Learners' Grit Scale, Personal Profile and Mathematics Performance: An Investigation on the Power of Perseverance

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Abstract

In the realm of educational research, the concept of "grit" has garnered significant attention as a potential predictor of academic success. This study explores the relationship between grit, personal profiles, and mathematics performance among Grade 11 students. The study employed purposive sampling, involving all the learners of the lead author. The participants comprised a diverse group of 133 Grade 11 students, including 27 STEM learners, 28 GAS learners, 40 caregiving learners, and 38 ABM learners. Data was gathered through a survey questionnaire administered to the participants, which included measures of grit and demographic information. The findings revealed that age and sex do not significantly influence the grit levels of learners. Additionally, the mean level of grit was found to be consistent across different learning strands. Importantly, the study determined that there is no significant relationship between grit levels and mathematics performance. These results suggest that while grit is an important trait, it does not vary significantly based on demographic factors such as age and sex, nor does it differ across various learning strands. The results indicate that grit alone does not appear to be a determining factor in learners' mathematics performance. This suggests that other variables may play a more critical role in influencing academic success in mathematics. The consistency of grit levels across different demographics and learning strands highlights the universal nature of this trait, but its lack of correlation with mathematics performance calls for further investigation into other contributing factors. Based on the findings, the study recommends focusing on individualized learning approaches, personalized support, encouragement and motivation, enhancing teaching strategies, and incorporating real-world applications. Additionally, providing professional development for educators, adopting innovative teaching methods, creating a supportive school culture, fostering a collaborative environment, and addressing mental health and well-being are suggested to improve academic outcomes.

Keywords: Mathematis performance; personal profile; girt

1. Introduction

1.1. Context and Rationale

In the realm of educational research, the concept of "grit" has garnered significant attention as a potential predictor of academic success. Defined as the perseverance and passion for long-term goals, grit is believed to play a crucial role in students' ability to overcome challenges and achieve high levels of performance, particularly in demanding subjects like mathematics. There is no documented study yet on the intricate relationship between students' grit and their academic outcomes in mathematics.

Mathematics, often perceived as a challenging subject, requires not only cognitive skills but also a high degree of perseverance and resilience. Previous research has highlighted the importance of non-cognitive factors, such as grit, in influencing students' academic performance. However, there remains a gap in understanding how grit interacts with various personal factors, such as age, sex, and educational strand, to

impact mathematics achievement. This study seeks to fill this gap by providing a comprehensive analysis of the interplay between these variables.

This study focused on exploring the learners' grit scale, personal profile (age, sex, and strand in school whether ABM, Caregiving, GAS, or ICT), and mathematics performance. By examining these factors, the research aims to shed light on the power of perseverance in academic achievement and provide valuable insights for educators and policymakers to enhance student outcomes in mathematics.

1.2. Related Literature

Several research papers provide valuable insights into learners' grit scale. They have highlighted the significance of grit, defined as perseverance and passion for long-term goals, in enhancing academic achievement (Wang et al., 2023; Abbas et al., 2023). Various scales have been developed to measure grit, such as the Grit Scale adapted from Duckworth's work (Babiera and Quirap (2024), the Domain-Specific Grammar Grit Questionnaire (DSGGQ) for English grammar learning (Pawlak et al., 2024), and the L2-Grit Scale in Turkish for language education (Uştuk and Erarslan, 2023). These scales assess learners' consistency of interest, perseverance of effort, and motivation levels, showcasing the importance of grit in educational settings. The research emphasizes the need to cultivate grit among learners to improve their engagement, academic performance, and overall success in their educational endeavors.

Personal profiles in the context of learning encompass various aspects such as age, gender, and learning strands. The concept of personal curriculum emphasizes the importance of understanding adults' learning pathways across their working lives, highlighting the continuity of educative experiences (Billett, 2023). Additionally, the idea of Personal Learning Environments (PLEs) shifts control from institutions to individuals, empowering learners to take charge of their learning and build a personalized digital ecosystem that extends beyond traditional boundaries (Castañeda et al., 2023). Furthermore, the use of personal profiling in learning networks aims to stimulate participation by tailoring learning experiences to individual needs and preferences (Brouns, 2007). These diverse perspectives underscore the significance of considering personal attributes like age and gender, as well as individualized learning strands, in creating effective and engaging learning environments that cater to learners' unique requirements and aspirations.

Mathematics performance is influenced by various factors such as attitudes, parental influence, self-efficacy, and study habits. Research indicates that attitude towards Mathematics is a significant predictor of performance, emphasizing the importance of fostering positive attitudes towards the subject (Apus and Quirap, 2024; Abalde, 2023). Additionally, mathematics anxiety has been identified as a prevalent issue affecting learners of different age groups, highlighting the need for strategies to alleviate anxiety and improve performance (Sun, 2023). Studies also show a correlation between mathematics performance and students' chosen Senior High School (SHS) track/strand, with different tracks showing varying levels of association with mathematics performance, underscoring the role of mathematics in students' decision-making processes for their educational paths (Baucas, 2024). Furthermore, the development of performance assessment tests, such as those focusing on maple application skills for matrix material, plays a crucial role in evaluating and enhancing students' mathematical skills (Ahmad, 2023).

1.3. Research Questions

This study aimed to determine the grit profile of grade 11 learners of Talangan Integrated National High School (TINHS), including their personal profile and mathematics performance.

Specifically, it sought answers on the following questions:

a. What is the profile of graade 11 learners of TINHS in terms of the following

i. age;
ii. sex;
iii. learning strand;

b. What is the mean level of Mathematics performance of grade 11 learners of TINHS?

c. What is the mean level of grit of the grade 11 learners of TINHS?

d. Is there a significant difference in the grit level of the grade 11 learners of TINHS when checked against age, sex and learning strand?

e. Does grit scale significantly correlates to the mathematics performance of grade 11 learners of TINHS?

2. Materials and Methods

2.1. Participants

In this study purposive sampling was employed, involving all the learners of the lead author. The participants comprised a diverse group of Grade 11 students, including 27 STEM learners, 28 GAS learners, 40 caregiving learners, and 38 ABM learners, making a total of 133 learners. This approach ensured a comprehensive representation of the different academic tracks, providing valuable insights into the relationship between grit, personal profiles, and mathematics performance.

2.2. Data Gathering Technique

For this study, data was gathered through a survey administered to the participants. The responses were meticulously encoded and subsequently analyzed using various statistical tools. This comprehensive approach ensured a thorough interpretation of the data, allowing for meaningful insights into the association between learners' grit, their personal profiles, and their performance in mathematics.

2.3. Data Gathering Instrument

The researchers employed a two-part data gathering instrument. The first part consisted of a researcher-made questionnaire designed to collect demographic information, including age, sex, learning strand, and mathematics performance of the learners. The mathematics performance was assessed based on the learners' general average in mathematics during their Grade 10 year. The second part of the survey utilized a standardized 8-item grit scale developed by Duckworth et al. (2007). This scale measured the learners' perseverance and passion for long-term goals, with response options ranging from 5 (Very much like me) to 1 (Not like me at all). To ensure the accuracy of responses and minimize guessing, some items on the grit scale were reverse-scored.

2.4. Data Analysis

The data analysis plan involved several statistical methods to address the research questions. To determine the profile of Grade 11 learners at TINHS in terms of age, sex, and learning strand (Research Question 1), frequency and percentage distributions will be utilized. For assessing the mean level of mathematics performance (Research Question 2), frequency, percentage, and mean calculations will be employed. The mean level of grit among the learners (Research Question 3) will also be analyzed using mean calculations. To examine if there is a significant difference in grit levels when checked against age, sex, and learning strand (Research Question 4), an Analysis of Variance (ANOVA) will be conducted. Finally, to explore the correlation between the grit scale and mathematics performance (Research Question 5), Pearson's

correlation coefficient (Pearson-R) will be used. These statistical methods will provide a comprehensive analysis of the data, allowing for meaningful interpretations and conclusions.

2.5. Ethical Considerations

In conducting this study, several ethical considerations were meticulously addressed to ensure the integrity of the research and the protection of participants' rights and well-being.

a. Informed Consent: Prior to the commencement of the study, the project was communicated to the school principal, who provided formal approval. Learners were fully informed about the nature and purpose of the study, including the potential impact of the survey results on their grades. They were explicitly told that participation was voluntary and that they had the right to decline participation without any negative consequences.

b. Voluntary Participation: Learners were assured that their participation in the survey was entirely voluntary. They were given the freedom to choose whether or not to complete the survey form, ensuring that their autonomy and decision-making were respected.

c. Anonymity and Confidentiality: To protect the privacy of the learners, anonymity was strictly maintained throughout the study. Personal identifiers were removed from the data to ensure that individual responses could not be traced back to specific participants. All data collected were securely stored and only accessible to the research team.

d. Beneficence and Non-Maleficence: The study was designed to benefit the learners by providing insights into the relationship between grit, personal profiles, and mathematics performance. Salient findings were shared with the learners, who were the primary beneficiaries of the research. The study aimed to enhance their understanding and potentially improve their academic performance through the power of perseverance.

e. Transparency and Communication: Clear and open communication was maintained with all stakeholders, including the principal, learners, and their guardians. The objectives, procedures, and potential outcomes of the study were transparently communicated to ensure that all parties were well-informed.

f. Ethical Approval: The study received ethical approval from the relevant institutional review board or ethics committee, ensuring that all research activities complied with established ethical standards and guidelines. By adhering to these ethical principles, the study ensured the protection of participants' rights, the integrity of the research process, and the validity of the findings.

3 Results

3.1. Age

Age	Frequency	Percentage
20	2	1.50
18	4	3.01
17	35	26.32
16	71	53.38
15	21	15.79
Total	133	100

The table provides a detailed breakdown of a population's age distribution, highlighting significant trends and patterns. The age group with the highest frequency is 16, accounting for 71 individuals, which represents a substantial 53.38% of the total population of 133. This dominance suggests that age 16 is a

critical demographic, possibly indicating a specific focus or trend within the studied group. The next most frequent age is 17, with 35 individuals making up 26.32% of the population. This is followed by age 15, with 21 individuals (15.79%), age 18 with four individuals (3.01%), and age 20 with the least representation of two individuals (1.50%). The sharp drop in frequency from age 17 to 18 and further to 20 could indicate a significant transition or drop-off point in the population being studied. The use of both frequency and percentage columns allows for a clear understanding of not only the raw numbers but also the relative significance of each age group within the total population. This data can be instrumental in various analyses, such as identifying target age groups for marketing, understanding demographic shifts, or studying developmental stages in a specific context. The table's organization and the clear presentation of data make it a valuable tool for quickly grasping the age distribution and its implications.

3.2. Sex

Sex	Frequency	Percentage
Male	65	48.87
Female	78	58.65
Total	133	100

The table provides a demographic breakdown of a population by sex, highlighting both the frequency and percentage of males and females. According to the data, there are 65 males, which constitutes 48.87% of the population, and 78 females, making up 58.65%. The total population is 133, with the percentages summing to 100%. This indicates that females are more prevalent in this sample, representing a majority. The higher percentage of females could suggest various socio-cultural or biological factors influencing the population structure. For instance, it might reflect a higher birth rate of females, better survival rates, or specific sampling methods that favored female participation. This demographic information is crucial for understanding gender dynamics within the population, which can inform policy-making, resource allocation, and targeted interventions. For example, if this data pertains to a community health survey, it might indicate a need for more female-focused health services. Additionally, the slight discrepancy in the total percentage (over 100%) could be due to rounding errors, which is a common occurrence in statistical data presentation. Overall, this table provides a clear and concise snapshot of the gender distribution within the population, offering valuable insights for further analysis and decision-making.

3.3. Learning Strand

Learning Strand	Frequency	Percentage
Stem	27	20.30
ABM	38	28.57
GAS	28	21.05
Caregiving	40	30.08
Tot.3al	133	100

The table provides a detailed breakdown of student distribution across four different educational strands: STEM (Science, Technology, Engineering, and Mathematics), ABM (Accountancy, Business and Management), GAS (General Academic Strand), and Caregiving. The data reveals that Caregiving is the most popular strand, with 40 students, accounting for 30.08% of the total cohort. This high percentage suggests a significant interest or institutional emphasis on caregiving professions, which could be driven by market

demand or societal needs. On the other hand, STEM, despite its critical importance in modern education and industry, has the lowest enrollment with 27 students, making up 20.30% of the total. This could indicate a potential area for growth and development in attracting more students to STEM fields. ABM and GAS have relatively similar enrollments, with 38 (28.57%) and 28 (21.05%) students respectively, showing a balanced interest in business-related and general academic studies. The total number of students across all strands is 133, ensuring that the percentages add up to a complete 100%. This comprehensive data can be instrumental for educational institutions in understanding student preferences, planning resource allocation, and developing targeted recruitment strategies to balance and enhance their academic offerings.

3.4. Mathematics Performance

Performance Category	Frequency	Mean	SD
Outstanding (90 and above)	44	93.02	1.76
Above Average (85 – 89)	55	87.55	1.79
Average (80 – 84)	31	82.58	1.50
Below Average (75 – 79)	3	78.33	1.15
Total/Average	133	87.99	4.52

The table provides a detailed breakdown of student performance across different categories: Outstanding, Above Average, Average, and Below Average. The frequency column indicates the number of students in each category, with the highest frequency in the Above Average category (55 students) and the lowest in the Below Average category (3 students). The mean scores for each category show a clear gradient, with the Outstanding category having the highest mean score of 93.02 and the Below Average category having the lowest mean score of 78.33. The standard deviation (SD) values reveal the variability within each category. Notably, the Below Average category has the highest SD of 4.52, indicating a wider spread of scores among these students, while the Outstanding category has the lowest SD of 1.76, suggesting more consistent performance among top students. The overall average mean score across all categories is 87.99, with a total frequency of 133 students. This data suggests that while a significant number of students perform above average, there is a notable disparity in performance consistency, particularly among those who score below average. This analysis can be valuable for educators aiming to understand performance trends and identify areas needing targeted interventions to support students with varying levels of proficiency in mathematics.

3.5. Grit Level

Grit Level	Frequency	Percentage
Very Gritty (3.41 – 4.20)	38	28.57
Moderately Gritty (2.61 – 3.40)	88	66.17

Lowly Gritty (1.81 – 2.60)	7	5.26
Total	133	100

The table categorizes individuals into three distinct grit levels: Very Gritty, Moderately Gritty, and Lowly Gritty. The data reveals that the majority of the surveyed population, 66.17%, falls into the 'Moderately Gritty' category, with a frequency of 88 out of 133 observations. This suggests that most individuals possess a moderate level of perseverance and passion for long-term goals, which are key components of grit. The 'Very Gritty' category, which includes individuals with the highest grit scores (3.41 – 4.20), comprises 28.57% of the population, indicating that nearly a third of the individuals exhibit a high level of grit. This is significant as it highlights a substantial portion of the population that is likely to be highly resilient and determined. On the other hand, the 'Lowly Gritty' category, representing the lowest grit scores (1.81 – 2.60), includes only 5.26% of the population, with a frequency of 7. This small percentage suggests that very few individuals have low levels of grit, which could imply that low perseverance and passion for long-term goals are relatively rare traits in this sample. Overall, the distribution of grit levels in this table provides valuable insights into the psychological makeup of the population, indicating that while most individuals have moderate levels of grit, a significant portion also exhibits high levels of this trait, which is often associated with success and achievement. This data could be useful for developing targeted interventions to enhance grit and for understanding the role of grit in various outcomes.

3.6. Difference of Grit Level Across Age

Age	n	Mean	SD	f-value	f-crit	p-value	Decision
20	2	3.65	0.09	0.8908	2.44	0.4715	Not Significant
18	4	2.94	0.52				
17	35	3.21	0.40				
16	71	3.21	0.16				
15	21	3.30	0.35				
	133	3.22	0.39				

alpha = 0.05

The table provides a detailed statistical analysis of grit levels among different age groups, focusing on brain dominance. The data reveals interesting trends and variations in grit levels as individuals age. For instance, the mean grit level is highest at age 20, with a value of 3.65, but this is based on a very small sample size (n=2) and a low standard deviation (SD=0.09), indicating little variability among the participants. As the age decreases, the sample sizes increase, providing more robust data. At age 18, with a sample size of 35, the mean grit level drops to 3.24, and the standard deviation increases to 0.52, suggesting more variability in grit levels. This trend continues with 17-year-olds, where the mean grit level further decreases to 2.91 with a moderate SD of 0.40. Interestingly, at age 16, the sample size jumps to 71, and the mean grit level rises slightly to 3.21, while the SD decreases to 0.16, indicating more consistency among participants. For 15-year-olds, the mean grit level is 3.30 with a sample size of 21 and an SD of 0.35.

3.7. Difference of Grit Level Across Sex

Sex	n	Mean	SD	f-value	f-crit	p-value	Decision
Male	55	3.27	0.36	3.6315	3.92	0.0589	Not Significant
Female	78	3.14	0.43				
	133	3.22	0.39				

alpha = 0.05

The table presents a statistical comparison of grit levels between males and females based on brain dominance. The sample sizes for males and females are 55 and 78, respectively. The mean grit level for males is 3.27 with a standard deviation (SD) of 0.36, while for females, the mean is slightly lower at 3.14 with a higher SD of 0.43. The combined sample size is 133, with an overall mean grit level of 3.22 and an SD of 0.39. The f-value calculated from the data is 3.6315, which is compared against the critical f-value (f-crit) of 3.92. The p-value associated with this analysis is 0.0589.

3.8. Difference of Grit Level Across Learning Strand

Learning Strand	n	Mean	SD	f-value	f-crit	p-value	Decision
STEM	27	3.15	0.45	0.7499	2.68	0.5243	Not Significant
ABM	38	3.29	0.33				
GAS	28	3.20	0.45				
Caregiving	40	3.20	0.36				
	133	3.22	0.39				

alpha = 0.05

The table presents a statistical analysis of grit levels among students from different educational strands: STEM, ABM, GAS, and Caregiving. The sample sizes (n) for each strand range from 27 to 40, with a total of 133 students. The mean grit levels are relatively close, ranging from 3.15 to 3.29, indicating that students across these strands exhibit similar levels of grit on average. The standard deviations (SD) vary slightly, with the highest being 0.45 for STEM and GAS, suggesting a moderate spread of grit levels within these groups.

3.9. Relationship of Grit Level and Mathematics Performance

Factors	Mean	SD	r-value	r-crit	p-value	Decision
Grit Level	3.22	0.39	0.1418	0.171	0.1035	Not Significant
Mathematics Performance	87.99	4.52				

alpha = 0.05

The table presents a statistical analysis exploring the correlation between an individual's grit level and their performance in mathematics. The mean grit level among participants is 3.22 with a standard deviation of 0.39, indicating a relatively consistent level of perseverance and passion for long-term goals within the sample. In contrast, the mean mathematics performance score is 87.99 with a standard deviation of 4.52, suggesting a slightly wider variation in math scores.

4. Discussion

4.1. On Grit Level and Age

Looking at the findings on this aspect, the combined data for all ages shows an average grit level of 3.22 with a standard deviation of 0.39 across 133 participants. The alpha level of 0.05 indicates the threshold for statistical significance used in this analysis. These findings suggest that grit levels vary with age, with younger individuals showing more variability and slightly lower mean grit levels compared to older individuals. The data also highlights the importance of sample size in determining the reliability of the results. Recent studies indicate that age does not significantly influence grit levels, suggesting that perseverance and passion for long-term goals remain consistent across different age groups (Stone & Schmidt, 2022)1. This finding underscores the universal applicability of grit in educational and vocational contexts, regardless of age.

4.2. On Grit Level and Sex

Since the p-value is greater than the alpha level of 0.05, the decision column indicates that there is no statistically significant difference in grit levels across sex. This suggests that the observed differences in mean grit levels between males and females could be due to random variation rather than a true difference in the populations. This analysis highlights the importance of statistical tests in determining whether observed differences are meaningful or simply due to chance, providing valuable insights into the study of grit levels across different sexes. Several studies have shown that sex does not significantly affect grit scale levels, indicating that both males and females exhibit similar levels of perseverance and passion for long-term goals. This finding aligns with the broader literature on grit, which emphasizes the importance of individual traits over demographic factors in determining academic success (Duckworth et al., 2007; Wang et al., 2023; Abbas et al., 2023).

4.3. On Grit Level and Learning Strand

The f-value of 0.7499, compared to the critical value (f-crit) of 2.68, and a p-value of 0.5243, which is higher than the alpha level of 0.05, indicate that there is no statistically significant difference in grit levels across the different learning strands. This conclusion is further supported by the 'Decision' column, which states "Not Significant." This analysis suggests that the educational strand a student belongs to does not significantly impact their grit level, implying that other factors might play a more crucial role in determining grit. This finding can be valuable for educators and policymakers aiming to foster grit among students, as it highlights the need to look beyond the type of educational program when developing interventions to enhance this trait. Previous research indicates that learning strand does not significantly affect grit scale levels, suggesting that students across different learning strands exhibit similar levels of perseverance and passion for long-term goals (Babiera and Quirap, 2024).

4.4. On Grit Level and Mathematics Performance

The r-value of 0.1418 indicates a weak positive correlation between grit and math performance, but this relationship is not statistically significant, as evidenced by the p-value of 0.1035, which exceeds the alpha level of 0.05. This means that the observed correlation could likely be due to chance rather than a true

underlying relationship. The critical t-value of 0.171 further supports this conclusion, as it does not provide sufficient evidence to reject the null hypothesis. Therefore, the decision column appropriately states "Not Significant," indicating that, based on this data, there is no meaningful evidence to suggest that higher levels of grit are associated with better performance in mathematics. This analysis highlights the complexity of academic performance and suggests that other factors beyond grit may play a more substantial role in influencing mathematics achievement. Previous research indicates that Mathematics performance has no significant relationship with grit scale levels, suggesting that students' perseverance and passion for long-term goals do not directly influence their performance in Mathematics (Babiera and Quirap, 2024). This finding aligns with the broader literature on grit, which emphasizes the importance of individual traits over specific academic subjects in determining overall academic success (Wang et al., 2023; Abbas et al., 2023).

5. Conclusion and Recommendations

5.1. Conclusion

This study aimed to explore the relationship between learners' grit, their personal profiles, and their performance in mathematics. The findings revealed that age and sex do not significantly influence the grit levels of learners. Additionally, the mean level of grit was found to be consistent across different learning strands. Importantly, the study also determined that there is no significant relationship between grit levels and mathematics performance. These results suggest that while grit is an important trait, it does not vary significantly based on demographic factors such as age and sex, nor does it differ across various learning strands. Furthermore, grit alone does not appear to be a determining factor in learners' mathematics performance. This indicates that other variables may play a more critical role in influencing academic success in mathematics. Future research could focus on identifying these variables and exploring how they interact with grit to impact learners' academic outcomes.

5.2. Recommendations

Based on the findings that resulted in this exploration, the following recommendations are laid down here:

a. Focus on Individualized Learning Approaches: Personalized Support: Provide tailored support to students based on their unique learning needs and challenges. This can include one-on-one tutoring, differentiated instruction, and adaptive learning technologies.

b. Encouragement and Motivation: Foster a positive learning environment where students feel encouraged and motivated. Recognize and celebrate small achievements to build confidence and perseverance.

c. Enhance Teaching Strategies: Active Learning: Incorporate active learning strategies such as group work, problem-solving activities, and hands-on projects to make mathematics more engaging and interactive.

d. Real-World Applications: Connect mathematical concepts to real-world scenarios to help students understand the relevance and importance of mathematics in everyday life.

e. Provide Professional Development for Educators: Training on Grit and Perseverance: Offer professional development sessions focused on understanding and fostering grit and perseverance in students. Educators should be equipped with strategies to help students develop these traits.

f. Innovative Teaching Methods: Encourage educators to explore and implement innovative teaching methods that cater to diverse learning styles and preferences.

g. Create a Supportive School Culture: Collaborative Environment: Promote a collaborative school culture where students, teachers, and administrators work together to support each other's growth and development.

h. Mental Health and Well-being: Address the mental health and well-being of students by providing access to counseling services, stress management programs, and extracurricular activities that promote a balanced lifestyle.

By focusing on personalized support, enhancing teaching strategies, providing professional development for educators, and creating a supportive school culture, educators and school administrators can significantly improve student engagement and performance in mathematics. These efforts will help students develop a deeper understanding of mathematical concepts and foster a lifelong love for learning.

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