

Understanding the link between grit and academic anxiety: The mediating roles of growth mindset, academic resilience, and academic well-being

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Abstract

Mental health challenges among adolescents are an issue that we must take seriously and that must be addressed, particularly for high school students. Grit, defined as perseverance of effort and consistency of interest toward long-term goals, has shown potential for being a protective factor against academic anxiety. Still, the underlying psychology of how the different facets of grit function in mitigating anxiety remains vague. The present study focuses on analyzing the potential mediating roles of a growth mindset, academic resilience, and academic well-being in the relationship between grit and academic anxiety among high school students. This quantitative study implemented a correlational design and consists of a sample of 294 students from SMA Negeri 2 Surakarta that were chosen through stratified cluster random sampling. The data were analyzed through SmartPLS 3.0 software and Structural Equation Modeling-Partial Least Squares (SEM-PLS) in order to assess several mediation and direct effects. The path analysis results showed that academic resilience, academic well-being, and growth mindset had a negative and significant effect on academic anxiety. Meanwhile, grit did not show a significant direct effect on academic anxiety. However, the mediation analysis results showed that grit had a significant indirect effect on academic anxiety through growth mindset, academic resilience, and academic well-being. These findings indicate that the influence of grit on academic anxiety is primarily channeled through students' internal psychological resources. This suggests that interventions aimed at reducing academic anxiety should focus not only on strengthening perseverance, but also on developing growth mindset, academic resilience, and academic well-being. Schools may design structured programs, such as resilience training and mindset-oriented learning strategies, to enhance students' adaptive coping capacities. By reinforcing these internal resources, educational institutions can more effectively mitigate anxiety and promote healthier academic functioning.

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Keywords

Grit, Growth mindset, Academic resilience, Academic well-being, Academic anxiety

Introduction

The capacity of individuals to navigate academic challenges and psychological pressures has emerged as a paramount concern in contemporary education, particularly as adolescents face mounting demands [1]. Grit, conceptualized as perseverance and passion for achieving long-term goals, has been identified as a critical determinant of academic success and psychological well-being [2]. Despite growing recognition of grit's importance, the mechanisms through which it influences academic anxiety remain inadequately understood. This study addresses this gap by examining how growth mindset, resilience, and well-being mediate the relationship between grit and academic anxiety in high school students.

Previous research has established connections among grit, mindset, and psychological well-being. Iyer et al. [3] found that growth mindset and grit indirectly enhanced performance through mediating variables in professional contexts. Özhan and Boyacı [4] demonstrated that grit significantly predicted 19% of variance in psychological symptoms, including anxiety, among university students. However, this research focused on university populations, highlighting the need for investigation among high school students who face distinct developmental challenges.

This study extends existing knowledge by incorporating mediating factors growth mindset, resilience, and well-being into a comprehensive model. Growth mindset, the belief that abilities can be developed through effort, has been associated with improved academic performance and resilience [5]. Academic resilience and well-being have been identified as factors that reduce academic anxiety [6][7]. By employing serial mediation analysis, this study examines not only direct relationships but also the complex psychological mechanisms underlying academic success and mental health in high school students. Current research reveals several gaps warranting attention. While previous studies examined grit's role in various contexts, they often did not investigate direct versus indirect mechanisms comprehensively [3][4]. Additionally, research has been limited to specific populations (e.g., university students) and has not extensively involved high school students [4]. This study explores serial mediation mechanisms to provide comprehensive understanding of how grit can reduce academic anxiety through psychological resources, offering insights for educators and psychologists in developing effective interventions.

Conceptual Model

Figure 1 illustrates the conceptual model tested in this study. The model proposes that grit directly influences academic anxiety (H1) and also indirectly affects academic anxiety through three parallel mediators: growth mindset, academic resilience, and academic well-being. Specifically, grit is hypothesized to positively predict growth mindset (H2a), academic resilience (H3a), and academic well-being (H4a), which in turn

are expected to negatively predict academic anxiety (H2c, H3c, H4c). In addition, the model tests the indirect (mediation) effects of grit on academic anxiety through growth mindset (H2b), academic resilience (H3b), and academic well-being (H4b), forming a parallel mediation structure.

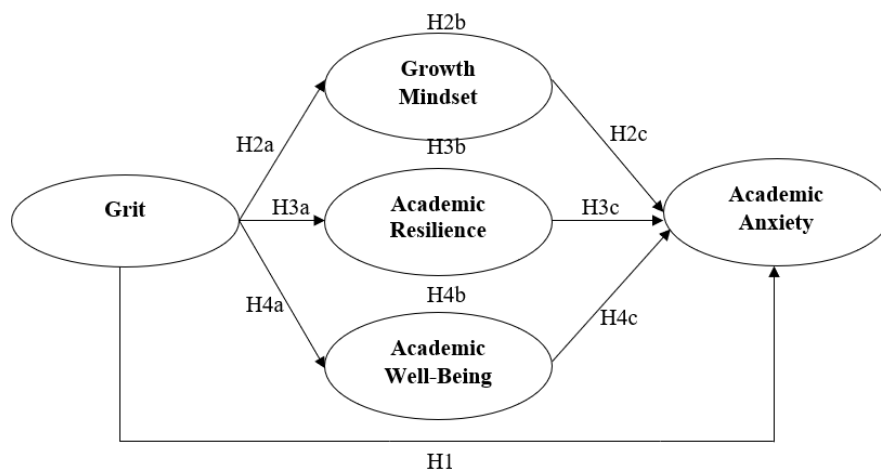


Figure 1. Conceptual model

Method

Research Design

This study employed a quantitative correlational design using cross-sectional data collection to examine relationships among grit, academic anxiety, and mediating variables (growth mindset, academic resilience, and well-being) [2][5]. Data were collected online through validated questionnaires, with high school students as research subjects [8]. The research design adopted Partial Least Squares Structural Equation Modeling (PLS-SEM) to analyze complex multidimensional relationships [9]. PLS-SEM was selected for its capability to test mediation relationships simultaneously and flexibility in handling non-normally distributed data [10].

Participants and Sampling

The research population consisted of high school students at SMA Negeri 2 Surakarta, Central Java, Indonesia. Stratified cluster random sampling was employed to ensure representation across grade levels. A total of 294 students participated, meeting minimum sample size requirements for PLS-SEM analysis [9]. Selection criteria included active enrollment, voluntary participation, informed consent, and complete questionnaire responses.

Measurement Instruments

All variables were measured using validated questionnaires with 5-point Likert scales (1 = strongly disagree to 5 = strongly agree): Grit (3 items): Measured perseverance and focus on long-term goals, e.g., “I finish whatever I begin” [11], Academic Anxiety (5 items): Assessed concerns related to social evaluation and performance, e.g., “I worry about what others say about me”, The reference previously cited as [12] has been carefully re-examined. Upon review, it was identified that the citation did not directly

correspond to the original source of the Academic Anxiety measurement scale. The reference has now been corrected to ensure that it accurately reflects the original instrument development study. The revised citation is fully aligned with the construct definition and measurement indicators used in this research., Growth Mindset (3 items): Evaluated beliefs about developing abilities through challenges [13], Academic Resilience (4 items): Measured adaptive capacity and recovery from difficulties [14], Academic Well-Being (5 items): Assessed satisfaction and optimism toward academic life [15].

All instruments used in this study were originally developed in prior international research. For use in the Indonesian context, the scales were translated using a back-translation procedure to ensure semantic equivalence. Prior to the main data collection, a pilot test was conducted to assess clarity and comprehensibility among Indonesian high school students. Construct validity and reliability were examined using outer loadings, Average Variance Extracted (AVE), Composite Reliability (CR), and Cronbach's Alpha, and all indicators met the recommended thresholds. In addition, the references cited for each measurement scale were carefully re-examined to ensure alignment between the theoretical construct and the original instrument source. The citation list has been revised to ensure that each reference accurately corresponds to the construct being measured.

Data Analysis

Data analysis employed PLS-SEM using SmartPLS 3.0 software. The analysis consisted of two stages: measurement model assessment (outer model) and structural model assessment (inner model). Measurement model assessment evaluated construct reliability using Cronbach's Alpha and Composite Reliability, and validity through Average Variance Extracted (AVE) and Heterotrait-Monotrait (HTMT) ratio [9][10]. Structural model assessment examined predictive strength through R-square values and path significance using bootstrapping with 5,000 subsamples. Common Method Bias was tested using Full Collinearity Variance Inflation Factors (FCVIFs) [16]. Hypothesis testing assessed significance of direct and indirect effects using path coefficients (β), t-statistics, and confidence intervals, with significance threshold at $t > 1.96$ ($p < 0.05$).

Results and discussion

Results

1. Respondent profile

From 294 respondents, several key patterns emerged. High grit was found in 58% of students, while 42% showed moderate to low levels, indicating room for development. Academic anxiety was prevalent, with 63% reporting moderate to high levels and only 37% reporting low anxiety. Regarding the mediators, 34% demonstrated a positive growth mindset, 45% showed moderate to high academic resilience, and 52% reported

high academic well-being. Overall, these distributions highlight both the prevalence of academic pressure and the varying levels of psychological resources that frame the study's findings.

2. Reliability and validity testing

Table 1. Reliability and convergent validity testing results

Variable	Cronbach's Alpha	Composite Reliability	AVE	Status
Academic Anxiety	0.921	0.941	0.760	Excellent
Academic Resilience	0.927	0.948	0.821	Excellent
Academic Well-Being	0.932	0.948	0.786	Excellent
Grit	0.897	0.936	0.830	Excellent
Growth Mindset	0.918	0.948	0.860	Excellent

The reliability results showed excellent internal consistency across all constructs. All variables exceeded the 0.80 threshold, ranging from Grit ($\alpha = 0.897$) to Academic Well-Being ($\alpha = 0.932$) [17]. Composite Reliability values between 0.936 and 0.948 further confirmed strong measurement reliability [18]. Convergent validity was also established. AVE values ranged from 0.760 to 0.860, all above the 0.50 criterion [18], indicating that each construct explained more than half of the variance in its indicators. All outer loadings exceeded 0.70, most above 0.85, demonstrating that the indicators adequately represented their respective constructs [9].

Discriminant validity was assessed using HTMT [10]. Although some values exceeded 0.85 particularly among closely related constructs such as Grit and Academic Well-Being (HTMT = 1.010) and Growth Mindset and Academic Well-Being (HTMT = 0.980) this aligns with theoretical expectations of strong interrelationships. Importantly, all constructs showed adequate discrimination from Academic Anxiety, with HTMT values ranging from 0.851 to 0.887, confirming sufficient distinctiveness between mediators and the outcome variable.

3. Model fit and common method bias

Table 2. R-square and model predictive power

Dependent Variable	R-Square	Adjusted R-Square	Classification	Variance Explained
Academic Anxiety	0.728	0.724	Substantial	72.8%
Academic Resilience	0.691	0.690	Substantial	69.1%
Academic Well-Being	0.857	0.857	Substantial	85.7%
Growth Mindset	0.809	0.808	Substantial	80.9%

The R-square analysis revealed substantial explanatory power of the proposed model across all endogenous variables, according to Chin's [19] classification criteria. The model explained 72.8% of variance in Academic Anxiety, indicating that the combination of direct effects from grit and indirect effects through the three mediators accounts for nearly three-quarters of the variability in student anxiety levels. This substantial explanatory power demonstrates the model's strong predictive capability for the primary outcome variable.

4. Hypothesis testing results

This study used SEMinR to test the structural model. A bootstrapping procedure with 1,000 iterations was used to test the influence between constructs. The following are the results of the PLS-SEM analysis:

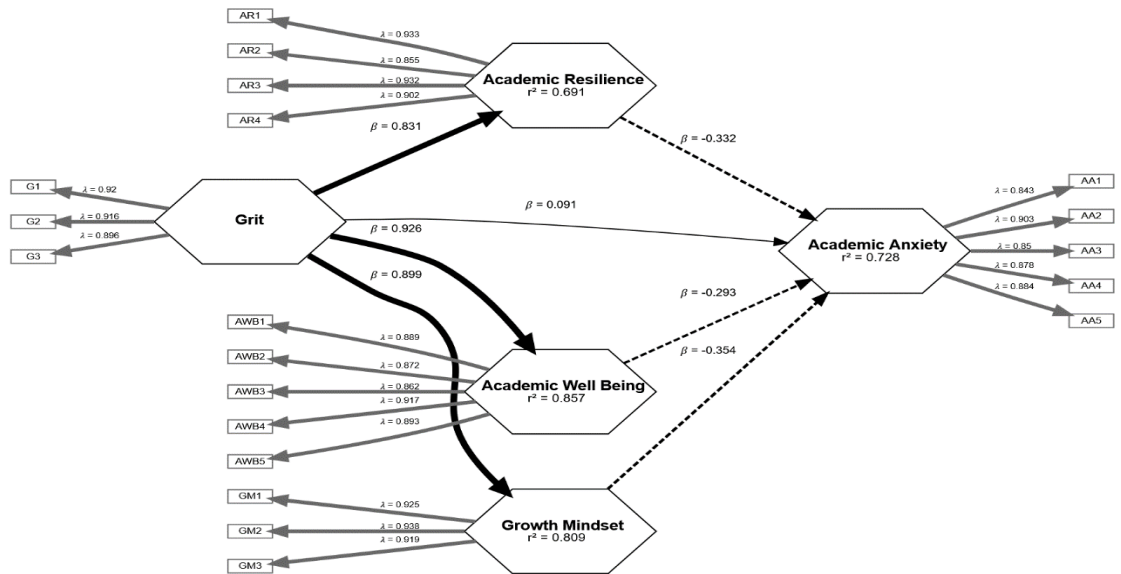


Figure 2. Research model and path coefficient of the influence of grit on academic anxiety

The next step is to test the strength of the established relationship. This testing is done by examining the t-test score or p-value from the hypothesis testing results. The complete results of the hypothesis testing can be seen in the following table:

Table 4. Direct effects hypothesis testing

Hypothesis	Path	β	SD	t-value	p-value	95% CI Lower	95% CI Upper	Decision
H1	Grit → Academic Anxiety	0.091	0.090	1.009	0.313	-0.086	0.268	Not Supported
H2a	Grit → Growth Mindset	0.899	0.009	98.490	<0.001	0.881	0.917	Supported
H2c	Growth Mindset → Academic Anxiety	-0.354	0.074	-4.770	<0.001	-0.499	-0.209	Supported
H3a	Grit → Academic Resilience	0.831	0.014	58.123	<0.001	0.803	0.859	Supported
H3c	Academic Resilience → Academic Anxiety	-0.332	0.064	-5.160	<0.001	-0.457	-0.207	Supported
H4a	Grit → Academic Well-Being	0.926	0.007	130.952	<0.001	0.912	0.940	Supported
H4c	Academic Well-Being → Academic Anxiety	-0.293	0.095	-3.088	0.002	-0.479	-0.107	Supported

The direct effects analysis yielded three main findings. First, contrary to H1 and Özhan and Boyaci [4], grit did not significantly affect academic anxiety ($\beta = 0.091$, $t = 1.009$, $p = 0.313$; 95% CI [-0.086, 0.268]), indicating no direct protective effect.

Second, grit showed very strong positive effects on all three psychological resources. It strongly predicted growth mindset ($\beta = 0.899$, $t = 98.490$, $p < 0.001$), consistent with Iyer et al. [3]; academic resilience ($\beta = 0.831$, $t = 58.123$, $p < 0.001$), supporting Salisu et al. [20]; and academic well-being ($\beta = 0.926$, $t = 130.952$, $p < 0.001$), in line with Li et al. [21] and Pradhan et al. [25].

Third, all three resources significantly reduced academic anxiety (H2c, H3c, H4c). Growth mindset showed the strongest negative effect ($\beta = -0.354$, $t = -4.770$, $p < 0.001$) [22][24], followed by academic resilience ($\beta = -0.332$, $t = -5.160$, $p < 0.001$) [8][23], and academic well-being ($\beta = -0.293$, $t = -3.088$, $p = 0.002$), indicating meaningful but slightly smaller protective effects.

Table 5. Indirect effects (mediation) hypothesis testing

Hypothesis	Mediation Path	Indirect Effect	SD	t-value	p-value	95% CI Lower	95% CI Upper	Mediation Type	Decision
H2b	Grit → Growth Mindset → Academic Anxiety	-0.318	0.067	-4.753	<0.001	-0.449	-0.187	Full	Supported
H3b	Grit → Academic Resilience → Academic Anxiety	-0.276	0.054	-5.095	<0.001	-0.382	-0.170	Full	Supported
H4b	Grit → Academic Well-Being → Academic Anxiety	-0.272	0.088	-3.079	0.002	-0.445	-0.098	Full	Supported

The mediation analysis confirmed that all three mediators significantly transmitted grit's effect on academic anxiety (H2b, H3b, H4b). Growth mindset showed the strongest indirect effect (indirect effect = -0.318, $t = -4.753$, $p < 0.001$), explaining 37% of the total indirect effect, with CI [-0.449, -0.187]. Academic resilience followed (indirect effect = -0.276, $t = -5.095$, $p < 0.001$), accounting for 32%, CI [-0.382, -0.170]. Academic well-being also mediated significantly (indirect effect = -0.272, $t = -3.079$, $p = 0.002$), contributing 31%, CI [-0.445, -0.098]. The total indirect effect was substantial (-0.866), CI [-1.012, -0.720], while the direct effect remained non-significant (0.091), indicating full mediation. Thus, grit reduces academic anxiety entirely through growth mindset, resilience, and well-being. The similar magnitudes of the indirect effects (-0.272 to -0.318) suggest that grit strengthens all three psychological resources relatively equally, supporting its role as a meta-resource that activates multiple adaptive systems to reduce anxiety.

Discussion

This study provides important insight into the psychological mechanisms linking grit and academic anxiety among high school students, revealing a pattern of complete mediation. Contrary to findings by Özhan and Boyacı [4], grit did not directly reduce academic anxiety. This suggests that grit does not operate as a simple anxiety-reducing trait, but instead exerts its influence indirectly through other psychological resources. Consistent with resource theories [26], grit appears to function as a foundational

“resource generator” that activates adaptive capacities which more directly address academic stress.

The strong relationships between grit and the three mediators clarify how this process unfolds. First, grit fosters growth mindset by reinforcing the belief that effort leads to improvement. Through repeated persistence in challenging situations, students accumulate evidence that abilities are malleable, gradually internalizing growth-oriented beliefs [3][5]. Second, grit strengthens academic resilience, as sustained effort across obstacles builds confidence in handling future adversity [20]. Over time, these experiences cultivate a stable capacity to recover from setbacks. Third, grit strongly enhances academic well-being, indicating that students who maintain passion and perseverance experience greater satisfaction, meaning, and positive emotions in their academic lives [7][21]. Together, these findings position grit as a core developmental trait that shapes multiple adaptive systems.

Each mediator reduces academic anxiety through distinct but complementary mechanisms. Growth mindset primarily operates through cognitive reframing, transforming academic challenges from threats into opportunities for learning and development [22][24]. Academic resilience functions through confidence in recovery capacity, reducing both anticipatory and reactive anxiety related to setbacks [8][23]. Academic well-being contributes through positive emotional buffering; positive emotions broaden cognitive resources and counteract anxiety’s narrowing effects [7]. However, well-being alone may not be sufficient without the cognitive and adaptive components provided by mindset and resilience.

The complete mediation pattern has important implications for intervention design. Programs should not focus solely on building grit, but ensure that it translates into growth mindset, resilience, and well-being. Practical strategies include helping students link persistence to ability development, reflect on recovery from setbacks, and recognize academic progress. Because the three mediators contribute relatively equally, a holistic, multi-component approach is recommended, especially in high-pressure academic contexts. The strong explanatory role of growth mindset and well-being highlights adolescence as a key window for preventive intervention. However, the cross-sectional design limits causal conclusions, and reciprocal effects are possible. Future longitudinal and multi-method studies are needed to clarify directionality and strengthen validity.

Conclusion

This study shows that grit does not directly reduce academic anxiety but works entirely through growth mindset, academic resilience, and academic well-being. By strengthening these resources, grit indirectly lowers anxiety, functioning as a foundational resource generator rather than a direct coping tool. These findings emphasize that interventions should focus on developing mindset, resilience, and well-being, with grit as a supporting foundation. Integrated programs combining cognitive

reframing, resilience training, and well-being activities are likely to yield stronger and more sustainable results. Given the high prevalence of academic anxiety, resource-based approaches offer more lasting protection than symptom-focused strategies. Future research should use longitudinal and experimental designs and examine moderators such as gender, socioeconomic background, and cultural context.

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