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Mindset and Self-Control: Exploring its Relationship and Differences in Mathematics Performance

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Abstract: ***Attaining a college degree is never an easy task; throughout the process, many academic challenges and setbacks might encounter which will surely test the overall character and determination of the students to succeed. In the past, the students' academic achievement was mainly attributed to intelligence and aptitude, and only a few studies attempted to examine the relationship between non-cognitive factors and skills of learning. The current study aims to determine the relationship between mathematics performance and non-cognitive factors such as mindset and self-control. Moreover, the present study also determines if mathematics performance differs based on mindset and level of trait self-control. This study used the descriptive-correlational method of research among 272 first-year college students enrolled in mathematics subjects. The data were generated by using a survey questionnaire and were analyzed using frequency count, percentage, weighted mean, standard deviation, and Pearson r correlation. The study results reveal that mindset and self-control serve as factors in the difference in students' mathematics performance. Further, a direct positive relationship was found between growth mindset and mathematics performance. However, no significant relationship was found between self-control and mathematics performance.***

Keywords: mathematics performance, mindset, non-cognitive factors, self-control

1. Introduction

Securing a college degree serves as an edge to succeed and prosper in life. It is a powerful tool to open up more career opportunities and advancements. Chang (2014) states that completing a college degree benefits both the individual and society. People with at least bachelor's degrees have lower rates of unemployment, poverty, smoking, and obesity than those who have only earned a high school diploma. Though having a degree does not warrant life success, there is still no doubt regarding the benefits of being a degree holder. It enables students to have specialized knowledge and advanced skills needed in their respective fields. Hence, the students need to receive a high-quality college education to be prepared and ready to compete in the future.

For years, educational psychologists and researchers attempt to investigate the predictors of students' school achievement and the underlying reasons for their success and failure. Traditionally, cognitive factors such as intelligence and aptitude serve as the primary aspects of students' academic success. However, recent research shows that academic performance does not depend entirely on cognitive factors, which might be when students strive for higher education. Contemporary psychologists believe that non-cognitive factors like mindset and self-control have comparable importance to cognitive factors in determining students' success and failure.

Stadler et al. (2016) found out that cognitive ability only accounts for 4% to 5% of the variance of university students' academic performance. Still, a large part of the variance cannot be accounted for by differences in cognitive ability. Further, Dweck (2006) concluded that attitude is a better predictor of achievement and success as compared to Intelligence Quotient (IQ). Moreover,Vergara (2020) recent study, the findings reveal that non-cognitive factors and skills directly correlate to students' achievement. It is concluded that taking to account the motivational construct plays a significant role in students' attainment of better academic results. Hence, it is apparent that more research is needed to gain better insight into the relationship between academic achievement and non-cognitive factors to broaden further the existing knowledge, which eventually improves the quality of education.

This paper intends to determine the level of mindset and self-control ofcollege students in learning mathematics. Furthermore, it will explore its existing relationship and differences in students' mathematics performance. It will be an excellent opportunity to advance our knowledge regarding non-cognitive factors of learning and their influence on the students' performance.

2. Literature Review

Mindset is defined as one's belief that either intelligence is a malleable trait that can be improved through effort or is relatively constant. It influences persons' self-awareness, self-esteem, creativity, ability to face challenges, resilience to setbacks, levels of depression, and our tendency to stereotype, among other things (Dweck, 2006). According to the Mindset Theory, beliefs can be categorized as a growth mindset and a fixed mindset. The former referred to incremental views based on the notion that intelligence and qualities can be changed or cultivated through effort. People with this kind of mindset see challenges as an opportunity to learn and improve one's capabilities. Even when they experience failure, they treat it positively.

On the other hand, the fixed mindset refers to the belief that intelligence and ability are constant. It focuses on permanent

traits. They quickly fear challenge and devalue effort. Macnamara & Rupani (2017) state that fixed-minded people have a high probability of avoiding challenges and assume failure is based on inadequate ability that cannot be changed. This belief of leads to a helpless behavior pattern and a weak desire to learn. Furthermore, McCutchen et al. (2015) added that fixed mindsets, or entity beliefs, generally have lower achievement, especially when facing difficult academic tasks since a fixed mindset inhibits their belief in overcoming academic obstacles.

However, the study of Lou, Masuda & Li (2017) emphasized that fixed mindset was not associated with self-esteem but have a significant relationship to ability loss and performance-avoidance goals. Thus, it can be deduced that this kind of mindset does not promote success and more excellent academic performance. Yet, it contradicts what Bahnik & Vranka (2017) found out that mindset has no significant relationship to a test result. Brysacz (2017) likewise find the same result in his paper wherein mindset yielded no significant relationship to academic performance.

Self-control is another non-cognitive factor which hypothesized to be an essential aspect of students' academic success. According to Baumeister et al. (2007), self-control refers to the ability to change individual responses in line with the set of standards such as ideals, values, a moral and social expectations in pursuit of long-term goals. It enables a person to override one's inner thoughts to avoid undesirable behavioral tendencies and resist temptation. Baumeister added that self-control was possibly associated with emotional problems, school underachievement, lack of persistence, various failures at task performance, relationship problems and dissolution, and more. Hence, the students need to develop a high level of self-control to improve academic achievement and performance and establish overall well-being.

This supports the study of Duckworth & Gross (2014), which states that self-control can also be attributed as a determinant of success together with grit aside from talent and opportunity. The data analysis shows that self-control and grit predict students' success outcomes over the above intelligence. It is further strengthened by Tangney et al.'s (2004) research study, where it was found that higher scores in self-control were correlated to higher grade point average, better adjustment, and optimal emotional response. However, Stewart (2015) did not support the validity of self-control since his study shows a small yet significant relationship between self-control and academic performance.

Research Objectives

The claims mentioned earlier enthused the researcher to examine the relationship of mindset and self-control to first-year college students' mathematics performance. Specifically, the study sought to determine the following.

1) To determine the respondents'
   a) Mindset in learning mathematics
   b) Extent of Self-control
   c) Mathematics Performance
2) To distinguish if there was a significant difference in mathematics achievement when student grouped according to:
   d) Mindset
   e) Level of Self-control
3) To determine if there exists a significant relationship among mindset, self-control, and mathematics achievement.

3. Methodology

This study used a descriptive-correlational research method. Descriptive research provides a snapshot of the current state of affairs. It also provides a relatively complete picture of what is occurring at a given time. On the other hand, correlational research is designed to discover relationships among variables and predict future events from present knowledge. It also allows testing of expected relationships between and among variables and the making of predictions (Stangor 2011). Thus, it is appropriate considering that this study aims to determine and describe the current level of students' mindset and self-control. Furthermore, a correlational analysis was usedtoassess the relationship of the variables.

The study respondents were 272 university students from Nueva Ecija University of Science and Technology enrolled in a mathematics class.

The study utilized a survey questionnaire as a primary tool for data gathering. The Mindset Questionnaire was adapted from Diehl's (2008) study, which was composed of 20 item questions to measure the growth mindset and fixed of students, while the 13-item Self-control Scale was taken from the survey of Stewart (2015).

Data were generated using a survey questionnaire and were statistically analyzed using frequency count, percentage, weighted mean, standard deviation, and Pearson r using Microsoft excel and SPSS v. 21.

4. Results and Discussion

4.1 Students' Mindset, Extent of Self-control and Performance in learning Mathematics

a) Mindset in learning mathematics

The table above shows that the respondents' mindset in learning Mathematics garnered a general weighted mean is 2.84 with a standard deviation of 0.28. The table also displays that 206 out of 272 or 75.74% respondents have a "*growth mindset with some fixed ideas*", 38 or 13.97% have "*fixed mindset with some growth ideas*" while only 28 or 10.29% of the students hold "*strong growth mindset*" in learning Mathematics. Note that the results show that no respondents were identified to have a "*strong fixed mindset*."

Table 1: Students' Mindset in learning Mathematics

Mindset	f	%	Mean	SD
Strong Growth Mindset	28	10.29	2.84	0.28
Growth Mindset with some Fixed ideas	206	75.74		
Fixed mindset with some Growth ideas	38	13.97		
Strong Fixed Mindset	0	0.00		
Total	272	100		

The data indicate that most of the students believe that their intelligence and ability to learn the subject matter can be further improved and developed through hard work and dedication. However, at a certain point, they still some doubt with regards to their capabilities. According to Dweck (2006), people with a growth mindset do not think they are special people, born with the right to win. They are people who work hard, who learn how to keep their focus under pressure. People in a growth mindset do not just seek challenge; and they thrive on it.

b) Extent of Self-control

Table 2: Extent of Students' Self-Control

Self-Control	f	%	Mean	SD
Excellent	0	0.00	2.35	0.33
Good	76	27.94		
Average	178	65.44		
Poor	18	6.62		
Total	272	100		

Table 2 shows the extent of respondents' self-control, having 2.35 as the general weighted mean with a standard deviation of 0.33. The table presents that 178 or 65.44% of the respondents hold an "average" self-control, 76 or 27.94% possessed "good" self-control, and 18 or 6.62% have "poor" self-control. However, no respondents hold excellent self-control.

It must be noted that the majority of the student-respondents hold "average" self-control. In the study of Yang, Zhao, Chen, Simeng, & Zhao (2017), students with average self-control have the ability to override or change their inner response to achieve their goals in learning Mathematics. However, sometimes tempted to do things not align with the plans that might distract them from studying Mathematics. Similarly, students with "good" self-control have greater willpower to resist temptation and self-regulate their learning effectively.

c) Mathematics Performance

It can be observed that the respondents' Mathematics Performance has a general weighted mean of 83.24 with a standard deviation of 4.08. The table also shows that 98 or 36.03% of the respondents performed "Satisfactory," 97 or 35.66% performed "very satisfactory", while 55 or 20.22% performed "Unsatisfactory" It must be noted that only 12 or 4.41% performed "Outstanding" in Mathematics The data revealed that students' Mathematics performance has This indicates that students had an overall "satisfactory" performance in mathematics.

Table 3: Students' Mathematics Performance

Mathematics Performance	f	%	Mean	SD
Outstanding	12	4.41	83.24	4.08
Very Satisfactory	97	35.66		
Satisfactory	98	36.03		
Unsatisfactory	55	20.2		
Poor	10	3.68		
Total	272	100		

The results were consistent with De Silva's (2006) findings on the factors associated with non-performing Filipino students in Mathematics. They were found to have the average mental ability but still encountering Mathematics difficulties. Therefore, it can be inferred that up to the present time, the mathematics performance of students is still not quite good.

4.2 The difference in mathematics performance when students grouped according to Mindset and Extent of Self-control

a) Mindset and Mathematics Performance

Table 4: Difference in Mathematics Performance when Student Grouped According to Mindset

Mindset	f	Mean	SD	F-value	P-value
Strong Growth Mindset	28	82.54	6.42	5.25	0.006
Growth Mindset with some Fixed ideas	206	83.65	3.88		
Fixed mindset with some Growth ideas	38	81.42	2.68		

Table 4 shows a significant difference in Mathematics performance when group according to mindset since the p-value was less than .05 or p = 0.006. Based on the post-hoc analysis using Scheffe, students with "fixed mindset with some growth ideas" have significantly lower mathematics ideas as compare to students with a "Growth mindset with some Fixed ideas" Hence, the null hypothesis must be rejected that there is no significant difference in mathematics performance when group according to the mindset in learning mathematics. Analysis of variance was used as a statistical tool with a 5% level of significance.

The result is in accordance with the study of McCutchen, Jones, Carbonneau & Mueller, C.E. (2015), which found out that mindset impacts students' academic performance. It also supports the hypothesis that the growth mindset has a beneficial and positive effect on students' academic performance. However, it must be noted based on the statistical analysis that the difference in the mathematics performance of those students with "Strong Mindset" as compared to students with "Fixed Mindset with some Growth ideas" is not significant even it is slightly higher.

b) Self-Control and Mathematics Performance

Table 5: Difference in Mathematics Performance when Student Grouped According to the extent of Self-control

Self-Control	f	Mean	SD	F-value	P-value
Good	76	84.28	3.90	12.879	0.000
Average	178	83.20	4.18		
Poor	18	79.00	0.011		

The table presents a significant difference in Mathematics performance when group according to the extent of self-control since the p-value was less than .05 or p = 0.000. Based on the post-hoc analysis using Scheffe, students with "Poor" self-control have significantly lower mathematics performance as compare to students with "Average" and "Good" self-control. Thus, the null hypothesis must be rejected that there is no significant difference in mathematics performance when group according to the extent of self-control. Analysis of variance was used as a statistical tool with a 5% level of significance.

The results agree with the findings of the research conducted by King & Gaerlan (2013), where the results indicated that self-control positively predicted positive academic emotions (enjoyment, hope, and pride) and negatively predicted negative emotions (anger, anxiety, shame, hopelessness, and boredom). A possible pathway was found through which self-control impacts academic performance by proffering the mediational role of academic emotions and engagement. Likewise, the study of Zhu, Au & Yates, G. (2016) reveals that students with a high level of self-control have a positive impact on students learning outcomes, which mediated through self-regulated learning and course participation, while the students with a low level of self-control or self-regulatory learning skills may have greater difficulty completing online or blended courses.

4.3 The relationship among mindset, self-control, and mathematics performance

Table 6: Correlation of Mathematics Performance, Mindset and Self-Control

	Mathematics Performance	Mindset	Self-Control
Mathematics Performance	1		
Mindset	.255**	1	
Self-Control	0.31	.315**	1
**. Correlation is significant at the .001 level (2 tailed).			

Table 6 shows that the Mathematics performance was significantly correlated to mindset since the p-value was less than .001 or p = 0.000. It also revealed that there was a very low positive correlation between Mathematics performance and mindset since r = .255. Therefore, the null hypothesis states that no significant relationship between mathematics performance and mindset is rejected.

However, it was also found out that there is no significant relationship determine between Mathematics performance and the extent of self-control since the p-value was greater than .001. The relationship between Mathematics performance and self-control might be mediated by mindset since the relationship between mindset and self-control was significant.

5. Conclusion

Based on the findings of the study, the following conclusion was drawn. First, the majority of the student-respondents have a "Growth Mindset with some Fixed ideas" in learning Mathematics. Second, most of the respondents have an average level of self-control. Third, the majority of the respondents have a satisfactory level of mathematics performance. Students' mindset is a factor that contributes to differences in the performance of the students. Similarly, self-control also serves as a factor in the difference in students' mathematics performance. In addition, mindset has a direct relationship and significantly predicts the mathematics performance of the student respondents. The relationship between self-control and mathematics performance can have mediated by mindset.

6. Recommendations

Based on the conclusion of the study, the following recommendations were drawn. School leaders, including classroom teachers, need to find solutions at the local level to improve students' Mathematics performance. Indeed, a growth mindset workshop or educational interventions might be an excellent first step in any effective training program, given their association with a wide range of positive academic outcomes. Teachers may create a classroom environment that provides opportunities where students can thrive and develop a growth mindset. Furthermore, teachers' training should expose teachers to non-cognitive factors such as mindset and self-control that may increase students' academic performance. Focus instructional strategies that develop a growth mindset and high-level self-control may be beneficial. Additional studies with a larger sample size and longer timeframe are needed to clarify the relationship of trait self-control and academic performance to determine if it is significantly mediated by mindset.

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