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The Predictive Role of Language Proficiency and Non-Cognitive Skills on Mathematical Competence among Maritime Students

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ABSTRACT: Mathematical competence is a fundamental requirement in the maritime industry, as it supports essential functions such as navigation, vessel operations, safety management, and data-driven decision-making among maritime professionals. This study examined the predictive role of language proficiency and non-cognitive skills on the mathematical competence of maritime students at Capitol University in Cagayan de Oro City, Philippines. Using a causal research design, data were collected from 88 third-year maritime students using stratified random sampling and adapted research instruments. Data were collected through face-to-face administration, and prior to conducting the linear regression analysis, several critical assumptions were carefully examined. Descriptive statistics revealed that students demonstrated high levels of language proficiency, non-cognitive skills, with reading comprehension and social skills obtaining the highest mean scores. Also, mathematical competence was generally rated as high with applied maritime mathematical skills obtaining the highest mean score. However, only non-cognitive skills significantly predicted mathematical competence with academic behavior emerging as the only significant dimension. The findings highlight the critical role of behavioral and attitudinal factors in strengthening mathematical performance in maritime education and suggest that enhancing students' study habits, engagement, and responsibility may be more impactful than focusing solely on language proficiency.

KEYWORDS: Academic Perseverance, Behavioral Discipline, Maritime Cadets, Regression Analysis.

I. INTRODUCTION

1.1 Background

The maritime shipping industry remains essential to the global economy, and as it moves further into the digital and automated era, maritime education increasingly depends on solid mathematical skills. These skills help learners confidently use modern technology for navigation and managing ships safely and efficiently. Novitasari et al. (2024) reviewed 138 studies and identified seven key areas, showing that Mathematical competence is an essential skill for maritime cadets. This is supported by a survey of 174 maritime experts, which found that strong analytical and Mathematical abilities are among the most important skills for safely operating autonomous ships (Belabyad et al., 2025). In addition, Sharma (2023) noted that the use of technology, such as simulators, online learning platforms, and smart tutoring systems, can greatly support students in developing the skills needed for Maritime Education and Training (MET). This is closely connected to mathematical competence because many of the task's future seafarers handle, like navigation, checking ship stability, planning cargo, and assessing risks, all rely on Mathematical competence. By providing timely feedback, adapting lessons to each learner's needs, and offering realistic scenarios where students can practice their skills. These features make it easier for students to understand and apply Mathematics in real maritime situations. The study even reports that Maritime Education Training (MET) programs have seen improvements in students' accuracy and overall technical performance (Sharma, 2023). Adding to this, found that teaching mathematics using maritime examples helps students develop better problem-solving and higher-order. Altogether, these findings underline that strong mathematical skills are not just academic but also, they are vital for safety, efficiency, and success in the global maritime industry (Putri & Hartono, 2024).

Mathematical ability is essential in maritime education because students regularly use math for navigation, ship stability, and daily operations. As the maritime industry follows higher international standards and uses English as the main language of instruction, cadets must handle more complex Mathematical concepts than before (Bernhofer, 2022). Mathematical competence is influenced not only by technical knowledge but also by language proficiency and non-cognitive skills. Strong English skills help students understand Mathematical ideas, read charts and manuals, and correctly apply formulas in real situations (Astuti, 2023). At

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the same time, non-cognitive skills such as motivation, perseverance, and self-confidence help students stay focused and overcome challenging Mathematical tasks. Research shows that both language proficiency and non-cognitive skills play an important role in students' Mathematical performance (Azkiyah, 2023; Sultanova et al., 2024). This study therefore examines how these two factors contribute to the Mathematical competence of maritime students.

In line with earlier points, the Philippines ranked 76th out of 81 countries in Mathematics, 77th in reading and 79th in science in the latest PISA 2025 results, highlighting the need to improve both language and Mathematical skills, which are crucial for the academic performance of maritime students. Studies show that these skills can be strengthened through targeted training. For example, Geron et al. (2024) found that a focused Mathematics development program significantly improved maritime students' problem-solving abilities and overall Mathematical competence. Similarly, Rubio (2024) reported that students' performance in maritime Mathematics was strongly influenced by teaching strategies designed specifically for the maritime curriculum, emphasizing that success in Mathematics depends not only on natural ability but also on effective instruction. Lopez (2022) found that Filipino students with stronger English skills performed better in Mathematics, indicating that language ability helps students understand mathematical concepts more clearly. Additionally, Hangad and Clarin (2023) noted that grammar and vocabulary skills are essential for maritime students' communication, which indirectly supports their ability to read technical manuals, follow instructions, and solve Mathematical problems in English-based programs. Hence, these findings highlight that both Mathematical competence and language proficiency are essential for preparing maritime students to meet the academic and operational demands of the maritime industry.

Although research shows that language and Mathematical skills are essential in maritime education, as they directly affect a student's ability to learn and handle technical tasks (Bernhofer, 2022; Astuti, 2023), few studies have looked specifically at language proficiency and non-cognitive skills among maritime students at Capitol University in Cagayan de Oro, Philippines. This study explores how these skills influence the mathematical competence of maritime students at the university, aiming to provide insights that can help improve teaching and learning in the maritime program.

This study looks at how language skills and non-cognitive abilities, such as academic mindset, perseverance, study habits, and social skills, affect the math skills of maritime students. Mathematics is used every day in maritime work, from reading charts to making safety calculations, so students who struggle with Mathematics may also have trouble with future shipboard tasks. Understanding which skills matter most can help maritime programs improve teaching, provide better language support, and help students build the soft skills they need to succeed. This study is also important because few local studies have looked at these factors, making it a valuable contribution to improving maritime education.

1.2 Objectives

1.2.1 Examine the level of language proficiency of maritime students in terms of reading comprehension, writing ability, and oral communication.

1.2.2 Assess the level of non-cognitive skills of maritime students in terms of academic behavior, academic mindset, academic perseverance, and social skills.

1.2.3 Evaluate the Mathematical competence of maritime students in terms of algebraic and symbolic manipulation, problem-solving analytical thinking, and applied maritime Mathematic skills.

1.2.4 Examine how language proficiency and non-cognitive skills influence or predict the Mathematical competence of maritime students.

1.3 Hypotheses

The following hypotheses were tested at 0.05 level of significance:

H_{01}: Language proficiency does not significantly predict mathematical competence.

H_{02}: Non-cognitive skills do not significantly predict mathematical competence.

1.4 Literature Review

This study is mainly related to the meta-analysis by Peng et al. (2020), which shows strong evidence that language skill and Mathematical performance are closely related. On 344 studies with 360,000 participants, their study shows a moderate yet consistent relationship between language proficiency and Mathematics performance, this means that students with stronger language abilities tend to perform much better in Mathematics. This relationship remains important even after these main factors are present

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like intelligence and working memory, highlighting that language plays its own role in contributing to Mathematical understanding. Peng et al. (2020) also found that the relationship of language and Mathematics becomes stronger as tasks becomes more complex and technical such as when students must interpret information, solve problems, or understand specialized math vocabulary words. This is especially important to maritime education, where cadets regularly work with technical manuals, charts, and importantly English-based instructions when doing navigation or stability-related computations. Because of this a well-established link between language and Mathematics, their study serves as a key anchor for examining how language proficiency and non-cognitive traits influence the mathematical competence of maritime students.

Language Proficiency

Language Proficiency, particularly proficiency in Maritime English or the language of instruction, is a fundamental determinant of success in maritime education because of the heavy reliance on technical written and spoken materials, such as procedures, manuals, navigational problem statements, and safety reports, where low Language ability can result in misunderstanding, slower learning of procedures, and poorer performance in content tasks mediated by language (Faradillah, 2025; Lumban Batu et al., 2021). Recent empirical research confirms that effective instructional strategies like Content-Based Instruction (CBI) significantly improve cadets' Maritime English proficiency by connecting Language learning with real maritime content, better preparing students for the linguistic and operational demands of the industry (Sulistiono et al., 2024; Hafita et al., 2024). In addition, studies highlight the need for accessible and responsive language learning platforms and blended or task-based teaching methods to address the challenges posed by online and mixed teaching modalities, which may otherwise reduce interaction and participation among less proficient students (Yurzhenko et al., 2023; Andiansyah et al., 2025). Research such as needs analyses of Maritime English curricula and learning materials underscores persistent gaps in specialized Language support that directly affect cadet readiness for technical tasks, including mathematical interpretations embedded within word problems and navigational calculations (Dirgeyasa, 2025; Komari et al., 2025). These findings imply that enhancing Maritime English skills through language-sensitive approaches, scaffolded multimedia, and peer collaboration not only improves communication competence but also supports comprehension and performance in technical subject areas critical to maritime professions (Sulistiono et al., 2024; Lumban Batu et al., 2021).

Non-Cognitive Skills

Non-cognitive skills, such as perseverance, self-control, motivation, and socio-emotional abilities, are increasingly recognized as essential for academic success, personal growth, and career outcomes, complementing traditional cognitive skills (Education Endowment Foundation, 2013; Heckman & Kautz, 2018; Bowles, Gintis, & Osborne, 2017). Research shows that these skills not only predict academic performance but also help mediate the effects of socioeconomic status and improve employment opportunities, especially when nurtured early through preschool programs or supportive school environments (Alemo & Persson, 2023; Klemenčič, 2024; OECD, 2025; Lee & Xu, 2025). Defining and measuring non-cognitive skills can be challenging because they overlap with personality traits and social competencies (Yao, 2021; Park, Glewwe, & Huang, n.d.). Studies also suggest that school programs that encourage collaboration, persistence, and social interaction can strengthen these skills, close achievement gaps, and promote social integration (Duckworth, 2024; OECD, 2025). For these reasons, embedding non-cognitive skill development into educational policies and curricula is vital for supporting holistic growth and lifelong success (Education Endowment Foundation, 2013; Heckman & Kautz, 2018).

Mathematical Competence

Mathematical competence is the ability to understand and use Mathematical learnings to solve problems in everyday activities and also complex situations (Peng et al., 2020; Putri et al., 2024). It can be divided into three main areas. First is Algebraic and Symbolic Manipulation, it applies in working with equations, variables, and symbols to represent and solve problems (Sharma, 2023; Putri et al., 2024). Second is Problem-Solving and Analytical Thinking it is the usage to reason logically, clearly think in complicated situations, and perform a step-by-step methods to provide answer and solution to the problem (Icamina, 2021; Germo, 2024). Lastly, Applied Maritime Mathematics Skills is bringing up Mathematics in real-world maritime situations, like navigation calculations, stability and load assessments, cargo planning, and reading charts (Sharma, 2023; Zghyer et al., 2022). Algebra and symbolic reasoning are very important because they assist students to solve real problems. Research shows that teaching algebra in circumstances like relating to practical situations helps learners understand and remember lessons better (Putri et al., 2024; Sharma, 2023). In maritime world, algebra is used in fuel consumption calculations, ship stability formulas, and speed–distance–time

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problems. Problem-solving and analytical thinking are also very important in handling multi-step problems. A study indicates that active learning strategies, such as problem-based learning and guided problem-solving exercises, aids students develop these skills (Icamina, 2021; Germo, 2024).

For maritime students, these strategies are really helpful because they frequently encounter realistic challenges in navigation, ship operations, and technical decision-making. Applied Mathematics skills are developed by students in practice real-life scenarios and use simulation tools. A study reveals that students gain more confidence, accuracy, and practical understanding often when engage in exercises like navigation calculations, cargo planning, and stability analysis through the use of simulators or interactive lessons (Sharma, 2023; Zghyer et al., 2022; Maghoromi, 2023). Hands-on learning in maritime education has shown cadets to improve in applied mathematical skills (Politeknik Pelayaran Sorong, 2025). Non-cognitive traits, are very important because these traits help cadets push through any academic problems and also obstacle they face in life, these traits are self-discipline, persistence, motivation, and confidence, play an important role in mathematical learning. Pizon and Ytoc (2021) discovered that these traits can greatly determine the mathematical performance of students, every so often much better than cognitive ability. In maritime education, students with strong non-cognitive skills are likely to complete technical and hard tasks and apply their knowledge effectively (Astuti, 2023; Putri et al., 2024). Research purposes that bringing together practical learning, technology, realistic simulations, and strong non-cognitive skills results in the best outcomes in Mathematics. Students learn best in competence when practicing in the real-world problems and are guided in an encouraging environment (St Omer et al., 2025; Sharma, 2023). For maritime students, this means that being good in math does not solely depend on intelligence, rather also in practice, problem-solving strategies, and personal traits like discipline and confidence.

II. METHODOLOGY

This study employed a causal research design to examine how language proficiency and non-cognitive skills will predict the mathematical competence of maritime students. This design was chosen because it allows the researcher to investigate relationships among variables as they naturally occur, without manipulating any conditions. The study was conducted at private university in Cagayan de Oro City, Philippines focusing on students enrolled in the maritime education program. A total of 88 currently enrolled third year maritime students participated, selected through stratified random sampling to ensure fair representation across each section. This sampling approach strengthens the validity of the findings by minimizing selection bias and ensuring that the perspectives of students from different sections are adequately represented in the analysis (Cano et al., 2026).

A survey questionnaire served as the main research instrument, measuring language proficiency, non-cognitive skills, and mathematical competence using a four-point Likert scale ranging from 1 (Strongly Disagree) to 4 (Strongly Agree). Language proficiency items were adapted from recent studies emphasizing academic language use and communication in higher education (Alonzo & Kim, 2023; Ortega & Song, 2024). The non-cognitive skills section was based on the study of Rulida et al. (2024), which includes academic behavior, academic mindset, academic perseverance, and social skills. Mathematical competence items were drawn from competency-based mathematics frameworks focusing on problem-solving and real-world applications (Santos & Reyes, 2023). The questionnaire was validated by two experts in the field of maritime education and language to ensure clarity, relevance, and alignment with maritime education standards, thus, confirming that the items appropriately measured the intended constructs and were suitable for the target respondents (Cano & Lomibao, 2022).

Data collection commenced after receiving approval with ethical standards strictly observed. Participants were informed of the study's purpose, assured of voluntary participation, and guaranteed confidentiality, with informed consent obtained before distribution. The researchers personally administered and collected the questionnaires to ensure completeness and accuracy. Collected data were tallied, organized, and analyzed using statistical software. To describe the levels of language proficiency, non-cognitive skills, and mathematical competence, mean was used with the following qualitative descriptions for the Mean Range: 3.25-4.00 (Very High); 2.50-3.24 (High); 1.75-2.49 (Low); 1.00-1.74 (Very Low). These qualitative descriptions were anchored on the class interval approach in Likert-scale interpretation, wherein the range of the scale was divided into equal intervals to provide appropriate qualitative descriptions of the computed mean scores. This method is widely applied in survey research to support clearer understanding of respondents' perceptions, attitudes, and levels of agreement toward the measured variables (Lindner et al., 2024; Bhandari & Nikolopoulou, 2023). Moreover, the standard deviation (SD) was utilized to determine the extent of variability of the responses relative to the mean, where smaller SD values signify more consistent or homogeneous responses, while larger SD

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values reflect greater variability among respondents (Alabi & Bukola, 2023; El Omda & Sergent, 2024). For clearer interpretation, the study employed the following criteria: SD values less than 0.50 were considered indicative of low variability, values ranging from 0.50 to 0.99 were interpreted as moderate variability, and values of 1.00 and above were regarded as high variability. These classifications are consistent with established practices in the analysis of Likert-scale data in descriptive survey research. Furthermore, linear regression analysis assessed the predictive influence of language proficiency and non-cognitive skills on mathematical competence, with hypotheses tested at a 0.05 level of significance. Prior to linear regression analysis, the linearity between variables, independence of errors, and normality residuals were carefully checked being the most critical assumptions. The explanatory power of the regression model was also interpreted based on the proportion of variance explained by the predictors, following established guidelines for evaluating model strength in regression analysis (Hayes, 2022).

III. RESULTS AND DISCUSSION

On the Level of Language Proficiency

Table 1 presents the summary of the respondents' level of language proficiency across three dimensions: reading comprehension, writing ability, and oral communication. The overall mean score of 3.22 with a standard deviation of 0.70 indicates that the respondents' level of language proficiency is described as High. This means that, on average, the respondents demonstrate strong language skills across the three areas assessed. The standard deviation of 0.70 reflects moderate variability, suggesting that while most respondents rated themselves highly, there are slight differences in their level of proficiency

Table 1. Respondents' Level of Language Proficiency

Dimension	Mean	SD	Description
Reading Comprehension	3.25	0.71	Very High
Writing Ability	3.18	0.71	High
Oral Communication	3.22	0.69	High
Overall	**3.22**	**0.70**	**High**

Legend: 3.25-4.00 (Very High); 2.50-3.24 (High); 1.75-2.49 (Low); 1.00-1.74 (Very Low)

Among the three dimensions, the highest mean was found in Reading Comprehension with a mean of 3.25 and a standard deviation of 0.71, which is described as Very High. This shows that respondents generally possess strong reading skills, including the ability to understand, analyze, and interpret written texts effectively. The standard deviation of 0.71 indicates moderate variability, meaning most respondents consistently rated themselves very highly in reading comprehension.

The second highest mean was observed in Oral Communication, with a mean of 3.22 and a standard deviation of 0.69, described as High. This indicates that respondents are generally confident and competent in expressing their ideas verbally. The standard deviation of 0.69 suggests moderate consistency in responses, showing that most respondents have a similar level of oral communication skills.

On the other hand, the lowest mean was found in Writing Ability, with a mean of 3.18 and a standard deviation of 0.71, which is still described as High. Although it is the lowest among the three dimensions, the result indicates that respondents still demonstrate strong writing skills. The standard deviation of 0.71 reflects moderate variability, suggesting that while many respondents perform well in writing, some may need further improvement compared to reading and oral communication. Overall, the findings suggest that the respondents have a generally high level of language proficiency, with reading comprehension as their strongest area and writing ability as the area that may require slight enhancement.

The findings of this study revealed that respondents demonstrated a high overall level of language proficiency, with reading comprehension rated very high, and writing ability and oral communication rated high. These results support the study of Alonzo and Kim (2023), who emphasized that academic language proficiency significantly influences learning outcomes in higher education. According to their study, strong reading and communication skills enable students to better understand course materials, engage in academic discussions, and perform effectively in written assessments. The very high rating in reading comprehension in this study suggests that respondents possess the foundational skills necessary for academic success.

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Furthermore, the results align with the findings of Komari et al. (2025), who highlighted that English language proficiency is essential for academic and career advancement in the maritime industry. They noted that effective communication skills are critical in ensuring safety, coordination, and professional competence in international maritime settings. The high ratings in oral communication and writing ability in the present study indicate that respondents are generally prepared to meet both academic demands and future professional responsibilities, although continued enhancement of writing skills may further strengthen their overall competence.

On the Level of Non-Cognitive Skills

Table 2 presents the summary of the respondents' level of non-cognitive skills across four dimensions: academic behavior, academic mindset, academic perseverance, and social skills. The overall mean score of 3.14 with a standard deviation of 0.71 indicates that the respondents' level of non-cognitive skills is described as High. This means that, on average, the respondents demonstrate positive behaviors, attitudes, and interpersonal skills that support their academic performance. The standard deviation of 0.71 reflects moderate variability, suggesting that while most respondents rated themselves highly, slight differences exist in their non-cognitive skill levels.

Table 2. Respondents' Level of Non-Cognitive Skills

Dimension	Mean	SD	Description
Academic Behavior	3.07	0.69	High
Academic Mindset	3.04	0.72	High
Academic Perseverance	3.22	0.74	High
Social Skills	3.25	0.65	Very High
Overall	**3.14**	**0.71**	**High**

Legend: 3.25-4.00 (Very High); 2.50-3.24 (High); 1.75-2.49 (Low); 1.00-1.74 (Very Low)

Among the four dimensions, the highest mean was found in Social Skills, with a mean of 3.25 and a standard deviation of 0.65, which is described as Very High. This indicates that respondents strongly demonstrate teamwork, cooperation, communication, and the ability to build positive relationships with others. The moderate standard deviation of 0.65 suggests fairly consistent responses, meaning most respondents perceive themselves as highly competent in social interactions.

The second highest mean was observed in Academic Perseverance, with a mean of 3.22 and a standard deviation of 0.74, described as High. This suggests that respondents generally show determination, resilience, and persistence in completing academic tasks despite challenges. The standard deviation of 0.74 indicates moderate variability, showing that while many students demonstrate strong perseverance, some may vary in their level of persistence. On the other hand, Academic Behavior (M = 3.07, SD = 0.69) and Academic Mindset (M = 3.04, SD = 0.72) both obtained high ratings.

These findings indicate that respondents generally possess positive study habits, responsible classroom behavior, and a growth-oriented attitude toward learning. Although these dimensions received the lowest means among the four, they remain within the high descriptive level, suggesting that respondents exhibit generally strong non-cognitive attributes. Overall, the findings imply that students demonstrate well-developed non-cognitive skills, particularly in social competence and perseverance.

The findings of this study are supported by Heckman and Kautz (2018), who emphasized that non-cognitive skills such as perseverance, motivation, self-discipline, and social competence play a critical role in academic achievement and long-term outcomes. Their review highlighted that students who demonstrate strong behavioral and attitudinal skills tend to perform better academically because these attributes enhance effort, engagement, and resilience in challenging tasks. The high levels of academic perseverance and behavior found in this study align with their conclusion that non-cognitive competencies significantly contribute to educational success.

Similarly, the Organization for Economic Co-operation and Development (2025) reported that social and emotional skills are strong predictors of academic performance and adaptability in educational settings. The OECD emphasized that students with well-developed social skills and positive academic mindsets are more likely to collaborate effectively, manage stress, and sustain motivation. The very high rating in social skills and high levels of academic mindset observed in this study support these findings,

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suggesting that respondents possess essential personal qualities that enhance both their academic engagement and future professional readiness.

On the Level of Mathematical Competence

Table 3 presents the summary of the respondents' level of mathematical competence across three dimensions: algebraic and symbolic manipulation, problem solving and analytical thinking, and applied maritime mathematical skills. The overall mean score of 3.01 with a standard deviation of 0.70 indicates that the respondents' level of mathematical competence is described as High. This suggests that, on average, the respondents demonstrate solid mathematical knowledge and skills necessary for academic and maritime-related tasks. The standard deviation of 0.70 reflects moderate variability, indicating slight differences in competence levels among respondents.

Table 3. Respondents' Level of Mathematical Competence

Dimension	Mean	SD	Description
Algebraic and Symbolic Manipulation	2.86	0.68	High
Problem Solving and Analytical Thinking	2.97	0.66	High
Applied Maritime Mathematical Skills	3.20	0.73	High
Overall	**3.01**	**0.70**	**High**

Legend: 3.25-4.00 (Very High); 2.50-3.24 (High); 1.75-2.49 (Low); 1.00-1.74 (Very Low)

Among the three dimensions, the highest mean was found in Applied Maritime Mathematical Skills, with a mean of 3.20 and a standard deviation of 0.73, described as High. This indicates that respondents are particularly competent in applying mathematical concepts to maritime-related contexts, such as navigation, measurement, and technical computations. The standard deviation of 0.73 suggests moderate variability, meaning most respondents show strong applied skills, although some differences exist.

The second highest mean was observed in Problem Solving and Analytical Thinking, with a mean of 2.97 and a standard deviation of 0.66, described as High. This implies that respondents are generally capable of analysing mathematical situations, interpreting data, and solving structured problems effectively. The relatively lower standard deviation of 0.66 indicates consistent responses among participants in this area.

On the other hand, Algebraic and Symbolic Manipulation obtained the lowest mean of 2.86 with a standard deviation of 0.68, which is still described as High. Although it ranked lowest among the three dimensions, the result suggests that respondents maintain adequate skills in handling equations, formulas, and symbolic representations. Overall, the findings indicate that respondents demonstrate a strong level of mathematical competence, particularly in applying mathematics within maritime contexts.

The findings of this study are supported by Santos and Reyes (2023), who emphasized that mathematical competence, particularly in problem-solving and analytical thinking, is essential for success in tertiary education. Their study highlighted that students who can interpret problems, apply appropriate strategies, and analyze results tend to demonstrate stronger academic performance. The high rating in problem solving and analytical thinking in the present study aligns with their conclusion that analytical skills are central to mathematical proficiency. Furthermore, Novitasari et al. (2024) stressed that mathematical literacy is a key competency in maritime education, as cadets are required to apply mathematical concepts in real-world maritime tasks such as navigation, measurement, and technical calculations. Their systematic review emphasized the importance of contextualized and applied mathematics training. The high mean in applied maritime mathematical skills found in this study supports this claim, suggesting that respondents are developing the practical mathematical abilities necessary for maritime academic and professional demands.

Influence of Language Proficiency and Non-Cognitive Skills on Mathematical Competence

Table 4 presents the results of the multiple linear regression analysis examining whether language proficiency and non-cognitive skills significantly influence mathematical competence. Based on the model summary, the regression model is statistically significant, as indicated by an F-value of 11.207 with a p-value of <0.001. The model explains 19% of the variance in mathematical competence (Adjusted $R^2 = 0.190$), indicating that the predictors provide a meaningful contribution to mathematical competence.

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Table 4. Regression Analysis on the Influence of Language Proficiency and Non-Cognitive Skills on Mathematical Competence

Predictors	Unstandardized Coefficients (B)	Standardized Coefficients (β)	t-value	p-value	Interpretation
(Constant)	1.559	-----	3.979	<0.001	-----
Language Proficiency	-0.041	-0.049	-0.501	0.617	Not Significant
Non-Cognitive Skills	0.504	0.463	4.724	<0.001	Significant
Model Summary: *Adjusted* $R^2 = 0.190$*; F-value* $= 11.207$*; p-value* $=< 0.001$*; Interpretation* = Significant					

With respect to the predictors, language proficiency shows no statistically significant influence on mathematical competence. The unstandardized coefficient of -0.041 indicates that an increase of one unit in language proficiency results in a 0.041 unit decrease in mathematical competence, holding other factors constant. The standardized coefficient of -0.049 reflects a very weak negative influence, and the associated t-value of -0.501 with a p-value of 0.617 leads to the decision to not reject the null hypothesis. This confirms that language proficiency does not significantly influence mathematical competence when non-cognitive skills are considered. In contrast, non-cognitive skills show a statistically significant influence on mathematical competence. The unstandardized coefficient of 0.504 indicates that an increase of one unit in non-cognitive skills results in a 0.504 unit increase in mathematical competence. The standardized coefficient of 0.463 reflects a moderate positive influence, and the associated t-value of 4.724 with a p-value of <0.001 leads to the decision to reject the null hypothesis. This confirms that non-cognitive skills significantly influence mathematical competence.

The findings are consistent with the study of Heckman and Kautz (2018), who emphasized that non-cognitive skills such as perseverance, self-regulation, and behavioral discipline strongly predict academic outcomes. Similarly, Rulida et al. (2024) found that non-cognitive skills are significantly related to academic performance among senior high school education students who are about to enter college The present results highlight that in maritime education, mathematical competence is more strongly influenced by students' non-cognitive attributes than by language proficiency alone.

Table 5 presents the results of the simple linear regression analysis examining whether language proficiency (when studied alone or as sole predictor) significantly influences mathematical competence. Based on the model summary, the regression model is not statistically significant, as indicated by an F-value of 0.078 with a p-value of 0.781. The model explains only 0.1% of the variance in mathematical competence ($R^2 = 0.001$), indicating that language proficiency does not provide a meaningful explanatory contribution to mathematical competence.

With respect to the predictor, language proficiency shows no statistically significant influence on mathematical competence. The unstandardized coefficient of 0.025 indicates that an increase of one unit in language proficiency results in only a 0.025 unit increase in mathematical competence, holding other factors constant. The standardized coefficient of 0.030 reflects a very weak positive influence, and the associated t-value of 0.279 with a p-value of 0.781 leads to the decision to not reject the null hypothesis. This confirms that language proficiency does not significantly predict mathematical competence, supporting the result in Table 4.

Table 5. Regression Analysis on the Influence of Language Proficiency on Mathematical Competence

Predictor	Unstandardized Coefficients (B)	Standardized Coefficients (β)	t-value	p-value	Decision	Interpretation
(Constant)	2.929	-----	9.951	<0.001	----	-----
Language Proficiency	0.025	0.030	0.279	0.781	Do not reject H_{01}	Not Significant
Model Summary: $R^2 = 0.001$*; F-value* $= 0.078$*; p-value* $= 0.781$*; Interpretation* = Not Significant						

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The results indicating that language proficiency does not significantly predict mathematical competence present an interesting contrast to the meta-analytic findings of Peng et al. (2020), who reported a moderate relationship between language and mathematics across educational contexts. One possible explanation is contextual saturation: respondents already exhibit high language proficiency in Table 1, resulting in limited variability and reduced predictive power. When language skills reach a functional threshold, their incremental contribution to performance differences may diminish.

Additionally, studies such as Lenz et al. (2024) suggest that language effects are more pronounced in linguistically demanding mathematical tasks. If the mathematical competence instrument emphasized computational or applied procedural items rather than linguistically complex word problems, the predictive strength of language proficiency may be attenuated. This interpretation aligns with Bernhofer (2022), who noted that language of instruction influences performance primarily when conceptual processing is language intensive. Hence, in this maritime cohort, language proficiency may serve as an enabling condition rather than a direct determinant of mathematical competence.

Table 6 presents another result of simple linear regression analysis examining whether non-cognitive skills (when studied as sole predictor) significantly influence mathematical competence. Based on the model summary, the regression model is statistically significant, as indicated by an F-value of 22.358 with a p-value of <0.001. The model explains 20.6% of the variance in mathematical competence (R^2 = 0.206), indicating that non-cognitive skills provide a substantial and reliable explanatory contribution to mathematical competence.

Table 6. Regression Analysis on the Influence of Non-Cognitive Skills on Mathematical Competence

Predictor	Unstandardized Coefficients (B)	Standardized Coefficients (β)	t-value	p-value	Decision	Interpretation
(Constant)	1.455	-----	4.394	<0.001	----	-----
Non-Cognitive Skills	0.495	0.454	4.728	<0.001	Reject H_{02}	Significant
Model Summary: $R^2 = 0.206$; *F-value* $= 22.358$; *p-value* $=< 0.001$; *Interpretation* = Significant						

With respect to the predictor, non-cognitive skills show a statistically significant influence on mathematical competence. The unstandardized coefficient of 0.495 indicates that an increase of one unit in non-cognitive skills corresponds to an increase of 0.495 units in mathematical competence, holding other factors constant. The standardized coefficient of 0.454 reflects a moderate positive influence, and the associated t-value of 4.728 with a p-value of <0.001 leads to the decision to reject the null hypothesis. This confirms that non-cognitive skills significantly predict mathematical competence, supporting the result in Table 4.

The statistically significant predictive effect of non-cognitive skills, explaining 20.6% of the variance in mathematical competence, strongly supports the theoretical arguments advanced by Heckman and Kautz (2018) and the OECD (2025), who emphasized the measurable academic returns of behavioral and attitudinal traits. The moderate standardized coefficient (β = 0.454) indicates that non-cognitive skills exert a meaningful influence on mathematical outcomes, beyond mere descriptive association.

This finding is also consistent with Pizon and Ytoc (2021), who argued that perseverance, discipline, and motivation may rival or exceed cognitive ability in predicting mathematics performance. In the maritime context, where sustained practice, attention to procedural detail, and disciplined study are required for technical mastery, behavioral regulation appears to be a central driver of competence. Thus, the results substantiate the claim that strengthening structured academic habits may yield tangible gains in maritime mathematics performance.

Table 7 presents the results of the multiple regression analysis examining whether the dimensions of non-cognitive skills significantly influence mathematical competence. Based on the model summary, the regression model is statistically significant, as indicated by an F-value of 9.383 with a p-value of <0.001. The model explains 27.8% of the variance in mathematical competence (Adjusted R^2 = 0.278), indicating that, collectively, the dimensions of non-cognitive skills contribute significantly to mathematical competence.

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Table 7. Regression Analysis on the Influence of the Dimensions of Non-Cognitive Skills on Mathematical Competence

Predictors	Unstandardized Coefficients (B)	Standardized Coefficients (β)	t-value	p-value	Interpretation
(Constant)	2.206	-----	5.692	<0.001	-----
Academic Behavior	2.293	0.381	2.582	0.012	Significant
Academic Mindset	0.062	0.082	0.544	0.588	Not Significant
Academic Perseverance	0.050	0.075	0.494	0.622	Not Significant
Social Skills	-0.136	-0.160	-1.697	0.093	Not Significant
Model Summary: *Adjusted* $R^2 = 0.278$*; F-value* $= 9.383$*; p-value* $=< 0.001$*; Interpretation* = Significant					

With respect to the four dimensions, only academic behavior shows a statistically significant influence on mathematical competence. The unstandardized coefficient of 2.293 indicates that an increase of one unit in academic behavior corresponds to an increase of 2.293 units in mathematical competence, holding other variables constant. The standardized coefficient of 0.381 reflects a moderate positive influence, and the associated t-value of 2.582 with a p-value of 0.012 confirms its statistical significance. On the other hand, academic mindset (p = 0.588), academic perseverance (p = 0.622), and social skills (p = 0.093) do not show statistically significant influences, as their p-values are greater than 0.05. Although social skills show a negative coefficient (-0.136), the effect is not significant. Hence, among the four dimensions of non-cognitive skills, only academic behavior significantly predicts mathematical competence.

This finding aligns with Bowles et al. (2017), who cautioned that broad non-cognitive constructs often overlap conceptually but differ in predictive strength depending on outcome specificity. It also reflects the Education Endowment Foundation (2013) assertion that structured behavioral interventions have more immediate academic effects than generalized attitudinal improvements. In the maritime setting, where mathematical mastery requires consistent practice and procedural accuracy, disciplined academic behavior likely facilitates repeated exposure and deliberate practice, leading to competence gains.

Interestingly, social skills showed a negative but non-significant coefficient. While collaboration is essential in maritime operations, mathematical competence in academic assessment contexts may depend more heavily on individual task engagement than interpersonal interaction. Therefore, the findings suggest that targeted enhancement of academic behavioral practices, rather than broad socio-emotional programming, may be the most efficient strategy for improving mathematical outcomes in maritime education.

IV. CONCLUSION

This study affirms that mathematical competence in maritime education is shaped not only by students' academic knowledge, but more importantly by the behavioral qualities that enable them to persist, engage, and perform in demanding learning environments. Although the respondents demonstrated generally high levels of language proficiency, non-cognitive skills, and mathematical competence, the findings clearly showed that language proficiency did not significantly predict mathematical competence. Instead, non-cognitive skills emerged as the more decisive factor, with academic behavior standing out as the only significant dimension. These results suggest that in professional programs such as maritime education, where students are expected to apply mathematics in precise, high-stakes, and operationally relevant contexts, disciplined study habits, responsibility, task engagement, and consistent academic conduct may matter more than language proficiency alone in shaping mathematical performance.

More broadly, the study highlights an important direction for maritime and higher education institutions worldwide: strengthening mathematical competence requires going beyond content delivery and language support toward the intentional cultivation of productive academic behaviors. As the maritime industry becomes increasingly technology-driven, data-reliant, and safety-critical, institutions must prepare students not only to understand mathematical concepts, but also to develop the self-regulation and academic discipline needed to apply them accurately in real-world settings. Thus, the study contributes to the growing

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global discourse that student success in technical education is deeply connected to non-cognitive development, and it underscores the need for educational interventions that build both competence and character as foundations of future professional readiness.

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