of proficiency.

Table 6. Frequency of the Post-test Score of the Respondents in Higher Order Thinking Skills in terms of Creating

Scale	Post-test	
	f	%
90-100	6	17
85-89	7	19
80-84	16	45
75-79	7	19
74 and below	0	0

Legend: 90 and above: Advanced 85-89: Proficient 80-84: Approaching Proficient 75-79: Developing 74 and below: Beginning

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ISSN: 2704-3010
Volume V, Issue II
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Available online at https://www.instabrightgazette.com

Table 6 revealed that out of thirty-six (36) students, the highest frequency is sixteen (16) with a total of forty-five percent (45%) which means that most of the students got a score ranging from 80-84 while the lowest frequency is six (6) with a total of seventeen percent (17%) which means that six students got a score ranging from 90-100. The majority of the respondents are in the developing level of proficiency.

Part II. Test of Difference between the Pre-test and Post-test Scores of the Respondents in Higher Order Thinking Skills

Table 7. Test of Difference between the Pre-test and Post-test Scores of the Respondents in terms of analyzing, evaluating, and creating

HOTS		M	SD	t-value	p-value	Interpretation
Analyzing	Pre-test	21.38	8.28	8.43	.000	significant
	Post-test	34.02	10.34			
Evaluating	Pre-test	20.02	7.57	8.31	.000	significant
	Post-test	32.00	10.14			
Creating	Pre-test	21.05	7.98	8.65	.000	significant
	Post-test	32.02	9.41			

Legend: $p < 0.05$ – significant, $p > 0.05$ – not significant

The values from the t-test can be derived that there are significant differences on the pre-test and post-test scores of the respondents on the higher order thinking skills tests. It shows that there is an improvement from the pre-test to the post-test evaluation of the students. Based on the mean score of the pre-test and post-test, this may imply that the use of Design Thinking Method such as brainstorming, group analysis, innovation and creative ideas helped in improving the students' higher order thinking skills. Design educator Robin Vande Zande made a case for design thinking method in secondary education stating that design thinking can help train students in problem solving through the design process (Vande Zande, et al., 2014). Design

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ISSN: 2704-3010
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Thinking Method helps students to find solutions to complex and open ended problems, thus, enhancing their higher order thinking skills. Likewise, design thinking supports students' problem solving performance by contributing critical thinking, social development, teamwork skills, and negotiating meaning (Carroll, et al 2010). Vande Zande also purports that understanding design thinking method can help students become more critical thinkers (Watson 2015).

Conclusion

The hypothesis stating that there is no significant difference between the pre-test and post-test score of the respondents in thinking skills test in terms of analyzing, evaluating and creating is rejected.

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ISSN: 2704-3010
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