

## Original Research Article

# The Mediating Effect of Students' Resiliency to the Relationship of Self-concept and Mathematics Performance

### ABSTRACT

Several studies have found links between students' self-concept and mathematics performance. However, few related researches has been conducted during this time of COVID-19 where learning mathematics is said to be really tough and challenging for the students. Recent articles also claimed that in this difficult times, students' resiliency really matters towards their performance. Hence, this study investigated the mediating effect of students' resiliency to the relationship between self-concept and mathematics performance of the junior high school students. The study was conducted using descriptive - correlational method. Employing stratified random sampling, a total of 278 students were subjected to the study. Descriptive statistics was used to describe the respondents' self-concept, resiliency, and mathematics performance. Mediation analysis was then employed to describe the mediating effect of students' resiliency. Results show that the respondents maintained positive perception towards mathematics in this new normal. The resiliency level indicated that students exhibit persistence in learning mathematics in the face of adversity. Data confirmed that self-concept directly influence mathematics performance, but also have an indirect effect through the students' resiliency. This result supports the importance of self-concept to the students' mathematics performance, but also stressed the significance of cultivating students' resiliency in this new normal.

*Keywords: Self-concept, resiliency, mathematics performance, new normal, mediation*

### 1. INTRODUCTION

The world is now experiencing an unexpected crisis that causes the most challenging pivotal phases in education [1]. Due to the strict implementation of public health measures [2], the traditional face-to-face mode of learning delivery is prohibited and shifted to distance learning approach, a learning delivery mode where interaction takes place between the teachers and students which they are geographically remote from each other during instruction and the lesson proper delivers outdoors the traditional face-to-face platform [3].

Learning mathematics in the new normal is really tough and truly challenging. There will be uncertainties, anxieties, and fears. Misconceptions may arise and hatred for the subject may happen that will lead to a negative self-perception towards the subject. Students' self-concept about their academic abilities is vital in their effort to adjust with their school tasks and responsibilities because these perceptions could influence the extent of efforts students to exert for their school tasks [4]. The academic performance of students who have a lesser interest in doing the task would be negatively affected [5]. On the other hand, students who have high self-

**Comment [11]:** The introduction is too general and less focus to the contexts of this study. It should provide the information (issues) about students' (primary or secondary or university?) mathematics in Philippine?

Why resiliency is significant in this contexts?

What are the limitations of the related previous studies? It shows the significance of this study.

concept on a particular subject likely aims to perform well in whatever related tasks are given to them. In turn, this brings positive effects on their performance in the subject. Thus, a high academic self-concept directly relates to better academic achievement [6].

According to Rahayu, Altaftazani, Kelana, et al. [7], the implementation of learning with methods that are different from usual will certainly have an impact on students both positive and negative impacts. A positive impact is that children can learn from home with family and children can avoid COVID-19 exposure. While the negative impact is that 80% of children want to go back to school, the majority of students are not happy about distance learning. Students find it difficult to understand the material delivered through distance learning, students are confused in completing assignments, and students lack confidence when completing math assignments.

Despite of the challenges, the ingenuity and resilience of the Filipinos were demonstrated in the midst of the pandemic [8]. Resilience in mathematics is student reflexivity in making the decision when encountering a new situation [9]. Many studies on resilience have been done to prove that resilience is one of the reasons for student success in mathematics.

Now that our educational institutions navigate to this new mode of teaching-learning modalities, it is worthy therefore to study the mediating effect of students' resiliency to the relationship of self-concept and mathematics performance of the students.

## 2. MATERIAL AND METHODS

### 2.1 Research Design

This study is quantitative in nature and employed a descriptive - correlational research design.

### 2.2 Research Instrument

A descriptive survey questionnaire was used to gather the desired data of this study, which consists of three parts. The first part consists of questions that elicit the demographic profile of the respondents in terms of age and gender. The second part was the Mathematical Resilience Scale (MRS) that was developed by Kooken, Welsh, McCoach, et al. [10] which was a 23-item survey for the measurement of students' resiliency in mathematics, with reported reliability values of 0.92, 0.80, 0.76, and 0.87 for the value factor, the struggle factor, the growth factor, and the entire scale, respectively. The third part was an adapted 20-item self-report questionnaire titled, "Self-concept towards Mathematics" that was developed by Ayodele [11] in which students were asked to rate how they feel, act, value and evaluate themselves in mathematics on a four-point scale. The reliability coefficient of the instrument is reported to be at 0.74 Cronbach- $\alpha$ .

**Comment [12]:** What about the mathematics performance instrument? Author need to explain it.

**Comment [13]:** Did author adapt or adopt it? Please explain clearly the dimensions involved with the number of items

**Comment [14]:** Did author adapt or adopt it? Please explain clearly the dimensions involved with the number of items.

### 2.3 Respondents of the Study

In getting the sample size, the Slovin's formula was used. The stratified random sampling was employed so that respondents will be proportionally distributed to different Secondary Schools of Malita East District. The respondents of this study were the randomly selected Junior High School students of Malita East, Davao Occidental for the School Year 2021-2022. The distribution of respondents is presented in Table 1 below:

**Comment [15]:** Citation? How the formula was applied?

**Table 1. The Distribution of Respondents**

NAME OF SCHOOL	POPULATION	SAMPLE SIZE
----------------	------------	-------------

1. Benjamin Velasco Bautista Sr. National High School	498	151
2. Bolila National High School	292	89
3. Tingolo Integrated School	125	38
<b>TOTAL</b>	<b>915</b>	<b>278</b>

## 2.4 Data Gathering

After obtaining the necessary permissions to conduct the study, the researcher initiated orientation to the parents and students during the scheduled module distribution. The questionnaire was then given to the respondents and was retrieved along with the module retrieval.

The mathematics performance data such as the first quarter and second quarter subject grades in Mathematics for the SY 2021-2022 were secured from the Guidance Designate/planning officer of the respective schools.

**Comment [16]:** This information is unclear. Is it the standardised test or school level test?

If school level test, how did author justify the equivalence of the test?

## 2.5 Statistical Analysis

The data gathered were tallied, tabulated, and prepared in a manner suitable for use in SPSS. Descriptive statistics was used to describe the respondents' levels of self-concept, resiliency, and mathematics performance. Mediation analysis was then employed to describe the mediating effect of students' resiliency to the relationship between self-concept and mathematics performance of the junior high school students.

## 3. RESULTS AND DISCUSSION

### 3.1 Self-concept of the Students towards Mathematics

The level of self-concept of the students towards Mathematics is presented in Table 2. Among the 20 indicators of self-concept, Mathematics improves understanding of other subjects and feeling delighted when answering Mathematics questions; both obtained the highest mean rating of 2.680 with qualitative description "High". Aside from the mentioned indicators above, capability of making a good grade in Mathematics and learning Mathematics gives meaning to learning activities, as well as, mathematics is suitable only for gifted students and encourages to apply detailed steps to solving personal problems also shared an equal mean rating of 2.586 and 2.597, respectively, with descriptive rating of "High". On the other hand, mathematics is an easy subject to pass obtained the lowest mean rating of 2.554 with qualitative description "High". The overall level of self-concept of the students towards Mathematics is "High" with mean rating of 2.611. This means that in learning Mathematics, students' interest towards the subject is notable. They display positive perception towards Mathematics.

**Comment [17]:** What are the sources referred to determine the level?

**Table 2. The level of self-concept of the students towards Mathematics**

Indicators	Mean	Std. Deviation	Descrip
Mathematics is an easy subject to learn.	2.583	.7398	High
Mathematics is an easy subject to pass.	2.554	.7227	High
Mathematics helps me find a new way of doing things.	2.568	.8416	High
Every question in Mathematics is answerable.	2.604	.8592	High
Mathematics lessons give me satisfaction.	2.647	.8443	High
Mathematics improves my understanding of other subjects.	2.680	.7937	High
Mathematics improves my learning and retention capacities.	2.558	.8381	High
I am good at Mathematics as a subject.	2.651	.7815	High
I am capable of making a good grade in Mathematics.	2.586	.8442	High

**Comment [18]:** items

I feel delighted when answering Mathematics questions.	2.680	.8423	High
Mathematics facilitates my studying independently.	2.655	.8600	High
Mathematics is suitable only for gifted students.	2.597	.8473	High
Mathematics encourages me to apply detailed steps to solving my personal problems.	2.597	.8036	High
Mathematics makes me think fast.	2.619	.8273	High
My present knowledge of Mathematical concepts is high.	2.601	.8762	High
Mathematics is worth passing well.	2.622	.8224	High
I do extra work to learn Mathematics.	2.665	.8280	High
Mathematics is important in my future career.	2.594	.7673	High
I am comfortable in Mathematics lessons.	2.579	.8577	High
Learning Mathematics gives me meaning to learning activities.	2.586	.8442	High
<b>SELF-CONCEPT (OVERALL)</b>	<b>2.6113</b>	<b>.74772</b>	<b>High</b>

### 3.2 Students' Resiliency in Mathematics

The level of students' resiliency in Mathematics is presented in Table 3. Among the three constructs of students' resiliency, Struggle obtained the highest mean rating of 3.703 with qualitative description "High". It is followed by Value and Growth with 3.69514 and 3.690 mean ratings, respectively, with descriptive rating of "High". The overall resiliency level of the respondents is "High" with mean rating of 3.696. This implies that students exhibit persistence in learning mathematics in the face of adversity. They recognize that struggle is part of learning mathematics. And for students to succeed in mathematics, they need to perceive math as valuable [12]. Bandura and Cervone [13] found that when the motivational investment of the group is high, the staying power in the face of setbacks is strengthened, hence enhancing performance. Students need to be challenged at the appropriate degree in order to continue to engage in the study of mathematics. Similarly, students should be able to adapt to the learning pattern without going through face-to-face [14].

**Comment [I9]:** What are the sources referred to determine the level?

**Table 3. The level of students' resiliency in Mathematics**

Resiliency Constructs	Mean	Std. Deviation	Description
Value	3.695	.8628	High
Struggle	3.703	.8469	High
Growth	3.690	.8390	High
<b>Resiliency (Overall)</b>	<b>3.696</b>	<b>.8394</b>	<b>High</b>

**Comment [I10]:** what are the meaning for these constructs?

### 3.3 Mathematics Performance of the Students

Table 4 shows the level of Mathematics performance of the students. Majority of the respondents displayed Proficient Level of mathematics performance with 48.56% of the total sample population. It is followed by Approaching Proficiency Level, Developing Level, Advanced Level, and Beginning Level with 29.14%, 16.55%, 5.76%, and 0%, respectively, of the total sample population. The average Mathematics grades of the respondents for the School Year 2021 – 2022 is 84.39 with qualitative description "Approaching Proficiency" and a standard deviation of 3.86. This implies that in general, the respondents developed fundamental knowledge, skills and guidance from the teacher or with peers and can transfer them these understanding through authentic tasks.

**Table 4. The Mathematics Performance of the Students**

Range of Means	Descriptive Level	Frequency (f)	Percentage (%)
90% and above	Advanced	16	5.76
85% – 89%	Proficient	135	48.56
80% – 84%	Approaching Proficiency	81	29.14
75% – 79%	Developing	46	16.55
74% and below	Beginning	0	0.00

n=278; Mean=84.39; SD=3.89

### 3.4 The Mediating Effect of Students' Resiliency to the Relationship of Self-concept and Mathematics Performance of the Students

The Mediation Effect Analysis of students' resiliency to the relationship of self-concept and mathematics performance of the students is presented in Table 5. It was found that the level of Self-concept towards Mathematics significantly affects the level of Students' Resiliency with the regression coefficient of 0.91 and p-value of less than 0.05. Further, results also showed that Students' Resiliency had a significant effect on their Mathematics Performance with regression coefficient of 1.16 with p-value of less than 0.05. These results conform to the study of Kwek, Bui, Ryne, & Fung So [15] that self-concept and resilience are significant predictors of academic achievement.

The overall indirect effect is 1.06 which is the product of the direct effects of Self-Concept to Students' Resiliency and Students' Resiliency to the Mathematics Performance with p-value of less than 0.05.

On the other hand, the direct effect of Self-concept to the Mathematics Performance of the Students has a regression coefficient of 3.49 with p-value of less than 0.05. This implies that Self-concept had a significant effect on the Mathematics Performance of the Students. The result supported the study of Guay, Ratelle, Roy, & Litalien [16], which aimed to investigate the self-concept of the students, as they found that students who have high academic self-concept have higher grades because they are more motivated to perform well in school.

Moreover, the Total Effect has a regression coefficient of 4.55 which is the sum of indirect and direct effect. The Indirect Effect is 1.06 which means that mediation of resiliency to relationship of self-concept and mathematics performance of the students is about 23.30%, while direct effect of self-concept to mathematics performance is 76.70%. Since, the direct effect of Self-concept to Mathematics performance is nonzero and is significant, we can say that the mediation of resiliency exhibited is partial mediation. This result implies that mathematics self-concept remains a predictor to mathematics performance. However, students' resiliency in mathematics also matters in this time of COVID-19. Nurturing students' resiliency would significantly improve the effect of mathematics self-concept towards mathematics performance.

Comment [I11]: Performance or achievement?

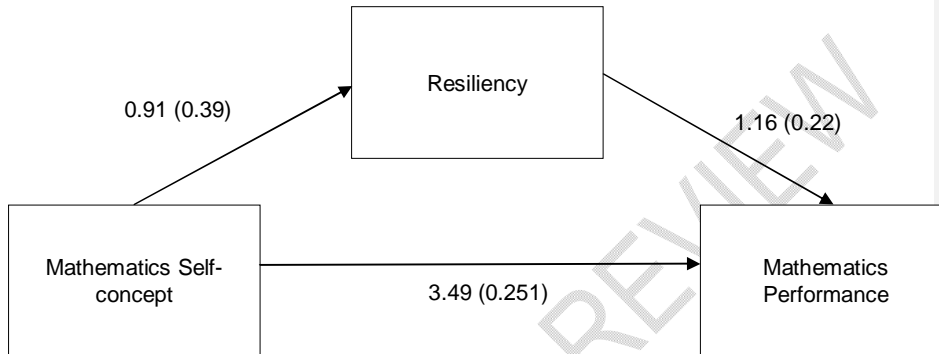
**Table 5. Mediation Effect Analysis of students' resiliency to the relationship of self-concept and mathematics performance of the students.**

Effect	Estimates	SE	Lower CI	Upper CI
Indirect Effect	1.06*	0.22	0.62	1.51
Self-Concept → Resiliency	0.91*	0.39	0.84	0.99
Resiliency → Math Performance	1.16*	0.22	0.72	1.60
Direct Effect				
Self-Concept → Math Performance	3.49*	0.25	2.99	3.98
Total Effect	4.55*	0.15	4.25	4.85

\*p<0.05; SE=Standard Error; CI= Confidence Interval

Finally, to check whether the mediation exists is significant, Sobel Test was employed and the result is presented in Table 6. Since the p-value is less than 0.05 level of significance, then we reject the null hypothesis and conclude that the mediation effect of Resiliency to the Relationship between Students' Self-concept and their Mathematics Performance is significant.

The result of the study was somehow related to the previous study of Martinez, Landa, Lopez, & Leon [17], that self-concept mediates the relationship between resilience and academic achievement. Their results suggest that, although resilience is not able to predict students' academic scores directly, they are able to do it through self-concept.



**Figure 1. The Mediating Effect of Resiliency on the Relationship between Students' Self-concept and their Mathematics Performance**

**Table 6. Summary of Sobel Test of Mediation**

Indirect Effect	Estimates	SE	p-value
Self-Concept → Resiliency	0.91	0.39	0.031
Resiliency → Math Performance	1.16	0.22	

#### 4. CONCLUSION AND RECOMMENDATIONS

Mathematics performance of students got the attention of the educators for several decades now. A lot of researchers attempted to model mathematics performance. It is generally believed that students' performance is influenced by a lot of factors. Identifying which of the several factors are significant is one of the key steps [18]. The results of this study contributed to the body of knowledge in mathematics education by acknowledging self-concept as a predictor to students' mathematics performance and resiliency as the significant mediating variable. Further, the following were drawn:

1. The respondents display high level of self-concept towards Mathematics which means that in learning Mathematics, students' interest towards the subject is notable. They display positive perception towards Mathematics. It is recommended to continue inculcating these variables among the students by designing meaningful classroom and school activities which may boost self-concept and resiliency among students.
2. The respondents display high level of resiliency which means that students exhibit persistence in learning mathematics in the face of adversity. They recognize that struggle is part of learning mathematics.
3. Students exhibit approaching proficiency level on their Mathematics grades which means that the students developed fundamental knowledge, skills and guidance from

**Comment [I12]:** It is not advisable to present discussion in the number labeling form. Author did not discuss the findings comprehensively and critically, supported by the previous studies' finding and related sources.

Author more to repeat the findings in this part.

The recommendation is only in a sentence (last sentence)

the teacher or with peers and can transfer them these understanding through authentic tasks. Yet, lot of students still struggle in learning Mathematics and perform poorly in the subject. Hence, it is recommended to develop and implement intervention programs that will address the learning needs of the learners particularly in this challenging time of COVID-19 pandemic.

4. Mathematics self-concept remains a significant predictor to mathematics performance, hence, nurturing this variable is important in enhancing mathematics performance.
5. Students' Resiliency significantly mediates the relationship of Self-concept and Mathematics Performance of the students. Cultivating students' resiliency would significantly improve the effect of mathematics self-concept towards mathematics performance. Hence, cultivating resiliency among the learners shall always be considered in school programs and activities to prepare the students in uncertain times and cope with adversities.
6. Further exploration on the interaction of students' self-concept, resiliency, and mathematics performance would be worthwhile. Inclusion of other non-cognitive variables and studying them in a structural equation modelling is recommended.

## REFERENCES

- [1] Flores, I. 2020. Self-efficacy and mathematics performance of students in the new normal education. *World Journal of Educational Research*
- [2] Miranda, A. T. 2020. The distribution of covid-19 cases in the philippines and the benford's law. *Philippine e-Journal for Applied Research and Development*, 10, 29-34.
- [3] Magsambol, B. 2020. Fast facts: deped's modular learning. Retrieved from <https://www.rappler.com/newsbreak/iq/things-to-know-deped-modular-learning>
- [4] Farrington, C. A., Roderick, M., Allensworth, E., Nagaoka, J., Keyes, T. S., Johnson, D. W., & Beechum, N. O. (2012). Teaching adolescents to become learners: the role of noncognitive factors in shaping school performance: a critical literature review. *Consortium on Chicago School Research*. 1313 East 60<sup>th</sup> Street, Chicago, IL 60637. Retrieved from <https://bit.ly/2lfm5lk>
- [5] Pintrich, P. R. 2000. Multiple goals, multiple pathways: The role of goal orientation in learning and achievement. *Journal of Educational Psychology*, 92(3): 544. <https://doi.org/10.1037/0022-0663.92.3.544>
- [6] Khalaila, R. 2015. The relationship between academic self-concept, intrinsic motivation, test anxiety, and academic achievement among nursing students: Mediating and moderating effects. *Nurse Education Today*, 35(3): 432-438.
- [7] Rahayu, G. D. S., Altaftazani, D. H., Kelana, J. B., Firdaus, A. R., & Fauzi, M. R. (2020, October). Analysis of elementary school students' mathematical resilience during learning during the covid 19 Pandemic. In *Journal of Physics: Conference Series* (Vol. 1657, No. 1, p. 012001). IOP Publishing.
- [8] Simbulan, N.P. 2020. The Philippines COVID-19 and its impact on higher education in the philippines. *The HEAD Foundation*. Retrieved from: <https://headfoundation.org/HESB8/covid-19-and-its-impact-on-higher-education-in-the-philippines/>
- [9] Hernandez-Martinez P., Williams J. 2013. Against the odds: resilience in mathematics students in transition. *Br Educ Res J.*, 39(1): 45-59
- [10] Kooken, J., Welsh, M., Mcoach, D., Johnston-Wilder, S., Lee, C. 2013. Mathematics resilience scale. *Storrs, CT: University of Connecticut*.

- [11] Ayodele, O. J. 2011. Self-concept and performance of secondary school students in mathematics. *Journal of Educational and Developmental Psychology*, 1(1), 176-183.
- [12] Deci, E. L., Vallerand, R. J., Pelletier, L. G., & Ryan, R. M. 1991. Motivation and education: The self-determination perspective. *Educational Psychologist*, 26(3-4), 325–346. [https://doi.org/10.1207/s15326985ep2603&4\\_6](https://doi.org/10.1207/s15326985ep2603&4_6)
- [13] Bandura, A., & Cervone, D. 2000. Self-evaluative and self-efficacy mechanisms of governing the motivational effects of goal systems. In E. T. Higgins & A. W. Kruglanski (Eds.), *Motivational science: Social and personality perspectives* (pp. 202–214). Psychology Press.
- [14] Kamsurya, R. 2020. Learning evaluation of mathematics during the pandemic period COVID-19 in Jakarta. *International Journal of Pedagogical Development and Lifelong Learning*, 1(2), ep2008
- [15] Kwek, A., Bui, H. T., Rynne, J., & Fung So, K. K. 2013. The impacts of self-esteem and resilience on academic performance: an investigation of domestic and international hospitality and tourism undergraduate students. *J. Hospital. Tour. Educ.* 25, 110-122
- [16] Guay, F., Ratelle, C. F., Roy, A., & Litalien, D. 2010. Academic self-concept, autonomous academic motivation, and academic achievement: Mediating and additive effects. *Learning and Individual Differences*, 20(6): 644-653. Department Of Education (2020). *Learning opportunities shall be available*. The basic education learning continuity plan in the time of COVID-19. Retrieved from: [https://www.deped.gov.ph/wpcontent/uploads/2020/07/DepEd\\_LCP\\_July3.pdf](https://www.deped.gov.ph/wpcontent/uploads/2020/07/DepEd_LCP_July3.pdf)
- [17] Martinez, I., Landa, J. M., Lopez, R., & Leon, S. 2022. Self-concept as a mediator of the relationship between university students' resilience and academic achievement. *Front. Psychol.* 12:747168.
- [18] Miranda, AT. 2018. Cognitive ability, psycho-sociological characteristics and study habits of students: a structural model on mathematics performance. *Asian Journal of Multidisciplinary Research*, Vol. 1, No. 3 Special Issue, pp 51-57