

Non-Cognitive Domains Contributing to Mathematical Competency among Freshmen College Students

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Abstract

The study assessed the influence of non-cognitive domains of college students in relation to parents' involvement, teachers' pedagogical approach, learning materials, and classroom environment to the mathematical competency of freshmen university students taking the course Mathematics in the Modern World. A descriptive-correlational research design was utilized in describing the non-cognitive domains and mathematical competency. The respondents of this study were a total of 732, composed of 368 college students from public state universities and colleges, plus 364 from private colleges in Oriental Mindoro. This study used the survey questionnaires as the main tool in data gathering. Regression was used in determining how dimensions of non-cognitive domains predict mathematical competency. Results revealed that the highest predictor of mathematical competency contributing 34% followed by parents' involvement (6%), learning materials (3%), and teachers' pedagogical approach (1%).

Keywords: Non-cognitive domains, Mathematics in the Modern World; Mathematical Competency

Introduction

Mathematical proficiency is a multidimensional construct composed of five strands: conceptual knowledge, procedural fluency, strategic competence, adaptive reasoning, and productive disposition (Gray, 2018). These elements define students' ability to effectively apply Mathematics, which globally requires not only technical skills but also problem-solving, critical and creative thinking, and positive attitudes (Tarmizi et al., 2010; PISA, 2012). In Malaysia, for instance, mathematical competency extends beyond computation to broader cognitive and emotional skills (Tarmizi et al., 2010). Conceptual understanding allows students to grasp underlying principles and avoid procedural errors, while fluency and strategic competence support problem-solving (Gray, 2018). The PISA framework highlights seven core competencies, including mathematizing, reasoning, and devising strategies (OECD, 2013), with Turner (2010) noting that tasks requiring multiple competencies are often more challenging.

Beyond cognition, emotional intelligence (EI) affects mathematical learning. Anxiety can hinder performance and foster avoidance, but EI, through self-regulation, mitigates such effects and promotes resilience (Nor et al., 2016). Malaysia's National Educational Philosophy also recognizes emotional alongside intellectual development to prevent behavioral issues. Similarly, non-cognitive domains such as motivation, integrity, and interpersonal skills have been linked to academic performance and long-term success (Farrington et al., 2012; Clinton & Hattie, 2013).

Parental involvement is central in nurturing these skills. Active engagement—such as homework support and fostering a learning-friendly home improves student performance, motivation, and self-esteem (Jeynes, 2016; Chen, 2020; Hornby & Lafaele, 2011). A supportive home environment further enhances attitudes toward Mathematics (Muola, 2010; Kapur, 2018; Brawner & Leus, 2018). Socioeconomic status also influences this support: parents with higher education and resources provide more materials and intellectual stimulation, while economic hardship often limits access (Brawner & Leus, 2018; Mwaurwa, 2014; Kapur, 2018).

Instructional strategies and classroom environments also matter. Peer-interactive and student-centered approaches enhance comprehension and engagement (Brawner & Leus, 2018; Kapur, 2018; Lucas & Corpuz, 2014). Effective classroom management fosters accountability and study habits, while disorganized settings reduce performance (Lucas & Corpuz, 2014; Sakirudeen & Sanni, 2017; Kudari, 2016). Teacher-student dynamics and structured lessons strengthen focus and academic success (Sitko, 2013; Kudari, 2016).

In the Philippines, Mathematics is emphasized as a foundational subject, developing reasoning and problem-solving (DOST-SEI, 2011). Time allocations under the K–12 curriculum and national assessments such as NAT and NCAE highlight its importance. Enrichment programs like MTAP and MTG also address learning gaps. At the tertiary level, Mathematics in the Modern World under CHED’s General Education Curriculum (CMO No. 20, s. 2013) introduces students to Mathematics as a discipline of patterns, reasoning, and applications in daily life.

With the foregoing discussions above, the study assessed whether the dimensions of non-cognitive domains predict mathematical competency.

Objectives of the Study

This study aims to examine the Non-Cognitive Domains Contributing to Mathematical Competency among Freshmen College Students. Specifically, it seeks to achieve the following objectives:

1. Determine the Constructs of Noncognitive domains that predict Mathematical Competency in terms of the following:
 - 1.1 Conceptual Understanding
 - 1.2 Procedural FluencyStrategic Competence
 - 1.3 Adaptive Reasoning
 - 1.4 Productive Disposition
2. Evaluate the Constructs of Noncognitive domains that predict Mathematical Competency

Methodology

To generate quantitative data for this study, a descriptive-correlational research design was employed. A total of 732 respondents participated, comprising 368 college students from public state universities and colleges and 364 from private colleges in Oriental Mindoro. The public state universities and colleges included Mindoro State University (Calapan, Bongabong, and Main Campus), Baco Community College, and City College of Calapan, while the private colleges included Divine Word College of Calapan, Southwestern Institute of Business and Technology, Inc., John Paul College, Prince of Peace

College, and Abada College. All respondents had previously completed the course *Mathematics in the Modern World*. Stratified random sampling was used to determine the appropriate sample size.

The researcher gathered data using a questionnaire that was personally made for the study. The first part asked questions about non-cognitive factors such as parental involvement, teachers' teaching methods, learning materials, and the classroom environment. The second part measured the students' mathematical skills, including their understanding of concepts, accuracy in solving problems, ability to plan solutions, logical reasoning, and positive attitude toward math. The data were analyzed using statistical tools, and Regression Analysis was used to find out if the non-cognitive factors could predict the students' level of mathematical competency.

Before data collection, the questionnaire was validated by three subject matter experts—Mathematics teachers holding a Doctor of Philosophy in Education major in Mathematics Education. Informed consent was obtained from all respondents, ensuring they were aware of the study's purpose and voluntarily agreed to participate. Transparency was maintained, emphasizing that participants had the right to withdraw their data at any time without repercussions. To uphold confidentiality and prevent potential harm, all collected information was handled in strict compliance with RA 10173, also known as the Data Privacy Act, ensuring that respondents' identities remained anonymous. Data collection commenced only after securing full consent from the participants.

Results and Discussion

1. Constructs of Noncognitive domains predict Mathematical Competency

This section discusses the constructs of non-cognitive domains of college students in relation to parents' involvement, teachers' pedagogical approach, learning materials, and classroom environment that predict Mathematical competency in relation to conceptual understanding, procedural fluency, strategic competence, adaptive reasoning, and productive disposition, as shown in tables 1 to 5 as follows.

1.1 in terms of Conceptual Understanding

Table 1
Constructs of non-cognitive domains predict Conceptual Understanding

Independent Variables	Unstandardized Coefficients	t - value	p - value	Verbal Interpretation	R ² Change
(Constant)	.786	7.527	.000		
Learning Materials	.195	5.592	.000	Significant	.340
Parents' Involvement	.223	7.562	.000	Significant	.074
Classroom Environment	.171	3.912	.000	Significant	.033
Teachers' Pedagogical Approach	.155	3.612	.000	Significant	.010

a. Dependent Variable: Conceptual Understanding $R^2 = 0.456$ $F = 152.458$ $P - value = .000$

A linear regression analysis was used to find out how much academic buoyancy and other factors can predict conceptual understanding. The table presents the variables included in the study that serve as predictors. The results show that the model explains 46% of the total variance in conceptual understanding

($R^2 = 0.46$, $F = 152.458$, $p = .000$). Among all the predictors, learning materials had the strongest influence on conceptual understanding, contributing 34%, followed by parental involvement (7%), classroom environment (3%), and teachers' pedagogical approach (1%). This means that 54% of the factors affecting conceptual understanding were not covered in this study.

All the variables showed a positive relationship with conceptual understanding. Learning materials had a beta coefficient of 0.195 ($t = 5.592$, $p = .000$), which means that better learning materials are linked to higher conceptual understanding. Parental involvement had a beta coefficient of 0.223 ($t = 7.562$, $p = .000$), showing that active parent participation helps improve students' understanding. The classroom environment also had a positive effect with a beta coefficient of 0.171 ($t = 3.912$, $p = .000$), meaning that a better classroom setup leads to better learning. Lastly, the teachers' pedagogical approach had a beta coefficient of 0.155 ($t = 3.612$, $p = .000$), indicating that effective teaching strategies also contribute to improved conceptual understanding.

The resulting regression model can be expressed as: Conceptual Understanding = $0.786 + 0.195(\text{Learning Materials}) + 0.223(\text{Parents' Involvement}) + 0.171(\text{Classroom Environment}) + 0.155(\text{Teachers' Pedagogical Approach})$.

The findings reject the null hypothesis, confirming that these four factors significantly predict conceptual understanding. This supports the idea of Farruggia et al., who found that students' academic mindset and determination have a strong impact on academic success. Based on this, students with lower performance should be given early support and intervention, as developing positive academic habits can greatly improve their chances of success.

1.2. in terms of Procedural Fluency

Table 2

Constructs of Noncognitive Domains Predict Procedural Fluency

Independent Variables	Unstandardized Coefficients	t - value	p - value	Verbal Interpretation	R ² Change
(Constant)	1.048	9.210	.000		
Learning Materials	.271	6.536	.000	Significant	.278
Parents' Involvement	.192	5.467	.000	Significant	.040
Classroom Environment	.183	4.025	.000	Significant	.015

a. *Dependent Variable: Procedural Fluency* $R^2 = 0.333$ $F = 120.963$ $P - value = .000$

A linear regression analysis was used to find out how much academic buoyancy can predict procedural fluency. Table 2 shows the variables in the study that serve as predictors of procedural fluency. The results revealed that the model explained 33% of the total variation in procedural fluency ($R^2 = 0.33$, $F = 120.963$, $p = .000$). Among the predictors, learning materials had the strongest effect, explaining 28% of procedural fluency, followed by parents' involvement (4%) and classroom environment (2%). This means that 67% of the factors affecting procedural fluency were not included in the study.

All variables had positive relationships with procedural fluency. Learning materials had an unstandardized beta coefficient of 0.271 ($t = 6.536$, $p = .000$), showing that better learning materials lead to higher procedural fluency. Parents' involvement had a beta coefficient of 0.192 ($t = 5.467$, $p = .000$), indicating that more active parental involvement also improves procedural fluency. Lastly, the classroom

environment had a beta coefficient of 0.183 ($t = 4.025$, $p = .000$), which means a better classroom environment helps students become more fluent in procedures.

The resulting model can be expressed as: Procedural Fluency = $1.048 + 0.271(\text{Learning Materials}) + 0.192(\text{Parents' Involvement}) + 0.183(\text{Classroom Environment})$.

Based on these findings, the null hypothesis stating that none of the variables predict procedural fluency is rejected. This supports the study of Colmar et al., who found that academic buoyancy is significantly related to reading and math performance, especially in procedural fluency, using structural equation modeling.

1.3 in terms of Strategic Competence

Table 3

Constructs of non-cognitive domains predict Strategic Competence

Independent Variables	Unstandardized Coefficients	t - value	p - value	Verbal Interpretation	R ² Change
(Constant)	.847	7.179	.000		
Learning Materials	.243	6.165	.000	Significant	.307
Parents' Involvement	.219	6.586	.000	Significant	.057
Classroom Environment	.129	2.620	.009	Significant	.017
Teachers' Pedagogical Approach	.119	2.452	.014	Significant	.005

Dependent Variable: Strategic Competence R² = 0.386 F = 114.302 P - value = .000

A linear regression analysis was used to find out how much academic buoyancy can predict strategic competence. The results shown in Table 3 indicate that several factors were tested as predictors of strategic competence. The overall model explained 39% of the variation in students' strategic competence ($R^2 = 0.39$, $F = 114.302$, $p = .000$). Among the variables, learning materials turned out to be the strongest predictor, contributing 31%, followed by parental involvement (6%), classroom environment (2%), and teachers' teaching approach (1%). This means that about 61% of the factors affecting strategic competence were not covered in this study.

All the variables showed a positive relationship with strategic competence. Specifically, learning materials had a beta value of 0.243 ($t = 6.165$, $p = .000$), meaning that better learning materials lead to higher strategic competence. Parental involvement had a beta value of 0.219 ($t = 6.586$, $p = .000$), showing that students with more involved parents also perform better. The classroom environment had a beta value of 0.129 ($t = 2.620$, $p = .000$), indicating that a positive learning space contributes to students' competence. Lastly, the teachers' pedagogical approach had a beta value of 0.119 ($t = 2.452$, $p = .000$), meaning that effective teaching methods also play a role, though to a smaller extent.

The regression equation developed from the study is as follows: Strategic Competence = $0.847 + 0.243(\text{Learning Materials}) + 0.219(\text{Parents' Involvement}) + 0.129(\text{Classroom Environment}) + 0.119(\text{Teachers' Pedagogical Approach})$.

The findings led to the rejection of the null hypothesis, proving that these variables significantly predict students' strategic competence. This supports Graven and Stott's idea that flexibility and efficiency, often linked with procedural fluency, are closely related to conceptual understanding, making it difficult to separate one from the other when assessing learners' skills.

1.4 in terms of Adaptive Reasoning

Table 4

Constructs of Noncognitive Domains Predict Adaptive Reasoning

Independent Variables	Unstandardized Coefficients	t - value	p - value	Verbal Interpretation	R ² Change
(Constant)	1.092	9.617	.000		
Classroom Environment	.220	4.638	.000	Significant	.263
Parents' Involvement	.172	5.353	.000	Significant	.056
Learning Materials	.115	3.030	.003	Significant	.011
Teachers' Pedagogical Approach	.134	2.875	.004	Significant	.008

Dependent Variable: Adaptive Reasoning R² = 0.337 F = 92.469 P – value = .000

A linear regression approach was used to find out how much academic buoyancy can predict adaptive reasoning. Table 4 shows all the factors studied that may influence adaptive reasoning. The results revealed that the model explained 34% of the total variation, with R² = 0.34, F = 92.469, p = .000. Among the factors, the classroom environment was found to be the strongest predictor of adaptive reasoning, contributing 26%, followed by parents' involvement (6%), learning materials (1%), and teachers' pedagogical approach (1%). This means that there is still 66% of adaptive reasoning that is influenced by other factors not included in this study.

All variables showed a positive relationship with adaptive reasoning. The classroom environment had a beta value of 0.220 (t = 4.638, p = .000), meaning that better classroom conditions are linked to stronger adaptive reasoning skills. The parents' involvement also had a positive effect with a beta value of 0.172 (t = 5.353, p = .000), showing that active parental support helps improve students' reasoning abilities. Meanwhile, learning materials had a beta of 0.115 (t = 3.030, p = .000), suggesting that sufficient and effective learning materials can also enhance adaptive reasoning. Lastly, the teachers' pedagogical approach had a beta of 0.134 (t = 2.875, p = .000), which indicates that effective teaching strategies contribute to students' reasoning development.

Based on these findings, the regression model is expressed as: Adaptive Reasoning = 1.092 + 0.220(Classroom Environment) + 0.172(Parents' Involvement) + 0.115(Learning Materials) + 0.134(Teachers' Pedagogical Approach).

In conclusion, the study rejects the null hypothesis, confirming that all the identified factors significantly predict adaptive reasoning. This supports the findings of Muin et al., who also showed that students' adaptive reasoning improves when they are taught using more effective and creative teaching methods.

1.5 in terms of Productive Disposition

All the predictors had a positive relationship with productive disposition. The classroom environment had a beta value of 0.256 (t = 5.070, p = .000), which means that a better classroom environment increases students' productive disposition. Parents' involvement also had a positive effect with a beta of 0.216 (t = 6.309, p = .000), showing that when parents are more involved, students tend to have higher productive disposition. Learning materials had a smaller but still positive impact, with a beta of 0.133 (t = 3.273, p = .000), meaning that access to good materials helps students become more positive and

motivated. The teachers' pedagogical approach also contributed, though to a lesser extent, with a beta of 0.105 ($t = 2.105$, $p = .000$).

Table 5*Constructs of Noncognitive Domains Predict Productive Disposition*

Independent Variables	Unstandardized Coefficients	t - value	p - value	Verbal Interpretation	R ² Change
(Constant)	.946	7.818	.000		
Classroom Environment	.256	5.070	.000	Significant	.278
Parents' Involvement	.216	6.309	.000	Significant	.068
Learning Materials	.133	3.273	.001	Significant	.012
Teachers' Pedagogical Approach	.105	2.105	.036	Significant	.004

Dependent Variable: Productive Disposition $R^2 = 0.362$ $F = 102.945$ $P - value = .000$

The final model from the study can be summarized as: Productive Disposition = $0.946 + 0.256(\text{Classroom Environment}) + 0.216(\text{Parents' Involvement}) + 0.133(\text{Learning Materials}) + 0.105(\text{Teachers' Pedagogical Approach})$.

This means that all the factors significantly predict productive disposition, so the null hypothesis was rejected. The result supports the findings of Awofala et al., who discovered that senior high school students show high levels of productive disposition in mathematics. Their study also found that students' positive attitude and creativity toward math were strongly related to better math performance. Hence, it is recommended that teachers continue to encourage creativity and positive attitudes among students to improve learning outcomes.

2. Summary of Constructs of Noncognitive domains that predict Mathematical Competency

Table 6*Summary of Constructs of Noncognitive domains that predict Mathematical Competency*

Independent Variables	Unstandardized Coefficients	t - value	p - value	Verbal Interpretation	R ² Change
(Constant)	.928	9.188	.000		
Learning Materials	.215	6.351	.000	Significant	.343
Parents' Involvement	.197	6.901	.000	Significant	.062
Classroom Environment	.159	3.772	.000	Significant	.028
Teachers' Pedagogical Approach	.117	2.804	.005	Significant	.006

Dependent Variable: Mathematical Competency $R^2 = 0.439$ $F = 142.166$ $P - value = .000$

A linear regression analysis was used to find out how much academic buoyancy can predict a student's mathematical competency. Table 6 shows all the variables included in the study that serve as predictors of mathematical competency. The results reveal that the model explains 44% of the total variance in mathematical competency, with $R^2 = 0.44$, $F = 142.166$, and $p = .000$. Among all the predictors, the classroom environment had the biggest effect, contributing 34%, followed by parents' involvement (6%),

learning materials (3%), and teachers' pedagogical approach (1%). This means that 56% of the factors influencing mathematical competency were not covered in this study.

All the variables showed a positive relationship with mathematical competency. The classroom environment had a beta coefficient of 0.215, indicating that a better classroom environment increases students' mathematical competency by this amount. Similarly, parents' involvement had a beta of 0.197, meaning that higher parental involvement also improves mathematical competency. Learning materials had a beta of 0.159, showing that having sufficient and effective learning materials helps boost students' math skills. Lastly, teachers' pedagogical approach had a beta of 0.117, which means that the way teachers teach also contributes positively, though to a lesser degree.

Based on these findings, the model can be expressed as: $\text{Mathematical Competency} = 0.928 + 0.215(\text{Classroom Environment}) + 0.197(\text{Parents' Involvement}) + 0.159(\text{Learning Materials}) + 0.117(\text{Teachers' Pedagogical Approach})$.

The results reject the null hypothesis, meaning that all these factors significantly predict mathematical competency. These findings support Moula's idea that the home environment plays a crucial role in a student's academic success. The support, motivation, and learning atmosphere provided by the family strongly influence a child's performance in school. A home that encourages learning, promotes open communication, and maintains a positive environment helps students achieve better academic results.

Conclusion

The study found that classroom environment is the strongest predictor of mathematical competency (34%), followed by parents' involvement (6%), learning materials (3%), and teachers' pedagogical approach (1%). However, 56% of the variance remains unexplained. The findings reject the null hypothesis and recommend prioritizing classroom improvement, strengthening parental involvement, investing in quality learning materials, and enhancing teacher development to better support students' mathematical competency.

Recommendation

It is recommended that universities should prioritize improving the classroom environment, as it has the highest impact on students' mathematical competency. Increasing parental involvement through regular communication, workshops, and home-based activities can further enhance student performance. Schools should also invest in high-quality learning materials, such as interactive tools and digital resources, to support diverse learning needs. Instructors should be provided with continuous professional development to enhance their pedagogical approaches and integrate innovative teaching strategies.

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