



The Relationship of Self-Concept and Mathematics Performance of College Students in the New Normal

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

This study aimed to explore the relationship between self-concept and mathematics performance of first-year college students. Descriptive correlational research design was employed and stratified random sampling technique was used. A total of three hundred twenty-eight (328) students were subjected to the study. In gathering the data, an adopted survey questionnaire was used. Mean and standard deviation were used for description of quantitative variables and percentage (%) was used for categorical variables. Spearman correlation analysis was then employed to analyze the relationship among the considered variables. Results revealed that most of the respondents exhibit moderate level of self-concept toward learning mathematics during the time of pandemic. This implies that, students' interest in mathematics is notable and display a positive perception of the subject. The mathematics performance of most of the respondents belonged to a very good level, implying that students developed fundamental knowledge and skills in mathematics subject.

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Correlation analysis revealed that self-concept is significantly correlated to the mathematics performance of the students. Hence, it is recommended to incorporate activities and approaches into the math curriculum that are designed to boost students' self-concept towards mathematics.

Keywords: Self-concept towards mathematics; mathematics performance; college students learning; learning mathematics.

1. INTRODUCTION

One of the topics that garners attention in several educational research studies is students' performance in mathematics [1]. Mathematics is a basic subject, offered and taught in most schools, nonetheless considered challenging and tough by many students. It becomes a common remark in several reports and studies that students indeed struggle in learning mathematics. Arenillo and Cruzado claimed that the subject mathematics itself evokes fear and anxiety to students [2]. Much more in this time of COVID-19 pandemic where school premises were closed and education shifted from face to face classes to distance learning, due to the implementation of public health protocols. As observed, students struggle to understand the mathematical concepts and to perform mathematical operations stipulated in modules [3]. Educational institutions are trying to cope with managing the pandemic challenges [4-6] while some educators and researchers are trying to explore the non-cognitive dimensions of students [7-11] & [3] one of which is the students' self-concept towards mathematics.

"Self-concept is defined as the way a person thinks, feels, acts, values and evaluates one-self in connection to mathematical performance" [12]. "As claimed by Marsh and Martin, self-concept is formed through experience with and interpretations of one's environment" [13]. "Mathematics self-concept has to do with how sure a person is of being able to learn new topics in mathematics, perform well in mathematics class, and do well on mathematics tests" [14]. The mathematics self-concept refers to an individual's beliefs, attitudes, and feelings about their mathematical ability and identity. This study is anchored on the belief that self-efficacy is learned, is organized, and is dynamic [15]. It is learned through experiences with mathematics, both in and out of the classroom, and is influenced by a variety of factors such as prior knowledge, instructional practices, and social and cultural norms. It is organized in that it consists of multiple dimensions, including beliefs about one's ability to understand and perform

mathematical tasks, enjoyment of mathematics, and the value and importance of mathematics in one's life. Further, it is also dynamic, meaning it can change over time. It can be affected by ongoing experiences and learning, as well as by changes in individual motivation and engagement.

"Several researchers and educators claimed that mathematical self-concept is an important construct students must nurture in learning mathematics and it has been linked to academic performance" [16,3,17]. "Most of the studies support the belief that self-concept is a strong facilitator of academic achievement in mathematics and that a positive or negative change in self-concept tends to produce a commensurate change in academic achievement" [12]. Research has shown that students who have a positive self-concept in mathematics tend to perform better in mathematics than those with a negative self-concept. This is because students who believe in their own abilities are more likely to take on challenges and persevere when faced with difficulties, which are important skills for success in mathematics. In contrast, students who have a negative self-concept in mathematics may avoid challenging tasks, leading to poorer performance. In spite of the abundance of literature on mathematics self-concept and mathematics performance, Peteros claimed in 2019 that self-concept have been less explored in the Philippine educational setting [18]. Recent local studies on self-concept were focused on high school students [18,3,11]. Further, very few were conducted with college students as respondents, particularly in the new normal settings. Bringula, Reguyal, Tan, & Ulfa investigated the self-concept of undergraduate students but in a qualitative lens of research [19]. Hence, this quantitative study is proposed to explore the relationship of mathematics self-concept and mathematics performance of college students in the new normal.

The teachers, students, and academic institutions may benefit from the study's findings. Teachers can enhance their teaching strategies resulting from the study's conclusions. Schools

may use the study's results to strengthen institutionalized programs and activities reflecting on students' self-concepts in mathematics learning. As a result, students' mathematical self-concept may be enhanced and their mathematics learning may be successful.

1.1 Objectives

This study explored the relationship between the self-concept towards mathematics and mathematics performance of first year college students of Southern Philippines Agri-Business and Marine and Aquatic School of Technology (SPAMAST), Malita, Davao Occidental, Philippines during the first semester of school year 2021 - 2022. Specifically, it aimed to:

1. Determine the level of self-concept of college students in Mathematics;
2. Measure the Mathematics performance of the respondents in terms of their grade in Mathematics in the Modern World subject;
3. Find out if there is a significant relationship between the students' self-concept and their mathematics performance.

2. MATERIALS AND METHODS

2.1 Research Design

Descriptive - correlational research design was used in this study aimed in describing the relationship of mathematics self-concept and their mathematics performance. In gathering of data, descriptive survey was also employed which utilized questionnaire to find out the level of self-concept of the respondents.

2.2 Research Instrument

The researchers used survey questionnaire to gather the data on the self-concept of respondents towards mathematics. An adopted survey questionnaire of Peteros, Gamboa, Etcuban, Dinauanao, Sitoy, & Arcadio [18], which was a modification of Mathematics Self-concept formulated by Kvedere [20] known as Mathematics Self-Concept was used. The questionnaire has three constructs: Learned, Organized, and Dynamic. This questionnaire is consist of thirty (30) statements answerable by very high, high, moderate, low, and very low. The mathematics performance of the students was based on their grades in the subject Mathematics in the Modern World which were obtained from the respective institute offices of the College.

2.3 Respondents of the Study

The study was conducted at Southern Philippines Agri-Business and Marine and Aquatic School Technology, a state college that offers quality education in the field of agriculture, agri-business, fisheries, marine sciences, human services and teacher education. The target population were the first year college students since they were the ones enrolled in the subject Mathematics in the Modern World as basis of the mathematics performance in this study. The population size was 1,805. Using the Slovin's formula, a sample size of 328 first-year college students was obtained. It was proportionally distributed throughout the four (4) institutes of the college, namely: Institute of Teacher Education and Information Technology (ITEIT), Institute of Human Service (IHS), Institute of Fisheries and Marine Sciences (IFMS) and Institute of Agricultural Technology and Entrepreneurial Studies (IATES) (See Table 1).

2.4 Data Gathering

The researchers collected data online because of the strict implementation of public health measures during the COVID-19 pandemic [21]. Permission to conduct the study was obtained from the office of the respective Institute Deans. After receiving the necessary approvals, the researchers used an adopted questionnaire as the data gathering tool and administered it to the randomly selected group of first-year college students through Google Form. General direction for completing the questionnaire was provided and offered the option for respondents to remain anonymous. Participants were also given the option to opt out of answering the questionnaire if they were not comfortable. It was emphasized that by responding to the questionnaire, the respondents gave their consent to participate in the study. The researchers used the students' grades in mathematics in the modern world, obtained from the respective institute offices of the College, as measure of their mathematics performance.

2.5 Statistical Analysis

The data collected was organized and formatted for use in SPSS. The frequency and percentage were utilized to describe the distribution of respondents. Mean was used to describe the level of self-concept towards mathematics and mathematics performance. Spearman correlation analysis was then conducted to examine the significant relationship between the variables at 95% confidence interval.

Table 1. Distribution of respondents of the study

Institute	Number of students	Sample size
ITEIT	573	104
IHS	575	104
IFMS	166	31
IATES	491	89
Total	1805	328

3. RESULTS AND DISCUSSION

3.1 The Self-Concept of Students towards Mathematics

The student’s self-concept towards mathematics is shown in Table 2. The indicator “learned” has a mean of 3.174 interpreted as moderate self-concept which means that in learning mathematics, students’ interest in the subject is notable, and they display a positive perception towards mathematics. The statement “Learning mathematics gives meaning to learning activities”, got the highest mean of 3.451 interpreted as high self-concept, while the statement “I am good at mathematics” got the lowest mean of 2.909 interpreted as moderate self-concept. This result is similar to the claimed of Peteros et al. that the level of students’ mathematics self-concept as learned is moderate [18]. This is an implication that the students still need to be assisted to enhance their self-concepts in learning mathematics subject.

Further, the results of the study showed that students had moderate self-concept regarding the indicator "organized" with a mean of 3.166. However, they had a high self-concept, with mean 3.543, when it came to the statement "Mathematics helps to find new ways of understanding things," indicating a strong confidence in learning mathematics and a positive perception of the subject. On the other hand, the statement "Mathematics is an easy subject to pass" had the lowest mean of 2.832, indicating a moderate self-concept and a notable interest in learning mathematics, but still with a positive perception of the subject. According to Purkey, an individual's self-concept may change over time as they face different experiences and challenges in life, and it is based on how consistently their perception of themselves aligns with their actual experiences [15].

In terms of self-concept as dynamic, results show a mean of 3.395 implying that the students have

a moderate level of interest and positive perception towards mathematics. The statement "Mathematics is essential in the future" received the highest mean score of 3.832, indicating a high level of confidence in their ability to learn and succeed in mathematics. The statement "My present knowledge of mathematical concepts is high" had the lowest mean score of 3.043, indicating a moderate level of self-concept in regards to their current understanding of mathematical concepts. As claimed by Timmerman, Luit, & Toll, the self-concept of individuals can be shaped and altered by the influences of the environment around them [22]. This is a result of socialization and interactions with others. Most students tend to have a moderate level of self-concept that is dynamic in nature. This indicates that they exhibit moderate levels of enthusiasm and engagement in mathematical and practical tasks, and their decisions may also change over time based on their experiences.

In general, the student’s level of self-concept in terms of learned, organized, and dynamic has an overall mean of 3.2447 with a description of moderate self-concept implying that in terms of learning mathematics, students’ interest towards the subject is notable and displays a positive perception towards mathematics. In the study of Peteros et al., “it was concluded that the students had a moderate level of self-concept which implies that the self-concept of the students based on their belief that they can perform well in the subject when they exert more effort in doing Math-related tasks” [18]. “However, this self-concept needs to be improved because this could help the respondents develop a positive attitude towards the subject, which can also help in improving the students’ academic performance. Amri and Widada added that there is a positive direct effect of self-concept on mathematical understanding skills” [17].

Table 2. Self-concept of students towards mathematics

Items	Mean	SD	Description
1. I learn Mathematics quickly.	3.104	0.6365	Moderate
2. In my Mathematics class, I understand even the most challenging work.	3.095	0.6909	Moderate
3. I have never felt incapable of learning math.	3.037	0.6533	Moderate
4. I am good at mathematics.	2.909	0.7279	Moderate
5. I am capable of making a good grade in mathematics.	3.119	0.7003	Moderate
6. I do extra work to learn mathematics.	3.256	0.8576	Moderate
7. Learning mathematics gives me meaning to learn activities.	3.451	0.8037	High
8. Even if the work in mathematics is hard, I can learn it.	3.262	0.7692	Moderate
9. Every question in mathematics is answerable.	3.168	0.8235	Moderate
10. I am sure I can learn the skills taught in mathematics class well.	3.338	0.7888	Moderate
Learned	3.174	0.5165	Moderate
11. I usually do well in mathematics.	3.119	0.6781	Moderate
12. Mathematics is more enthusiastically for me than for a significant number of my schoolmates.	3.021	0.6747	Moderate
13. I have dependably accepted that mathematics is a standout amongst my best subjects.	3.076	0.7803	Moderate
14. I get good marks in mathematics.	3.146	0.7146	Moderate
15. Mathematics is an easy subject to pass.	2.832	0.7415	Moderate
16. Mathematics is worth passing well.	3.345	0.8015	Moderate
17. Mathematics help to find a new way of finding things.	3.543	0.8191	High
18. When I do Math, I feel confident that I have done it correctly.	3.070	0.8556	Moderate
19. It takes me any longer to comprehend mathematics ideas than the average individual.	3.085	0.6581	Moderate
20. When I have difficulties in Math, I know I can handle them if I try.	3.421	0.8530	High
Organized	3.166	0.5401	Moderate
21. I can do practically all the work in Mathematics class if I do not give up.	3.457	0.8376	High
22. Mathematics improves my understanding of other subjects.	3.399	0.8065	Moderate
23. Mathematics improves my learning and retention capacities.	3.396	0.8099	Moderate
24. I feel delighted when answering Mathematics questions.	3.183	0.8295	Moderate
25. Mathematics is suitable for all students.	3.463	0.9180	High
26. Mathematics encourages me to apply detailed steps to solve my problems.	3.549	0.8589	High
27. Mathematics makes me think fast.	3.311	0.8922	Moderate
28. My present knowledge of mathematical concept is high.	3.043	0.7448	Moderate
29. Mathematics is essential in the future.	3.832	0.9150	High
30. I am comfortable in mathematics.	3.311	0.8818	Moderate
Dynamic	3.395	0.6303	Moderate
Self-Concept (Overall)	3.245	0.5228	Moderate

Legend: Moderate (2.61-3.40), High (3.41-4.20)

3.2 The Mathematics Performance of the Students

The student's mathematics performance is shown in Table 3. A number of respondents displayed a good level of mathematics performance which has the frequency of 109 students and the percentage of 33.23% which implies that students developed fundamental knowledge and skills but need minimal guidance from the teacher or peer. Superior level and fair level have the lowest frequency which had 62 students with the percentage of 18.90%, which means that students possess the minimum knowledge and skills and core understanding but needs helps and guidance from teachers and peers. The average Mathematics grades of the respondents is 1.907 with the qualitative description very good and a standard deviation of 0.486. Hence, the majority of the respondents had developed a core understanding towards mathematics but some of them had struggles and difficulties in acquiring knowledge and skills in mathematics subject. In the study of Roman and Villanueva, it was revealed that first year college students had a satisfactory performance in Mathematics in the Modern World [23]. Moreover, Dela Rosa and Nicasio also claimed that students who were remarked as good in Mathematics in the Modern World were advanced, average, and slow learners are merge and some are struggling in dealing with assessment in mathematics in the modern world [24].

3.3 Students' Self-Concept and Mathematics Performance

Table 4 shows the relationship between self-concept and mathematics performance among first-year college respondents of the study. The self-concept indicator "Learned" was found to have a very low correlation with mathematics performance, indicated by an r-value of 0.123, and a significant relationship, indicated by a p-value of 0.026 which is less than the 0.05 level of

significance. On the other hand, the self-concept indicator "Organized" was found to have a very low correlation with mathematics performance, indicated by an r-value of 0.105, but a non-significant relationship, indicated by a p-value of 0.057 which is greater than the 0.05 level of significance. The self-concept indicator "Dynamic" was found to have a very low correlation with mathematics performance, indicated by an r-value of 0.129, and a significant relationship, indicated by a p-value of 0.019.

The overall students' self-concept towards mathematics has a very low correlation to mathematics performance with an r-value of 0.138. However, the relationship between the self-concept and mathematics performance is significant, as indicated by a p-value of 0.012. This suggests that enhancing students' self-concept in mathematics could lead to improved performance in the subject. Hence, we can reject the null hypothesis and conclude that there is a significant relationship between college students' self-concept and their mathematics performance. This result is aligned with the claim of Timmerman et al. that the correlation between math self-concept and math achievement in the four domains of mathematics, such as measurement, relations, numbers, and scale were small to medium, positive and significant. Meanwhile, Obilor also stressed that there is a significant positive relationship between the mathematics self-concept of students and students' mathematics achievement which implies that students with high mathematics self-concept will generally achieve high in mathematics than those with low mathematics self-concept [25]. However, Oko's findings opposed to this result claiming that there was no significant relationship between students' self-concept and academic performance in mathematics [26]. Yet, it has to be noted that their study was conducted a decade ago and was focused on Nigeria students.

Table 3. Mathematics performance of the students

Range of scores	Description level	Frequency (f)	Percentage (%)
1.49-1.00	Superior	62	18.90
1.99-1.50	Very Good	95	28.96
2.49-2.00	Good	109	33.23
2.50-3.00	Fair	62	18.90

n=328; %=100; Mean=1.907; SD=0.486

Legend: Superior (1.49-1.00), Very Good (1.99-1.50), Good (2.49-2.00), Fair (3.00-2.50)

Table 4. Relationship between students’ self-concept towards mathematics performance

Indicators	r-value	Description	p-value	Interpretation
Learned	0.123	Very Low	0.026	Significant
Organized	0.105	Very Low	0.057	Not significant
Dynamic	0.129	Very Low	0.019	Significant
Self-concept (Overall)	0.138	Very Low	0.012	Significant

4. CONCLUSIONS

Based on the findings and statistical results of the study the following conclusions were made:

1. First year college students in the new normal exhibit moderate level of self-concept towards mathematics. This means that in learning mathematics, students’ interest towards the subject is notable. While they show some interest in the subject, it may not be particularly strong. However, they generally view mathematics in a positive light, see it as useful and valuable, and may view their ability to learn it as a positive personal trait.
2. Students displayed a very good level of mathematics performance which means that students have developed fundamental knowledge and skills. This suggest that students obtained basic understanding of key concepts and principles of the subject, able to apply this knowledge in practical ways, and can build upon in the future.
3. There is a significant relationship between students’ self-concept and mathematics performance. This implies that there is a clear link between students’ self-concept towards mathematics and their performance in the subject. That is, students who have a positive self-concept towards mathematics perform better in math classes and assessments.

5. RECOMMENDATIONS

Based on the summary, findings, and conclusions, the researchers made the following recommendations:

1. The college students display a moderate level of self-concept. This can still be improved by providing them with additional support and resources. This could include offering extra help sessions with teachers, providing access to online resources or educational materials, or organizing study groups or peer tutoring programs. By providing students with the support they need to succeed in math, school administrators and teachers can help

boost their self-concept towards the subject.

2. Generally, respondents exhibit very good level of mathematics performance in the new normal. However, there are still a significant number of students who struggle to learn math 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. This could involve using a variety of teaching methods and resources to help students understand key concepts and principles, and providing opportunities for students to practice and apply what they have learned. By building a strong foundation, students will be better equipped to tackle more advanced material and may be less likely to struggle with math in the future.
3. Self-concept is significantly correlated to their mathematics performance. Hence, it is recommended to incorporate activities and approaches into the math curriculum that are designed to boost students’ self-concept. This could include using real-world examples and problems to make math more relevant and engaging, using interactive resources and manipulatives to help students understand key concepts more deeply, or providing opportunities for students to take on leadership roles or work on independent projects in math class. By helping students develop a more positive self-concept towards mathematics, teachers and school administrators can potentially improve their performance in the subject.
4. Further exploration of the interrelation of self-concept and mathematics performance would be worthwhile, particularly in this post-lockdown condition. The inclusion of other non-cognitive factors could provide valuable insights and inform strategies for improving students’ math performance.

CONSENT

As per international standard or university standard, respondents’ written consent has been collected and preserved by the author(s).

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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