Digital Literacy and Engagement of Freshmen Maritime Students in Relation to Academic Performance

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ABSTRACT

This study examined students' digital literacy, engagement in developing mathematical skills, and academic performance in mathematics. It also explored whether digital literacy and student engagement were significantly related to students' achievement in mathematics. Using a descriptive-correlational research design, the study involved 184 student participants enrolled during the academic year 2025 - 2026. Data on digital literacy and engagement were collected through a standardized questionnaire, while students' mathematics grades were used to assess academic performance. The findings showed that the participants generally demonstrated high levels of digital literacy and were actively engaged in developing their mathematical skills. Cognitive engagement emerged as the strongest dimension, followed by behavioral and emotional engagement. However, despite these positive characteristics, students' overall mathematics performance remained at a satisfactory level. Moreover, the results revealed that neither digital literacy nor engagement had a statistically significant relationship with mathematics achievement. These findings suggest that while digital competence and active participation contribute to the learning process, they may not be sufficient to improve academic outcomes on their own. The study emphasizes the need for instructional approaches that strengthen students' conceptual understanding, critical thinking, and problem-solving skills while integrating technology in meaningful and purposeful ways to support higher mathematics achievement.

Keywords: Digital literacy, student engagement, mathematical skills, academic performance, mathematics achievement.

INTRODUCTION

The rapid advancement of digital technology has significantly transformed the educational landscape, particularly in higher education, where students increasingly rely on online platforms and digital resources to support their learning. As technology becomes more integrated into academic settings, digital literacy has emerged as an essential competency that enables students to access, evaluate, comprehend, and effectively utilize digital information. Students with stronger digital literacy skills are generally better equipped to use technological resources for academic purposes, which may contribute to improved learning and academic performance (Xu et al., 2021).

The widespread adoption of online and blended learning during and following the COVID-19 pandemic further highlighted the importance of digital literacy among students. Those with adequate digital skills are more capable of engaging in online discussions, completing academic tasks, accessing learning materials, and communicating effectively within virtual learning environments (Kara, 2021). Alongside digital literacy, student engagement remains an important factor in academic achievement. Students who actively participate in learning activities and demonstrate greater involvement in their studies are more likely to attain favorable academic outcomes (Kuzminykh et al., 2021).

Within maritime education, digital technologies such as simulation-based training, online learning platforms, and other technology-supported instructional tools have become increasingly integrated into teaching and

learning. This development requires maritime students to possess sufficient digital competencies to effectively navigate academic requirements and prepare for the technological demands of the maritime industry. The integration of digital technologies in maritime education may also enhance students' participation and involvement in learning, thereby contributing to improved academic performance (Koh et al., 2023).

METHODOLOGY

Research Design

This study employed a quantitative descriptive-correlational research design to describe existing conditions and examine the relationships among the selected variables without manipulating them. Specifically, the study investigated the relationship between digital literacy, student engagement, and the academic performance of freshmen Marine Engineering students in mathematics. Quantitative data were collected and analyzed to provide an objective assessment of whether students' digital competencies and participation in learning activities are associated with their performance in mathematics. This research approach was considered appropriate because it allows the researcher to examine patterns and relationships among variables while maintaining the natural conditions in which the students learn (Creswell & Creswell, 2022).

Subject and Respondents of the Study

The subject and respondents of this study were the Bachelor of Science in Marine Engineering freshmen students of a private maritime institution in Negros Occidental enrolled during the academic year 2025-2026.

Population and Sample Size

The study population consisted of 340 Bachelor of Science in Marine Engineering (BSMarE) students enrolled at a private maritime institution in Negros Occidental during the academic year 2025–2026. Using Yamane's formula to determine the appropriate sample size, a total of 184 students were selected as respondents for the study. The study employed stratified random sampling to ensure that each group in the population was properly represented. Respondents were randomly selected through the lottery method, giving every qualified participant an equal chance of being included. This approach helped minimize selection bias and ensured a more representative sample.

Data Gathering Instrument

To measure the respondents' level of digital literacy, the study employed a standardized questionnaire adapted from the Digital Literacy Scale: Validity and Reliability Study with the Rasch Model developed by Avinç and Doğan (2024). The questionnaire demonstrated strong validity and excellent reliability, with a Cronbach's alpha of 0.982, split-half reliability of 0.945, and an ICC of 0.984. The instrument comprised 20 items designed to assess the respondents' ability to use and engage with digital technologies and information effectively. Responses were measured using a five-point Likert scale, with 5 representing Strongly Agree, 4 Agree, 3 Neutral, 2 Disagree, and 1 Strongly Disagree. The respondents were instructed to select the response that most accurately reflected their level of digital literacy.

To assess the respondents' level of engagement in developing mathematical skills, the study utilized a standardized questionnaire adopted from Students' Engagement and Their Performances in Mathematics by Tamban and Flores (2021) and has been widely used to measure students' engagement in mathematics. The instrument contained 33 items grouped into three dimensions of student engagement: behavioral engagement, emotional engagement, and cognitive engagement. A four-point Likert scale was employed, wherein 4 represented Highly Engaged, 3 Engaged, 2 Not Engaged, and 1 Highly Not Engaged. The respondents rated each statement according to the extent to which it described their participation, involvement, and engagement in mathematics-related learning activities.

The respondents' academic performance was measured using their recorded grades in mathematics. The grades were interpreted according to the institution's established grading scale. A grade of 95–100 was classified as

Excellent, 80–94 as Very Good, 70–79 as Good, 60–69 as Satisfactory, 50–59 as Pass, and 0–49 as Failure. This grading classification provided a consistent basis for describing the respondents' academic performance and determining their level of achievement in mathematics.

Data Gathering Procedures

Before the commencement of data collection, the researcher obtained the necessary institutional permissions and ensured that appropriate ethical procedures were observed. A formal request for permission to conduct the study was submitted to the appropriate authorities of the Graduate School of La Carlota City College. Initial approval was sought from the President of the institution, after which the approved request was endorsed to the School Dean for final authorization. The administration of the survey proceeded only after all required approvals had been secured.

To minimize disruption to the respondents' regular face-to-face classes, the survey was administered through Google Forms, as authorized by the school administration. The researcher personally facilitated the data-gathering process and remained available to clarify any questions or concerns regarding the questionnaire without influencing the respondents' answers. Participation was voluntary, and the respondents were appropriately informed about the purpose of the study, the nature of their participation, and the intended use of the information they provided.

The researcher also observed measures to protect the privacy, confidentiality, and anonymity of the respondents. The information gathered was treated with strict confidentiality and was used solely for academic and research purposes. Respondents were not required to disclose unnecessary personally identifying information, and the collected responses were handled responsibly throughout the research process. Upon completion of the survey, the responses were electronically collected, organized, and prepared for statistical analysis. The data were subsequently analyzed and interpreted in accordance with the objectives of the study while maintaining the integrity and confidentiality of the participants' information.

Data Analyses

All collected data in this study were analyzed using the SPSS version 2025 and utilizing descriptive, inferential, and correlational analyses summarize as follows:

For statement of problem number 1, to determine the level of digital literacy the respondents, mean and standard deviation was used. The formula for the mean an standard deviation were:

$$\bar{x} = \frac{\Sigma x}{n}$$

Where:

$\bar{x}$ = Mean or Average

Σx = sum of all scores in the population

n = total number population

$$SD = \sqrt{\frac{\Sigma(x - \bar{x})^2}{n - 1}}$$

Where:

SD = Standard Deviation

$\bar{x}$ = Mean or Average

x = individual scores in the population

n = total number population

To interpret the mean of the level of digital literacy the respondents the following interpretation guide was used:

Scale	Description	Mean Score Range	Interpretation	Verbal description
5	Strongly Agree	4.21- 5.00	Very high level	The respondents exhibit a very high level of digital literacy and are highly confident in using digital technologies.
4	Agree	3.41- 4.20	High level	The respondents exhibit a high level of digital literacy and are generally capable of using digital technologies effectively.
3	Neutral	2.61- 3.40	Moderate level	The respondents exhibit a moderate level of digital literacy, showing adequate knowledge and skills in using digital technologies.
2	Disagree	1.81- 2.60	Low level	The respondents exhibit a low level of digital literacy and may experience difficulties when using digital technologies.
1	Strongly Disagree	1.00- 1.80	Very low level	The respondents exhibit a very low level of digital literacy and have limited knowledge and skills in using digital technologies.

For statement of problem number 2, to determine the engagement level of freshmen marine engineering students, mean and standard deviation was used.

To interpret the mean of the level of engagement of the respondents, the following interpretation guide was used:

Scale	Description	Mean Score Range	Interpretation	Verbal Description
4	Highly Engage	3.25 – 4.00	Very high level of participation	The respondents demonstrate a very high level of engagement, showing active involvement and consistent participation in the activities.
3	Engage	2.50 - 3.24	High level of participation	The respondents demonstrate a high level of engagement, with regular involvement and willingness to participate in the activities.
2	Not Engage	1.75 - 2.49	Limited participation	The respondents demonstrate limited engagement, with minimal involvement and participation in the activities.
1	Highly Not Engage	1.00 - 1.74	Very low participation	The respondents demonstrate very low engagement, showing little interest or involvement in the activities.

For statement of problem number 3, to interpret the mean of the level of Achievement in Mathematics of the first year BSMarE students the following scale was used:

Grading	Description
95-100	Excellent
80-94	Very Good
70-79	Good
60-69	Satisfactory
50-59	Pass
0-49	Failure

For statement of problem number 4, to determine the relationship between the level of digital literacy of the respondents and their academic performance in mathematics, Pearson Product Moment of Correlation was used.

The formula Pearson Product Moment of Correlation was:

$$r = \frac{n(\Sigma xy) - (\Sigma x)(\Sigma y)}{\sqrt{[n\Sigma x^2 - (\Sigma x)^2][n\Sigma y^2 - (y)^2]}}$$

where:

r = Correlation

Σxy = Sum of product of paired scores

Σx = Sum of x scores

Σy = Sum of y scores

Σx^2 = Sum of squared x scores

Σy^2 = Sum of squared y scores

For statement of problem numbers 5, to determine the relationship between the level of engagement of the respondents and their academic performance in Mathematics, Pearson Product Moment of Correlation was used.

RESULTS AND DISCUSSION

This section presents, analyzes, and interprets the data gathered in the study, together with the corresponding discussion and implications of the findings. The results are presented in tables to facilitate a clear and systematic analysis of the data. The presentation follows the sequence of the research problems and objectives, ensuring that each finding is appropriately discussed and interpreted in relation to the purpose of the study.

Level of Digital Literacy

The table below reveals the level of digital literacy of the freshmen marine engineering students.

Table 1. Level of Digital Literacy of students.

No.	Statements	Mean	SD	Interpretation
1	I know the rules to follow when using digital tools (commenting, sharing personal information, etc.).	3.99	0.91	High
2	I know that not all the information I find on the internet is reliable.	3.92	0.98	High
3	I can work in a team, collaborating well with my peers,	3.89	0.92	High

	using digital technologies.			
4	I know that using digital technologies for long periods of time can negatively affect my health.	3.86	0.97	High
5	I have sufficient knowledge on issues related to cyber security, internet fraud, fraud, etc.	3.73	0.85	High
6	I do not have difficulty researching topics on the internet that I do not understand during classes.	3.59	0.94	High
7	I can solve technological problems of programs or tools.	3.45	0.89	High
8	I follow important new technologies.	3.81	0.85	High
9	I mostly install educational applications on my digital technology devices (mobile phone, tablet, computer, etc.).	3.74	0.9	High
10	Using digital tools increases my interest in the course.	3.72	0.93	High
11	I can easily express my thoughts in my social communication with digital resources.	3.67	0.89	High
12	I feel confident in my searches for information on the internet (research, homework, etc.).	3.75	0.89	High
13	I have sufficient skills in digital technologies.	3.54	0.84	High
14	I can easily prepare posters, banners, collages, etc. in digital environment.	3.55	0.84	High
15	I have no difficulty in studying my school courses online.	3.52	0.91	High
16	I can use passwords to protect my technological devices where my personal information is recorded.	4.11	0.89	High
17	I can use digital teaching materials (e.g., presentations, digital stories, blogs, etc.) to present what I have learned.	3.84	0.85	High
18	I often collaborate with my classmates over the internet (Skype, Facebook, Zoom, Microsoft Teams, etc.).	3.79	0.84	High
19	I can learn new digital technologies without difficulty.	3.64	0.78	High
20	I know how to solve the technical problems I encounter with digital technologies (tablet, phone, computer, smart board, etc.).	3.58	0.82	High
Overall	**Digital Literacy overall mean**	**3.73**	**0.66**	**High**

Legend: (4.21 – 5.00)-Very High; (3.41 – 4.20)-High; (2.61 – 3.40)-Moderate; (1.81 – 2.60)-Low; (1.00 – 1.80)-Very Low

Table 1 presents the respondents' level of digital literacy across indicators involving their knowledge, skills, attitudes, and use of digital technologies. The overall mean of 3.73 (SD = 0.66), interpreted as High, indicates that the respondents generally demonstrated adequate digital literacy competencies. This finding suggests that the students are capable of using digital technologies for academic activities, communication, information access, and other learning-related purposes. The relatively low standard deviation further indicates that the respondents' ratings were reasonably consistent, suggesting a generally similar level of digital literacy across the group.

Among the indicators, the statement, "I can use passwords to protect my technological devices where my personal information is recorded," obtained the highest mean score of 4.11 (SD = 0.89), interpreted as High. This result indicates that the respondents have a strong awareness of the importance of protecting personal information and maintaining digital security. Their ability to recognize and apply basic security measures reflects responsible technology use and suggests that they are aware of potential privacy and security risks in digital environments.

The statement, "I know the rules to follow when using digital tools," ranked second, with a mean of 3.99 (SD = 0.91). This finding suggests that the respondents have a good understanding of appropriate practices when

using digital technologies. Awareness of digital rules and responsible online behavior is particularly relevant in academic settings, where students regularly use digital platforms to communicate, collaborate, access learning materials, and exchange information.

Similarly, the respondents demonstrated awareness of the need to evaluate information obtained online. The statement, "I know that not all the information I find on the internet is reliable," obtained a mean of 3.92 (SD = 0.98). This result indicates that the students recognize the importance of critically examining digital information rather than accepting online content without evaluation. Such awareness is particularly valuable in academic work, where students are expected to identify credible sources and distinguish reliable information from inaccurate or misleading content.

The findings also indicate that the respondents are capable of using digital technologies for collaboration. The statement, "I can work in a team, collaborating well with my peers, using digital technologies," obtained a mean of 3.89 (SD = 0.92), while "I often collaborate with my classmates over the internet" received a mean of 3.79 (SD = 0.84). These results suggest that the students are relatively comfortable using digital platforms to communicate, exchange ideas, and accomplish tasks with their classmates. Such competencies are increasingly important in contemporary education, where collaborative learning may extend beyond the physical classroom through online platforms and other digital tools.

In terms of using technology to support learning, the respondents also demonstrated favorable perceptions. The statement, "I can use digital teaching materials to present what I have learned," obtained a mean of 3.84 (SD = 0.85), while "Using digital tools increases my interest in the course" recorded a mean of 3.72 (SD = 0.93). These findings indicate that the respondents recognize the usefulness of digital resources in presenting learning outputs and supporting their academic activities. The results further suggest that technology may contribute to making learning activities more accessible and engaging for students.

Despite the generally high level of digital literacy, some areas received comparatively lower ratings. The statement, "I can solve technological problems of programs or tools," obtained the lowest mean of 3.45 (SD = 0.89), followed by "I have no difficulty in studying my school courses online" with a mean of 3.52 (SD = 0.91) and "I have sufficient skills in digital technologies" with a mean of 3.54 (SD = 0.84). Although these indicators remained within the High category, their comparatively lower scores suggest that some respondents may still encounter difficulties when troubleshooting technical problems, managing online coursework, or handling more demanding digital tasks. These areas may therefore benefit from additional practice, guidance, and technology-supported learning opportunities.

Overall, the findings demonstrate that the respondents possessed a high level of digital literacy, particularly in digital security, responsible technology use, information evaluation, collaboration, and the use of digital resources for learning. Their ability to engage with digital technologies suggests that they are generally prepared to participate in technology-enhanced educational environments. Nevertheless, the lower ratings in technical problem-solving and confidence in digital skills point to areas where further development may be beneficial. Providing students with opportunities to practice troubleshooting, navigate different digital platforms, and perform more complex technology-related tasks may help strengthen their digital competencies and enable them to use technology more effectively in support of their academic work.

The findings are consistent with recent research emphasizing the contribution of digital literacy to students' academic experiences and outcomes in higher education. Benedict et al. (2024) examined the relationship among digital learning, digital literacy, and academic performance and found that students with stronger digital literacy skills tended to demonstrate better academic outcomes. Their findings suggest that the ability to access, evaluate, and use digital resources effectively can support students in completing academic tasks and managing learning demands. The researchers also highlighted the importance of critical thinking, indicating that digital competence becomes more valuable when students can critically analyze and apply the information they obtain through digital technologies.

Similarly, Holm (2024) found that digital literacy was associated with improved academic performance among students participating in online learning. Students with stronger digital competencies were better able to

navigate learning platforms, access course materials, and complete academic requirements. This finding supports the present results, particularly the respondents' generally high ratings in using digital technologies for learning and collaboration. It also suggests that digital competence can help students adapt more effectively to learning environments where technology plays a central role.

Ibrahim and Aldawsari (2023) likewise reported a positive relationship between students' digital capabilities and academic achievement. Their study further indicated that self-efficacy contributed to this relationship, suggesting that students who are confident in their ability to use digital technologies are more likely to participate actively in learning activities and attain favorable academic outcomes. This finding provides additional support for the present study, as the respondents' high level of digital literacy indicates a generally positive capacity to engage with technology for academic purposes.

Further support is provided by Getenet et al. (2024), who examined the relationships among digital literacy, attitudes toward technology, self-efficacy, and online learning engagement. Their findings indicated that students with higher digital literacy tended to demonstrate greater engagement in online learning. This suggests that digital literacy extends beyond technical knowledge and may facilitate students' active participation in learning activities. The result is particularly relevant to the present study because the respondents demonstrated strong competencies in digital collaboration and the use of technology-supported learning materials.

The findings are also supported by Li et al. (2025), whose meta-analysis established a positive association between digital literacy and academic achievement across multiple studies. The researchers noted that digitally competent students are better positioned to manage learning tasks, locate relevant information, and adapt to technology-mediated educational environments. These capabilities can provide students with practical advantages when completing academic requirements and accessing learning resources, thereby supporting their academic development.

Moreover, Lin (2024) reported that educational digitization can contribute positively to student performance when digital technologies are integrated with appropriate instructional strategies and supported by adequate digital competencies. This finding reinforces the importance of not only providing students with access to technology but also developing their capacity to use these tools effectively. In the context of the present study, the respondents' high digital literacy suggests that they possess a strong foundation for participating in technology-enhanced learning. However, the relatively lower ratings in technical troubleshooting and digital problem-solving indicate that continued development of these competencies may further strengthen their ability to benefit from digital learning opportunities.

Level of Engagement in Developing Mathematical Skills

The table presents the overall level of engagement among freshmen Marine Engineering students across three dimensions: behavioral engagement, emotional engagement, and cognitive engagement. It provides an overview of the students' involvement and participation in learning activities based on these three indicators.

Table 2. Level of Engagement of students in Developing Mathematical Skills.

Statements	Mean	SD	Interpretation
Behavioral Engagement	**3.04**	**0.35**	**High**
1. I can remember best by listening to a lecture that includes information, explanations and discussions.	3.22	0.61	High
2. I participate in the discussion in math class.	3.17	0.55	High
3. I get easily distracted in math class.	2.79	0.75	High
4. I work hard in math class.	3.18	0.57	High
5. At home I review math problems that I did not understand in school.	3.11	0.61	High
6. When I see difficult math problems, I stop working on them.	2.42	0.81	Low

7. Sometimes I skip difficult math questions.	2.74	0.72	High
8. When I make mistakes in math, I work until I correct them.	3.21	0.57	High
9. I follow my teacher's directions in math class.	3.38	0.55	Very High
10. I sometimes act out as if I am studying in math class.	2.84	0.69	High
11. I ask my friends or teachers for help when I can't solve math problems.	3.33	0.6	Very High
Emotional Engagement	**2.89**	**0.41**	**High**
12. I am interested in learning new things in math.	3.33	0.59	Very High
13. I do not like attending math classes.	2.23	0.92	Low
14. Learning math is fun.	3.18	0.63	High
15. I feel excited when I study in math class.	3.07	0.59	High
16. I feel bored when I study in math.	2.45	0.84	Low
17. I am excited about solving difficult math problems.	3	0.64	High
18. I like to study other subjects rather than math.	2.83	0.71	High
19. Time passes very quickly when I study math.	3.03	0.64	High
20. I forget where I am when I study math.	2.8	0.73	High
21. I want to spend more time solving math problems.	3.02	0.65	High
Cognitive Engagement	**3.19**	**0.4**	**High**
22. I want to get good grade in math class.	3.42	0.58	Very High
23. Sometimes I follow my best guess when I do not know the answer.	3.11	0.67	High
24. When I study math, I ask myself questions to make sure I understand it correctly.	3.32	0.52	Very High
25. I try to connect math to real-life situations.	3.15	0.61	High
26. I try to think of different ways to solve math problems.	3.26	0.6	Very High
27. I try to develop my own strategy when I solve math problems.	3.27	0.56	Very High
28. I set goals for myself when I study math.	3.24	0.54	High
29. When I can't solve a math problem, I try to change my strategy.	3.22	0.53	High
30. I often think about something else when I study math.	2.96	0.61	High
31. At home I think about what I learned in math class.	3.02	0.62	High
32. I am focused when I study math.	3.16	0.55	High
33. I memorize important facts to understand math better.	3.17	0.54	High
Engagement in Developing Mathematical Skills as a Whole	**3.05**	**0.35**	**High**

Legend: (3.26 – 4.00)-Very High; (2.51 – 3.25)-High; (1.76 – 2.50)-Low; (1.00 – 1.75)-Very Low

Table 2 presents the respondents' level of engagement in developing mathematical skills across three dimensions: behavioral, emotional, and cognitive engagement. The findings indicate an overall mean of 3.05 (SD = 0.35), interpreted as High, suggesting that the freshmen Marine Engineering students were generally engaged in their mathematics learning. This level of engagement reflects their active participation in classroom activities, positive involvement in learning experiences, and use of various cognitive strategies when dealing with mathematical tasks. Although the three dimensions were generally rated high, differences were observed in the extent to which students demonstrated behavioral, emotional, and cognitive engagement.

In terms of behavioral engagement, the respondents obtained an overall mean of 3.04, interpreted as High. This indicates that students generally participated in mathematics-related activities, followed classroom expectations, and exerted effort in completing academic tasks. The highest ratings were observed in following teachers' instructions (M = 3.38, Very High) and seeking assistance from teachers or peers when needed (M =

3.33, Very High). These results suggest that the respondents were willing to follow guidance and seek support when encountering difficulties in mathematics. Their willingness to ask for assistance and cooperate with others may contribute to their ability to address challenging mathematical tasks.

The respondents also demonstrated persistence in completing their work and correcting mistakes, indicating a willingness to continue learning despite difficulties. However, the findings show that some students occasionally experienced difficulty sustaining their attention, as reflected in the ratings for becoming distracted (M = 2.79) and sometimes skipping difficult items (M = 2.74). Despite these challenges, the relatively low rating for giving up when faced with difficult problems (M = 2.42, Low) suggests that most students were generally willing to persevere rather than immediately abandon challenging mathematical tasks. Overall, the findings indicate that behavioral engagement was evident through students' participation, effort, help-seeking behavior, and persistence.

For emotional engagement, the respondents obtained a mean of 2.89, interpreted as High. This indicates that students generally demonstrated favorable emotional responses toward mathematics, although their feelings varied across different learning situations. The highest ratings were observed in students' interest in learning new mathematical concepts (M = 3.33, Very High) and their perception that mathematics can be enjoyable (M = 3.18, High). These findings suggest that students are capable of developing positive feelings toward mathematics, particularly when they encounter new concepts or engage in challenging but meaningful problem-solving activities.

However, comparatively lower ratings were obtained for statements related to disliking mathematics classes (M = 2.23, Low) and experiencing boredom during mathematics lessons (M = 2.45, Low). Although these indicators were interpreted as low, their presence suggests that some students may still experience less favorable emotions during particular learning situations. This may indicate that students' emotional engagement is influenced by the nature of the activity, the manner in which lessons are delivered, and their individual experiences with mathematical tasks. Providing varied, relevant, and interactive learning activities may therefore help sustain students' positive emotional involvement in mathematics.

Among the three dimensions, cognitive engagement obtained the highest overall mean of 3.19, interpreted as High. This finding indicates that the respondents were generally active in using thinking strategies, monitoring their understanding, and regulating their learning while studying mathematics. The highest ratings were observed in striving to obtain good grades (M = 3.42), checking their understanding by asking questions (M = 3.32), and developing personal strategies for solving mathematical problems (M = 3.27). These results suggest that students were not merely completing mathematical tasks but were also making conscious efforts to understand concepts, evaluate their progress, and identify effective ways of solving problems.

The respondents also reported using different approaches to solve mathematical problems and establishing personal learning goals. These behaviors reflect the presence of self-regulated learning and strategic thinking, which are important when dealing with mathematical tasks that require analysis and problem-solving. Nevertheless, the rating for becoming distracted while studying (M = 2.96) indicates that maintaining consistent concentration remains a challenge for some students. Thus, while the respondents demonstrated strong cognitive involvement, opportunities to further develop sustained attention and self-regulation may strengthen their engagement in mathematics.

Overall, the findings show that the respondents demonstrated a High level of engagement in developing mathematical skills, with an overall mean of 3.05 (SD = 0.35). Cognitive engagement obtained the highest mean (M = 3.19), followed by behavioral engagement (M = 3.04) and emotional engagement (M = 2.89). This pattern suggests that the students were particularly engaged in the thinking and problem-solving aspects of mathematics, while their behavioral participation was also consistently evident. Emotional engagement, although still high, was comparatively lower, suggesting that students' positive feelings toward mathematics may not always be as strong as their behavioral and cognitive involvement. Strengthening students' emotional connection to the subject through relevant, interactive, and meaningful learning experiences may help sustain their engagement across all three dimensions.

The overall finding is consistent with the view that student engagement represents the effort, emotional involvement, and cognitive investment that learners devote to the learning process. Joshi et al. (2022) emphasized that engagement is an important component of mathematics learning because students who

actively invest their effort, emotions, and thinking are better positioned to participate meaningfully in classroom activities. The high overall engagement observed in the present study reflects this multidimensional nature of student involvement, as the respondents demonstrated active participation, positive learning experiences, and the use of cognitive strategies in mathematics.

The findings on behavioral engagement are supported by Rejas and Tan (2023), who reported that students tend to demonstrate stronger behavioral involvement when learning environments are interactive, supportive, and conducive to collaboration. In the present study, behavioral engagement obtained a mean of 3.04, indicating that respondents were generally active in mathematics classes. Their willingness to follow instructions, seek assistance, exert effort, and persist with academic tasks reflects positive behavioral involvement. However, the occurrence of distraction and hesitation when dealing with difficult problems suggests that maintaining consistent behavioral engagement may still depend on the level of difficulty and demands of the learning task.

For emotional engagement, the findings are consistent with Aquino et al. (2024), who noted that students' emotional involvement in mathematics may be influenced by teaching strategies, classroom conditions, and the perceived relevance of learning activities. The present study recorded a mean of 2.89 for emotional engagement, which was interpreted as High. Students' strong interest in learning new concepts and their perception that mathematics can be enjoyable indicate generally positive emotional involvement. However, the presence of boredom and reduced interest among some respondents suggests that students may respond differently depending on the nature and presentation of mathematics lessons. This highlights the importance of creating learning experiences that are engaging, relevant, and responsive to students' interests and learning needs.

The highest level of engagement was observed in the cognitive dimension, with a mean of 3.19. This finding indicates that respondents actively employed strategies that required them to think, reflect, monitor their understanding, and explore different approaches to mathematical problems. Their tendency to establish learning goals, check their understanding, and develop personal problem-solving strategies demonstrates meaningful cognitive investment in learning. This result is consistent with Sharmin et al. (2023), who emphasized that cognitive engagement can be strengthened when students are encouraged to think critically, reflect on their learning, and apply multiple strategies in solving mathematical problems. The present findings similarly suggest that opportunities for independent thinking and strategic problem-solving may help students develop deeper and more sustained engagement with mathematics.

Level of Academic Performance in Mathematics

The table below reveals the level of academic performance of the freshmen marine engineering students in mathematics.

Table 3. Level of Academic Performance in Mathematics.

Level of Academic Performance in Mathematics	f	Mean	SD	Interpretation
Excellent	1	66.12	10.55	Satisfactory
Very Good	24			
Good	33			
Satisfactory	72			
Pass	52			
Failure	2			
Total	184			

Legend: (95-100)- Excellent; (80-94)- Very Good; (70-79)-Good; (60-69)-Satisfactory; (50-59)-Pass; (0-49)-Failure

Table 3 presents the academic performance in Mathematics of the 184 freshmen Marine Engineering students. The findings indicate an overall mean score of 66.12 and a standard deviation of 10.55, which corresponds to a Satisfactory level of academic performance. This suggests that, on average, the respondents demonstrated an acceptable level of competence in Mathematics, although their individual performance varied.

The frequency distribution further shows that the largest number of respondents, 72 students, were classified as Satisfactory, while 52 students obtained a Pass rating. Meanwhile, 33 students achieved a Good level, and 24 students were classified as Very Good. Only one student attained an Excellent level, whereas two students were classified under Failure. These results indicate that most of the respondents were able to meet the basic academic requirements in Mathematics, with the majority performing within the satisfactory to good range.

The standard deviation of 10.55 indicates a considerable variation in the respondents' academic performance. While a number of students demonstrated relatively strong mathematical achievement, others obtained lower results, suggesting differences in their level of mathematical understanding and mastery. The limited number of students in the Excellent category also suggests that only a small proportion of the respondents attained the highest level of performance.

Overall, the results show that the freshmen Marine Engineering students demonstrated a Satisfactory level of academic performance in Mathematics. Although most students were able to achieve passing or satisfactory results, the findings highlight the importance of providing appropriate instructional support and learning opportunities to further strengthen their mathematical knowledge, problem-solving abilities, and overall academic performance.

This finding is relevant to the study of Geron et al. (2024), who examined a mathematics development program involving 358 maritime students, including Bachelor of Science in Marine Engineering students. Their findings demonstrated substantial improvements in students' mathematics and problem-solving skills following the implementation of the Basic Gymathics program. The researchers emphasized the value of mathematics interventions specifically designed around the needs of maritime students, particularly in addressing difficulties in solving mathematical and word problems. This supports the present finding by suggesting that satisfactory mathematical performance can be further strengthened through learning activities that are contextualized to the maritime curriculum.

The present result is also consistent with the findings of Villegas et al. (2024), who investigated mathematics performance among 329 first-year college students in the Philippines. Their study found that most students demonstrated a very good level of mathematics performance, although only a small number reached the highest level of achievement. The researchers further found that problem-solving confidence, approach-avoidance style, and personal control were significant predictors of mathematics performance. These findings suggest that students' mathematical achievement may be influenced not only by their understanding of mathematical concepts but also by their confidence and willingness to persist when faced with challenging problems.

Similarly, Laroga et al. (2024) found that psychological and instructional factors were significantly associated with college students' performance in higher Mathematics. In particular, learning engagement emerged as the strongest predictor, followed by the learning environment and self-efficacy. Their study highlights the importance of considering students' engagement, confidence, and learning conditions when developing strategies to improve mathematical achievement. This provides further support for the present finding that students' satisfactory performance may be improved through approaches that address not only mathematical content but also the broader learning experiences of students.

Relationship between the Level of Digital Literacy of the students and their Academic Performance in Mathematics

The table below shows the relationship between the level of digital literacy of freshmen marine engineering students to their academic performance in Mathematics.

Table 4. Relationship between the Level of Digital Literacy of the students and their Academic Performance in Mathematics.

Variable	Correlation (r_s)	p-value	Decision for Ho	Interpretation
Digital Literacy vs. Academic Performance	0.08	0.28	Failed to Reject Ho	Not Significant

Table 4 presents the relationship between students' level of digital literacy and their academic performance in mathematics. The results show a computed correlation of 0.080 with a p-value of 0.280, which is higher than the 0.05 level of significance. Based on this outcome, the decision is failed to reject the null hypothesis, indicating that there is no significant relationship between digital literacy and students' academic performance in mathematics.

This finding implies that students' ability to use digital tools, navigate online platforms, or access digital learning resources does not necessarily correspond to higher performance in mathematics. In other words, being digitally skilled does not automatically guarantee better performance in the subject. This suggests that digital literacy, while valuable in modern learning environments, may not directly influence students' mastery of mathematical concepts or their academic outcomes in this context.

The result further suggests that mathematics performance may be more strongly influenced by other academic factors such as conceptual understanding, study habits, motivation, instructional quality, and cognitive ability. Although digital literacy can support access to learning materials and enhance engagement with resources, its impact on achievement may remain limited if it is not effectively integrated into teaching strategies and learning activities.

This outcome also reflects the idea that the benefits of digital literacy in education depend largely on how it is applied in the learning process. Simply possessing digital skills is not sufficient to improve academic performance unless these skills are purposefully used to support problem-solving, practice, and deeper understanding of mathematical concepts within structured instruction.

Overall, the findings indicate that there is no significant relationship between digital literacy and academic performance in mathematics among the respondents. This highlights the importance of not only developing students' digital competencies but also ensuring that these skills are meaningfully integrated into mathematics instruction to better support learning outcomes.

The findings of the present study are consistent with those reported by Li et al. (2025), who noted that the influence of digital literacy on academic achievement is often indirect and becomes more meaningful when supported by appropriate learning strategies and favorable educational conditions. The present findings suggest that having higher levels of digital literacy does not necessarily result in better academic performance in mathematics. This indicates that digital competence alone may not be sufficient to improve subject-specific achievement and must be complemented by effective learning strategies and supportive instructional practices.

Holm (2024) emphasized that digital literacy can contribute to improved learning outcomes in certain contexts, particularly in online learning environments, but its effectiveness depends largely on how students use these skills in structured academic activities. The findings of the present study further suggest that students' ability to use digital tools, access online learning platforms, and locate digital resources does not automatically lead to better understanding or performance in mathematics. Although digital literacy is an important 21st-century competency, its influence on academic achievement appears to depend on how effectively it is incorporated into teaching strategies and learning activities. Thus, digital skills may serve primarily as supportive competencies that enhance learning rather than as direct predictors of mathematics performance.

Moreover, Chen (2025) supported this perspective by emphasizing that academic success is more closely associated with cognitive engagement and self-regulated learning than with digital literacy alone. The absence of a significant relationship in the present study suggests that other academic and cognitive factors may have a

stronger influence on students' mathematics performance. These factors may include conceptual understanding, problem-solving skills, motivation, and effective self-regulated learning strategies. Thus, although students may possess adequate digital skills, these competencies may not necessarily result in higher academic achievement when they are not supported by strong foundational knowledge and productive learning habits.

In addition, Cornillez (2024) similarly reported that digital literacy does not strongly predict mathematics performance when it is not supported by guided instruction and meaningful engagement in learning activities. The findings of the present study further emphasize that the educational benefits of digital literacy depend largely on how effectively digital skills are applied within the learning process. When digital tools are not purposefully integrated into instructional strategies, their potential to support mathematical understanding may be limited. Therefore, having digital skills alone may not be sufficient to improve academic achievement unless these skills are intentionally applied to problem-solving, concept development, and other meaningful mathematical tasks.

Overall, the findings indicate that there is no significant relationship between digital literacy and academic performance in mathematics among the respondents. This suggests that although digital literacy is an important competency in modern education, it should not be considered a direct or independent determinant of academic achievement. Rather, its potential benefits are more likely to be realized when combined with effective teaching strategies, active cognitive engagement, and well-structured learning experiences that directly promote mathematical understanding. This finding is consistent with Colanggo and Ucang (2025), who emphasized the importance of integrating digital skills with appropriate pedagogical practices and meaningful learning activities to support students' academic development.

Relationship between the Level of Engagement of the students and their Academic Performance in Mathematics

The table below shows the relationship between the level of engagement of freshmen marine engineering students to their Academic Performance in Mathematics.

Table 5. Relationship between the Level of Engagement and Academic Performance in Mathematics of the students.

Variable	Correlation (r_s)	p-value	Decision for Ho	Interpretation
Engagement vs. Academic Performance	-0.078	0.296	Failed to Reject Ho	Not Significant

Table 5 presents the relationship between students' level of engagement in developing mathematical skills and their academic performance in mathematics. The results show a computed correlation of -0.078 with a p-value of 0.296, which is higher than the 0.05 level of significance. Consequently, the decision is to fail to reject the null hypothesis, indicating that there is no statistically significant relationship between students' engagement and their academic performance in mathematics.

This result suggests that students' level of engagement, whether behavioral, emotional, or cognitive, does not necessarily correspond to higher achievement in mathematics. While engagement is widely recognized as an important component of learning, the findings imply that being actively involved in class activities or showing interest in mathematics does not automatically lead to improved academic performance. This highlights the idea that engagement alone may not be sufficient to produce measurable gains in mathematics achievement.

The finding further implies that academic performance in mathematics may be shaped more strongly by other factors such as conceptual understanding, mastery of skills, study habits, instructional quality, and the ability to apply learned concepts in assessments. Even if students demonstrate high levels of engagement, their performance may remain unchanged if they lack deep understanding or adequate practice in solving mathematical problems. This reflects the complex nature of mathematics learning, where multiple variables

interact to influence achievement. Overall, the results indicate that there is no significant relationship between students' engagement and their academic performance in mathematics. This suggests that while engagement is an essential part of the learning process, it must be supported by effective teaching strategies and strong conceptual development to translate into improved academic outcomes.

The findings of the present study are consistent with Li et al. (2025), who emphasized that students' academic achievement is influenced by the interaction of multiple factors rather than by engagement alone. The results suggest that student engagement, by itself, may not be sufficient to directly affect academic performance. Instead, students' achievement is likely influenced by a combination of academic abilities, cognitive processes, learning strategies, and other factors that shape their overall learning experience.

Holm (2024) similarly emphasized that the positive effects of student engagement are more evident when supported by appropriate learning strategies and favorable learning conditions. The findings of the present study suggest that although students may demonstrate varying levels of behavioral, emotional, and cognitive engagement, these forms of engagement do not necessarily translate into higher mathematics performance. Participation in class discussions, interest in lessons, and effort in completing academic tasks may contribute to the learning process, but they do not automatically result in improved academic outcomes. This indicates that student engagement may function primarily as a supporting factor rather than a direct predictor of achievement, particularly when it is not accompanied by sufficient conceptual understanding and effective learning strategies.

Furthermore, consistent with Chen (2025), the findings reflect the complexity of mathematics learning, in which academic achievement is influenced by students' cognitive readiness and the quality of instructional conditions rather than by engagement alone. The results suggest that mathematics performance may be more strongly affected by factors such as mastery of mathematical concepts, problem-solving skills, and self-regulated learning practices. Thus, even highly engaged students may not necessarily achieve better performance when they lack adequate conceptual understanding or effective and structured study habits.

Overall, the findings are consistent with Colanggo and Ucang (2025), who emphasized the importance of combining student engagement with effective instructional practices to support improved academic outcomes in mathematics. The results indicate that there is no significant relationship between students' level of engagement and their academic performance in mathematics. This suggests that while engagement plays an important role in the learning process, it may not be sufficient by itself to enhance academic achievement. For engagement to contribute more effectively to learning, it should be supported by appropriate teaching strategies, guided practice, and meaningful opportunities for students to apply and strengthen their understanding of mathematical concepts.

CONCLUSION

Based on the findings of the study, it can be concluded that the students generally possess a high level of digital literacy and are capable of using digital tools for learning, communication, information searching, and other academic purposes. They also demonstrate awareness of responsible and safe technology use, indicating that they are generally prepared to meet the digital demands of their studies. In terms of engagement in developing mathematical skills, the students show stronger involvement in cognitive and behavioral activities, particularly in applying learning strategies, thinking critically, and solving mathematical problems. However, their emotional engagement with mathematics is comparatively lower, suggesting the need for learning experiences that can further develop their interest, enjoyment, and positive attitudes toward the subject. The students' academic performance in mathematics was generally satisfactory, indicating that they were able to meet the basic academic requirements, although further guidance and support are needed to help them strengthen their mathematical skills and achieve higher levels of performance. Finally, the findings suggest that having strong digital literacy skills or being highly engaged in mathematics does not necessarily guarantee better academic performance. This implies that students' achievement in mathematics may depend on several interacting factors, such as their prior knowledge, learning strategies, motivation, instructional experiences, and other academic and personal circumstances.

REFERENCES

1. Avinç, E., & Doğan, F. (2024). Digital literacy scale: Validity and reliability study with the Rasch model. *Education and Information Technologies, 29*, 22895–22941. https://doi.org/10.1007/s10639-024-12662-7
2. Aquino, R. M., Calantas, E. J., & Buen, M. T. (2024). Understanding STEM learners: Engagement and success in mathematics. *Antorcha, 10*(1).
3. Creswell, J. W., & Creswell, J. D. (2022). *Research design: Qualitative, quantitative, and mixed methods approaches* (6th ed.). SAGE Publications.
4. Flores, S. L., Tamban, V. E., Lacuarin, N. M., Bando, M. M., & Cortezano, G. P. (2021). Students' engagement and their performances in mathematics. *Paripex Indian Journal of Research, 10*(4), 164–167. https://doi.org/10.36106/paripex/7211471
5. Geron, G., Gonzales, A., & Castillo, A. (2024). Effectiveness of basic gymathics as a math development program in the maritime curriculum. *International Journal of Research Studies in Education, 13*(6), 119–134. https://doi.org/10.5861/ijrse.2024.24053
6. Getenet, S., Cantle, R., Redmond, P., & Albion, P. (2024). Students' digital technology attitude, literacy and self-efficacy and their effect on online learning engagement. *International Journal of Educational Technology in Higher Education, 21*, Article 3. https://doi.org/10.1186/s41239-023-00437-y
7. Holm, P. (2024). Impact of digital literacy on academic achievement: Evidence from an online anatomy and physiology course. *E-Learning and Digital Media, 22*(2), 139–155. https://doi.org/10.1177/20427530241232489
8. Ibrahim, R. K., & Aldawsari, A. N. (2023). Relationship between digital capabilities and academic performance: The mediating effect of self-efficacy. *BMC Nursing, 22*, Article 434. https://doi.org/10.1186/s12912-023-01593-2
9. Joshi, D. R., Adhikari, K. P., Khanal, B., Khadka, J., & Belbase, S. (2022). Behavioral, cognitive, emotional and social engagement in mathematics learning during COVID-19 pandemic. *PLOS ONE, 17*(11), Article e0278052. https://doi.org/10.1371/journal.pone.0278052
10. Kara, M. (2021). Revisiting online learner engagement: Exploring the role of learner characteristics in an emergency period. *Journal of Research on Technology in Education, 54*(Suppl. 1), S236–S252. https://doi.org/10.1080/15391523.2021.1891997
11. Koh, L. Y., Li, K., Chia, Y. Y., & Yuen, K. F. (2023). Quality design for maritime studies programme in the digital era. *Maritime Policy & Management, 50*(3), 301–320. https://doi.org/10.1080/03088839.2021.1983220
12. Kuzminykh, I., Ghita, B., & Xiao, H. (2021). The relationship between student engagement and academic performance in online education. In *Proceedings of the 5th International Conference on E-Society, E-Learning and E-Technologies* (pp. 97–101). Association for Computing Machinery. https://doi.org/10.1145/3485768.3485796
13. Laroga, J. F., Camallere, C., Pagador, M. J., Barino, R. J., Mameng, K., Go, M., & Goles, N. (2024). Predictive model for college students' performance in higher mathematics. *Social Sciences & Humanities Open, 10*, 101134. https://doi.org/10.1016/j.ssaho.2024.101134
14. Li, F., Cheng, L., Wang, X., Shen, L., Ma, Y., & Islam, A. Y. M. A. (2025). The causal relationship between digital literacy and students' academic achievement: A meta-analysis. *Humanities and Social Sciences Communications, 12*, Article 108. https://doi.org/10.1057/s41599-025-04399-6
15. Lin, J. (2024). Has the digitization of education improved students' academic performance? A meta-analysis based on 21 experimental and quasi-experimental studies. *Journal of Social Systems and Policy Analysis, 1*(3), 89–99. https://doi.org/10.62762/JSSPA.2024.199620
16. Ravikumar, T., Raghunandan, G., Benedict, J. D., Seshadri, V., & Abhinandan, N. (2024). Relationship between digital learning, digital literacy and academic performance of higher education students: Moderated mediation role of critical thinking. *International Research Journal of Multidisciplinary Scope, 5*(3), 39–50. https://doi.org/10.47857/irjms.2024.v05i03.01054
17. Rejas, M. T., & Tan, D. A. (2023). Student academic performance and engagement in mathematics through flipped classroom in a synchronous learning environment. *American Journal of Educational Research, 11*(3), 165–174. https://doi.org/10.12691/education-11-3-10

18. Sharmin, S., Bhattacharjee, A., Sadik, R., Patre, P. R., Koiler, R., Getchell, N., & Barmaki, R. L. (2023). Insights into cognitive engagement: Comparing the effectiveness of game-based and video-based learning. *arXiv*. https://doi.org/10.48550/arXiv.2307.13637
19. Villegas, C. T., Estopa, M. M. J. S., Lagat, R. A., & Miranda, A. T. (2024). Problem-solving appraisals as predictors of mathematics performance among college students. *Asian Journal of Education and Social Studies, 50*(10), 362–372. https://doi.org/10.9734/ajess/2024/v50i101626