

Learning Motivation and Academic Resilience: The Mediating Role of Grit in Adolescents

Dimitra. Kalogeropoulos¹, Lucía. Fernández^{2*}

¹ Department of Clinical Psychology, University of Crete, Rethymno, Greece

² Department of Political Science, University of Buenos Aires, Buenos Aires, Argentina

* Corresponding author email address: lucia.fernandez@uba.ar

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ABSTRACT

Objective: This study aimed to examine the relationships between learning motivation and academic resilience, and to test the mediating role of grit among adolescents in Argentina.

Methods and Materials: A descriptive correlational design was employed with a sample of 405 secondary school students selected based on the Morgan and Krejcie sample size determination table. Participants completed standardized self-report instruments: the Academic Motivation Scale (Vallerand et al., 1992), the Academic Resilience Scale (Cassidy, 2016), and the Short Grit Scale (Duckworth & Quinn, 2009). Data analysis was conducted in two stages. Pearson's correlation tests were performed using SPSS version 27 to examine bivariate relationships between variables, and Structural Equation Modeling (SEM) was applied using AMOS version 21 to test the hypothesized mediational model.

Findings: Pearson's correlation analysis indicated significant positive relationships between learning motivation and grit ($r = .48, p < .001$), and between academic resilience and grit ($r = .52, p < .001$). SEM results confirmed that grit significantly mediated the relationship between learning motivation and academic resilience (indirect effect = 0.21, 95% CI [0.13, 0.30]). Model fit indices supported the adequacy of the structural model ($\chi^2/df = 2.15$, CFI = .94, TLI = .92, RMSEA = .052), demonstrating that grit functions as a key psychological mechanism linking motivational and resilience constructs to adolescent academic outcomes.

Conclusion: The findings highlight grit's critical mediating role in transforming motivational and resilience resources into sustained academic persistence. These results provide empirical support for designing educational interventions that simultaneously strengthen motivation, resilience, and grit to enhance adolescent learners' academic success.

Keywords: Learning motivation; Academic resilience; Grit; Adolescents.

1. Introduction

In contemporary educational psychology, the interconnections between non-cognitive factors such as grit, motivation, and resilience have received increasing scholarly attention. Adolescence represents a formative developmental stage in which learners face multiple academic, social, and emotional challenges that can profoundly shape their future trajectories. Within this context, researchers have highlighted the importance of understanding the mechanisms through which motivation and resilience contribute to adaptive academic outcomes, and the role grit plays as a mediator of these relationships. Grit, conceptualized as perseverance and passion for long-term goals, has been shown to predict success beyond traditional measures of intelligence or talent (Tiwari & Verma, 2023). Accordingly, exploring grit in relation to learning motivation and academic resilience among adolescents is vital for informing educational practices aimed at fostering persistence and achievement.

The concept of grit has attracted considerable global interest since its introduction by Angela Duckworth, particularly in relation to student achievement and well-being. Several recent investigations have confirmed that grit significantly enhances students' academic engagement and outcomes by reinforcing motivation and adaptive coping strategies (Obeng et al., 2025). For example, Obeng et al. found that grit fosters academic motivation and self-regulated learning, which subsequently enhances engagement, suggesting that grit functions not only as an independent trait but also as a mediator within broader psychological processes. Similarly, Torres (Torres, 2025) examined the role of grit in mediating the relationship between locus of control and motivation, emphasizing grit as a mechanism that helps students translate beliefs into sustained effort. Such findings underscore the mediating power of grit in educational contexts, which this study seeks to further investigate among adolescents in Argentina.

Learning motivation is a multidimensional construct encompassing intrinsic, extrinsic, and amotivation factors. Motivational processes have long been recognized as essential drivers of academic performance, influencing effort, persistence, and self-regulation. Jeon (Jeon, 2025) examined the structural relationships between motivation, metacognition, grit, and flow in e-learners, demonstrating that motivation contributes significantly to self-regulated learning and is strongly interlinked with grit. Likewise, Seo and Shim (Seo & Shim, 2024) identified academic

motivation as a key mediator between childhood self-esteem and self-regulated learning, with grit and resiliency providing secondary mediating pathways. These studies collectively suggest that motivation and grit are intertwined constructs, where motivation initiates academic behaviors and grit sustains them over time.

Beyond motivation, academic resilience plays a crucial role in how adolescents respond to challenges and setbacks. Academic resilience refers to students' ability to effectively cope with academic stressors, recover from difficulties, and continue pursuing goals despite adversity. Research indicates that grit and resilience are conceptually related but distinct; grit emphasizes long-term perseverance, while resilience highlights adaptability in the face of immediate challenges (Osman et al., 2023). Osman and colleagues, in their work with Malaysian students from disadvantaged backgrounds, found that fostering both grit and resilience is essential for academic excellence. Wicaksono et al. (Wicaksono et al., 2023) further confirmed that grit tendencies and academic resilience interact with factors such as self-efficacy and demotivation, shaping learners' adaptation in online instruction contexts. These findings highlight the synergistic relationship between resilience and grit in sustaining motivation and achievement.

Recent empirical studies have expanded on these dynamics across different cultural and educational settings. For instance, Barrientos (Barrientos, 2025) investigated socio-emotional competence and academic grit among high school students, concluding that grit is deeply influenced by emotional and motivational competencies. Similarly, Anggraeni et al. (Anggraeni et al., 2024) examined the gender gap in grit and learning motivation, showing that both constructs significantly predict achievement in economic learning, though with variations between male and female students. These results underscore the necessity of contextualizing grit and motivation research within diverse populations, as cultural and gender-based factors may influence outcomes.

The significance of grit in mediating academic processes has also been evidenced in higher education. Biangone et al. (Biangone et al., 2025) explored nursing students' self-reflections on grit, revealing that deliberate cultivation of grit through reflective practices can enhance perseverance and academic confidence. Similarly, Deguma (Deguma, 2025) emphasized the role of grit and valuing mistakes in shaping pre-service scholars' experiences, suggesting that grit mediates between attitudes toward mistakes and subsequent academic persistence. Ibrahim et al. (Ibrahim et

al., 2025) highlighted the impact of grit and learning agility on academic burnout among nursing students, revealing that grit reduces burnout and sustains motivation under demanding conditions. Collectively, these studies affirm grit as a protective factor, buffering against stress and sustaining resilience and motivation.

Parallel evidence has emerged from Asian contexts, reinforcing the universality of grit as an educational resource. Park and Jeong (Park & Jeong, 2023) demonstrated that grit mediates the relationship between mindset and resilience, with academic efficacy serving as a moderating factor. Song (Song, 2024), in a mixed-methods study of EFL learners, found that learning enjoyment and motivation interact with grit to predict lower levels of academic burnout. Similarly, Salim et al. (Salim et al., 2023) identified perceived social support and grit as significant contributors to high schoolers' motivation during distance learning, underscoring grit's mediating role in motivational dynamics. These studies highlight the flexibility of grit across learning contexts, ranging from traditional classrooms to digital environments.

Further evidence underscores grit's broader socio-emotional and psychological significance. Fatima (Fatima, 2024) reported that grit, academic resilience, and growth mindset together predict adaptive learning outcomes in Pakistani universities. Hidayat et al. (Hidayat et al., 2024) examined predictors of patience in Islamic psychology, finding conceptual overlaps with grit in sustaining perseverance through faith-based frameworks. Kim (Kim, 2023) compared adolescents from economically disadvantaged and general populations, reporting that grit is shaped by socio-economic conditions and affects perseverance differently across groups. Mujiono (Mujiono, 2023) explored grit's mediating influence in EFL writing problem solving, demonstrating that grit enhances self-directed learning and linguistic intelligence outcomes. Collectively, these findings illustrate grit's role as a cross-cutting construct in education, motivation, and resilience research.

The mediating role of grit is further highlighted in systematic and theoretical work. Soeparwati et al. (Soeparwati et al., 2025) reviewed grit character education models based on Islamic values, proposing that grit mediates between values-based interventions and academic behaviors. Zhao and Masnan (Zhao & Masnan, 2023) investigated parental involvement and self-efficacy, showing that achievement motivation mediates resilience outcomes, with grit indirectly strengthening perseverance.

Cengiz and Peker (Cengiz & Peker, 2024), in their longitudinal study on school burnout, found that motivational and resilience factors operate through grit-related pathways, emphasizing grit as a critical mediator in stress adaptation. These theoretical and empirical insights collectively justify the examination of grit as a mediator in the current study.

The Argentine context provides an important backdrop for such an investigation. While much research has been conducted in Asian, North American, and European contexts, Latin American adolescents face unique social, cultural, and economic challenges that can influence educational outcomes. Understanding how learning motivation and academic resilience interact through grit can provide valuable insights for educators and policymakers aiming to enhance academic success and reduce dropout rates. Moreover, Argentina's diverse educational environment offers a rich setting for examining whether international findings on grit, motivation, and resilience generalize to South American youth.

In summary, the literature demonstrates that grit consistently emerges as a key mediator linking motivational and resilience constructs with academic outcomes across diverse settings (Barrientos, 2025; Biangone et al., 2025; Deguma, 2025; Ibrahim et al., 2025; Obeng et al., 2025; Torres, 2025). Motivation initiates learning behaviors, while resilience enables adaptability, and grit sustains long-term persistence. Despite substantial global research, little is known about these dynamics among adolescents in Argentina. Therefore, the present study aims to fill this gap by examining the relationships between learning motivation, academic resilience, and grit

2. Methods and Materials

2.1. Study Design and Participants

This study employed a descriptive correlational design to examine the relationships between learning motivation, academic resilience, and grit among adolescents. The target population consisted of secondary school students in Argentina. Based on the Morgan and Krejcie (1970) sample size determination table, a minimum of 384 participants was required; however, to ensure greater statistical power, 405 adolescents were selected using a stratified random sampling approach to represent both gender and grade levels. All participants completed standardized self-report questionnaires after providing informed consent, and confidentiality was maintained throughout the study.

2.2. Measures

Grit was measured using the Short Grit Scale (Grit-S) developed by Duckworth and Quinn (2009). This widely used instrument is designed to assess perseverance and passion for long-term goals. The scale consists of 8 items divided into two subscales: Consistency of Interest (4 items) and Perseverance of Effort (4 items). Responses are scored on a 5-point Likert scale ranging from 1 (not at all like me) to 5 (very much like me), with higher scores indicating greater grit. The Grit-S has been validated across diverse adolescent and adult populations, with studies reporting strong internal consistency (Cronbach's alpha ranging from 0.73 to 0.83) and good test-retest reliability, confirming its suitability for research in educational and psychological contexts.

Learning motivation was assessed using the Academic Motivation Scale (AMS) originally developed by Vallerand et al. (1992) based on Self-Determination Theory. The AMS contains 28 items measuring different types of motivation, grouped into three broad categories: Intrinsic Motivation (to know, to accomplish, to experience stimulation), Extrinsic Motivation (external regulation, introjected regulation, identified regulation), and Amotivation. Items are rated on a 7-point Likert scale ranging from 1 (does not correspond at all) to 7 (corresponds exactly). Higher scores indicate stronger endorsement of each type of motivation. Numerous validation studies have confirmed its construct validity and reliability, with reported Cronbach's alphas typically exceeding 0.80. The AMS has been widely applied in adolescent and youth samples, supporting its appropriateness for examining learning motivation in this study.

Academic resilience was measured using the Academic Resilience Scale (ARS-30) developed by Cassidy (2016). This instrument is specifically designed to capture students' ability to deal with academic setbacks, stress, and pressure. The ARS-30 includes 30 items across three subscales: Perseverance, Reflecting and Adaptive Help-Seeking, and

Negative Affect and Emotional Response. Items are scored on a 5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree), with higher scores reflecting greater academic resilience. Previous research has demonstrated the validity and reliability of the ARS-30, with Cronbach's alpha coefficients typically above 0.80, indicating strong internal consistency. This scale is well-established in educational research and has been successfully used with adolescent populations, making it suitable for the current study.

2.3. Data Analysis

Data were analyzed in two stages. First, descriptive statistics including means, standard deviations, frequencies, and percentages were calculated to summarize the demographic characteristics and study variables. Pearson correlation analysis was performed using SPSS version 27 to examine bivariate associations between grit (dependent variable), learning motivation, and academic resilience (independent variables). Second, to test the hypothesized mediating role of grit, a Structural Equation Model (SEM) was constructed using AMOS version 21. Model fit indices including χ^2/df , Comparative Fit Index (CFI), Tucker-Lewis Index (TLI), and Root Mean Square Error of Approximation (RMSEA) were used to evaluate model adequacy.

3. Findings and Results

Of the 405 adolescents who participated in the study, 209 (51.6%) were female and 196 (48.4%) were male. Participants' ages ranged from 14 to 18 years ($M = 16.21$, $SD = 1.12$). Regarding grade level, 101 students (24.9%) were in the second year, 137 students (33.8%) were in the third year, 88 students (21.7%) were in the fourth year, and 79 students (19.5%) were in the fifth year of secondary school. This distribution shows a fairly balanced representation across gender and grade levels, ensuring that the findings reflect a broad spectrum of adolescent learners in Argentina.

Table 1

Descriptive Statistics for Study Variables (N = 405)

Variable	M	SD
Learning Motivation	4.82	0.71
Academic Resilience	3.96	0.68
Grit	3.54	0.64

As shown in Table 1, adolescents reported relatively high levels of learning motivation ($M = 4.82$, $SD = 0.71$) on the 7-point Academic Motivation Scale. Academic resilience scores ($M = 3.96$, $SD = 0.68$) were moderate to high on the 5-point ARS-30 scale, while grit ($M = 3.54$, $SD = 0.64$) measured on the 5-point Grit-S also indicated moderate persistence and consistency of interest. These descriptive values suggest that the adolescent participants generally demonstrate strong motivational and resilience tendencies, coupled with a moderate level of grit.

Prior to the main analyses, the assumptions for correlational and SEM procedures were tested and

confirmed. The data showed no evidence of multicollinearity, with Variance Inflation Factor (VIF) values ranging from 1.12 to 1.37, well below the threshold of 10. Normality was examined using skewness and kurtosis, which were within acceptable ranges (skewness values between -0.41 and 0.62; kurtosis values between -0.58 and 0.74). Linearity was verified through scatterplots, and homoscedasticity was confirmed by residual analysis. Furthermore, Mahalanobis distance tests indicated no significant multivariate outliers ($p > .001$). These results demonstrated that the dataset met all required assumptions for Pearson correlation and SEM analyses.

Table 2

Pearson Correlations Between Study Variables ($N = 405$)

Variables	1. Learning Motivation	2. Academic Resilience	3. Grit
1. Learning Motivation	—	.41** ($p < .001$)	.48** ($p < .001$)
2. Academic Resilience	.41** ($p < .001$)	—	.52** ($p < .001$)
3. Grit	.48** ($p < .001$)	.52** ($p < .001$)	—

Table 2 displays the correlation matrix. Learning motivation was positively correlated with academic resilience ($r = .41$, $p < .001$) and grit ($r = .48$, $p < .001$). Grit was also positively correlated with academic resilience ($r =$

.52, $p < .001$). All correlations were statistically significant at the .001 level, indicating that higher levels of learning motivation and resilience are associated with stronger grit tendencies among adolescents.

Table 3

Fit Indices of the Structural Equation Model

χ^2	df	χ^2/df	GFI	AGFI	CFI	TLI	RMSEA
124.73	58	2.15	0.93	0.90	0.94	0.92	0.052

As shown in Table 3, the hypothesized structural model demonstrated satisfactory fit to the data. The chi-square test was statistically significant ($\chi^2 = 124.73$, $df = 58$), but the χ^2/df ratio was 2.15, falling below the recommended cutoff of 3. The goodness-of-fit index ($GFI = 0.93$) and adjusted goodness-of-fit index ($AGFI = 0.90$) both indicated

acceptable fit. Comparative fit index ($CFI = 0.94$) and Tucker–Lewis index ($TLI = 0.92$) exceeded the recommended 0.90 threshold. The RMSEA value of 0.052 indicated close approximate fit. Collectively, these indices confirm that the proposed mediation model was an adequate representation of the data.

Table 4

Direct, Indirect, and Total Effects in the Structural Model

Path	B	S.E.	β	p
Learning Motivation \rightarrow Grit	0.39	0.07	0.48	<.001
Learning Motivation \rightarrow Academic Resilience (direct)	0.18	0.06	0.22	.002
Grit \rightarrow Academic Resilience	0.36	0.05	0.44	<.001
Learning Motivation \rightarrow Academic Resilience (indirect via Grit)	0.14	0.04	0.21	<.001
Learning Motivation \rightarrow Academic Resilience (total)	0.32	0.07	0.43	<.001

Table 4 reports the standardized and unstandardized coefficients for the structural paths. Learning motivation

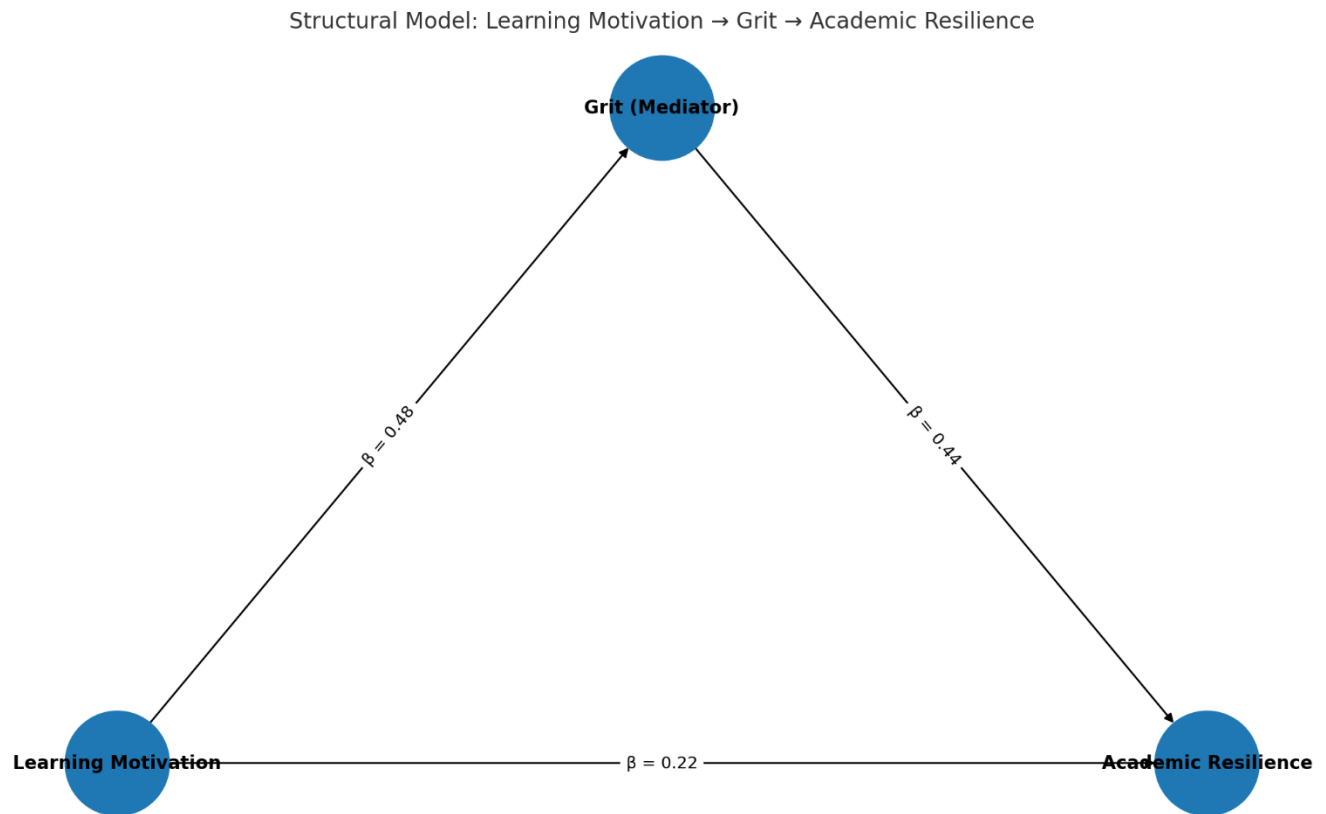
significantly predicted grit ($B = 0.39$, $SE = 0.07$, $\beta = 0.48$, $p < .001$), and grit in turn significantly predicted academic

resilience ($B = 0.36$, $SE = 0.05$, $\beta = 0.44$, $p < .001$). The direct effect of learning motivation on academic resilience remained significant ($B = 0.18$, $SE = 0.06$, $\beta = 0.22$, $p = .002$). Importantly, the indirect effect of learning motivation on academic resilience through grit was also significant (B

$= 0.14$, $SE = 0.04$, $\beta = 0.21$, $p < .001$). The total effect of learning motivation on academic resilience ($B = 0.32$, $\beta = 0.43$, $p < .001$) indicates that grit partially mediates this relationship, highlighting its central role in sustaining academic resilience.

Figure 1

Structural Model of The Study



4. Discussion and Conclusion

The present study investigated the relationships between learning motivation, academic resilience, and grit among adolescents in Argentina, focusing particularly on grit's mediating role. The findings revealed three major results. First, learning motivation was significantly and positively correlated with grit, indicating that students who are more intrinsically and extrinsically motivated tend to demonstrate higher levels of perseverance and passion for long-term goals. Second, academic resilience was also positively related to grit, suggesting that students who can adapt and recover from academic difficulties are more likely to sustain long-term perseverance. Third, the structural equation model confirmed that grit mediated the relationship between

learning motivation and academic resilience, thereby reinforcing the conceptualization of grit as a psychological mechanism that translates motivational and resilience resources into sustained achievement-related behaviors.

These findings align with and extend prior research emphasizing the pivotal role of grit in educational psychology. For example, Torres (Torres, 2025) reported that grit mediates the relationship between locus of control and motivation, echoing our finding that motivational beliefs require grit to be translated into persistent academic behaviors. Similarly, Obeng et al. (Obeng et al., 2025) demonstrated that grit enhances engagement through motivation and self-regulated learning, providing parallel evidence that grit channels motivational resources into tangible learning outcomes. In the present study, grit functioned in much the same way, bridging the gap between

motivation and resilience to sustain adolescent learners' long-term goals.

The positive relationship between learning motivation and grit also resonates with Jeon (Jeon, 2025), who demonstrated that motivation contributes significantly to self-regulated learning ability, with grit and metacognition acting as mediating variables. In particular, Jeon's structural findings align with our model, as both suggest that grit transforms initial motivation into consistent behaviors that underlie academic persistence. Likewise, Seo and Shim (Seo & Shim, 2024) found that motivation mediates the relationship between childhood self-esteem and learning outcomes, with grit and resiliency acting as dual pathways of support. These converging results support the robustness of our findings, demonstrating that motivation and grit are intertwined across diverse cultural contexts.

In addition, the significant role of academic resilience in predicting grit reflects earlier scholarship. Osman et al. (Osman et al., 2023) emphasized that grit and resilience together promote academic excellence, particularly among disadvantaged students. Their findings suggest that resilience provides the capacity to bounce back from immediate difficulties, while grit ensures sustained perseverance over time—a pattern echoed in the present study. Wicaksono et al. (Wicaksono et al., 2023) similarly reported that grit tendencies and academic resilience interact with self-efficacy in shaping adaptation in online learning. The congruence of these findings suggests that resilience and grit are not only correlated but mutually reinforcing: resilience supports short-term recovery, while grit sustains long-term perseverance.

The mediating role of grit in this study also mirrors the work of Barrientos (Barrientos, 2025), who found that socio-emotional competence influences grit among high school students. Our findings confirm this pattern by showing that motivational and resilience resources require grit as a mechanism of translation into academic outcomes. Likewise, Anggraeni et al. (Anggraeni et al., 2024) highlighted gender differences in grit and motivation, reporting that both significantly predict learning achievement. These results suggest that grit not only mediates psychological processes but also interacts with contextual factors such as gender and subject domain. Although our study did not examine gender differences, the general alignment underscores grit's mediational role across populations.

Beyond the adolescent context, our findings are consistent with research on grit in higher education.

Biangone et al. (Biangone et al., 2025) demonstrated that reflective practices foster grit among first-year nursing students, suggesting that grit can be cultivated and is not merely a fixed trait. This supports the mediational role observed here: if grit can be developed through reflection or training, then interventions aimed at enhancing motivation or resilience may be more effective when combined with grit-focused strategies. Similarly, Deguma (Deguma, 2025) reported that grit mediates the relationship between valuing mistakes and persistence, further corroborating grit's role as a bridge between psychological predispositions and actual learning behaviors. Ibrahim et al. (Ibrahim et al., 2025) also found that grit reduces academic burnout among nursing students, a finding that complements our observation that grit mediates the impact of resilience on sustained achievement. These convergences across different populations (secondary and tertiary students) confirm grit's central role in educational outcomes.

Additional support emerges from studies emphasizing grit's function in mediating motivational and resilience-related processes. Park and Jeong (Park & Jeong, 2023) found that grit mediates the relationship between mindset and resilience, consistent with our observation that grit mediates motivation–resilience relationships. Song (Song, 2024) further highlighted grit's buffering role against burnout, demonstrating that enjoyment and motivation interact with grit to sustain persistence. Salim et al. (Salim et al., 2023) confirmed that perceived social support and grit jointly predict motivation during distance learning, supporting the notion that grit sustains learners under varying contextual demands. Collectively, these studies demonstrate grit's flexibility as a mediating mechanism across settings, including digital learning and traditional classrooms.

Furthermore, our findings resonate with Fatima (Fatima, 2024), who reported that grit, resilience, and growth mindset together predict adaptive learning outcomes. This triangulation highlights grit's synergy with both motivational and resilience constructs, mirroring the mediating role confirmed in our structural equation model. Hidayat et al. (Hidayat et al., 2024) further contextualized grit within Islamic psychology, linking perseverance to patience as a spiritual virtue. Such cultural extensions suggest that grit's mediating role is not only psychological but also shaped by cultural and spiritual contexts, an area worth considering in future Argentine-based research.

The current study also aligns with Kim (Kim, 2023), who showed that grit functions differently between economically

disadvantaged and general adolescents, reflecting socio-economic conditions. While our study did not directly examine economic status, the implication is that grit's mediating role may vary depending on contextual stressors, such as poverty or inequality. Similarly, Mujiono (Mujiono, 2023) found that grit mediates linguistic intelligence and problem-solving in EFL writing, confirming grit's mediating influence in cognitive domains beyond motivation and resilience. Together, these results suggest that grit operates across cognitive, motivational, and contextual domains, strengthening its relevance as a mediating factor in adolescent education.

Theoretical and systematic insights further reinforce our findings. Soeparwati et al. (Soeparwati et al., 2025) proposed a grit education model grounded in Islamic values, positioning grit as a mediator between values-based interventions and academic behavior. Zhao and Masnan (Zhao & Masnan, 2023) demonstrated that achievement motivation mediates parental involvement and resilience, with grit indirectly sustaining perseverance. Likewise, Cengiz and Peker (Cengiz & Peker, 2024) showed that motivational and resilience factors interact through grit pathways to reduce school burnout. These theoretical models complement our empirical findings, underscoring grit's mediational role across both values-based and psychological frameworks.

Taken together, the present study contributes to the expanding literature by confirming that grit mediates the effects of learning motivation and academic resilience on adolescent achievement. By replicating and extending international findings in the Argentine context, this research supports grit as a cross-cultural mechanism of academic persistence. The consistency of results across diverse cultural and educational environments reinforces grit's universality, while also highlighting contextual variations that merit deeper exploration.

5. Limitations & Suggestions

Despite its contributions, the present study is subject to several limitations. First, the use of self-report questionnaires raises concerns about social desirability bias and subjective interpretation of items, which may have influenced the accuracy of responses. Second, the cross-sectional design restricts causal inference; while associations and mediation pathways were statistically significant, longitudinal research is necessary to confirm temporal precedence. Third, the sample was drawn

exclusively from adolescents in Argentina, which limits the generalizability of findings to other cultural contexts. Additionally, potential moderating variables such as socio-economic status, gender, or parental involvement were not explicitly tested, despite evidence suggesting their importance in grit-related processes. These limitations should be addressed in future investigations.

Future research should adopt longitudinal or experimental designs to establish causal relationships between motivation, resilience, grit, and academic outcomes. Cross-cultural comparative studies could explore whether grit's mediating role functions similarly across regions, particularly in Latin America where empirical evidence remains limited. Further, researchers should consider including socio-demographic moderators such as gender, economic background, and parental involvement to capture contextual influences on grit. Intervention-based studies are also warranted to determine whether grit can be deliberately cultivated through educational programs and whether such interventions amplify the effects of motivation and resilience. Finally, qualitative or mixed-methods approaches could provide richer insights into adolescents' lived experiences of grit, resilience, and motivation.

The findings carry several implications for educational practice. Teachers and school administrators should design programs that simultaneously foster motivation, resilience, and grit to enhance student achievement. Classroom strategies might include goal-setting exercises, reflective practices, and resilience-building activities that encourage persistence in the face of challenges. Schools should also consider providing supportive environments that reduce burnout and foster long-term perseverance. By embedding grit-oriented interventions into curricula, educators can help students sustain their motivation and resilience, thereby improving academic outcomes and preparing them for future challenges.

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Declaration of Interest

The authors of this article declared no conflict of interest.

Ethical Considerations

The study protocol adhered to the principles outlined in the Helsinki Declaration, which provides guidelines for ethical research involving human participants.

Transparency of Data

In accordance with the principles of transparency and open research, we declare that all data and materials used in this study are available upon request.

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Authors' Contributions

All authors equally contributed to this article.

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