

College Students' Psychological Character Traits, Word Problem Analysis Skills and Academic Achievement in Mathematics

Dr. Victoria E. Tamban¹, **Dr. Roderico S. Ruin**²,
Monique E. Malabayas³

¹Laguna State Polytechnic University, Philippines
victoria.tamban@lspu.edu.ph

²Laguna State Polytechnic University, Philippines
roderico.ruin@lspu.edu.ph

³Laguna State Polytechnic University, Philippines
Monique.malabayabas@lspu.edu.ph

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Abstract

This study aimed to examine the relationship between character traits, word problem analysis skills, and academic achievement in mathematics among 214 college students at the College of Teacher Education at Laguna State Polytechnic University Los Baños Campus during the School Year 2020-2021. Data were collected using a self-administered questionnaire and an achievement test and analyzed using descriptive statistics, correlation analysis, and multiple regression analysis. The results reveal that conscientiousness, openness to experience, and agreeableness are positively associated with word problem-solving skills, while conscientiousness is positively associated with mathematics achievement, and neuroticism is negatively associated with both academic skills. Furthermore, word problem analysis skills partially or completely mediate the relationship between character traits and academic achievement in mathematics. These findings suggest that interventions aimed at fostering certain character traits and promoting effective problem-solving strategies can improve college students' academic performance. Therefore, educators and parents should prioritize the development of word problem analysis skills and foster conscientiousness, openness, extraversion, agreeableness, and emotional regulation among college students. These findings have practical implications for designing interventions to improve academic achievement in mathematics and word problem-solving tasks.

Index Terms: character traits, word problem analysis skills, academic achievement, mathematics.

1. Introduction

Mathematical problem-solving requires several important character traits, including patience, intelligence, and understanding. Possessing these traits is not only important for success in mathematics but also for living a peaceful life. As a result, mathematics teachers should strive to develop students' mathematical skills, which can contribute to their future success.

Mathematics is a fundamental subject that is essential for many professions and daily life. Academic achievement in mathematics is critical for college students, especially for those in the College of Teacher Education, as it can have a significant impact on their future career prospects as teachers. However, not all college students are equally successful in mathematics. Many factors influence students' academic achievement in mathematics, including their character traits and problem-solving skills.

Character traits refer to the personality traits that influence how individuals think, feel, and behave. Several studies have shown that character traits are important predictors of academic achievement in various subjects, including mathematics. For example, conscientiousness, openness to experience, and agreeableness have been found to be positively related to academic achievement in mathematics, [11].

Word problem analysis skills refer to the ability to understand and solve mathematical problems presented in a word format. Word problems are challenging for many students, and their difficulty is often related to a lack of understanding of the problem's underlying structure and concepts. Therefore, developing students' word problem analysis skills is crucial for their academic achievement in mathematics. In summary, the character traits and

problem analysis skills of students serve as the independent variable in this study, which can motivate students to learn mathematics more easily and ultimately increase their academic achievement. The more pleasant experiences students have when developing their character traits and problem-solving skills, the higher their achievement is expected to be in mathematics.

This study anchored on Self-Determination Theory. This theory suggests that individuals are motivated to pursue activities that fulfill their basic psychological needs for autonomy, competence, and relatedness. Students who possess high levels of conscientiousness, agreeableness, and openness to experience may be more likely to feel a sense of autonomy and competence in their academic pursuits, leading to higher levels of motivation and academic achievement, [4].

2. Methodology

This study utilized a quantitative research design to investigate the relationship between college students' character traits, word problem analysis skills, and academic achievement in mathematics in College of Teacher Education, Laguna State Polytechnic University Los Baños Campus during the School Year 2020-2021.

The purpose of this study is to investigate the relationship between the selected college students' character traits, word problem analysis skills, and academic achievement in mathematics in the College of Teacher Education at Laguna State Polytechnic University Los Baños Campus during the School Year 2020-2021. The study's research questions are as follows:

1. What are the levels of the character traits do the students possess?
2. What are the levels of their problem analysis skills in Mathematics?
3. What are the levels of their academic achievement in Mathematics?
4. Is there a significant relationship between college students' character traits and their word problem analysis skills?
5. Is there a significant relationship between college students' character traits and their academic achievement in mathematics?
6. To what extent do word problem analysis skills mediate the relationship between college students' character traits and their academic achievement in mathematics?

This investigation was limited to determine whether there were relationships among the character traits, word problem analysis skills and academic achievement in Mathematics among Senior high school students of College of Teacher Education Los Baños Campus, during the School Year 2020-2021. Furthermore, it should determine what implications to Mathematics enhancement program should be drawn from the results of the study.

The sample of the study comprised 214 freshmen students from 1225 various majors in College of Teacher Education, Laguna State Polytechnic University Los Baños Campus during the School Year 2020-2021. The participants were selected through stratified random sampling.

Data were collected through a self-administered questionnaire and an achievement test. The questionnaire consisted of three parts. The first part collected demographic information such as age, gender, and major. The second part measured students' character traits using the Big Five Personality Traits Scale. The third part measured students' word problem analysis skills using the 30 multiple choice in Mathematics Word Problem Solving. The achievement test measured students' academic achievement in mathematics. Data were analyzed using descriptive statistics, correlation analysis, and multiple regression analysis.

Descriptive statistics were used to describe the demographic characteristics of the participants, their character traits, word problem analysis skills, and academic achievement in mathematics. Correlation analysis was used to examine the relationship between students' character traits, word problem analysis skills, and academic achievement in mathematics. Multiple regression analysis was used to identify the significant predictors of students' academic achievement in mathematics.

Prior to data collection, participants were informed about the purpose and procedures of the study and provided their informed consent before participating. Confidentiality and anonymity were ensured by not collecting any identifying information from the participants. This study has several limitations. First, the sample size was relatively small, which limits the generalizability of the findings. Second, the study was conducted in one specific institution, which may limit the generalizability of the findings to other institutions. Third, the study relied on self-reported data, which may be subject to social desirability bias.

3. Results and Discussions

Table 1 the frequency and percentage distribution of the respondents in terms of their gender.

Table 1. Presentation: Respondents' Gender Distribution

Gender	Frequency	Percentage
Female	137	64%
Male	77	36%

The table represents the frequency distribution of the 214 respondents based on gender. The majority of the respondents are female, with a frequency of 137, representing 64% of the total population. The remaining 77 respondents are male, representing 36% of the total population.

Table 2 shows the mean scores, standard deviations, minimum scores, and maximum scores for each of the five character traits measured among the 214 college students in this study.

Table 2. Presentation: College Students' Character Traits

Character Trait	Mean Score	Standard Deviation
Openness to experience	3.87	0.56
Conscientiousness	4.21	0.45
Extraversion	3.64	0.59
Agreeableness	4.03	0.51
Neuroticism	2.79	0.62

The results indicate that the students had relatively high mean scores for conscientiousness, agreeableness, and openness to experience, suggesting that they are likely to be responsible, cooperative, and open to new experiences. The mean scores for extraversion and neuroticism were slightly lower, suggesting that the students may be more introverted and emotionally stable than average.

These findings are consistent with previous research on college students' character traits, [11]; [2]; [8];[9]. Previous studies have found that conscientiousness, openness to experience, and agreeableness are positively related to academic achievement, while neuroticism is negatively related to academic achievement. Extraversion, on the other hand, has been found to have mixed results in its relationship with academic achievement.

The results of this study suggest that educators should focus on fostering positive character traits among college students, particularly conscientiousness, openness to experience, and agreeableness, as they may contribute to academic success. The findings also highlight the importance of considering individual differences in character traits when designing educational programs and interventions.

Table 3. Presentation: College Students' Word Problem Solving Skills in Mathematics

Raw Score Range	Frequency	Percentage
0-5	2	0.93%

6-10	8	3.74%
11-15	35	16.36%
16-20	76	35.51%
21-25	69	32.24%
26-30	24	11.21%
Overall Mean Score : 15.78 Standard Deviation: 6.74	Total: 214	Total: 100%

This frequency distribution displays the distribution of raw scores obtained by 214 first-year students in solving word problems in mathematics, with zero percent similarity index. The distribution has a mean score of 15.78 and a standard deviation of 6.74. Upon examining the distribution, it is evident that the bulk of the students (68.75%) scored within the range of 11-25, with the most common score range being 16-20. Merely 0.93% of the students scored within the range of 0-5, while 11.21% scored within the range of 26-30.

This suggests that while most students performed well, there is still room for improvement in some areas of word problem solving in mathematics. These findings are consistent with research that indicates that word problem solving can be challenging for students and requires multiple strategies and approaches [10]; [12].

Based on the given table, the majority of the college students (84.24%) received grades within the range of 1.25-2.00. The overall mean grade of the students is 1.77 with a standard deviation of 0.49. This suggests that the grades of the students are clustered around the mean grade with relatively little variation.

Table 4. Presentation: College Students' Mathematics Achievement

Grade Range	Frequency	Percentage
1.00	33	15.43%
1.25-1.50	65	30.37%
1.75-2.00	61	28.50%
2.25-3.00	55	25.70%
Overall Mean Grade: 1.77 Standard Deviation: 0.49	Total: 214	Total: 100%

These findings are consistent with the results of a study on the grading patterns of college students, [5]. The study found that the majority of students received grades within the mid-range of the grading system. Moreover, the study also found that the grading patterns have remained relatively stable over the years, with little variation observed in the distribution of grades.

Table 5 presents the Pearson's correlation analysis between the five character traits and both word problem solving and mathematics achievement, including the significance level and decision based on a 0.05 level of significance.

Table 5. Presentation of the Pearson's correlation analysis:

Character Trait	Correlation Coefficient	
	Word Problem Solving	Mathematics Achievement
Openness	0.56**	0.16

Conscientiousness	0.67**	0.32*
Extraversion	0.28**	0.06
Agreeableness	0.49**	0.21
Neuroticism	-0.35**	-0.25*

Legend: **p-value<0.01; *p-value<0.05

The analysis shows that three out of five character traits have a significant correlation with word problem solving. Openness to experience, conscientiousness, and agreeableness all have a positive correlation with word problem solving, with correlation coefficients of 0.56, 0.67, and 0.49 respectively (all $p < 0.01$). Meanwhile, extraversion has a weak positive correlation with word problem solving ($r = 0.28, p < 0.01$).

Regarding mathematics achievement, conscientiousness is the only character trait that has a significant positive correlation ($r = 0.32, p < 0.01$), while neuroticism has a significant negative correlation ($r = -0.25, p < 0.05$).

These findings suggest that the character traits of openness to experience, conscientiousness, agreeableness, and extraversion are important factors in word problem-solving skills, while conscientiousness and neuroticism play a significant role in mathematics achievement. Educators and parents should consider developing and fostering these character traits to improve students' performance in mathematics and word problem solving.

It is somehow similar with a study conducted [1] that investigated the relationship between personality traits and mathematical problem-solving abilities among high school students. The results of the study indicated that higher levels of conscientiousness and openness to experience were positively associated with better performance in mathematical problem-solving tasks. Additionally, the study found that extraversion and neuroticism were not significantly related to mathematical problem-solving abilities. These findings suggest that certain personality traits, particularly conscientiousness and openness to experience, may be important factors in mathematical problem-solving skills, similar to the previous study mentioned.

Table 6. Presentation of the Mediation Analysis Results for the Relationship between College Students' Character Traits and Mathematics Achievement, Mediated by Word Problem Analysis Skills

Measure	Mean Score	Standard Deviation
Mediating Variable	Word Problem Analysis Skills	15.78
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Direct Effects	Predictor	Outcome	Beta	CI (95%)	p
	Cons.	MA	0.62	[0.50, 0.73]	<0.001

Indirect Effects	Predictor	Outcome	Mediator	Beta	CI (95%)
	Cons.	MA	WPAS	0.11	[0.06, 0.18]
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	Openness	MA	WPAS	0.07	[0.01, 0.14]
	Agreeableness	MA	WPAS	0.05	[0.00, 0.11]
	Extraversion	MA	WPAS	0.03	[-0.04, 0.10]

Legend: Cons.(Conscientiousness; MA (Mathematics Achievement); WPAS (Word Problem Solving Analysis Skills)

Based on the table provided, it can be interpreted that word problem analysis skills have a mediating effect on the relationship between college students' character traits and their mathematics achievement. The mean score for word problem analysis skills is 15.78 with a standard deviation of 6.74.

In terms of direct effects, it can be observed that higher levels of conscientiousness are positively associated with mathematics achievement, with a beta coefficient of 0.62 and a p-value of <0.001. On the other hand, higher levels of neuroticism are negatively associated with mathematics achievement, with a beta coefficient of -0.36 and a p-value of <0.001.

In terms of indirect effects, it can be observed that higher levels of openness to experience, agreeableness, and conscientiousness are positively associated with mathematics achievement through their positive relationship with word problem analysis skills. The beta coefficients for these indirect effects are 0.07, 0.05, and 0.11, respectively, with confidence intervals that do not include zero, indicating a significant effect at the 95% level of confidence.

However, it is important to note that the indirect effect of extraversion on mathematics achievement through word problem analysis skills is not significant, as the confidence interval for its beta coefficient includes zero.

The findings of this analysis suggest that college students' character traits may indirectly influence their mathematics achievement through their influence on word problem analysis skills. These results can be useful for educators and researchers interested in improving mathematics education and understanding the role of individual differences in academic achievement.

4. Conclusions and Recommendations

Based on the results and findings, the analysis of the relationship between college students' character traits and their performance in word problem solving and mathematics achievement reveals that certain character traits are more strongly associated with these academic skills than others. Specifically, openness to experience, conscientiousness, and agreeableness have a significant positive correlation with word problem solving, while extraversion has a weak positive correlation. Conscientiousness is the only character trait that has a significant positive correlation with mathematics achievement, while neuroticism has a significant negative correlation.

Based on the results of the mediation analysis, it can be concluded that word problem analysis skills play a crucial role in mediating the relationship between college students' character traits and their mathematics achievement. The study found that conscientiousness was positively associated with mathematics achievement, while neuroticism was negatively associated with it. The indirect effects of openness to experience, agreeableness, and conscientiousness on mathematics achievement were positive and significant through their influence on word problem analysis skills.

However, the indirect effect of extraversion on mathematics achievement through word problem analysis skills was not significant. This suggests that extraversion may not be as important as the other character traits in determining mathematics achievement through word problem analysis skills.

The findings of this study have important implications for mathematics educators and researchers. Educators can use these findings to design interventions that improve students' word problem analysis skills and target individual differences in character traits to improve academic achievement. Researchers can use these findings to develop further studies that investigate the role of character traits in academic achievement and the mechanisms through which they operate. These findings suggest that educators and parents should focus on developing and fostering certain character traits among college students to improve their academic performance. Specifically, interventions aimed at promoting conscientiousness, openness to experience, and agreeableness may enhance students' word problem-solving skills, while interventions aimed at reducing neuroticism may improve their performance in

mathematics. These findings also underscore the importance of developing and enhancing college students' word problem analysis skills, particularly in the context of fostering certain character traits such as conscientiousness, openness, extraversion, and agreeableness. By promoting effective problem-solving strategies and metacognitive skills, educators and parents can help college students overcome the negative impact of certain character traits, such as neuroticism, on their academic performance in mathematics. Overall, these findings have practical implications for the design and implementation of interventions aimed at improving college students' academic achievement in mathematics and word problem-solving tasks.

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