CREATIVE THINKING SKILLS AND PROBLEM-SOLVING SKILLS IN MATHEMATICS AMONG GRADE 6 PUPILS

A Thesis
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ROSE ANGELIE L. TURLA
GRACE EJ M. DELA CRUZ
JHASTINE A. JOSON
APRIL JOY H. LICU
PATRICIA ANN C. ROYO

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Abstract

This study focused on the significant relationship between Creative Thinking Skills and Problem-Solving Skills in Mathematics among Grade 6 pupils. The study's respondents were thirty (30) Grade 6 pupils from one of the elementary schools in the District of Sta. Ana, Pampanga. The respondents were selected using simple random sampling techniques. The study used a survey questionnaire comprising the Creative Thinking Skills Test (Pentang et al.,2022) and a researcher-made word problem-solving written test and rubrics. The researchers found a high level of Creative Thinking Skills among the Grade 6 pupils, while the respondents' problem-solving skills were categorized as competent. The study revealed that the Creative Thinking Skills and Problem-Solving Skills in Mathematics of the Grade 6 pupils were very lowly correlated. Still, creative thinking and problem-solving in the applied subject are recommended to help students acquire the 21st-century skills that empower them to develop holistically and career ready.

Keywords: *Creative Thinking Skills, Problem-Solving Skills, Mathematics, Grade 6 pupils*

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Chapter 1

The Problem and Its Background

Introduction

One of the 21st-century skills is creativity. As stated in the book of Runco (2023), creativity is an essential and interesting topic to investigate, but there is no single definition. Treffinger (2011) researched and analyzed the literature on the concepts of creativity up to 2011 and discovered over 100 definitions. This difficulty is due to creativity being expressed in various ways, including technical innovation, education, commerce, health, economics, design, the arts and science, and various other undertakings. As a result, this has been examined using different methods and contexts, leading to studies on creativity in psychology and other fields. Different ways of viewing and measuring creativity continue to change and improve: Wilson et al. (1954) proposed that creativity is split into factors; Guilford (1960) developed the Alternative Uses Test based on Wilson's theories. Fluency is the number of created alternatives or solutions; Flexibility generates new ideas from various perspectives; Originality is the originality of the ideas or thoughts; and Elaboration, adding details and an idea to make a generated plan function, are the four factors defining this test. Torrance (1966) developed the Minnesota Tests of Creative Thinking, which use the same criteria as the latter to assess four creative aspects: fluency, flexibility, originality, and elaboration. He eventually renamed the test into the Torrance Test of Creative Thinking (TTCT). This is one of the most extensively used to test people's creative ability in general, and it is available in both figural and verbal formats (Okamoto et al., 2023). Before, creativity in students was

valuable in music, art, literature, or dance; however, creativity has evolved and is recognized as one of the essential learning skills for pupils in the 21st century since it gives them the tools to deal with an uncertain future (Shin et al.,2017). Creativity has become so valued in schools that it is encouraged in all fundamental classes, including physics, language, and mathematics (Beghetto & Kaufman, 2009; Gajda et al., 2017; Kasirer et al., 2021; Runco, 2003; Soh, 2017).

Most pupils consider mathematics difficult and tedious (Langoban, 2020). A study found that only 3 out of the 45 students loved the mathematics subject, 82% of the students hated it, and 75% believed that mathematics is complicated (Kurukkan et al., 2015). According to Programme for International Student Assessment (PISA) 2018, the Philippines ranked second to last in mathematics out of 79 participating nations. Also, it ranked second to worst Grade 5 mathematics skills among the different countries in Southeast Asia, as stated in the report of Southeast Asia Primary Learning Metrics (SEA-PLM) 2019. This is equivalent to only 17% of the minimum mathematical standard met. Fanchini et al. (2018) believe creativity can improve academic performance. Moreover, it has stated that creativity is required to solve mathematical problems. Problem-solving summarizes a sophisticated and rational cognitive process, consequently giving an acceptable explanation for problem resolution. This is particularly important in mathematics (Guzman, 2018; Wilson et al., 2011). The primary purpose of teaching mathematical problem-solving is for students to develop general competence in addressing real-life issues and using mathematics in real-life settings. Nevertheless, there are situations wherein the person with all the necessary information fails to solve the problem because the problem-solver mind is fixated on a method that drives them on the

wrong path. According to Einstein, "Mathematical creativity is more than the capacity to solve the problem; it is about the ability to recognize the problem" (Walia & Walia, 2017, p. 1294). Problem-solving skills are essential skills that can be developed in education (Franestian et al., 2020). Furthermore, creativity and problem-solving are two of the top ten abilities in demand in 2025 (World Economic Forum, 2020).

Kumar (2020) studied the relationship between Problem-Solving Ability and Creativity among Nagapattinam District higher secondary students. The study shows that higher secondary pupils have high problem-solving skills and modest creativity. These findings revealed no relationship between creativity and problem-solving skills among higher-secondary students. In addition, the study of Bacangallo et al. (2022) aims to investigate the relationship between pre-service teachers' creative thinking and problem-solving skills. The finding concluded that pre-service teachers show impressive creative thinking abilities, particularly fluency, flexibility, and elaboration skills. However, they need problem-solving abilities in statistics, particularly concerning central tendency, dispersion, and position measurements. These results concluded that the pre-service teachers' creative thinking and problem-solving skills were not correlated. Contrary to these results, Liu et al. (2022) study revealed a strong relationship between mathematical academic achievement and creativity. Numerous math competitions aim to foster students' creativity while utilizing mathematical knowledge (Kovari et al., 2020). It assumes pupils with better mathematics academic achievement are more creative than those with lower mathematics academic performance (Manchanda et al., 2012). Nevertheless, some researchers have shown a substantial positive relationship between mathematics achievement and creativity. As a result, pupils with better mathematical

achievements are more likely to be trailblazers and innovators.

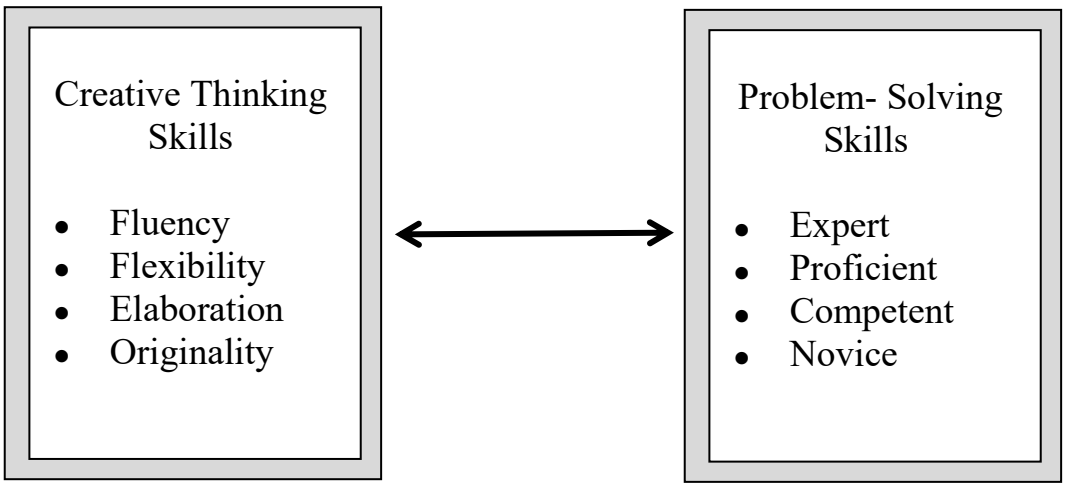
As presented in the literature, some studies have investigated the correlation between creativity and problem-solving skills in different groups. However, the presented studies have not examined the correlation between creativity and problem-solving skills among the lower grade levels. These results in the researchers conducting a study about the creative thinking skills and problem-solving skills in mathematics among the Grade 6 pupils in selected schools. This study aims to identify if there is a correlation between creative thinking skills and problem-solving skills in mathematics among Grade 6 pupils. This study allows researchers to collect information regarding the creative thinking skills and problem-solving skills in mathematics among Grade 6 pupils. Walia & Walia, 2017 p.1294, as cited by Gruntowicz (2018), states that seeing the problem entails displaying divergent thinking, the most advanced form of mathematical thought. It may also be examined if children's creative thinking skills affect their problem-solving skills. The researchers pursue this study to ensure that every learner can enhance their problem-solving skills regardless of their learning styles as well as the coping mechanism of the student. The study's results would benefit the pupils, teachers, curriculum developers, and future researchers by knowing the significant effect of creative thinking skills on problem-solving skills. Significantly, this study will help teachers take action regarding their teaching practices to their students with difficulties in problem-solving skills.

Conceptual framework

The conceptual framework used in this study was a conceptual model. The researchers use two rectangular figures to indicate the general construct (a) Creative Thinking Skills and (b) Problem-Solving Skills. The first rectangular figure shows the four aspects of creative thinking skills: fluency, flexibility, elaboration, and originality. The second rectangular figure categorized students' expertise level in problem-solving skills, such as expert, proficient, competent, and novice. The overarching conceptual framework was grounded in the Divergent Thinking Theory of Joy Paul Guilford (1967). This theory is the ability to develop several alternative solutions to a given circumstance or problem, which indicates the ability to think creatively and solve problems (Runco, 2011). This idea relates to this study in which two rectangular figures are connected with a double-headed arrow that indicates the correlation between creative thinking skills and problem-solving skills in mathematics among Grade 6 pupils (see Figure 1).

Figure 1

Creative Thinking Skills and Problem-Solving Skills Conceptual Model



Statement of the problem

The purpose of this study is to explore the Creative Thinking Skills and Problem-Solving Skills in Mathematics among Grade 6 Pupils.

Specifically, it aims to provide answers to the following questions:

1. How may the students be described in creative thinking skills in terms of:
    1.1. Fluency;
    1.2. Flexibility;
    1.3. Elaboration; and
    1.4. Originality?
2. How may the students be categorized in terms of problem-solving skills in terms of:
    2.1. Expert;
    2.2. Proficient;
    2.3. Competent; and
    2.4. Novice?
3. Is there a significant relationship between Creative Thinking Skills and Problem-Solving Skills in Mathematics among Grade 6 pupils?

Hypothesis

$H_{0:}$ There is no significant relationship between Creative Thinking Skills and Problem-Solving Skills in Mathematics among Grade 6 pupils.

$H_{1:}$ There is a significant relationship between Creative Thinking Skills and Problem-Solving Skills in Mathematics among Grade 6 pupils.

Significance of the study

The following people will benefit from the results of this study:

Students. The study will provide knowledge to the pupils about how creative thinking skills affect problem-solving skills. It could be an aid for them to enhance their creativity, which eventually improves their problem-solving skills, as well as their academic performance.

Teachers. The study's result can expand teachers' knowledge, especially mathematics teachers, with practical information about the effects of creative thinking skills on the mathematical problem-solving skills of the pupils. It also helps them to determine the learners' difficulties that will lead them to where they will focus their discussions and encourage them to use various strategies that foster student creativity.

Curriculum Developers. The result of the study can be a guide for the curriculum developer to enhance the instructional system in mathematics subjects, particularly at the elementary level.

Future Researchers. This study would help and assist future researchers who seek to conduct similar studies. This study could be used as a source, guide, or reference when conducting their research study.

Scope and Limitation

This study covers creative thinking skills and problem-solving skills in mathematics among Grade 6 pupils. This study determines the relativity of the learner's creativity to problem-solving skills. The Grade 6 pupils in one of the elementary schools

in the District of Sta. Ana were the study's respondents, and the 30 respondents were chosen at random.

Definition of Terms

The following terminologies are defined to grasp better the issues discussed in the study.

Competent. The pupils demonstrate a limited understanding of the problem. It uses a representation that gives some important information about the problem. It applies some appropriate procedures, and the answer is partially correct but lacks clarity.

Creative Thinking Skills. The ability to connect many notions and ideas to solve a problem (Yayuk, 2020).

Elaboration. The pupils' capacity to add details and an idea to make it more appropriate to address a problem and persuade others of the answer leads to more information and other additions (Aldossari, 2021).

Experts. The pupils under this level can demonstrate a rigorous understanding of the problem. It uses an original representation of the problem. Apply complete and accurate procedure, and can answer the problem correctly, exemplary, detailed, and precise.

Flexibility. The pupils can change their thinking style occasionally and generate new ideas from various perspectives (Aldossari, 2021).

Fluency. The pupils can generate a large number of alternatives, solutions, or ideas for the problem (Aldossari, 2021).

Novice. The pupils under this level can demonstrate little or no understanding of the problem. It uses a representation that provides little or no helpful information about the

problem. Applies inappropriate procedures, and there is no answer to the problem or incorrect answer.

Originality. The pupils can provide unique thoughts and ideas that vary from what we read in literature or other people's ideas (Bacangallo et al., 2022).

Problem-Solving Skills. The ability to identify problems, create and assess solutions, and implement the best solutions (Kaplan, 2023).

Proficient. The pupils under this level can demonstrate a substantial understanding of the problem. It uses a clear and effective representation of the problem. Applies appropriate procedures, and the answer is generally correct.

Acronym

CTST- Creative Thinking Skill Test

Chapter 2

Methods

This chapter discusses the research methodology, respondents, research tools, questionnaire validity, research locale, data collection, data analysis, and ethical considerations used in the study.

Research Design

This research was quantitative in nature, specifically correlational research design. This study used a quantitative research method to gather and analyze numerical data. In addition, quantitative research is a method for studying a particular group of people known as a sample population that investigates phenomena using numerical data and statistical, analytical, or computing tools (Adedoyin, 2020). At the same time, a non-experimental research method that makes it easier to predict how variables relate to one another is called correlational research design (Seeram, 2019). By using these methods, the study can provide reliable data about the correlation between creative thinking skills and problem-solving in mathematics among Grade 6 pupils.

Respondents

Grade 6 pupils participated in this survey as respondents from one of the Elementary Schools in the District of Sta. Ana, in the Academic Year 2022-2023. The researchers selected thirty (30) respondents using simple random sampling techniques. This sampling technique is a method where a subgroup of people chosen randomly by researchers to represent an entire group as a whole is known as a random sample. Each

population member is equally likely to get selected using this sampling procedure (Thomas, 2020).

Instrument

The instruments used for this study were the survey questionnaire and the written test and rubrics. The survey questionnaire covers the students' creative thinking skills, adapted with permission from Pentang et al. (2022) (See appendix B). The Creative Thinking Skill Test (CTST) was focused on the four aspects of creative thinking: (a) fluency, (b) flexibility, (c) elaboration, and (d) originality. This questionnaire comprises five questions for each aspect, wherein every question on the questionnaire is evaluated using a Likert scale with a value of 1 to 4, between 1 (never) to 4 (always). At the same time, the written test consists of 8-item word problem-solving questions developed by the researchers, following the curriculum guide in mathematics for the Grade 6 pupils. This was utilized to assess the respondents' problem-solving skills that were scored using the rubrics. The analytic rubrics used in this study were researchers-made and developed from reading and following the rules in creating analytic rubrics for problem-solving assessment. This analytic rubric focuses on assessing the four criteria in problem-solving skills: (1) understanding, (2) uses representation, (3) procedures, and (4) answers. Each criterion is graded on a scale of 1 to 4, with 1 being the lowest score (novice) and 4 being the highest (expert).

Validation of the Questionnaire

Five (5) validators validated the instrument used in this study to solicit further suggestions and comments regarding the questionnaire: Two (2) English Language

experts and (3) Math Elementary teachers. The (2) English Language expert teachers checked the grammar and structure of the instrument, particularly the creative thinking skills test. The validators simplify the complex words that are difficult to comprehend at the level of understanding of sixth graders. While the three (3) Math Elementary teachers also checked the validity and liability of the problem-solving written test in the Grade 6 pupils. From eleven (11) items of word problem-solving questions, only eight (8) items were accepted. The other items were rejected due to the level of difficulty of the problem, and some topics were not yet discussed among the Grade 6 pupils.

Research Locale

The study was administered in one of the Elementary Schools in the District of Sta. Ana, Pampanga.

Data Collection

The researchers requested permission from the Dean of the College of Education at Don Honorio Ventura State University to conduct a study to fulfill their research subject's requirements. The researchers also wrote a letter to the school principal of the selected Elementary School in the District of Sta. Ana to ask permission to conduct a study in the said school. After the permission was approved, the researchers used fishbowl techniques to select the 30 respondents among the Grade 6 pupils. Then, the researchers distributed an assent form to the selected respondents to ask for consent from their parents or guardians to allow their children to participate in the study and understand what their children will be expected to do. The survey questionnaire and written test were distributed on-site after the consent was authorized. Then, the

respondents were given 50 minutes to answer the survey questionnaire and retrieved it on the same day, right after the respondents answered the survey questionnaire.

Data Analysis

The respondent's answers to the survey questionnaire checklist were gathered, tallied, tabulated, and organized, including those scores derived from the problem-solving test were evaluated using an analytic rubric. The researchers used IBM SPSS Statistic v27, a statistical software package, to assess and examine the outcome of the data gathered using the following statistical treatment:

Descriptive statistics were used to describe the respondents' creative thinking skills in fluency, flexibility, elaboration, and originality, specifically the mean and standard deviation. The conversion table was used to change into a descriptive rating using the qualified mean below (Pentang et al., 2022).

Numerical Rating	Descriptive Rating
3.26-4.00	Very High
2.51-3.25	High
1.76-2.50	Moderate
1.00-1.75	Low

Descriptive statistics were also used to categorize the level of expertise in terms of problem-solving skills, specifically the frequency, percentage, mean, and standard

deviation. The conversion table was used to change into a descriptive rating using the qualified mean below.

Numerical Rating	Descriptive Rating
105-128	Expert
81-104	Proficient
57-80	Competent
32-56	Novice

Furthermore, the researchers used the Pearson correlation coefficient to evaluate the statistical hypotheses of the study to look at the relationship between Creative Thinking Skills and Problem-Solving Skills in Mathematics among Grade 6 pupils. The standard table for interpretation of the correlation is stated below.

Value of r	Verbal Interpretation
$0.80 \leq r \leq 1.0$	Very High Correlation
$0.60 \leq r \leq 0.79$	High Correlation
$0.40 \leq r \leq 0.59$	Moderate Correlation
$0.20 \leq r \leq 0.39$	Low Correlation
$0 < r \leq 0.19$	Very Low Correlation

Ethical Consideration

To make sure that the study was carried out as carefully and morally as feasible, the researchers distributed an assent form to the selected respondents who are minors to ask for consent from their parents or guardians to allow their children to participate in the study and understand what their children will be expected to do. After the letter was authorized, the respondents for this research were made aware that their identities and answers would remain anonymous, wherein the collected data would be confidential. Hence, the researchers conducted a survey in which the respondents' names were optional. Moreover, the researchers surveyed the available time of the respondents to encourage them to stay focused in their classes. In addition, all the included references utilized in this study were also properly credited.

Chapter 3

Results and Discussion

The results acquired in the survey supplied by the respondents about their abilities in creativity and problem-solving in mathematics were presented, examined, and interpreted in this chapter. Tables are used to present the results in the proper sequence and order based on the statement of the problem.

1. Creative Thinking Skills

1.1 Fluency

Table 1

Descriptive analysis of the respondents' fluency in Creative Thinking Skills

Indicators	Weighted Mean	Standard Deviation	Verbal Interpretation
I think of more than one solution and one answer	2.47	0.78	Moderate
I answered the question with many possible solutions.	2.33	0.76	Moderate
I respond to the question with many possible solution.	2.63	0.67	High
I was able to produce thoughts or ideas for solving problems.	2.40	0.62	Moderate
I was able to provide many ways to solve the problem.	2.43	0.82	Moderate
Fluency weighted mean	**2.45**	**0.43**	**Moderate**

As shown in Table 1, based on the responses of 30 respondents, it was identified that they have a high level of fluency in responding to the question with many possible

solutions, with a value of mean 2.63 (SD = 0.67). While a moderate level of fluency in thinking of more than one solution and one answer with a value of the mean of 2.47 (SD = 0.78). The respondents have a moderate level of fluency in answering the question with many possible solutions, with a mean of 2.33 (SD = 0.76). Then, the respondents also have a mean of 2.40 (SD = 0.62), equivalent to moderate fluency in producing their thoughts or ideas for solving problems. Furthermore, the respondents also have a moderate level of fluency in providing many ways to solve the problem, with a value mean of 2.43 (SD = 0.82). Overall, the Grade 6 pupils' creative thinking skills in fluency were moderate, with a weighted mean of 2.45 (SD = 0.43). This supported the study of Shafa et al. (2023), where the students' average has a moderate level of fluency and elaboration in creative thinking skills in solving maths problems resembling those on the Programme for International Student Assessment (PISA).

1.2 Flexibility

Table 2

Descriptive analysis of the respondents' flexibility in Creative Thinking Skills

Indicators	Weighted Mean	Standard Deviation	Verbal Interpretation
I create ideas for the varied question.	2.43	0.73	Moderate
I see the problem from a different point of view.	2.37	0.85	Moderate
I look for different techniques.	2.90	0.92	High
I can change my techniques to solve problems.	2.53	1.04	High
I could think of and solve the problem on my own.	2.83	0.87	High
Flexibility weighted mean	**2.61**	**0.49**	**High**

Table 2 presents the descriptive analysis of respondents on flexibility. Based on the responses of 30 respondents, it was identified that they have a high level of flexibility in looking for different techniques, with a mean of 2.90 (SD = 0.92). Then, the respondents have a high level of flexibility in changing their techniques to solve problems, with a mean of 2.53 (SD = 1.04). At the same time, they have a high level of flexibility with a mean of 2.83 (SD = 0.87) in thinking of and solving the problem independently. While the respondents have a moderate level of flexibility, with a value of the mean of 2.43 (SD = 0.73), which says they can create ideas for varied questions. Furthermore, respondents also have a moderate level of flexibility, with a mean of 2.37 (SD = 0.85), in terms of seeing the problem from a different point of view. Overall, the Grade 6 pupils' creative thinking skills in flexibility were high, with a weighted mean of 2.61 (SD = 0.49). This shows the respondents can use various solutions and procedures to solve problems. This supports the study of Saputri et al. (2020), where the students demonstrated the flexibility of creative mathematical thinking such as elimination, substitution, and combination (elimination-substitution). Thus, this is still influenced by an understanding of a mathematical concept and must still be trained and developed using Multiple Solution Tasks (MST).

1.3. Elaboration

Table 3

Descriptive analysis of the respondents' elaboration on Creative Thinking Skills

Indicators	Weighted Mean	Standard Deviation	Verbal Interpretation
I work and develop an idea to solve the problem	3.00	0.83	High

I was able to provide different ideas for a given problem	2.23	0.63	Moderate
I was able to create something different to solve the problem	2.57	0.82	High
I developed the idea of a solution with a simple explanation	2.97	1.03	High
I was able to look for meaning in a solution to a problem	2.23	0.68	Moderate
Elaboration weighted mean	**2.60**	**0.49**	**High**

As observed from the result in Table 3, the respondents have a high level of elaboration in working and developing their idea to solve the problem with a mean of 3.00 (SD = 0.83). The respondents also have a high level of elaboration, with a value of the mean of 2.57 (SD = 0.82), saying that they were able to create something different to solve the problem. Furthermore, the respondents have a high level of elaboration with a mean of 2.97 (SD = 1.03) in developing the idea of a solution with a simple explanation. While the respondents also have a moderate level of elaboration with a mean of 2.23 (SD = 0.63) in providing different ideas of a given problem. At the same time, the respondents have a moderate level of elaboration with a mean of 2.23 (SD = 68) in looking for the meaning of a solution to a given problem. Overall, the Grade 6 pupils have a high level of creative thinking skills in elaboration, with a weighted mean of 2.60 (SD = 0.49). This supports Asfar et al.'s (2019) study, which stated that the goal of the elaboration was to improve students' mathematical understanding through knowledge design and critical and creative thinking. Furthermore, the elaboration model could be used instead of a learning model to enhance students' mathematical knowledge.

1.4 Originality

Table 4

Descriptive analysis of the respondents' originality in Creative Thinking Skills

Indicators	Weighted Mean	Standard Deviation	Verbal Interpretation
I show new, engaging, and unique idea	2.30	0.70	Moderate
I think of unusual ways to express the problem	2.47	0.86	Moderate
I make a combination of different ways to solve a problem	2.60	0.67	High
I provide unique ideas that are valid and relevant to a new problem	2.10	0.61	Moderate
I improve the idea from the previous problem by solving a new problem	2.77	0.93	High
Originality weighted mean	**2.45**	**0.53**	**Moderate**

Table 4 shows the respondent's creative thinking skills in originality. The data shows that the respondents have a high level of originality in combining different ways to solve a problem, with a mean of 2.60 (SD = 0.67). The collected data also shows that the respondents have a high level of originality in improving the idea from the previous problem by solving a new problem, with a mean of 2.77 (SD = 0.93). At the same time, the data shows that the respondents have a moderate level of originality in showing new, engaging, and unique ideas, with a mean of 2.30 (SD = 0.70). The respondents also have a moderate level of originality, with a mean of 2.47 (SD = 0.86), in thinking of unusual ways to express the problem. Furthermore, they also have a moderate level of originality in providing unique ideas that are valid and relevant to a new problem, equivalent to a mean of 2.10 (SD = 0.61). Overall, the Grade 6 pupils have a moderate level of creative thinking skills in originality, with a weighted mean of 2.45 (SD = 0.53). To support this,

Akgul (2016) claims that there was a direct relationship between the ability to think creatively and the feature of originality. Therefore, pupils who have demonstrated originality can already demonstrate creative thinking.

Creative Thinking Skills of the respondents

Table 5

Overall descriptive analysis of Creative Thinking Skills

Aspects	Weighted Mean	Standard Deviation	Verbal Interpretation
Fluency	2.45	0.43	Moderate
Flexibility	2.61	0.49	High
Elaboration	2.60	0.49	High
Originality	2.45	0.53	Moderate
Overall Level of Creative Thinking Skills	**2.53**	**0.42**	**High**

Table 5 displays the overall results of Creative Thinking Skills. Regarding flexibility, respondents were described as high, with a weighted mean value of 2.61 (SD = 0.49). The respondents were also described as high in elaboration, with a weighted mean of 2.60 (SD = 0.49). In contrast with the respondents' fluency, the respondents have a moderate level of fluency with a weighted mean value of 2.45 (SD = 0.43) and a moderate level in the aspect of originality with a weighted mean value of 2.45 (SD = 0.53). The overall results showed that the respondents' Creative Thinking Skills were described as "High," with a general mean value of 2.53 (SD = 0.42). The result supports the study of Pentang et al. (2022), where the results of the creative thinking skills of their respondents were also described as high.

2. Problem-Solving Skills of the respondents

Table 6

Descriptive analysis of respondents' level of expertise in Problem-Solving Skills

Levels of Expertise	Ratings/Range	Frequency	Percentage (%)
Expert	105-128	0	0
Proficient	81-104	13	43.33
Competent	57-80	10	33.33
Novice	32-56	7	23.33
TOTAL		30	99.99

	Mean	Standard Deviation	Interpretation
Total Rating	73.33	18.11	Competent

As shown in Table 6, the respondents were categorized as “Competent” in their problem-solving written test with a general mean value of 73.33 (SD = 18.11). Most respondents (43.33%) got an average rating of 81 to 104 points over 128 points in their problem-solving written test. 10 out of 30 respondents (33.33%) obtained a competent rating, and 7 out of 30 (23.33%) got a novice rating. While none of the respondents got a rating of expert. This means the Grade 6 pupils in the selected school in the District in Sta. Ana, Pampanga can demonstrate a limited understanding of the problem, use a

representation that gives some important information about the problem, apply some appropriate procedures, and the answer is partially correct but lacks clarity.

3. Significant relationship between Creative Thinking Skills and Problem-Solving Skills in Mathematics among the Grade 6 pupils.

Table 7

Significant relationship between Creative Thinking Skills and Problem-Solving Skills

Variables	r	Verbal Interpretation
Creative Thinking Skills - Problem-Solving Skills	.156	Very low correlation

As presented above, it is evident that the computed r=.156 revealed that there is a very low correlation between creative thinking skills and problem-solving skills in mathematics among Grade 6 pupils (see Table 7). The result supports the study of Kumar (2020), which revealed no correlation between creativity and problem-solving skills among higher-secondary students. This also supports the study by Bacangallo et al. (2022) revealed no significant relationship between creative thinking and problem-solving skills of the pre-service teachers.

Chapter 4

Conclusions and Recommendations

This chapter provides a summary of the findings, conclusions, and suggested study recommendations.

Summary of the Findings

Following a thorough examination and interpretation of the data gathered, the significant findings of the study are presented:

1. Creative Thinking Skills.

In the aspect of flexibility, respondents were described as high, with a weighted mean value of 2.61 (SD = 0.49). The respondents were also described as high in elaboration, with a weighted mean of 2.60 (SD = 0.49). In contrast with the respondents' fluency, the respondents have a moderate level of fluency with a weighted mean value of 2.45 (SD = 0.43) and a moderate level in the aspect of originality with a weighted mean value of 2.45 (SD = 0.53). The overall results showed that the respondents' Creative Thinking Skills were described as "High," with a general mean of 2.53 (SD = 0.42).

2. Levels of expertise in Problem-Solving Skills

The respondents' problem-solving performance results were categorized as "Competent". This is equivalent to a general mean of 73.33 (SD = 18.11).

3. Significant relationship between Creative Thinking skills and Problem-Solving Skills in Mathematics among the Grade 6 Pupils

The significant relationship between Creative Thinking Skills and Problem-Solving Skills in Mathematics among Grade 6 Pupils revealed a very low correlation with the computed r=. 156.

Conclusions

The researchers occur with the following generalization, based on the summary of the findings of the study:

1. The Grade 6 pupils, the respondents, describe their creative thinking skills in terms of fluency, flexibility, originality, and elaboration as "High".

2. The respondents' problem-solving skills were categorized as "Competent." It shows that the respondents can demonstrate a limited understanding of the problem. It uses a representation that gives some important information about the problem. It applies some appropriate procedures, and the answer is partially correct but lacks clarity.

3. The results showed a very low correlation between the two variables. This concluded that the creative thinking skills of the respondents have no significant relationship to their problem-solving skills.

Recommendations

Based on the conclusions, the following recommendations are hereby offered:

1. Students should improve their skills in solving word problems by always being involved in Mathematics. This study showed that some students still need help

understanding and answering simple problem-solving questions, particularly finding the area, perimeter, and probability.

2. Teachers should enhance their teaching strategy in teaching Mathematics by showing more examples and solutions to solving mathematical problems. They should also let the students explore different techniques to solve a problem to avoid rote learning of the formula that holds the pupils from trying different strategies to solve a problem. In this way, the students can enhance their flexibility and originality, which are the aspect of creative thinking skills found in the study that they are at a moderate level. Also, the teachers should enhance their teaching strategy, particularly in area and perimeter topics, so that the students can easily understand and answer particular questions on the said topic.

3. The curriculum developers should focus on the content about creativity in mathematics, which can help teachers integrate creativity into teaching mathematics.

4. For future researchers, the researchers still suggested that the same study be done with additional variables or considerations. This might result in having significant connections.

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