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RELATIONSHIP OF MINDSET, GRIT, AND AGE WITH ACADEMIC ACHIEVEMENT OF GRADE 10 STUDENTS

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ABSTRACT

The interplay between grit, growth mindset, and academic achievement has become a focal point in educational psychology. Grit and mindset have been studied as non-cognitive skills, whereas numeracy and literacy are cognitive skills. This quantitative study investigated the relationship between these non-cognitive (grit and mindset), chronological age, and cognitive (academic achievement) skills. The population of the study was the tenth-graders (N=21,104) studying in the public sector secondary schools in the Lahore District. A stratified sampling method followed by a lottery system was applied to collect the sample (n=420) from 10 schools in 5 Tehsils of Lahore. Data was collected by administering the two self-reporting questionnaires: The Mindset Survey by Dweck and the Short-Grit Scale (Grit-S) by Duckworth. Data was analyzed through SPSS for all four variables: Mindset, Grit, Age, and Academic Achievement (Marks%). The findings have shown a significant positive correlation between grit scores and academic achievement (Marks%). The study has also highlighted a moderate positive correlation between grit and mindset, and mindset and academic achievement (Marks%). There is a weak but positive correlation between age and academic achievement and age and grit.

Keywords: mindset, grit, age, academic achievement

Introduction

Understanding and improving the academic achievement of high school students, especially in grade 10, has been of interest to researchers around the globe (Sultanova et al., 2024). There is a strong connection between a person's quality of life, future career, and academic achievement (Moyano et al., 2020). High school is considered the golden age for students to learn and develop (Eryılmaz, 2012; Yu et al., 2023) In Punjab, Pakistan, public secondary schools, covering grades 9 and 10, play a crucial role in educating a significant portion of the population by providing comprehensive education (Awan & Hussain, 2020). Academic achievement during secondary education is critical for specialization and career preparation, providing a strong foundation in core subjects (Abenawe, 2022; Hussain, 2021). Quality education at this level equips students with the necessary knowledge and skills for success in higher education and the workforce while fostering social mobility and economic development (Abenawe, 2022). Beyond academics, secondary schools play a crucial role in developing non-cognitive skills like collaboration, resilience, perseverance, self-belief, and passion (Shahzad & Saeed, 2023; Collie, 2020).

Skills are the abilities that enable individuals to perform tasks effectively over time. Society values them for their role in the learning process (Oishi, 2023). Students require three types of skills for academic success: cognitive skills (thinking skills), technical skills (motor skills), and human skills (social/interactional skills). Cognitive skills include literacy and numeracy, which are

essential for academic performance. In contrast, non-cognitive skills encompass personal traits like motivation, communication, self-belief, and self-management, which are crucial for success in life and the workplace (Fredricks & Simpkins, 2011).

Numeracy and literacy are categorized as cognitive skills (OECD, 2020) and strongly predict important life outcomes, and education is one of them (OECD, 2013). Recently, the focus has shifted to "non-cognitive skills," a term coined by Bowles and Gintis (1974) to describe personality traits, motivation, interests, and beliefs that impact success beyond traditional cognitive measures like IQ (OECD, 2015, 2024; Gutman & Schoon, 2016). Non-cognitive skills provide the foundation for academic achievement in education in general and in secondary education. This study assumes academic achievement as a non-cognitive skill, and grit and mindset as non-cognitive skills. Historically, people have believed that achievement is solely a result of intellectual abilities, often measuring success and failure based on our level of intelligence.

Both grit and a mindset influence how individuals face challenges and setbacks. However, grit is a behavioral trait characterized by passion and perseverance to pursue long-term goals, while a mindset is a belief in one's ability that skills may be developed through effort (Duckworth et al., 2007). Park et al. (2020) conducted a longitudinal study on U.S. adolescents to explore the reciprocal relationship between grit and growth mindset, surveying them in the fall of eighth grade and the spring of ninth grade.

Growth Mindset

A growth mindset is "*the belief that your basic qualities are things you can cultivate through your efforts*" (Dweck, 2017, p. 7). Students with a growth mindset embrace challenges as opportunities to grow and view effort as a path to mastery. learn from criticism and find inspiration in peer success (Dweck, 2016). Additionally, the growth mindset nurtures resilience and risk-taking to enable individuals to rebound and learn from failure because it is a basic factor for grit and passion (Dweck, 2017).

Grit is defined as "*perseverance and passion for long-term goals*" (Duckworth et al., 2007, p. 1087). Grit helps maintain effort and passion for goals despite setbacks, and demonstrates stamina and hard work to achieve long-term objectives (Duckworth et al., 2007). Grit predicts high academic achievement, such as exam performance and GPA, in undergraduates and middle school students (Duckworth et al., 2007, 2011; Duckworth & Quinn, 2009).

Grit and Academic Achievement

Grit, particularly perseverance, is closely tied to academic success, with goal commitment being more influential than a growth mindset (Tang et al., 2019). Students who demonstrate high levels of grit and strong academic goals tend to perform better academically, though this combination is often rare and unstable (Tang et al., 2021).

Mindset and Academic Achievement

Mindset refers to the belief in whether traits like intelligence and creativity are fixed or can be developed (Dweck, 1999, 2006). It influences goal selection, motivation, and reactions to feedback (Dweck, 2017). While a growth mindset supports academic achievement by encouraging students to embrace challenges, its effects depend on individual factors such as psychological resilience and gender (Demir, 2023). Both grit and mindset contribute to academic performance, but goal commitment has a greater impact than mindset alone. Fostering goal commitment may enhance grit, suggesting it plays a key role in academic success (Tang et al., 2019). Secondary schools present rigorous academic demands and a challenging social environment, which may hinder students' potential. To succeed, students must build emotional resilience to cope with both academic and social pressures (Rivers et al., 2020). Duckworth et al. (2007) proposed that grit is crucial for high achievement. A growth mindset, the belief that intelligence can grow with effort, is strongly linked to academic success (Yeager & Dweck, 2020; Costa & Faria, 2018). Both grit and growth mindset are non-cognitive traits studied concerning academic performance, but findings have been inconsistent.

Age and Academic Achievement

This study considers the chronological age of students as one of the variables. This is related to the age in calendar years since birth (Mitina et al., 2020) of the participants as shown by their records and shared by the Board of Intermediate and Secondary Education, Lahore.

Research Gaps

Miles (2017) proposed a new model built on the two previous models that consist of seven core research gaps renamed: a) Evidence Gap, b) Knowledge Gap, c) Practical-Knowledge Conflict Gap, d) Methodological Gap, e) Empirical Gap, f) Theoretical Gap and g) Population Gap (Adu & Miles, 2023). Based on the literature studied, this study has attempted to address two major gaps: the methodological gap and the population gap. Previous studies have focused either on mindset or on grit but have not been made part of the same study findings for Secondary school male students (Jacobs, 2011; Müller-Bloch & Kranz, 2014; Miles, 2017). Additionally, the quantitative design has also been a missing link in the chain where grit has been analyzed as a moderator. The second gap is in population. Grade 10 male students have not been adequately represented or have been under-researched in the prior research (Robinson, et al, 2011).

Delimitations of the Study

This study focuses on grade 10 male students in public schools in District Lahore, characterized by distinct educational practices, cultural norms, and curriculum structures. It relies on self-reported student data, which may introduce bias or subjective interpretations of grit and mindset. Furthermore, the study does

not account for external factors like home environment, parental support, or socioeconomic status, which could influence students' grit, growth mindset, and academic achievement.

Problem Statement

Existing literature predominantly reflects perspectives from American, Western, or developed Eastern contexts, overlooking Pakistan's unique socio-cultural and educational dynamics. Additionally, there is a lack of planning, implementation, and assessment of non-cognitive skills like mindset and grit in the national curriculum. This study aims to investigate the correlation between mindset, grit, and academic achievement (measured by overall grades) among the targeted population. The findings will provide actionable recommendations for policymakers to integrate growth mindset and grit interventions into the curriculum, aligning with 21st-century skills such as soft skills, life competencies, and career readiness (UNESCO, 2023). Ultimately, the study will address critical gaps, propose solutions, and contribute to improving educational practices in Pakistan.

Research Questions

This study aims to investigate the relationship between mindset, grit, academic achievement, and age in grade 10 students. Specifically, the following research questions will be addressed:

1. Is there a significant relationship between the mindset and academic achievement?
2. Is there a significant relationship between grit and academic achievement?
3. Is there a significant relationship between age and academic achievement?
4. Is there any significant relationship between grit, mindset, age, and academic achievement?

Objectives

1. To explore the relationship between the mindset and academic achievement of students.
2. To investigate the relationship between grit and academic achievement.
3. To find out the relationship between age and academic achievement.
4. To investigate the relationship between mindset, grit, age, and academic achievement of grade 10 students.

Methodology

Materials and Methods

As researchers, whenever we conceive a research process to investigate a research problem, we frame our paradigm assumptions that shape and drive the entire research process (Creswell, 2018). As such it is important to understand the research paradigms so that correct and consistent assumptions are made right at the onset of the study. Epistemology tells us about how we receive knowledge, know about truth, and know about reality. In other words, it tells us about how we receive or collect knowledge

(Creswell & Plano-Clark, 2018). Ontology answers the question of what reality is, and what shapes reality; it tells us about knowledge and what is happening. It gives us an idea of the problem and possible solutions (Creswell, 2015). Ontology helps us answer three important basic questions: (1) What is reality? (2) What shapes reality? and (3) What is the relationship between each component that shapes reality or forms the knowledge for us (Creswell, 2015).

The table below shows the epistemological, ontological, and research philosophy underpinning the quantitative (deductive) research approach. Positivism is a philosophy that guides quantitative research design (Morgan, 2018; Saunders et al., 2016; Masue et al., 2013).

Table 1: ***Quantitative Method Research Ontology, Epistemology, Philosophies, and Approaches***

Ontological stance	Epistemological stance	Research Philosophy	Research Approach
Singular reality	Examine knowledge using established scientific designs and tools	Positivism	Quantitative (deductive)

Note: The table indicates the research paradigm.

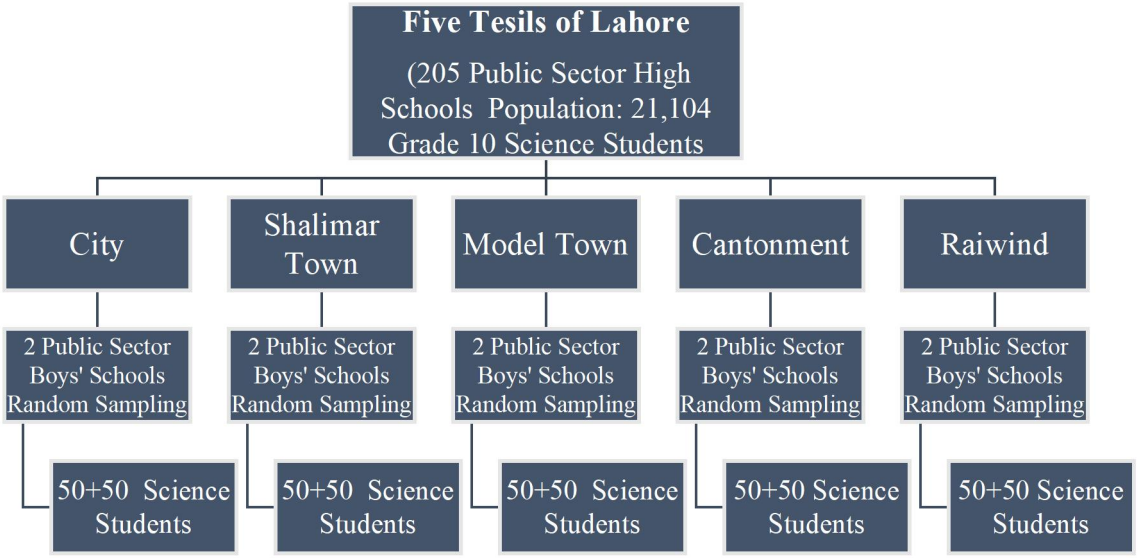
Population

The population comprised the N=21,104 grade 10 science students (BISE, 2024) from the public schools in District Lahore going to appear in Annual Examinations, to be conducted by the Board of Intermediate and Secondary Education, Lahore in March 2024.

Sample

The sample of this study was n=500 students from the ten schools of 5 Tehsils studying in the second-largest city of Pakistan, Lahore.

Figure 1: ***Population and Sampling Methods***



Note: Population and sample with the distribution of quantitative data collection

Plan of Work and Methodology Adopted

The correlational design is a research design that determines the relationship between variables (Creswell, 2013). The independent variables of this study are grade 10 students' mindset, grit, and age, whereas the dependent variable is the students' academic achievement.

Variables of the Study

The following are the four variables of the study:

1. Independent Variable 1: Growth Mindset (continuous, interval)
2. Independent Variable 2: Grit (continuous, interval)
3. Independent Variable 3: Age (ordinal)
4. Dependent Variable 3: Academic Achievement (continuous, interval)

Method of Data Collection

The students were requested to voluntarily complete the self-report Dweck's Growth Mindset Surveys and Duckworth's Short Grit Scale (Grit-S) sheets. Next, the total marks achieved by these students in the Annual Examinations, 2024, were collected from their respective schools.

Sampling Technique and Procedure

For sampling technique and procedure stratified sampling technique was followed by the simple random (lottery system) technique for the quantitative data.

Instruments

This research administered Dweck's Growth Mindset Surveys and Duckworth's Short Grit Scale (Grit-S) sheets to collect the

quantitative data. Formal permission was obtained from the concerned heads and students to complete the self-report instruments, namely the Growth Mindset Survey and Short-Grit Scale (Grit-S).

Pilot Testing

A pilot study was conducted to ensure the validity and reliability of the tools. Thirty students were requested for pilot testing. Initially, the Mindset Survey with 6 items was selected as a tool to be administered. Thirty-seven out of sixty students, from 5 different schools, showed their concern about some questions on the Mindset Survey. Based on this feedback, the Mindset Survey with 3 items was administered to the same number of students, and not even a single student showed any concern over the comprehension of the statements given on the Mindset Survey. Expert opinions from the relevant fields were considered to ensure the validity of the data collection tools. The reliability was calculated by applying Cronbach's Alpha statistical technique. It is important to share here that a 6-Item Mindset survey was administered during piloting, and more than half of the respondents raised one common concern that the same questions had been repeated, which confused us. Based on this feedback, the 6-Item survey tool was replaced with the 3-Item instrument.

Data Cleaning and Preparation

The data collected for this study was streamlined according to Tehsils, schools in each Tehsil, and two sets of instruments were separated accordingly. The data cleaning was carried out by observing an exclusion criterion, which is listed below:

Age: Removed the instruments with age <14 and >17.

Missing Values: Instruments with missing entries (even one) were removed

Nameless data: Students with no name, incomplete names or other missing demographic details were excluded from the final data.

Academic Achievement (Marks%): Students with missing Annual Examination results were also excluded from the data

Outliers: Retained Marks% values (5–99) and grit scores (8–40) as per scale ranges.

Distilled Dataset: The data was based on N = 420. Variables included Age (14–17) years (ordinal), Academic Achievement (5–99). Mindset Survey with 3-item scale (3 = fixed, 18 = growth; Cronbach's $\alpha = 0.51$) and Grit-S scale (8 items; $\alpha = 0.71$; max = 40).

Research Framework

This theoretical framework grants a comprehensive and inclusive understanding of the relationship among mindset, grit, and academic achievement of grade 10 students. Dweck's Mindset theory, presented in 2006, is a guide to a distinction between fixed and growth mindsets, suggesting that individuals' beliefs about the malleability of abilities can impact their motivation and academic achievement. With the development and implementation of empirical and scientific approaches, the term grit is defined as one

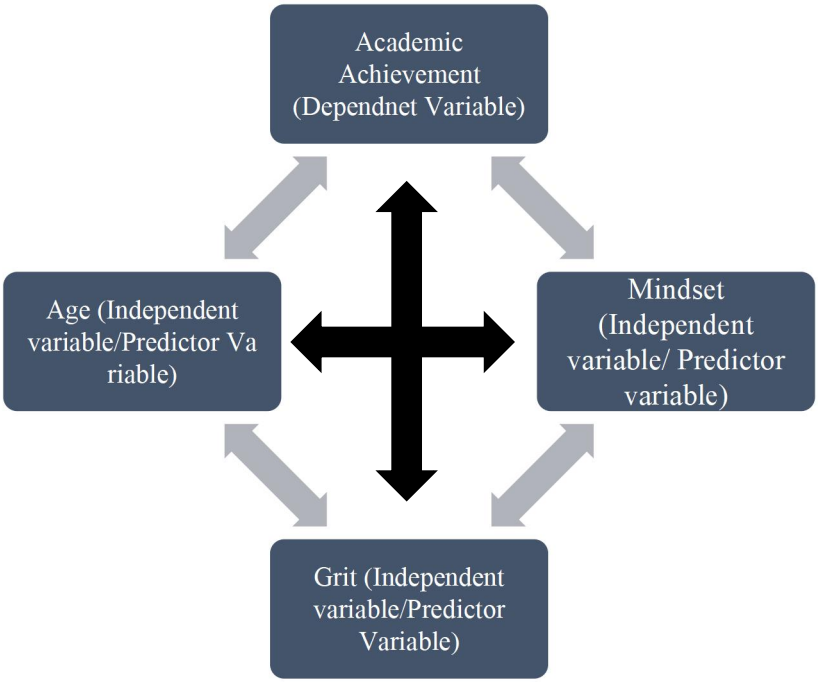
of the personality beliefs that helps people maintain their motivation and urge to perform better (Sudarji & Juniarti, 2020).

Grit, as a theory, was introduced by Duckworth. Grit consists of two non-cognitive skills: Perseverance of Effort and consistency of Interest. Grit was introduced as a belief-level personality construct consisting of persistence of effort and consistency of interest (Duckworth et al., 2007). In her book '*Grit: The Power of Passion and The Perseverance'*, Duckworth states that no matter the domain, highly successful individuals can be found in two ways: the first is individuals who are hardworking and very diligent, or diligent with their work. Secondly, some individuals know what goals they want to achieve by having a clear direction, not just having a strong will (Duckworth, 2016). Duckworth introduced grit as a new variable in positive psychology, similar to one of the five major beliefs known as conscientiousness (Muhibbin & Suryanto, 2020).

Conceptual Framework

Recent studies have confirmed that the mindset influences grit, which affects students' academic achievement. Grit is conceptualized as the consistency of interest and perseverance of effort (Duckworth and Quinn, 2009, 2016, 2019). The dearth of empirical data highlighted that one of the factors that can affect grit is the growth mindset (Chrisantiana and Sembiring, 2017; SRI International, 2018; Wahidah and Royanto, 2019). Mindset can be interpreted and conceptualized as a belief that directs individuals in overcoming situations, sorting out what is happening, and what to do (Kaparang and Gahauna, 2020). Dweck defines mindset as a frame of mind or individual beliefs used to view and understand the world (Dweck, 2006). Several studies underline findings showing the relationship between grit, mindset, and academic achievement. Therefore, the conceptual framework proposes that mindset, grit, and age may affect the academic achievement of grade 10 students, with higher grit levels and growth mindsets achieving better academic results, showing higher-order thinking skills, and taking challenges as opportunities better than those who lack this belief.

Figure 2: ***Conceptual Framework of the Study***



Note: The figure shows how three independent variables and one dependent variable are framed together.

The descriptive part has helped understand their correlation and answer the research questions.

Statistical Tests and Analysis

Descriptive statistics were computed with SPSS to analyze the data for all four variables (Mindset, Grit, Age, and Academic Achievement (Marks%). The collected dataset was cleaned to exclude participants with invalid ages (14-17) and missing values, resulting in a final sample of $n = 420$.

Findings and Results

Descriptive Statistics and Scale Reliability

Table 2 shows the descriptive statistics along with the study's variables. The variables were age, marks percentage (Marks%), grit score, and mindset score. The means and standard deviations are shown with the range, skewness, and kurtosis values. Moreover, the scale reliability by Cronbach's α for grit and mindset is also described.

Table 2: ***Descriptive Statistics and Scale Reliability***

Variable	M (*SD*)	Range	Cronbach's α
Age	15.3 (1.2)	14–17	-
Marks (%)	68.5 (21.5)	5–98	-
Mindset Score	11.7 (3.8)	3–18	0.51
Grit Score	26.6 (4.8)	8–40	0.71

Interpretation of Descriptive Statistics

The age variable ranges from 14 to 17, with a mean age of 15.3 years (*SD* = 1.2). The mean percentage score for the percentage of

marks is 68.5% (*SD* = 21.5), from a 5% to 98% range. The mean mindset score is 11.7 (*SD* = 3.8), ranging from 3 to 18. The average grit score is 26.6 (*SD* = 4.8), ranging from 8 to 40. The Cronbach's α for grit is 0.71, which is considered an acceptable level of reliability for the scale, and 0.51 for mindset, which is considered close to an acceptable level.

Pearson Correlation Analysis

Table 2 highlights the Pearson correlation coefficients between the students' age, marks percentage (Marks%), mindset, and grit. The analysis indicates the relationships between these variables, presenting whether significant correlations exist.

Table 3: ***Inter-correlations Between Age, Percentage of Marks, Mindset, and Grit***

Variable	1	2	3	4
Age	1			
Marks (%)	0.09	1		
Mindset	-0.04	0.22**	1	
Grit	0.11**	0.31**	0.38**	1

Note: *p < .05, **p < .01 (two-tailed). The effect size has been interpreted using Cohen's (1988) guidelines that indicate Small: as r = 0.10–0.29, Medium as r = 0.30–0.49, and Large as r = ≥ 0.50.

Interpretation of Pearson Correlations

There is a weak but positive correlation between age and Marks% (r = 0.09), statistically not significant (p > .05). This shows that age has little to no relationship with academic performance. The correlation between mindset score and age is negligible (r = -0.04), with no significant relationship between mindset score and age. This proposes that age does not play any significant role in shaping the mindset of learners toward learning. There is a weak but statistically significant positive correlation between the grit score and age (r = 0.11, p < .05). A small but significant positive correlation is seen between the mindset score and marks percentage (r = 0.22, p < .01). This suggests that students with a growth mindset (with the higher scores on the Mindset scale) tend to achieve higher academic marks. The moderate correlation implies the importance of mindset in academic achievement, with those possessing a more open and growth-oriented mindset likely putting more effort into their studies. The table also indicates a significant positive correlation (r = 0.31, p < .01) between grit scores and the percentage of marks, which suggests that students who show higher grit tend to achieve better academic grades. This supports the belief that grit is an important predictor of academic success. There is a moderate positive correlation (r = 0.38, p < .01) between grit and mindset. This supports that students with a growth mindset (as measured by the mindset score) are also more likely to demonstrate higher levels of grit, highlighting the interconnectedness between these two non-cognitive skills. People

with a growth mindset are more likely to persist through challenges and remain committed to their goals, which aligns with the characteristics of grit.

Table 4: ***Correlations Between Grit Subscales, Mindset, and Marks%***

Variable	Perseverance of Effort 1	Consistency of Interest 2
Marks (%)	.29**	.18*
Mindset	.42**	.21**

Notes: *p < .05, **p < .01 (two-tailed)

The table shows a stronger relationship between Perseverance of Effort with the percentage of marks (r = .29, p < .01) than the Consistency of Interest (r = .18, p < .05) which has also been confirmed by Credé et al. (2017), that Perseverance of Effort is crucial for the academic success. A strong correlation with a growth mindset (r = .42, p < .01) suggests that students who accept challenges persist strongly despite setbacks (Burnette et al., 2023). Whereas, a weak correlation between Consistency of Interest and academic achievement (Marks%) (r = .18, p < .05) indicates that a steady interest marginally improves academic achievements. Consistency of Interest is marginally correlated with the mindset (r = .21, p < .01).

Subscale Analysis: Perseverance vs. Consistency

Table 3 suggests the correlations between the subscales of grit (perseverance and consistency), mindset, and academic achievement (Marks%). The results propose the differential contributions of perseverance of effort and consistency of interest to academic performance and mindset.

Table 5: ***Correlations Between Grit Subscales (Perseverance of Effort and Consistency of Interest), Mindset, and Marks%***

Variable	1 Perseverance of Effort	2 Consistency of Interest
Marks (%)	0.09	1
Mindset	-0.04	0.22**

Notes: *p < .05, **p < .01 (two-tailed).

Interpretation of Subscale Correlations

Perseverance of Effort as a subscale of grit suggests a moderate positive correlation with mark percentage (r = 0.29, p < .01). This indicates that students who show more Perseverance of Effort tend to achieve better academically. Perseverance of Effort is a key factor of grit that drives long-term effort and persistent engagement in academic challenges, which is likely to increase their academic outcomes. The Consistency of Interest as a factor of grit exhibits a weak but significant positive correlation with mark percentage (r = 0.18, p < .05). Although the relationship is weaker than that of perseverance, it still suggests that students who maintain consistent interest over time tend to have slightly better academic performance. Consistency of Interest in academics may

foster continued engagement and learning over the long term. The results also highlight that Perseverance of Effort is strongly correlated with mindset ($r = 0.42$, $p < .01$), proposing that students who exhibit Perseverance of Effort are more likely to adopt a growth mindset. This finding underpins the notion that individuals having a growth mindset are more likely to persevere through challenges and persist in their efforts to improve. A growth mindset, which emphasizes learning and improvement, aligns well with the persistence required to overcome obstacles and achieve success. Consistency of Interest shows a moderate positive correlation with mindset ($r = 0.21$, $p < .01$), suggesting that students who show consistency in interest and efforts are more likely to possess a growth mindset. While the correlation is not as strong as that between Perseverance of Effort and Mindset, it proposes that consistent effort in academic pursuits is also associated with a belief in the capacity for growth and improvement.

The following are the questions of this study, with their answers as discovered by this study:

Research Questions

1. Is there a significant relationship between the mindset and academic achievement?

Answer: A moderate yet significant positive correlation exists between mindset scores and Marks%. This indicates that students with a growth mindset (those scoring higher on the Mindset scale) tend to achieve better academic marks.

2. Is there a significant relationship between grit and academic achievement?

Answer: The connection between grit and academic achievement (Marks%) is significant, with perseverance acting as the primary driver.

3. Is there a significant relationship between age and academic achievement?

Answer: A weak but positive relationship is observed between age and academic achievement.

4. Is there any significant relationship between grit, mindset, age, and academic achievement?

Answer: The connection between academic achievement and grit is significant, with Perseverance of Effort being the dominant factor. This aligns with Duckworth et al. (2007), who posit that grit's perseverance component drives long-term goal attainment. The relationship between mindset and grit is also significant aligning with Yeager et al. (2022), also aligns with the theory of Dweck (2015) that adaptive beliefs strengthen resilience. Age and grit have a weak but significant positive correlation, which suggests that older adolescents (17 years) showed slightly higher grit. While, age is weakly correlated with grit but not with the academic achievements (Marks%), underlining the supplementary role of the age of the students. The correlation between age and academic achievements

(Marks%) has been non-significant, indicating that maturity increases academic outcomes.

Discussion

This study examined the relationships between mindset, grit, academic achievement (Marks%), and age in adolescents aged 14–17. The findings revealed a significant correlation between grit, growth mindset, and academic achievement, with Perseverance of Effort being a stronger predictor of academic success than Consistency of Interest. The age of students played a marginal role, showing a weak relationship with grit but no significant link to academic achievement. These findings align with contemporary theories of non-cognitive skill development (Burnette et al., 2020; Yeager et al., 2022) and underscore the critical distinctions in how mindset and grit intersect to shape academic trajectories leading to ultimate achievements.

Grit and academic achievement have shown a significant positive correlation, emphasizing grit as a predictor of academic success. These findings validate Duckworth et al. (2007), who conceptualized grit as persistent passion and perseverance toward achieving long-term goals. However, the subscale analysis revealed that Perseverance of Effort contributed more strongly to academic achievement than Consistency of Interest. This peculiarity supports the meta-analysis conducted by Credé et al. (2017), which argues that perseverance of effort, not the consistency of interest, drives academic achievement in structured school environments. Burnette et al. (2023) noted that Perseverance of Effort mediated the relationship between growth mindset and achievement in adolescents, suggesting that effort regulation is crucial for overcoming academic challenges rather than relying solely on the stability of interest. Likewise, a longitudinal study by Park et al. (2018) suggested that students with high perseverance scores showed greater improvements in mathematics over time, even with low initial interest in the subject. These results imply that educational interventions should prioritize fostering tenacity in the face of obstacles rather than depending on innate interest alone.

The findings also showed a moderate correlation between grit and growth mindset, aligning with Dweck's theory (2015), which posits that adaptive beliefs about intelligence foster resilience. Students who view abilities as malleable (growth mindset) are more likely to persist through setbacks, a hallmark of grit. This synergy is particularly apparent in the subscale analysis of growth mindset, which correlates strongly with perseverance rather than consistency. This reinforces the concept that mindset shapes the perseverance of effort rather than the consistency of interest.

A national randomized controlled study by Yeager et al. (2022) suggested that growth mindset interventions enhanced both grit and academic achievement in underperforming schools, with effects lasting up to around two years. Similarly, Zeng et al. (2023) found that the relationship between mindset and grit influenced

resilience during the transition to high school, particularly among students facing socio-economic adversity. These studies illustrate that mindset and grit are reciprocally reinforcing constructs, with adaptive beliefs providing a psychological scaffold for sustained effort.

Unlike the hypotheses, age demonstrated a weak correlation with grit and no significant relationship with academic achievement (Marks%). This challenges developmental theories that suggest maturity inherently fosters self-regulation (Duckworth & Eskreis-Winkler, 2021). Nonetheless, the nominal increase in grit among older adolescents (17 years) may reflect transitional stressors, such as college preparation, which require greater perseverance (Zeng et al., 2023). Notably, age did not moderate the relationship between grit and academic achievement (Marks%), indicating that the benefits of grit are consistent across adolescence. This contrasts with cross-cultural studies by Liem et al. (2020), which found age-related increases in grit in collectivist cultures but not in individualist ones. The sample's homogeneity (ages 14–17, likely from similar educational systems) may clarify this inconsistency, emphasizing the importance of diverse demographic sampling in future research.

The subscale analysis revealed stark differences between perseverance of effort and consistency of interest. The stronger relationship between Perseverance of Effort and academic achievement (Marks%) aligns with findings from Credé et al. (2017), asserting that effort regulation is more critical than interest stability in academics. For example, a student may dislike algebra (low consistency) yet excels through disciplined study habits (high perseverance). This observation extends to mindset interactions. The significant relationship between Perseverance of Effort and a growth mindset highlights that students willing to accept challenges are better equipped to sustain effort during setbacks. Conversely, consistency of interest exhibited a weak relationship with mindset, implying that the stability of interests may arise from external factors rather than internal beliefs. These findings suggest a need for targeted interventions, encouraging educators to pair mindset training with goal-setting exercises to foster perseverance (Burnette et al., 2023).

Conclusion

This study brings forth numerous key findings that contribute to our understanding of the relationships between age, mindset, grit and academic achievement (marks percentage). A significant positive relationship between grit and marks percentage ($r = 0.31$, $p < .01$) confirms that grit plays a crucial role in academic achievements. The moderate positive correlation between mindset and grit ($r = 0.38$, $p < .01$) suggests that students with a growth mindset tend to have greater perseverance of effort and consistency of interest in their academic accomplishments, further contributing to the academic achievements of students. The

subscale analysis indicates that Perseverance of Effort is more strongly linked to both mindset and academic achievements than Consistency of Interest, emphasizing the significance of sustained effort over time. These findings underscore the critical role that both the mindset and grit play in determining academic achievements. Similarly, the weak but significant correlation between grit and age ($r = 0.11$, $p < .05$) suggests that older learners may develop more Perseverance of Effort, potentially due to maturity of age and accumulated experiences. These findings also contribute to the growing body of research on the significance of non-cognitive skills and psychological constructs, such as mindset and grit, in students' educational settings. This study also aligns with the previous studies carried out by Dweck (2006) and Duckworth et al. (2007) that underline the significance of a growth mindset and Perseverance of Effort for academic achievement. Nevertheless, there is a need to carry out more research to find out the causal interplay and prospective interventions that can help instill and inculcate these non-cognitive skills in our students. The relationship between a growth mindset and grit is proportionally correlated with the academic achievement of students (Ebenezer Nkrumah et al., 2021).

Whether a growth mindset is a function of grit or whether grit is a function of growth mindset remains open to debate, but these ideas are closely intertwined and can offer a valuable lens into how adolescents may operate when challenged academically. Secondary school education, in particular, plays a decisive role in career choices and opportunities. This demands a holistic understanding of how students learn and achieve better results (Najeeb Ullah et al., 2023). Therefore, cognitive skills (numeracy and literacy) and non-cognitive skills (mindset and grit) should be given proportional consideration, followed by meticulous planning and the best possible teaching. To conclude, the findings underline the significance of recognizing, developing, and fostering both a growth mindset and grit to improve students' academic achievements, explicitly by encouraging perseverance of effort in the face of challenges and consistency of interest at the crucial age of 14-17.

This study progresses understanding of how grit and a growth mindset jointly foster academic success, with Perseverance of Effort emerging as a cornerstone. While age plays a negligible role, the interplay between adaptive beliefs and sustained effort underscores the malleability of non-cognitive skills. For now, policymakers and educators should prioritize the interventions that cultivate resilience, confirming students are prepared to succeed in an increasingly challenging and demanding academic landscape.

Educational Impact and Implications Statement

The interplay between mindset, grit, age, and academic achievement is increasingly recognized as essential in educational psychology, highlighting the importance of non-cognitive skills

alongside cognitive abilities. This study examines the correlation among these constructs in male secondary school students in public sector schools in Lahore, Pakistan. Utilizing a quantitative design with a sample of 420 tenth-grade science students, the research employs Carol Dweck's Growth Mindset Survey and Angela Duckworth's Grit Scale to assess student attributes. Findings indicate that both grit and growth mindset significantly influence academic performance, suggesting that educational strategies should incorporate these skills to enhance outcomes. The study also investigates whether grit moderates the relationship between a growth mindset and academic achievement, indicating that fostering these traits can improve resilience and persistence. The findings have indicated that there was a very weak relationship between age, mindset, grit, and academic achievement. Implications for practice include integrated activities promoting grit and a growth mindset to enhance student engagement. To train educators on strategies to cultivate non-cognitive skills. Also, to support initiatives recognizing the importance of social-emotional learning alongside academic success. Generally, this research emphasizes the need to address non-cognitive skills for a holistic educational approach, leading to improved student academic success and personal development.

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