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Academic Grit, Interest, and Technological Attitudes as Predictors of Learners' Performance

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Abstract. As learning environments continue to evolve, it is essential to understand the psychosocial and technological factors that influence learners' academic success. This study examined the predictive roles of academic grit, academic interest, and technological attitudes on learners' performance in General Mathematics among 104 randomly selected Grade 11 STEM and ABM learners in a public school in Misamis Oriental. Using a descriptive-correlational design and both descriptive and inferential analyses, results revealed that learners demonstrated high levels of academic grit (M = 4.11, SD = 0.46) and positive technological attitudes (M = 3.98, SD = 0.53). In contrast, their academic interest was moderate (M = 3.42, SD = 0.51). Regression analysis revealed that academic grit ($\beta = 0.247$, $p = .005$) and technological attitude ($\beta = 0.220$, $p = .020$) were significant predictors of learners' mathematics performance, collectively explaining 9.8% of the variance (adjusted $R^2 = 0.098$). Conversely, academic interest did not significantly predict performance ($p > .05$). The findings suggest that perseverance and adaptability to digital tools contribute more strongly to academic achievement than interest alone. Hence, interventions that foster grit and promote purposeful technology integration may enhance learners' mathematical proficiency and overall academic resilience.

Keywords: Academic grit; Interest; Technological attitudes; Academic performance; Senior high school.

1.0 Introduction

Assessing and improving academic performance has become a global challenge, as it reflects educational quality and learner development. The pandemic has forced the shift to hybrid learning, making it crucial to study what makes learners successful in this new environment. Recent research indicates that non-cognitive variables, such as academic grit and interest, are substantially associated with motivation, perseverance, and learning success (Duckworth et al., 2019; Tang et al., 2021). Since digital tools are essential for learning across disciplines, learners' attitudes about technology have grown.

Despite these developments, public school learners struggle with technology-based education. Coristine et al. (2021) found that many learners struggle to use calculators and compasses, which hinders their learning in math and STEM. Socioeconomic inequality restricts access to resources in the Philippines, making this issue particularly concerning. In the 2018 PISA, over half of Filipino learners scored below the minimum in mathematics (OECD, 2019; Bernardo et al., 2022). Additionally, learners in Grades 6 and 10 achieved average mastery rates of 37.43% and 45.33% on the NAT (Masigan, 2021).

After two years of online and modular learning, learners in the ABM and STEM strands encountered challenges transitioning to hybrid learning at the respondent school. Many learners' learning abilities are hindered by their inability to use essential digital tools and programs, as well as by their lack of academic interest and confidence. In the "new normal" of education, these realities indicate that academic grit, academic interest, and technological attitudes may be essential predictors of learner performance.

Grit enables learners to persevere through technological challenges, while sustaining academic interest fuels motivation to explore and adapt to new digital learning environments. Together, these dispositions shape learners' technological attitudes- how confidently and purposefully they use digital tools to support their learning. Few empirical studies have assessed the combined predictive effect of technological attitudes, interest, and grit on learner performance in Philippine public secondary schools, particularly in hybrid learning environments. Thus, this study examined how senior high school learners' grit, interest, and technological attitudes explain their academic performance.

2.0 Methodology

2.1 Research Design

In this study, a descriptive–correlational research design was employed because it allows for both the description of learners' levels of academic grit, academic interest, and technological attitudes, and the determination of how these variables relate to their academic performance. This approach is appropriate for identifying the strength and direction of relationships among naturally occurring variables without manipulating them, which is essential in educational settings where ethical and practical constraints limit experimental control. It provides a means to quantify learners' behavioral tendencies and motivational dispositions, and to examine how these influence measurable academic outcomes. Moreover, the descriptive component offers a comprehensive profile of learners' psychological and technological readiness, while the correlational aspect reveals how these dimensions interact to explain variations in academic performance (Gamage et al., 2021). Thus, the design is tailored to capture both learners' current characteristics and their interconnected effects on performance.

2.2 Research Participants

A total of 104 Grade 11 learners from a single public institution in Misamis Oriental participated in the investigation. Stratified random sampling was implemented to ensure that both STEM and ABM strands were fairly represented. In this method, the population was stratified by strand membership, and participants were subsequently randomly selected in proportion to each group. This led to the identification of 104 learners as the representative sample. To meet the inclusion criteria, respondents must be enrolled in the ABM or STEM strand and be willing to participate during the study's academic year. Individuals who declined to participate or were absent during data collection were excluded.

2.3 Research Instrument

The survey questionnaire was the primary research tool in the study. The key factors of the research were analyzed using standardized scales in the questionnaire. The adapted tool for Learners' Attitude towards the Use of Mathematical Instrument (Aremu & Adeoluwa, 2022) evaluated technological attitudes, while the scales for Academic Grit (Clark & Malecki, 2019) and Academic Interest (Luo et al., 2019) evaluated academic motivation and perseverance. A standardized Grade 11 Mathematics Test was used to assess learners' academic performance. The research tool included standardized test items from the General Mathematics test. Likert scales were used to rate agreement. The five-point Academic Grit Scale, the four-point Academic Interest Scale, and the Attitude towards Mathematics scales were employed. Quantifying perceptions and attitudes via a Likert scale is beneficial in educational and social science research (Acock, 2020).

The adapted instruments were assessed for content validity by three experts. After refining the research tool, a pilot test was conducted with 30 Grade 11 respondents who were not included in the actual sample. The field testing ensured that the instrument's instructions, items, and scales were clear, culturally appropriate, and easily understood by the respondents. The reliability analysis yielded excellent internal consistency, with Cronbach's alphas of 0.980 for Academic Grit, 0.960 for Academic Interest, and 0.890 for Technological Attitude, indicating high reliability for all constructs. Results from the pilot test were used to revise the tool before administering it to the 104 randomly selected respondents across the ABM and STEM strands.

2.4 Data Gathering Procedure and Analysis

The researcher obtained permission from the Schools Division Superintendent of Misamis Oriental, the School Principal, and the Graduate School Dean of COC-PHINMA, Cagayan de Oro, before disseminating the survey questionnaire. The researcher collected data after approval. The 104 Grade 11 ABM and STEM learners were personally surveyed. Face-to-face management in school ensured clear instructions and helped learners with any questions they may have had. The entire process lasted for one week, allowing sufficient time for all respondents to participate without disrupting regular class schedules. Each questionnaire was retrieved immediately after completion to guarantee a 100% retrieval rate. After collection, the responses were carefully checked, tallied, summarized, and tabulated. The organized dataset was then subjected to appropriate statistical treatment and analysis.

This study employed descriptive and inferential statistics. Means and standard deviations were used to describe academic grit, interest, and technological attitude, respectively. Using inferential statistics to establish variable relationships. Multiple linear regression was used to assess the predictive value of academic grit, academic interest, and technology attitudes on learners' academic achievement, specifically their first-semester mathematics grade.

2.5 Ethical Considerations

To protect the participants' rights and welfare, the study strictly adhered to established ethical guidelines. Grade 11 learners were informed of the study's objectives, procedures, and the intended use of the data before providing their voluntary and informed consent. They were assured that participation was entirely voluntary and that they could withdraw from the study at any stage without any negative consequences. To maintain anonymity, respondents were instructed not to include personal identifiers in their responses. Numerical codes were used throughout data analysis and reporting to maintain traceability. After data collection, all responses were stored in password-protected, encrypted digital files accessible only to the researcher. Confidentiality was upheld by ensuring that individual data could not be linked to any participant. Upon completion of the study, all digital files were securely deleted, and any printed materials were shredded to ensure proper disposal of data. The study underwent ethics review and received approval from the institutional ethics committee, affirming compliance with the standards of responsible and ethical research conduct.

3.0 Results and Discussion

3.1 The Learners' Academic Grit, Interest, And Technological Attitudes in Math

Table 1 summarizes respondents' academic grit. Learner grit is high, as indicated by a mean score of 4.11 (SD = 0.62). This shows their endurance in studying a cognitively challenging subject. These results indicate that learners are committed to learning math despite its challenges. Hence, the respondents demonstrate perseverance and industriousness, enabling them to continue, overcome failures, and remain focused on their academic goals.

Table 1. *Summary of Respondents' Level on Academic Grit*

Academic Grit	Mean	SD	Verbal Desc.	Interpretation
Perseverance	4.13	0.62	High	Most likely Gritty
Industriousness	4.09	0.67	High	Most likely Gritty
Overall	**4. 11**	**0.62**	**High**	**Most likely Gritty**

Note: 4.50-5.00 Very High/Extremely Gritty; 3.50-4.49 High/Most Likely Gritty; 2.50-3:49 Average/Somewhat Gritty;1.50-2.49 Poor/Not Much Gritty; 1.00-1.49 Very Poor/Not at All Gritty

Clark and Malecki (2019) define academic grit as the concentration, resilience, and determination to meet long-term educational goals that align with personal ambitions. Perseverance was Most Likely Gritty with a mean of 4.13 (SD = 0.62). This implies that learners are focused on their long-term goals, despite setbacks. By creating challenging yet achievable learning assignments that encourage persistence, teachers can foster this valuable trait. These initiatives build resilience and help learners navigate challenging academic tasks. Recognition of perseverance can also help create assessments that prioritize prolonged effort and learning progress over outcomes. According to Karlen et al. (2019), the dispositional trait of academic grit motivates individuals to persist in their academic endeavors.

Industriousness was High but had the lowest mean of 4.09 (SD = 0.67). This implies that learners are committed, but the lower rating suggests areas for growth. Task relevance, support, and time management can affect industriousness. Addressing these may boost learner involvement and effort. Zygmunt et al. (2020) conducted a

meta-analysis and found that learners with higher grit tend to succeed and overcome hurdles. Accordingly, academic performance necessitates dedication and perseverance.

This research found that students had intense academic grit, supporting Duckworth et al. (2019), who stressed the importance of persistence and enthusiasm for long-term objectives. Datu et al. (2022) demonstrated that grit positively predicts Filipino students' involvement and academic motivation, emphasizing the relevance of perseverance in local circumstances. Credé et al. (2017) found that grit's predictive value for performance decreases when conscientiousness and drive are controlled for. These mixed results suggest that although grit is crucial, contextual factors such as instructional design, student motivation, and technology support that enhance endurance and effort in challenging subjects like mathematics may influence its impact.

Table 2 shows respondents' academic interest in emotion, value, knowledge, and engagement. Interest is moderate at 2.78 (SD = 0.34). Learners demonstrate moderate emotional engagement, identify value, self-assess their knowledge, and express readiness to engage in extended learning activities, indicating a balanced interest in mathematics. The low standard deviation suggests that respondents are consistent in their responses. Research demonstrates that supportive learning environments enhance learners' interest in and engagement with math in various ways.

Table 2. *Summary of the Respondents' Level of Academic Interest*

Academic Interest	Mean	SD	Interpretation
Emotion	2.72	0.51	Moderately Interested
Value	3.18	0.41	Moderately Interested
Knowledge	2.34	0.41	Partially Interested
Engagement	2.88	0.53	Moderately Interested
Overall	**2.78**	**0.34**	**Moderately Interested**

Note: 3.26-4.00 SA/Highly Interested; 2.51-3.25 A/Moderately Interested; 1.76-2.50 D/Partially Interested; 1.00-1.75 SD/Not Interested

Academic interest and self-efficacy lead to intrinsic motivation and effective learning practices, as noted by Shin and Bolkan (2021). Scholarly interest significantly impacts school-based learning and achievement, according to Schiefele et al. (2022). Liu et al. (2018) found that teenagers value math but are not emotionally invested in it. According to Cai et al. (2023), interest in mathematics is a complex concept that involves emotional attachment, perceived worth, knowledge, and willingness to commit effort, which explains the findings of this study.

The most gritty quality was perceived value, with an average of 3.18 (SD = 0.41). This suggests that learners value mathematics for its role in academic advancement and professional preparedness, particularly in analytical and problem-solving fields. Teachers can utilize real-world applications and project-based learning to enhance this perception. Shaffer and Stern (2021) stated that practical examples excite learners, while Rahman (2016) suggested that project-based learning can increase appreciation for the utility of mathematics.

Conversely, the lowest mean, 2.34 (SD = 0.41), indicated Partially Interested in self-assessed knowledge. Learners' confidence and knowledge in mathematics may be low due to inadequate comprehension of basic ideas or negative prior experiences. Such ideas may cause learners to avoid problems or seek support, reducing performance. Frenzel (2020) states that negative experiences and rote learning can reduce confidence. Diagnostic tests and targeted remediation (Van de Walle et al., 2021), as well as a supportive classroom that normalizes mistakes as learning opportunities (Lipponen et al., 2020), can help children gain mathematical confidence and a solid foundation.

Scheifele (2022) and Shin and Bolkan (2021) found that instructional relevance and perceived competence moderate students' academic interest in mathematics. These findings contradict those of Lau and Lee (2023), who reported that students with greater emotional involvement and interest in mathematics performed better. The findings indicate that although learners value mathematics, their interest in the subject is situational, possibly influenced by their level of technological confidence and prior learning experiences. Situational curiosity may become academic motivation by strengthening the relationship between interest, grit, and technology.

Table 3 shows respondents' technological attitude and perceived applicability in General Mathematics. The combined measure scores 2.68 (SD = 0.32), indicating a positive result. Learner attitudes about technology in mathematics learning were generally positive. Despite their lack of confidence and familiarity with technology, they appreciate its value and potential to help learning. A low standard deviation is a consistent trend among

responders, underscoring the need to promote effective technology integration in mathematics education. Cai and Hwang (2019) emphasized the importance of a theoretical framework that integrates technology into mathematics instruction to foster problem-solving and conceptual understanding in the digital age. Rosli et al. (2019) noted that skilled teachers utilize technology to enhance understanding, engagement, and mathematical skills.

Table 3. *Summary of the Respondents' Level of Technological Attitude*

Technological Attitude	Mean	SD	Interpretation
Awareness	2.47	0.41	Negative
Usefulness	2.88	0.38	Positive
Overall	**2.68**	**0.32**	**Positive**

Note: 3.26-4.00 SA/Very Positive; 2.51-3.25 A/Positive; 1.76-2.50 D/Negative; 1.00-1.75 SD/Very Negative

With a mean score of 2.88 (SD = 0.38), learners assessed technology, particularly mathematical tools, as helpful in their learning. Technology promotes involvement and problem-solving in mathematics (Yildiz, 2021). According to Van De Walle et al. (2020), interactive and visual tools make abstract concepts easier to understand. Yildiz (2021) advises that technology should support the development of mathematical skills. In contrast, negative awareness yielded a score of 2.47 (SD = 0.41). Some learners lack confidence or expertise in math technology. They may not understand how such tools can be applied to problem-solving. If its practical benefits are not made evident, learners may consider technology as useless. To overcome this, Reinhold et al. (2021) suggested targeted teacher training in integrating technology. If teachers lack experience, pupils may not fully appreciate the potential of technology in math. The results suggest that while learners recognize the value of technology in math, their limited awareness hinders their full utilization of it. To enhance technological awareness and math instruction, teachers must undergo professional development and integrate curricula.

3.2 The Learners' Performance in Mathematics During the First Semester

The learners' math scores are shown in Table 4. Most learners, 48 (46.2%), score 85–89, which is Very Satisfactory. Senior high school learners may perform well in math due to their perseverance, consistent study habits, and excellent educational support. Duckworth et al. (2019) define academic grit as persistence and dedication to long-term goals. Learners with tenacity persevere until they grasp subjects, ensuring academic success. Developing grit in learners is key to maintaining satisfactory to very satisfactory performance.

Table 4. *Distribution of Respondents' Level of Performance in Mathematics*

Scale	Frequency	%	Performance Level
90-100	22	2	Outstanding
85-89	48	46	Very Satisfactory
80-84	34	32	Satisfactory
75-79	0	0	Unsatisfactory
Below- 75	0	0	Did Not Meet Expectation
Total	**104**	**100.0**	

Note: Overall Mean (SD) = 86.21 (3.63) Very Satisfactory
O - Outstanding, VS- Very Satisfactory, S- Satisfactory, U- Unsatisfactory, DNME - Did Not Meet Expectation

Technology also appears to be a supportive factor in learner performance. Learners' positive attitudes toward using technological tools, such as computers, calculators, and educational applications, help make mathematics more engaging and accessible. As Triplett (2023) noted, technology integration in STEM subjects increases motivation, engagement, and comprehension. Similarly, Wu (2023) highlighted that technology can deepen understanding through interactive visualizations and collaborative learning. Thus, the synergy of academic grit and technology-enhanced learning creates a strong foundation for success in mathematics.

The fewest learners, 22 (21.2%), scored 90–100, which was Outstanding. While laudable, the limited percentage of learners reaching this highest performance level suggests room for improvement. It may indicate barriers such as limited opportunities for higher-order problem-solving, gaps in motivation, or a lack of enrichment strategies to push learners toward excellence. To address this, schools could implement more challenging mathematical tasks, promote real-world applications, and foster growth mindsets that encourage learners to aim for top-tier performance.

The statistics indicate that although most learners are doing well in General Mathematics, programs that promote academic grit, higher-order thinking, and technological integration require improvement. Perseverance provides drive, higher-order thinking enhances comprehension, and digital competence allows knowledge application.

This supports Duckworth et al. (2019) and Brookhart and Chen (2019), who noted that grit promotes long-term success and higher-order thinking predicts academic transfer. With organized pedagogical design and digital preparedness, technology integration improves engagement and analytical thinking, according to Cai and Hwang (2019) and Hwang et al. (2020). In the Philippines, Datu, Yuen, and Chen (2022) discovered that grit, self-efficacy, and learning techniques predict academic performance. These studies indicate that enhancing persistence, cognitive depth, and technology usage in mathematics teaching may improve student performance and adaptability in a changing educational environment.

3.3 Predictive Results of Academic Grit, Academic Interest, and Technological Attitudes on the Learners' Performance

The regression analysis in Table 5 predicts learner performance using academic grit (Model 1). Since the p-value is less than 0.05, academic grit is a significant predictor of learner performance, thereby rejecting the null hypothesis.

Table 5. *Result of the Test on Predictive Effect Through Regression Analysis Predicting the Learners' Performance by Academic Grit (Model 1)*

	Coefficients [a]				
	Unstandardized Coefficients				
Model 1	**B**	**S.E.**	**t-value**	**p-value**	**Interpretation**
(Constant)	79.566	2.327	34.190***	.000	Significant
Academic Grit	1.617	.560	2.887**	.005	Significant

Note: [a] Dependent Variable: Learner's Performance ANOVA for Regression=8.336, p<.05
*** p≤001 **p≤01 R^2 = .076

The constant value of 79.566 represents the intercept of the regression line, which means that when academic grit is zero, the predicted learner's performance remains at 79.566. The constant's t-value of 34.190 with a p-value of .000 indicates that it is significantly different from zero. Meanwhile, the coefficient for academic grit is 1.617, suggesting that for every one-unit increase in academic grit, learners' performance increases by 1.617 units. This result, supported by a t-value of 2.887 and a significant p-value of .005, confirms that academic grit has a significant positive effect on learners' performance.

The model's R^2 value of 0.076 indicates that academic grit accounts for approximately 7.6% of the variance in learners' performance. While this percentage is modest, it highlights that grit is an important contributor but not the sole factor influencing academic outcomes. In other words, grit plays a meaningful role, but other factors—such as academic interest, technological attitudes, and supportive learning environments—likely account for the remaining variance. These data suggest that academic perseverance and determination positively impact performance. Learner success is higher when they persevere. Educators and governments should acknowledge that grit alone does not explain academic performance and that such performance requires accompanying initiatives.

This result is consistent with the findings of Datu et al. (2020), who demonstrated that learners with higher grit levels exhibit greater engagement, better academic performance, and lower distress. Similarly, Muenks et al. (2020) found that grit, particularly perseverance of effort, positively predicts academic achievement and is partly mediated by behavioral engagement. According to Bernardo et al. (2022), grit, perseverance, and extracurricular pursuits significantly shape academic achievement. Therefore, cultivating resilience alongside fostering interest in mathematics can help more learners excel at the highest level. These studies reinforce the current findings, suggesting that grit not only contributes to performance but also enhances engagement and resilience in the learning process.

Table 6 shows the regression analysis predicting learners' performance using academic interest as the predictor variable (Model 2). Results reveal that academic interest is not a significant predictor of learners' performance. Since the p-value exceeds the 0.05 level, the null hypothesis is accepted. The regression line intercept is 84.925, which predicts learner performance when academic interest is 0. The constant's t-value is 28.430, and the p-value is.000 indicates a significant intercept. For every one-unit increase in academic interest, learner performance increases by 0.463 units, according to the coefficient for academic interest. The 0.434 t-value and.665 p-value imply that this effect is not significant. Thus, while academic curiosity exhibits a minor upward trend, it does not significantly impact learner performance in this model. The R-squared (R^2) score of 0.002 suggests that academic interest accounts for only 0.2% of the variance in learner performance. Academic curiosity does not significantly

predict performance, as it has low explanatory power. Instead, it emphasizes the need to uncover additional predictive factors, such as study habits, the learning environment, and external support.

Table 6: *Result of the Test on Predictive Effect Through Regression Analysis Predicting the Learners' Performance by Academic Interest (Model 2)*

	Coefficients [a]				
	Unstandardized Coefficients				
Model 2	B	S.E.	**t-value**	**p-value**	**Interpretation**
(Constant)	84.925	2.987	28.430***	.000	Significant
Academic Interest	.463	1.067	.434	.665	Not significant

Note: [a] Dependent Variable: Learner's Performance ANOVA for Regression=.188, p>.05

*** p≤.001 R^2 = .002

This study challenges the idea that academic interest improves learner performance. Interest may drive and engage, but it does not affect performance. De Vries et al. (2024) claim learner performance. Best described by integrating involvement, motivation, and study habits. Thompson and Fernandez (2020) suggest that psychological well-being and learning environments, rather than curiosity, have a greater influence on academic performance. Thus, academic interest can boost learner motivation and classroom engagement, but this study suggests that it does not predict academic performance. A comprehensive strategy that integrates cognitive, emotional, and behavioral components may improve learner results.

Table 7: *Result of the Test on Predictive Effect Through Regression Analysis Predicting the Learners' Performance by Technological Attitude (Model 3)*

	Coefficients [a]				
	Unstandardized Coefficients				
Model 3	B	S.E.	**t-value**	**p-value**	**Interpretation**
(Constant)	79.339	2.966	26.749***	.000	Significant
Technological Attitude	2.565	1.100	2.333*	.022	Significant

Note: [a] Dependent Variable: Learner's Performance ANOVA for Regression=5.443, p<.05

*** p≤.001 *p≤.05 R^2 = .051

Technological attitude regression analysis predicts learners' performance (Model 3), as seen in Table 7. The findings show that technological attitude predicts learner performance. A p-value below 0.05 rejects the null hypothesis. The regression line's intercept, 79.339, predicts learners' performance when the technological attitude is 0. Highly significant (t = 26.749, p =.000), the constant term is statistically distinct from zero. The coefficient for technological attitude is 2.565, meaning that the learner's performance will increase by 2.565 units for every unit increase in attitude. A positive technological attitude positively affects learner performance (t = 2.333, p = .022).

The R-squared value (R^2 = 0.051) indicates that the technology mindset accounts for 5.1% of the variance in learners' performance. Although technological attitude accounts for only a small percentage of the variance, this finding is relevant because it shows that learners with more positive attitudes toward technology perform better academically. In today's digital learning environments, favorable attitudes toward technology can contribute to academic success. While technological attitude is a substantial predictor of performance, the low R^2 suggests that other factors also affect academic performance. Thus, while encouraging positive technological attitudes is essential, educational stakeholders should also address study habits, motivation, socio-emotional support, and learning settings. Although technological attitude predicts performance, the low R^2 value implies that other factors also affect academic success. Promoting positive technological attitudes is essential; however, educational stakeholders should also consider study habits, motivation, socio-emotional support, and learning environments.

Table 8 shows a regression analysis of academic grit, academic interest, and technology attitude (Model 4) to predict learner performance. Academic grit and technological attitude predict learner performance, but academic interest does not. The null hypotheses are rejected because the p-values for grit and technical attitude are below 0.05. The regression line's intercept, 72.921, predicts learners' performance when all independent variables are set to 0. This constant is significant (t = 16.702, p =.000). Academic Grit coefficient (B = 1.601, t = 2.885, p =.005) implies that a one-unit increase in grit improves learner performance by 1.601 points. Each unit increase in Technological Attitude (B = 2.525, t = 2.365, p =.005) positively predicts performance by 2.525 points. These findings show that tenacity and technological attitude improve learner outcomes. Academic Interest (B = –0.019, t = –0.019, p = .985) is not statistically significant, indicating that it does not directly affect performance in this model. The Adjusted R^2 value of 0.098 suggests that academic grit and technological mindset explain 9.8% of the variance in learner performance. While low, its explanatory power highlights their importance and suggests that many other

variables are likely to influence performance.

Table 8: *Result of the Test on Predictive Effect Through Regression Analysis Predicting the Learners' Performance by Academic Grit, Academic Interest, and Technological Attitude (Model 4)*

	Coefficients [a]				
	Unstandardized Coefficients				
Model 4	B	S.E.	**t-value**	**p-value**	**Interpretation**
(Constant)	72.921	4.366	16.702***	.000	Significant
Academic Grit	1.601	.555	2.885**	.005	Significant
Academic Interest	-.019	1.018	-.019	.985	Not significant
Technological Attitude	2.525	1.067	2.365*	.020	Significant

Note: [a] Dependent Variable: Learner's Performance ANOVA for Regression=4.744, p<.05

*** p≤.001 **p≤.01 *p≤.05 Adjusted R^2 = .098

The findings indicate that academic grit—defined as perseverance and sustained effort in learning tasks—is a powerful predictor of performance, supporting programs that enhance resilience and goal commitment in learners. A favorable techno attitude shows learners' comfort with digital technologies, which is increasingly important in modern education. According to Taimalu and Luik (2019), technology-related attitudes, combined with pedagogical beliefs and self-efficacy, significantly influence the use of educational tools by instructors and learners. Academic curiosity is unimportant, challenging the idea that it drives accomplishment. This finding supports Wang and Lin's (2021) meta-analysis, which indicated that interest improves performance but also shapes interest. This suggests that interest may be a more effective predictor when combined with other characteristics, such as instructional techniques and self-efficacy.

The findings emphasize that fostering perseverance (also known as grit) and cultivating positive attitudes toward technology are crucial in enhancing learners' performance. At the same time, the relatively small proportion of explained variance suggests the need for further research that incorporates broader contextual and psychological variables, such as socioeconomic background, learning environment, and well-being. Holistic approaches provide a more comprehensive understanding of the factors that influence academic performance.

4.0 Conclusion

This study finds that academic grit and technological attitude are consistent and relevant predictors of math performance. Since grit is consistently essential, resilience and persistence should be basic educational achievements, not just auxiliary abilities. Tech-attitude emphasizes that learner achievement in math today depends on digital preparedness and good technology use. The findings imply that cognitive perseverance and digital adaptability complement each other. Students who persist through challenges are also more likely to explore and utilize digital tools that enhance their mathematical understanding. Strengthening these attributes can bridge performance gaps among learners with varying levels of access to and confidence in technology, ensuring equitable learning outcomes in hybrid and technology-driven settings.

These discoveries affect several areas. Growth mindsets, grit-building, and learning environments that normalize persistence through challenges should be promoted in schools. The findings suggest that policymakers should go beyond subject-specific expertise and combine resilience and computer literacy initiatives across grade levels. Teacher professional development programs that integrate digital technology and encourage perseverance are included.

The long-term consequences of attitudes toward grit and technology on STEM job preparedness and performance may be explored in future research. Intervention-based research evaluating grit-enhancing programs and technology-supported learning may also yield actionable findings for schools. These contributions demonstrate that perseverance and good digital dispositions are effective techniques for enhancing mathematics proficiency and are crucial investments in preparing learners for success in a technology-driven society.

5.0 Contributions of Authors

Author 1 was responsible for the conceptualization, data gathering, and data analysis, while Author 2 contributed to data analysis and interpretation and supervised data collection in accordance with ethical standards. Both authors collaborated closely throughout the research process to ensure accuracy, integrity, and adherence to methodological rigor.

6.0 Funding

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7.0 Conflict of Interests

Authors disclose no conflicts of interest related to research or findings.

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9.0 References

Acock, A. C. (2020). Data collection and analysis in sociology (5th ed.). Sage Publications. https://tinyurl.com/2amvzwmp

Aremu, B., & Adeoluwa, O. (2022). Assessing learners' learning attitude and academic performance through M-Learning during the COVID-19 pandemic. *Canadian Journal of Learning and Technology, 47*(3). https://doi.org/10.21432/cjlt28085

Bernardo, A., Cordel II, M., Lapinid, M. R., Teves, J. M., Yap, S., & Chua, U. (2022). Contrasting profiles of low-performing Mathematics students in public and private schools in the Philippines: Insights from machine learning. *Journal of Intelligence, 10*(3), 61. https://doi.org/10.3390/jintelligence10030061

Cai, J., Hwang, S., & Robison, V. (2019). Journal for research in Mathematics education: Practical guides for promoting and disseminating significant research in Mathematics education. ICME-13 Monographs, 425–442. https://doi.org/10.1007/978-3-030-15636-7_21

Clark, K. N., & Malecki, C. K. (2019). Academic grit scale: Psychometric properties and associations with achievement and life satisfaction. *Journal of School Psychology, 72*, 49–66. https://doi.org/10.1016/j.jsp.2018.12.001

Coristine, S., Russo, S., Fitzmorris, R., Beninato, P., & Rivolta, G. (2021). The importance of learner–teacher relationships. *Classroom Practice in 2021*. https://tinyurl.com/ysb76c63

Datu, J. A. D., Yuen, M., & Chen, G. (2017). Grit and determination: A review of literature with implications for theory and research. Journal of Psychologists and Counsellors in Schools, 27(2), 168-176. https://doi.org/10.1017/jgc.2016.2

de Vries, N., Meeter, M., & Huizinga, M. (2024). Does interest fit between learner and study program lead to better outcomes? A meta-analysis of vocational interest congruence as predictor for academic success. *Educational Research Review, 44*, 100619. https://doi.org/10.1016/j.edurev.2024.100619

Frenzel, A. C., Goetz, T., Lüdtke, O., Pekrun, R., & Sutton, R. E. (2009). Emotional transmission in the classroom: Exploring the relationship between teacher and learner enjoyment. *Journal of Educational Psychology, 101*(3), 705–716. https://doi.org/10.1037/a0014695

Karlen, Y., Suter, F., Hirt, C., & Merki, K. (2019). The role of implicit theories in learners' grit, achievement goals, intrinsic and extrinsic motivation, and achievement in the context of a long-term challenging task. *Learning and Individual Differences, 74*, 101757. https://doi.org/10.1016/j.lindif.2019.101757

Liu, R. D., Zhen, R., Ding, Y., Liu, Y., Wang, J., Jiang, R., & Xu, L. (2018). Teacher support and Math engagement: Roles of academic self-efficacy and positive emotions. *Educational Psychology, 38*(1), 3–16. https://doi.org/10.1080/01443410.2017.1359238

Luo, Z., Dang, Y., & Xu, W. (2019). Academic interest scale for adolescents: Development, validation, and measurement invariance with Chinese learners. *Frontiers in Psychology, 10*, 2301. https://doi.org/10.3389/fpsyg.2019.02301

Masigan, A. J. (2021, October 6). Our education crisis. Why and what next? (Part 1). *philstar.com*. https://tinyurl.com/34u6p2p9

Muenks, K., Wigfield, A., & Eccles, J. S. (2020). I can do this! The development and calibration of children's expectations for success and competence beliefs. *Developmental Review, 48*(2), 24–39. https://doi.org/10.1016/j.dr.2018.04.001

OECD. (2019). PISA 2018 results: What learners know and can do *(Vol. 1)*. OECD Publishing. https://doi.org/10.1787/5f07c754-en

Park, D., Tsukayama, E., Yu, A., & Duckworth, A. L. (2020). The development of grit and growth mindset during adolescence. *Journal of Experimental Child Psychology, 198*, 104889. https://doi.org/10.1016/j.jecp.2020.104889

Rahman, A., Zaid, N., Aris, B., Abdullah, Z., Mohamed, H., Van, H., & Meijden, D. (2016, October). Implementation strategy of project-based learning through flipped classroom method. In *2016 IEEE Conference on E-Learning, E-Management and E-Services (IC3e)* (pp. 1–5). IEEE. https://tinyurl.com/ms46c9dc

Reinhold, F., Strohmaier, A., Finger-Collazos, Z., & Reiss, K. (2021). Considering teachers' beliefs, motivation, and emotions regarding teaching Mathematics with digital tools: The effect of an in-service teacher training. *Front. Educ.* 6:723869. https://doi.org/10.3389/feduc.2021.723869

Rosli, M. S., Saleh, N. S., & Omar, M. F. (2020, April). Technology-assisted cognitive augmentation: An OLE prototype to nurture cognitive skills in Chemistry. In *AIP Conference Proceedings* (Vol. 2215, No. 1, p. 020021). AIP Publishing LLC. https://doi.org/10.1063/5.0000590

Shaffer, P., & Stern, J. (2021). Making Mathematics relevant for learners: The role of real-world applications. *International Journal of STEM Education, 8*(1), 1–12. https://doi.org/10.1186/s40594-021-00296-1

Schiefele, U., Streblow, L., & Retelsdorf, J. (2013). Dimensions of teacher interest and their relations to occupational well-being and instructional practices. *Journal for Educational Research Online, 5*(1), 7–37. https://tinyurl.com/yuvf6pxp

Shin, M., & Bolkan, S. (2021). Intellectually stimulating learners' intrinsic motivation: The mediating influence of learner engagement, self-efficacy, and learner academic support. *Communication Education, 70*(2), 146-164. https://doi.org/10.1080/03634523.2020.1828959

Tang, X., Wang, M. T., Guo, J., & Salmela-Aro, K. (2021). Building grit: The longitudinal pathways between mindset, self-regulation, and achievement in high school learners. *Journal of Youth and Adolescence, 50*(5), 973–985. https://doi.org/10.1007/s10964-019-00998-0

Taimalu, M., & Luik, P. (2019). The impact of beliefs and knowledge on the integration of information and communication technology into classroom practice. Computers & Education, 135, 20–32. https://doi.org/10.1016/j.tate.2018.12.012

Tariq, A., Mohyuddin, R., & Ismaeel, G. (2025). Building bridges to success: The role of teacher-learner relationships in academic achievement. *Review of Education, Administration & Law, 8*(1), 125–135. https://doi.org/10.47067/real.v8i1.411

Triplett, W. J. (2023). Impact of technology integration in STEM education. *Cybersecurity and Innovative Technology Journal, 1*(1), 16–22. https://doi.org/10.53889/citj.v1i1.295

Wu, X.-Y. (2023). Exploring the effects of digital technology on deep learning: A meta-analysis. *Education and Information Technologies, 29*(3). https://doi.org/10.1007/s10639-023-12307-1

Yildiz, B. (2021). The effects of technology-mediated flipped classroom on learners' Mathematics achievement and engagement. *Educational Technology Research and Development, 69*(6), 3219–3238. https://doi.org/10.1007/s11423-021-10008-4