Original Research Article

Reflective Thinking Skills and Attitude towards Problem-Solving as Mediated by Mathematical Resilience of the Students

ABSTRACT

Aims: This paper explored the mediating effect of mathematical resilience on the relationship between reflective thinking skills and student's attitude towards problem-solving.
Study design: This study utilized a non-experimental quantitative research design utilizing the descriptive-correlational technique.
Place and Duration of Study: The study was conducted at public high schools in the Province of Bukidnon, Philippines in the school year 2021-2022.
Methodology: The respondents of the study were 469 Junior High School students. The respondents were chosen using cluster sampling followed by simplified random sampling. There were three questionnaires utilized to collect the data. The items in each indicator revealed a good interpretation for both validity and reliability of the questionnaires.
Results: The result revealed that the respondents have a high level of both reflective thinking skills and mathematical resilience and has moderate level in their attitude towards problem-solving. The relationship between reflective thinking skills and attitude towards problem-solving; reflective thinking skills and mathematical resilience; and mathematical resilience and attitude towards problem-solving revealed an *r*-values of 0.521, 0.348, and 0.356 respectively, with a *p*- value of <0.001 which is highly significant at 0.01 level of significance. Furthermore, the result also shows that mathematical resilience partially mediates the relationship between reflective thinking skills and attitude towards problem-solving.
Conclusion: The attitude towards problem-solving is directly impacted by one's capacity for reflective thinking. On the other hand, the ability to engage in reflective thinking has an effect, albeit an indirect one, on students' mathematical resilience, which in turn influences the students' attitude toward problem solving.

Keywords: mathematics, problem-solving, attitude towards problem-solving, reflective thinking skills, mathematical resilience, mediating effect

1. INTRODUCTION

The ability to solve problems is seen as a 21st century competency that students must possess [24]. This is also recognized as one of the most important skills that must be developed in Philippine mathematics education [3]. The most recent PISA results from 2018 show that, despite the efforts of the Philippine education system, Filipino students' level of mathematics competence in foreign assessments declines. Most of the problems on the math subtest include application problems, which highlights how poorly the students score

when it comes to solving word problems. Numerous factors influence how people adjust to and deal with the persistent social and environmental issues the world is facing, that includes the problems on how to help the students improve in their performance in mathematics which leads to the increasing recognition of cognitive and psychological factors that influence it [11]. In this study we focus on students' reflective thinking skills, mathematical resilience and attitude towards problem solving. The variable 'attitude' is one of the most important factors that relates to achievement as much as students need to think and make decisions using appropriate strategies to solve mathematics problems [21]. Also, John Dewey [8] stresses the importance of problem-solving skill involved in modern educational approaches and for the development of problem-solving skill, reflective thinking skills of individual need to be developed. On the other hand, mathematical resilience is one of the students' nonintellectual aspects that must have to overcome anxiety, so that they will have a determined, persistent and confident attitude [23]. Thus, this study is focused in investigating the relationship of each variable and how they affect each other.

2. METHODOLOGY

2.1 Research Design

The descriptive-correlational research design was used in this study to describe what truly exists, to calculate the frequency with which the variables occur, and to classify the data and the findings in the exploratory studies which is the baseline for prospective hypotheses that may be used to guide for further correlational research [27]. In the field of education, this design is useful for it helps identifies and evaluates issues in policy, practices, and curriculum design, and it assists administrators in identifying and implementing effective remedies. To get more knowledge on any matters relevant to teaching, researchers may undertake small scale studies. Larger-scale studies, on the other hand, can be used to gain insight into school systems and examine ways to enhance student results. In connection, this study used descriptive-correlational to explain the degree of student's reflective thinking abilities and attitude toward problem solving in terms of the elements that influence them, as well as the level of mathematical resilience among the students. The relationship between the three variables of this research was examined in order to discover if mathematical resilience has a mediating influence on the relationship between the students' reflective thinking skills and their attitude toward problem solving. Lastly, mediation analysis (path analysis) within the non-experimental approach is a test that assesses whether a mediation effect is significant. Since, it analyzes the relationship between the independent variable and the dependent variable, as well as the relationship between the independent variable and the dependent variable with the mediation factor. In statistics, Tingley, Yamamoto, Hirose, Keele, and Imai [28] pointed out that a mediation model seeks to identify and explain the mechanism or process that underlies an observed relationship between an independent variable and a dependent variable via the inclusion of a third hypothetical variable, known as a mediator variable. Particularly, in this study the researcher examined the mediating effect of mathematical resilience towards the relationship between reflective thinking skills and attitude of the students towards problem solving.

2.2 Research Respondents

The respondents of this study were the junior high school students in the Department of Education in the Province of Bukidnon, Philippines. There was a total of 469 participants of which 209, 135, and 127 were from the Division of Bukidnon, Division of Malaybalay, and Division of Valencia, respectively. A Cluster Sampling followed by Simplified Random Sampling was implemented to ensure the fair distribution of the participants from the three DepEd divisions of the province of Bukidnon. A cluster random sample is a method in which

the total population is divided into clusters or groups. These clusters or groups are typically geographical locations or districts like villages, schools, wards, blocks, and so on [1]. In this study, the population was split into clusters according to the division offices that the province of Bukidnon had. These division offices include the Division of Bukidnon, the Division of Malaybalay, and the Division of Valencia. After that, the researcher applied a simplified random sampling by randomly selecting a school from each division where the participants for this study are obtained. This was done so as to simplify the random sampling process. Stratified random sampling is a method of sampling that involves the division of a population into smaller sub-groups known as strata. In stratified random sampling, or stratification, the strata are formed based on members' shared attributes or characteristics such as income or educational attainment. Stratified random sampling is appropriate in this study because there is heterogeneity in a population that can be classified with ancillary information [26].

2.2 Research Instrument and Statistical Tool

2.2.1 Instrument

The study employed questionnaires adapted from different studies and was modified to the context of respondents. The instrument was divided into three parts: reflective thinking skills, attitude towards problem solving, and mathematical resilience. The first part dealt with reflective thinking skills towards problem solving developed by Kızılkaya and Askar [18], with the following indicators: questioning, evaluating, and reasoning. It has a computed Cronbach's alpha of 0.941 which means that the internal consistency was excellent. The second tool was the Attitude Towards Problem Solving Scale (ATPSS) developed by Charles, Lester & O'Daffer [6], which is divided into three subscales: willingness, perseverance, and confidence with a Cronbach's alpha of 0.896 which rated as good after the pilot testing conducted. The third and last part of the questionnaire dealt with Mathematical Resilience Scale (MRS) which developed from the construct 'mathematical resilience' [17][20]. The reliability obtained a Cronbach alpha value of 0.922, indicating excellent reliability and consistency among the items. All these instruments were developed by drawing on the findings of a number of relevant studies and evaluations of the relevant literature. The drafts of these instruments were evaluated by the panel of experts for both their face validity and their content validity before they were administered. The validation produced an overall mean score of 4.3, which is considered to be very high.

2.2.2 Statistical Tool

This section contains the statistical tools that was utilized to attain the objectives of the study. Mean and standard deviation was used to characterize the reflective thinking skills, attitude of the students towards problem solving, and students' mathematical resilience. Pearson Product Moment Correlation was used to determine if there is a significant relationship between and among the reflective thinking skills, attitude of the students towards problem solving, and mathematical resilience of the students. Lastly, path analysis Sobel Z-test was used to determine if mathematical resilience significantly mediates the relationship between reflective thinking skills and attitude of the students towards problem-solving.

3. RESULTS AND DISCUSSION

3.1 Level of Student's Reflective Thinking Skills

Table 1 shows the level of reflective thinking skills of the junior high school students in Bukidnon with an overall mean of 3.74 with a "High" descriptive level. The high level was reflected in the respondents' high ratings for all indicators of reflective thinking skills, in which

among the indicators reasoning has the highest mean and standard deviation of 3.82 and 0.625, respectively. This is followed by questioning with a mean of 3.73 and a standard deviation of 0.591, and finally evaluation with a mean of 3.69 and a standard deviation of 0.634. This signifies that the respondents' responses to reflective thinking skills were oftentimes reflected in the items of questioning, evaluation, and reasoning.

Table 1. Level of Reflective Thinking Skills

Items	SD	Mean	D.L.
Questioning	0.591	3.73	High
Evaluation	0.634	3.69	High
Reasoning	0.625	3.82	High
Overall	**0.529**	**3.74**	**High**

The high-level rating of reflective thinking skills among junior high school students in Bukidnon is due to the high-level rating of the indicators of reflective thinking, which include questioning, evaluation, and reasoning. When seeking to find a solution to a mathematical problem, students at a high-level rating oftentimes use a higher order thinking skills known as reflective thinking. The findings suggest that students reflect on the problem-solving process by asking questions to guide their thinking and improve their overall comprehension of the problem. This also suggests that students oftentimes evaluate the mathematical problems before attempting to solve them in order to assist them in determining the method that would yield the greatest results. Lastly, students are competent, on the basis of scientific reasoning, to ponder and rationally judge the difficulties that they have been presented with.

The result obtained in the level of reflective thinking skills corresponds to study of Hidayanto et al [15] which emphasized that students who engage in reflective thinking are able to define the processes that occur in their minds when they are attempting to solve problems, in addition to answering questions. The findings of Zulkifli and Hashim [32], shows that questioning is an intellectual process that leads to reflective thinking. This is helped along by questions that help students integrate their thoughts into a coherent concept or idea, so the high level of the indicator questioning is manifested in these findings. Also, a study supported the result of a high level rating for evaluation in which it is emphasized in the process of cultivating higher level skills such as reflective thinking that this is important for the development of problem-solving ability, which is one of the fundamental stages of reflective thinking, and performing evaluation by using reflection is one of the stages in this process [25]. The high-level rating of reasoning for reflective thinking skills is manifested in the study of Wang and Zheng [30], which emphasized the fact that articulating reasoning is the fundamental component of acquiring higher order thinking, as acknowledged by the vast majority of educators. This raises the likelihood of making good decisions when comparing and contrasting available options.

3.2 Level of Student's Attitude towards Problem-Solving

Table 2 indicates the level of attitude towards problem solving of the junior high school in Bukidnon which accumulated an overall mean of 3.30 with a "Moderate" descriptive level. Confidence is the highest among the indicators of attitude towards problem solving, with a mean of 3.79 or high level and a standard deviation of 0.520, followed by perseverance with a mean of 0.72 or high level and a standard deviation of 0.475, and finally, willingness with a mean of 3.39 or moderate level and a standard deviation of 0.588. This implies that the responses to attitude towards problem solving were oftentimes observed in the items of perseverance and confidence while sometimes observed in the items of willingness.

Table 2. Level of Attitude Towards Problem Solving

Items	SD	Mean	D.E.
Willingness	0.588	3.39	Moderate
Perseverance	0.475	3.72	High
Confidence	0.520	3.79	High
Overall	**0.411**	**3.30**	**Moderate**

According to the responses of the students in the categories of willingness, perseverance, and confidence, the level of attitude towards problem-solving among the junior high school students in the province of Bukidnon is moderate, indicates that students may occasionally have a constructive mentality when it comes to coping with mathematical problem-solving. According to the findings, among the indicators for the students' attitude toward problem-solving, confidence and perseverance had the highest mean, suggesting a high-level rating. This would imply that students typically have a high level of self-assurance in their ability to solve mathematical problems and exhibit determination while answering difficulties. On the other hand, students' willingness had the lowest mean score, which indicates a moderate level and suggests that students are occasionally willing to participate in problem solving.

The result in the level of attitude towards problems solving of the students is manifested in the findings of the study which indicate that students who have a positive attitude will have genuine interest and eagerness in studying the topic, and they will be constantly motivated to tackle an issue, regardless of the obstacles that they face [9]. On the other side, having a pessimistic outlook makes it more difficult to learn, which has a deleterious effect not only on the student's ability to absorb new information but also on the overall quality of their academic achievement [19]. The results on the indicators such as confidence and perseverance correspond to the study of Carbonneau et al. [5], which found that if a student possesses perseverance, there is a possibility he will finish a task to the best of his ability despite difficulties and obstacles. Additionally, the study of Tuzlukova and Usha-Prabhukanth [29] inferred that confidence plays an essential role in mathematics accomplishment because it is necessary in one's ability to understand mathematics and solve problems in order to get outstanding results.

3.3 Level of Student’s Mathematical Resilience

Shown in Table 3 are the mean scores for the items of mathematical resilience of the junior high school in Bukidnon with an overall mean of 4.06 described as high level. The high level could be attributed to the high rating given by the respondents in most of the items. This implies that the responses to the mathematical resilience were oftentimes manifested in most of the cases. The above mentioned overall mean was the result gathered from the computed mean scores of all items of the mathematical resilience. Responses of the participants are presented from highest to lowest, according to their mean value. Among the 24 items, ten (10) have very high-level means, of which the following statements are the first three with the highest means: 4.62 or Very High for struggle is a normal part of working on math, 4.59 or Very High for math can be learned by anyone, and 4.54 or Very High for everyone makes mistakes at times when doing math. Another first three statements of twelve (12) items with a high means: 4.17 or High for math is essential for my future, 4.12 or High for having a solid knowledge of math helps me understand more complex topics in my field of study, and 4.11 or High for math will be useful to me in my life’s work. Lastly, the following two (2) statements are of moderate means: 3.17 or Moderate for if someone is not

a math person, they would not be able to learn much math, and 2.74 or Moderate for people are either good at math or they are not.

Table 3. Level of Student's Mathematical Resilience

Items	SD	Mean	D.E.
Struggle is a normal part of working on math.	0.59	4.62	Very High
Math can be learned by anyone.	0.64	4.59	Very High
Everyone makes mistakes at times when doing math.	0.65	4.54	Very High
Everybody occasionally makes math errors.	0.68	4.51	Very High
Making mistakes is necessary to get good at math.	0.77	4.39	Very High
People in my peer group struggles sometimes with math.	0.72	4.35	Very High
People who work in math-related fields sometimes find math challenging.	0.73	4.34	Very High
Good mathematicians experience difficulties when solving problems.	0.80	4.32	Very High
When someone struggles in math, it doesn't mean they have done something wrong.	0.82	4.22	Very High
Math develops good thinking skills that are necessary to succeed in any career.	0.80	4.21	Very High
Math is essential for my future.	0.91	4.17	High
Having a solid knowledge of math helps me understand more complex topics in my field of study.	0.88	4.12	High
Math will be useful to me in my life's work.	0.92	4.11	High
Only smart people can do math.	1.12	4.10	High
Knowing math contributes greatly to achieving my goals.	0.88	4.07	High
Math courses are very helpful no matter what I decide to study.	0.87	4.05	High
Math teachers are sometimes stumped by a math problem.	0.88	3.94	High

It would be difficult to succeed in life without math.	0.95	3.88	High
Thinking mathematically can help me with things that matter to me.	0.90	3.87	High
Everyone's math ability is determined at birth.	1.17	3.82	High
If someone is not good at math, there are nothing that can be done to change that.	1.18	3.78	High
Some people cannot learn math.	1.17	3.51	High
If someone is not a math person, they won't be able to learn much math.	1.15	3.17	Moderate
People are either good at math or they aren't.	1.09	2.74	Moderate
Overall	**0.45**	**4.06**	**High**

The junior high school students' mathematical resilience obtained an overall descriptive rating of high. Most of the items in this category have a high descriptive level, demonstrating that students' mathematical resilience is frequently obvious when solving mathematical problems. Additionally, there are many items with a very high descriptive level, which implies that mathematical resilience is always present in the students when dealing with problem solving. The "Struggle is a normal part of working on math" has the highest mean that indicates a very high descriptive level among the 24 items in the mathematical resilience statements. This suggests that students who have mathematical resilience have a tendency to consider struggle as part of the process of learning mathematics. On the other hand, "People are either good at math or they are not" which has a moderate descriptive level, has the lowest mean score. This suggests that students would either think of themselves as being competent at dealing with mathematics or as not being good at it.

The outcome of this study's investigation into the number of students' mathematical resilience lines up with the findings of several other research on the subject of mathematical resilience. According to Gurefe and Akcakin [12], the ability to persevere when faced with a difficulty or issue is shown by students who have a high level of mathematical resilience. Students remain confident that they will be able to solve the problem even when they are in trouble if they have a good mathematical endurance because they have growth confidence that is related to their abilities [13]. Additionally, according to Johnston-Wilder and Lee [17], students who have mathematical resilience will have the following characteristics: the ability to persevere in the face of adversity, the ability to collaborate with their peers, the essential language skills necessary to communicate their knowledge, and the recognition that the more effort they put into mathematics, the more successful they will be.

3.4 Relationship between Reflective Thinking Skills and Attitude towards Problem-Solving

Table 4 summarizes the results of the tests of the relationship between reflective thinking skills and problem-solving attitude. The overall r - value of 0.521 with a $p < 0.001$ that is highly significant at the 0.01 level implied that the null hypothesis was rejected. It means that there is a significant relationship between reflective thinking skills and problem-solving

attitudes among junior high school students in Bukidnon. The findings revealed that the higher the students' reflective thinking skills, the more positive they are in dealing with mathematical problem-solving.

Table 4. Significant Relationship between Reflective Thinking Skills and Attitude towards Problem-Solving

	Reflective Thinking Skills			
Attitude Towards Problem-Solving	**Questioning**	**Evaluation**	**Reasoning**	**Overall Reflective Thinking Skills**
Willingness	0.293** (0.000)	0.316** (0.000)	0.260** (0.000)	0.337* (0.000)
Perseverance	0.402** (0.000)	0.424** (0.000)	0.385** (0.000)	0.470** (0.000)
Confidence	0.350** (0.000)	0.455** (0.000)	0.292** (0.000)	0.427** (0.000)
Overall Attitude Towards Problem-Solving	**0.441** (0.000)**	**0.505** (0.000)**	**0.395** (0.000)**	**0.521** (0.000)**

** Highly significant at 0.01 significance level

The findings in the relationship between reflective thinking skills and attitude towards problem solving are found to be consistent with the study of Ersözlü and Kazu [10] as cited by Demirel et al. [7], which suggests that activities that promote reflective thinking skills improve students' academic achievement and have a positive impact on their attitude toward the subject and that reflective thinking skills towards problem solving have a higher correlation with interest and sub-dimensions of attitudes towards Mathematics.

3.5 Relationship between Reflective Thinking Skills and Mathematical Resilience

The results of the tests conducted to evaluate the relationship between reflective thinking skills and mathematical resilience are presented in Table 5. It was observed that the indicators of reflective thinking skills have a positive correlation with mathematical resilience, with a *r* – value of 0.348 and a *p* – value of 0.001 that is highly significant at the 0.01 level, implying that there is a significant relationship between reflective thinking skills and mathematical resilience. This indicates that students' mathematical resiliency is directly proportional to the level of their ability to engage in reflective thinking.

Table 5. Significant Relationship between Reflective Thinking Skills and Mathematical Resilience

	Reflective Thinking Skills			
Mathematical Resilience	**Questioning**	**Evaluation**	**Reasoning**	**Overall Reflective Thinking Skills**
Overall Mathematical Resilience	0.374** (0.000)	0.253** (0.000)	0.275** (0.000)	**0.348** (0.000)**

** Highly significant at 0.01 significance level

The findings of Fezey [11] and Akdemir [2] revealed that resilient thinking can help facilitate the development of higher order cognition of which reflective thinking skills is thought to be one, coincides with the positive relationship between reflective thinking skills and mathematical resilience the result of this present study which shows. This suggests that resilient thinking can help facilitate the development of higher order cognition of the students in mathematics.

3.6 Relationship between Mathematical Resilience and Attitude towards Problem-Solving

Table 6 shows the results on the relationship between mathematical resilience and attitude towards problem solving. It was observed that the indicators of mathematical resilience and attitude towards problem solving revealed a computed overall *r* -value of 0.356 with a *p* – value of <0.001 which is highly significant at 0.01 level. Thus, the null hypothesis of no significant relationship between mathematical resilience and attitude towards problem solving is rejected. This implies that the higher the mathematical resilience of the students the positive the students are in dealing problem solving.

Table 6. Significant Relationship between Mathematical Resilience and Attitude of towards Problem Solving

Attitude towards Problem Solving	Mathematical Resilience Overall Mathematical Resilience
Willingness	0.420** (0.000)
Perseverance	0.367** (0.000)
Confidence	0.45 (0.332)
Overall Attitude Towards Problem Solving	**0.356**** **(0.000)**

** Highly significant at 0.01 significance level

The positive correlation in the relationship between mathematical resilience and attitude towards problem solving corresponds to the findings of the study of Hafiz et al. [14], that if a student possesses mathematical resilience, he or she will exhibit a positive attitude toward mathematics by not giving up easily when faced with obstacles when tackling mathematics issues. Furthermore, students that are resilient have a good attitude toward mathematics because they believe that learning mathematics is not tough; even when students face problems, they will maintain their confidence until they achieve excellence [22], which was supported of the study conducted by Hunt and Maloney [16] that shows a positive relationship between mathematical resilience and math attitudes, emphasizing the need to include a domain-specific measure of resilience in the school's curriculum.

3.7 Mediating Effect of Mathematical Resilience on the Relationship of the Reflective Thinking Skills and Attitude towards Problem-Solving of the Students

Show in Table 7 is the mediation analysis of reflective thinking skills, attitude towards problem solving, and mathematical resilience. As reflected on the table, three steps were met for the third variable (mathematical resilience) to be acting as the mediator. These are categorized as Steps 1 to 4, reflective thinking skills was found to significantly predict the mathematical resilience, at 0.01 level of significance, mathematical resilience significantly predicts the attitude towards problem solving, at 0.01 level of significance, and the reflective thinking skills significantly predicts attitude towards problem solving, at 0.01 level of significance which are the steps 1, 2, and 3, respectively. Additional analysis of the mediation process is necessary since each of the three steps—paths a, b, and c'—are significant.

Table 7. Mediation Analysis of the Three Variables
Regression Weights: (Group number 1 – Default model)

			Estimate	S.E.	C.R.	P	Label
MR	<---	RTS	.296	.037	8.039	***	
ATPS	<---	RTS	.351	.032	10.989	***	
ATPS	<---	MR	.183	.038	4.851	***	

Partial Mediation

As reflected in Figure 1, it shows that for every unit increase in reflective thinking skills there is a corresponding 0.30 unit increase in mathematical resilience. Also, for every unit increase in mathematical resilience there is 0.18 increase in the attitude towards problem solving of the students. Moreover, for every unit increase in reflective thinking skills there is 0.35 unit increase in the attitude towards problem solving of the students. This indicates that a student's attitude toward problem-solving can be improved both directly and indirectly by increasing their reflective thinking skills and their mathematical resilience. As a result, increased mathematical resilience acts as a mediator between reflective thinking skills and an improved attitude toward problem-solving on the part of students.

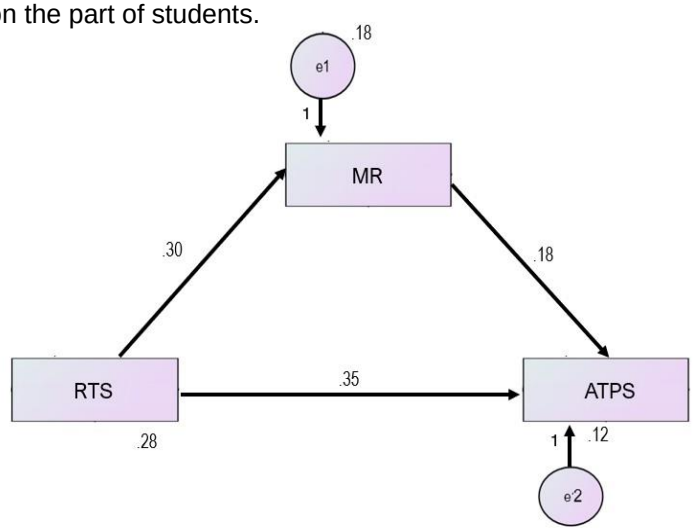

Figure 1: Mediation Model

Furthermore, other components, on the other hand, are either direct or mediated by variables not included in the model. As a result, it is partial mediation since the direct effect is significant at 0.01 level of significance - c' (with the presence of mathematical resilience) and indirect effect is highly significant with a *p* -value of 0.00004313 at 0.01 level of significance using the Sobel Z test. The fact that the mediating variable can still exert an influence on the relationship between the independent and dependent variables, on the other hand, makes this outcome a positive one. This would imply that the attitude towards problem solving is directly impacted by one's capacity for reflective thinking. In addition, the ability to engage in reflective thinking has an effect, albeit an indirect one, on students' mathematical resilience, which in turn has an effect on the students' attitude toward problem solving. Moreover, the total effect (c), the effect of reflective thinking skills to the attitude towards problem solving skills (without the presence of mathematical resilience) is 0.40, which is determined by taking the sum of the direct effect that is 0.35, and the indirect effect size (product of path a and path), which is 0.054. The radio index, which is obtained by dividing the indirect effect by the total effect, came out with a value of 0.14, indicating that the indirect path from reflective thinking skills through mathematical resilience to the attitude towards problem solving is accounted for about 14% of the total effect. Roughly 86 percent of the total effect can be classified as either direct or as being mediated by other variables that were not incorporated into the model. A limited number of researchers in the past have looked into the relationship that exists between the ability to engage in reflective thinking and the attitude towards problem-solving. The fact that not enough research has been done to study the relationship between two factors in which mathematical resilience acts as a mediator was the reason why this research was conducted. The purpose of this research was to provide a contribution to the existing body of knowledge concerning the potential indirect mediating variables for the association between reflective thinking skills and attitude toward problem-solving.

In this study, we investigated the mathematical resilience as a potential mediating construct to explain how reflective thinking skills affects the attitude of students toward problem-solving. In spite of the fact that this investigation did not uncover any evidence of full mediation, essential and direct effects were discovered which are consistent with the work of Johnston-Wilder et al. [17] that if a student possesses a high level of mathematical resilience, then learning mathematics is not a problem for him; rather, it is a challenge for him to solve mathematical problems in a variety of ways, possessing high-level thinking as reflective thinking being one of them. Also, Zanthy et al. [31] emphasizes that students with a positive attitude toward problem solving work hard and are resilient in the face of challenges, failure, and uncertainty in order to succeed. It's possible that these investigations will be helpful in enhancing previously conducted research on students' reflective thinking and mathematical resiliency. As a result of the findings, mathematical resilience is found to be a mediator in improving students' attitudes toward problem solving, which has been highlighted as a crucial factor in getting good results in mathematics.

4. CONCLUSION

According to the findings of this study, junior high school students in Bukidnon have a high level of reflective thinking abilities. This demonstrates that students often apply their reflective thinking abilities when attempting to find a solution to a problem, which is one factor that contributes to their capacity to successfully overcome challenges. The amount of attitude that students have toward problem-solving found to be in a moderate level and suggests that students occasionally hold a good attitude toward problem solving.

On the other hand, the results confirm a significant relationship between relationship between reflective thinking skills and attitude towards problem solving among students;

reflective thinking skills and mathematical resilience; mathematical resilience and attitude towards problem solving among students. Furthermore, the result also shows that mathematical resilience significantly mediates the relationship between reflective thinking skills and attitude towards problem solving among the junior high school students in Bukidnon.

Lastly, the findings supported the anchored theory of Harvey Carr's (1925) Functionalism Theory. For this reason, reflective thinking abilities are defined in this study as the mental activity of students that guides them to adjust to the given situation, i.e. resilience in mathematics. This brain activity also enables them to adjust to the environment, which leads to the development of new exterior behaviors such as having a good or negative attitude toward a certain situation. These results were found to be parallel to the propositions of the theory which this study was anchored.

CONSENT AND ETHICAL APPROVAL

The researcher obtained the necessary ethical approval from the University of Mindanao Ethics Review Committee (UMERC). A Parental and Inform Consent Form has been collected and preserved by the researcher(s) and the standardized protocol and criteria in conducting the study that were fully stipulated by UMERC were strictly followed such as the Voluntary Participation of Respondents, Permission from the Organization/Location, Conflict of Interest (COI), and Technology Issues

REFERENCES

1. Acharya, A. S., Prakash, A., Saxena, P., & Nigam, A. (2013). Sampling: why and how of it? Indian Journal of Medical Specialities, 4(2). https://doi.org/10.7713/ijms.2013.0032

2. Akdemir, E. (2018). Investigating the Reflective Thinking Skills of Students for Problem Solving. The Turkish Online Journal of Educational Technology, 1, 774–780. https://files.eric.ed.gov/fulltext/ED595226.pdf

3. Andrade, R. R., Fortes, E. C., & Mabilangan, R. A. (2020). Problem Solving Heuristics and Mathematical Abilities of Heterogeneous Learners. Universal Journal of Educational Research, 8(11), 5114–5126. https://doi.org/10.13189/ujer.2020.081111

4. Baron, R. M., & Kenny, D. A. (1986). The moderator–mediator variable distinction in social psychological research: Conceptual, strategic, and statistical considerations. Journal of Personality and Social Psychology, 51(6), 1173–1182. https://doi.org/10.1037/0022-3514.51.6.1173

5. Carbonneau, K. J., Wong, R. M., & Borysenko, N. (2020). The influence of perceptually rich manipulatives and collaboration on mathematic problem-solving and perseverance. Contemporary Educational Psychology, 61, 101846. https://doi.org/10.1016/j.cedpsych.2020.101846

6. Charles, R.; Lester, F. & O'Daffer, P. (1987). The analytic scoring scale. How to evaluate progress in problem-solving. Reston, VA: National Council of Teachers of Mathematics.

7.Demirel, M., Derman, I., & Karagedik, E. (2015). A Study on the Relationship between Reflective Thinking Skills towards Problem Solving and Attitudes towards Mathematics. Procedia - Social and Behavioral Sciences, 197, 2086–2096. https://doi.org/10.1016/j.sbspro.2015.07.326

8. Dewey, J. (1933). How We Think: A Restatement of the Relation of Reflective Thinking to the Educative Process. Boston, MA: D.C. Heath & Co Publishers.

9. Effandi Zakaria, & Normah Yusoff. (2009). Attitudes and problem-solving skills in algebra among Malaysian matriculation college students. European Journal of Social Sciences, 8(2), 232–245.

10. Ersözlü, ZN and Kazu H. (2011). "The effect of reflective thinking development activities applied in primary school fifth grade social studies course on academic achievement". Uludag University Faculty of Education, 24(1), 141-159.

11. Fazey, I. (2010). Resilience and Higher Order Thinking. Ecology and Society, 5(3). https://www.ecologyandsociety.org/vol15/iss3/art9/

12. Gurefe, N. & Akcakin, V. 2018. “The Turkish Adaptation pf the Mathematical Resilience Scale: Validity and Realiability Study”. Journal of Education Training Studies, 6(4): 38-47

13. Goodall, J., & Johnston-Wilder, S. (2015). Overcoming Mathematical Helplessness and Developing Mathematical Resilience in Parents: An Illustrative Case Study. Creative Education, 06(05), 526–535. https://doi.org/10.4236/ce.2015.65052

14. Hafiz, M., Darhim, & Dahlan, J. A. (2017). Comparison of Mathematical Resilience among Students with Problem Based Learning and Guided Discovery Learning Model. Journal of Physics: Conference Series, 895, 012098. https://doi.org/10.1088/1742-6596/895/1/012098

15. Hidayanto, E., Permadi, H., & Lestari, W. I. (2022). Thinking process of reflective impulsive cognitive style’s student to solving the mathematics problems. MATHEMATICS EDUCATION AND LEARNING. https://doi.org/10.1063/5.0102188

16. Hunt, T. E., & Maloney, E. A. (2022). Appraisals of previous math experiences play an important role in math anxiety. Annals of the New York Academy of Sciences, 1515(1), 143–154. https://doi.org/10.1111/nyas.14805

17. Johnston-Wilder, Sue and Lee, Clare (2010). Developing mathematical resilience. In: BERA Annual Conference 2010, 1-4 Sep 2010, University of Warwick.

18. KIZILKAYA, G., & AŞKAR, P. (2009). The Development of A Reflective Thinking Skill Scale towards Problem Solving. Education and Science, 34(154). https://www.researchgate.net/publication/284778082_The_Development_of_A_Reflective_Thinking_Skill_Scale_towards_Problem_Solving

19. Mazana, M. Y., Montero, C. S., & Casmir, R. O. (2018). Investigating Students’ Attitude towards Learning Mathematics. International Electronic Journal of Mathematics Education, 14(1). https://doi.org/10.29333/iejme/3997

20. McCoach, D. B., Johnston-Wilder, S., & Lee, C. (2016). Development and Validation of the Mathematical Resilience Scale. Measurement and Evaluation in Counseling and Development, 49(3), 217–242. https://doi.org/10.1177/0748175615596782

21. Mohd, N., & Mahmood, T. F. (2011). The Effects of Attitude Towards Problem Solving in Mathematics Achievements. Australian Journal of Basic and Applied Sciences, 5(12), 1857–1862. http://www.ajbasweb.com/old/ajbas/2011/December-2011/1857-1862.pdf

22. Murni, V. (2021, August 27). The Effect of Mathematical Resilience and Students' Perceptions of Online Lectures on Mathematical Power - EUDL. https://eudl.eu/doi/10.4108/eai.3-6-2021.2310762

23. Rohmah, S., Kusmayadi, T. A., & Fitriana, L. (2020). Problem Solving Ability of Junior High School Students Viewed by Mathematical Resilience. Universal Journal of Educational Research, 8(7), 3026–3033. https://doi.org/10.13189/ujer.2020.080731

24. Scherer, R., & Gustafsson, J. E. (2015). Student assessment of teaching as a source of information about aspects of teaching quality in multiple subject domains: an application of multilevel bifactor structural equation modeling. Frontiers in Psychology, 6. https://doi.org/10.3389/fpsyg.2015.01550

25. Sendil, C. (2015). Pre-service science teachers reflective thinking skills toward problem solving. Educational Research and Reviews, 10(10), 1449–1457. https://doi.org/10.5897/err2015.2228

26. Shi, F. (2015). Study on a Stratified Sampling Investigation Method for Resident Travel and the Sampling Rate. Discrete Dynamics in Nature and Society, 2015, 1–7. https://doi.org/10.1155/2015/496179

27. Sousa, V. D., Driessnack, M., & Mendes, I. A. C. (2007). An overview of research designs relevant to nursing: Part 1: quantitative research designs. Revista Latino-Americana De Enfermagem, 15(3), 502–507. https://doi.org/10.1590/s0104-11692007000300022

28. Tingley, D., Yamamoto, T., Hirose, K., Keele, L., & Imai, K. (2014). mediation:RPackage for Causal Mediation Analysis. Journal of Statistical Software, 59(5). https://doi.org/10.18637/jss.v059.i05

29. Tuzlukova, V., & Usha-Prabhukanth, K. (2018). Critical thinking and problem solving skills: English for science foundation program students' perspectives. Зборник Радова Филозофског Факултета У Приштини, 48(3), 37–60. https://doi.org/10.5937/zrffp48-18664

30. Wang, X., & Zheng, H. (2016). Reasoning Critical Thinking: Is It Born or Made? Theory and Practice in Language Studies, 6(6), 1323. https://doi.org/10.17507/tpls.0606.25

31. Zanthy, L. S., Kusuma, Y. S., & Soemarmo, U. (2019). Mathematical resilience analysis of senior high school students. Journal of Physics: Conference Series, 1315(1), 012074. https://doi.org/10.1088/1742-6596/1315/1/012074

32. Zulkifli, H., & Hashim, R. (2019). The Development of Questioning Skills through <i>Hikmah</i> (Wisdom) Pedagogy. Creative Education, 10(12), 2593–2605. https://doi.org/10.4236/ce.2019.1012187

558
559
560