ORIGINAL ARTICLE

Academic grit and academic engagement: The mediating effects of self-efficacy and educational expectations

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ABSTRACT

This study investigates the relationship between academic grit and academic engagement, with a focus on the mediating roles of academic self-efficacy and educational expectations. A sample of 1365 adolescents completed four questionnaires measuring academic grit, academic engagement, educational expectations, and academic self-efficacy. Structural equation modeling showed a good model fit (χ^2/df = 6.18, root mean squared error of approximation [RMSEA] = 0.07, Bentler's comparative fit index [CFI] = 0.99, Tucker-Lewis index [TLI] = 0.98, standardized root mean square residual [SRMR] = 0.02). Academic grit significantly predicted academic engagement (β = 0.36, $P < 0.001$). Both academic self-efficacy and educational expectations had significant mediating effects (indirect effect = 0.40, 95% confidence interval [CI; 0.32, 0.49]; indirect effect = 0.03, 95% CI [0.01, 0.04]), accounting for 51% and 3.8% of the total effect, respectively. These findings suggest that academic grit influences academic engagement both directly and indirectly through self-efficacy and expectations, underscoring the critical role of these mediators in enhancing students' academic success and providing insights for educational interventions.

Key words: grit, academic engagement, self-efficacy, educational expectations.

INTRODUCTION

Academic engagement plays a vital role in students' success and overall well-being (Schaufeli *et al.*, 2002; Singh & Chopra, 2018; Wang & Zhang, 2020). Notably, research by Liu (2015) found that 35.29% of adolescents exhibit low academic engagement, underscoring the urgent need to understand its determinants (Liu, 2015). Academic engagement is defined as a sustained and positive emotional connection with the learning process, characterized by three core attributes: Vigor, dedication, and absorption (Schaufeli *et al.*, 2002). It is crucial for fostering intrinsic motivation and improving academic outcomes. Among its predictors, academic grit has received increasing attention as a volitional trait that enables individuals to persist in long-term academic goals despite challenges. Research consistently shows that grit positively impacts academic outcomes, making it a key contributor to fostering sustained academic involvement (Lam & Zhou, 2019; O'Neal *et al.*, 2019). Therefore, clarifying how academic grit contributes to adolescent academic engagement represents an important research issue with significant theoretical and practical implications.

Academic grit plays a pivotal role in shaping adolescents' academic performance (Clark & Malecki, 2019). As a key volitional trait, academic grit exerts a positive influence

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on individuals' performance throughout the learning process (Clark & Malecki, 2019; Lin *et al.*, 2024). Research consistently finds a significant positive correlation between grit and academic engagement (Hodge *et al.*, 2018; W. Jiang, *et al.*, 2019). Adolescents with higher levels of grit tend to exhibit stronger engagement in their academic pursuits. For example, a study found that individuals with high levels of grit were more willing to exert additional effort to enhance their outcomes (Lucas *et al.*, 2015). Similarly, another study showed that highly gritty individuals were more inclined to spend extra time on tasks such as Sudoku compared to their low-grit counterparts (Kalia *et al.*, 2019). However, while the relationship between grit and academic engagement has been well-documented, the underlying mechanisms remain less understood. Most existing studies have focused on the predictive validity of grit rather than the psychological processes explaining how it promotes learning and engagement, leaving the mediating pathways insufficiently examined (Credé *et al.*, 2017; Datu *et al.*, 2018). Recent studies have begun to explore these mechanisms, suggesting that academic self-efficacy and educational expectations may act as key mediators in this relationship, providing deeper insights into the psychological processes that connect grit to academic engagement (Jiang *et al.*, 2023; Steinmayr *et al.*, 2018; Tang *et al.*, 2019).

Academic self-efficacy refers to adolescents' beliefs about their ability to successfully complete academic tasks and achieve their educational goals (Locke & Bandura, 1987). As an individual's assessment of self-competence, academic self-efficacy is positively correlated with perseverance (Usher *et al.*, 2019) and has been found to be a significant predictor of academic engagement (Jia *et al.*, 2020; Lavasani *et al.*, 2009). Building on these emerging mechanism-focused studies, the present study examines two theoretically grounded mediators—academic self-efficacy and educational expectations—to clarify how grit translates into engagement. Educational expectations refer to an individual's beliefs about their potential educational attainment and goals (Li & Yuan, 2019). These expectations reflect adolescents' aspirations regarding their academic future and are closely associated with academic grit (Tang *et al.*, 2021). Adolescents with high levels of academic grit typically exhibit a clearer understanding of the intrinsic value of their academic goals, which leads to elevated educational expectations. These heightened expectations drive them to set more ambitious goals and strive to achieve them (Wigfield, 1994; Wigfield & Eccles, 2002). Moreover, there is a significant positive correlation between educational expectations and academic engagement (Zhang *et al.*, 2020), suggesting that educational expectations serve as a powerful motivator, guiding students' proactive involvement in both learning and goal-setting.

The self-determination theory's basic needs framework posits that fulfilling individuals' essential needs for autonomy, competence, and relatedness enhances their commitment to goal achievement and fosters the development of more effective behavioral routines (Deci & Ryan, 1985; Ryan & Deci, 2020). Among these needs, autonomy and competence are particularly relevant for understanding how academic grit may translate into academic engagement *via* educational expectations (autonomy-related goals) and academic self-efficacy (competence-related beliefs). Therefore, this study aims to examine the relationship between academic grit and academic engagement in adolescents, focusing on the concurrent mediating roles of academic self-efficacy and educational expectations.

The following hypotheses are proposed: Hypothesis 1—academic grit is significantly positively correlated with academic engagement. Hypothesis 2—academic self-efficacy mediates the relationship between academic grit and academic engagement. Hypothesis 3—educational expectations mediate the relationship between academic grit and academic engagement. The hypothesized parallel mediation model is presented in Figure 1.

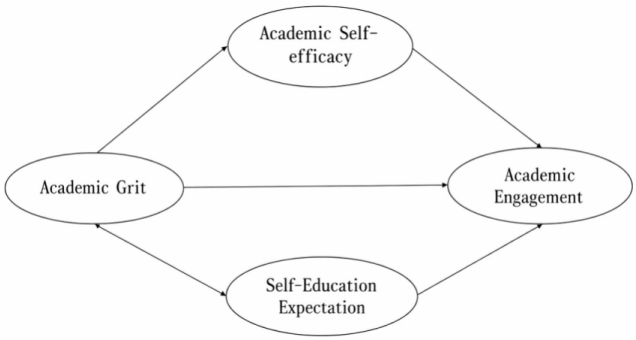

Figure 1. The mediating paths of self-education expectation and academic self-efficacy.

METHODS

Participants

Using random sampling and collective measurement methods, we selected 1365 adolescents from three junior middle schools in Guangdong Province, China, to participate in our survey. Data were collected offline using paper-and-pencil questionnaires administered face-to-face in classroom settings during regular school hours. Out of the 1284 collected questionnaires, 1178 were valid, resulting in an effective response rate of 92%. The sample consisted of 545 male participants (46%), 552 female participants (47%), and 81 participants (6.9%) who did not specify their gender. The average age of the

participants was 13.41 ± 0.77 years, with ages ranging from 12 to 17 years. This study received approval from the local ethics committee (Approval No. 2024042902). Informed consent was obtained from school administrators, teachers, and the participants' parents, in accordance with ethical guidelines. Additionally, consent was provided by the participants' head teachers. As a gesture of appreciation, all participants received a small gift upon completing the survey.

Measures

Academic grit

Adolescents' academic grit was measured using the academic grit scale (Lin *et al*., 2024). This scale comprises three dimensions: Clear goals, continuous effort, and positive beliefs, with 16 items rated on a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). Higher scores indicate greater academic grit. The overall Cronbach's α for this study was 0.93, indicating high internal consistency reliability.

Educational expectations

Following previous research methods (Zhang *et al*., 2020), educational expectations were measured using the item "my highest educational expectation is _____." Respondents could select from the following options: 1 (primary school), 2 (junior high school), 3 (senior high school or technical secondary school), 4 (junior college), 5 (undergraduate degree), 6 (master's degree), and 7 (doctoral degree). Higher scores indicated stronger educational expectations.

Academic self-efficacy

The academic self-efficacy scale (Liang, 2000) comprises 22 items, each rated on a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree) and comprises two dimensions: Learning ability self-efficacy (confidence in mastering academic knowledge and solving academic problems) and learning behavior self-efficacy (confidence in maintaining effective learning behaviors such as persistence and self-regulation). Higher scores indicate greater academic self-efficacy. In the present study, the Cronbach's α coefficient for the scale was 0.89, indicating high internal consistency reliability.

Academic engagement

The academic engagement scale (Schaufeli *et al*., 2002) was used to assess the academic engagement of participating adolescents, which has been translated and psychometrically validated in Chinese student samples (Fang *et al*., 2008). This scale consists of 17 items categorized into three dimensions: Vigor, dedication, and absorption. Respondents rated each item on a seven-point Likert scale ranging from 1 (never) to 7 (always). Higher scores indicate greater academic engagement. In the current study, the Cronbach's α coefficient for the scale was 0.95, indicating strong internal consistency reliability.

Data analysis

Descriptive statistics and correlation analyses were conducted using SPSS 20.0 (IBM Corp., Armonk, NY, USA), while Mplus 7.4 (Muthén & Muthén, Los Angeles, CA, USA) was used to test for common method bias and examine the mediating effects. Robust maximum likelihood estimation was employed to estimate model parameters, and the non-parametric percentile bootstrap method with bias correction was used to test the mediating effects. A 95% confidence interval (CI) that did not include 0 was considered indicative of a significant mediating effect. Prior to analysis, the data were cleaned, and any missing values were addressed using multiple imputation to ensure the robustness of the results.

RESULTS

Common method bias

To assess common method bias, we conducted a single-factor confirmatory factor analysis in Mplus 7.4, specifying all observed indicators to load on one latent factor. The model fit indices indicated a poor fit (χ^2 [1484] = 11222.047, root mean squared error of approximation [RMSEA] = 0.075, Bentler's comparative fit index [CFI] = 0.738, Tucker-Lewis index [TLI] = 0.728, standardized root mean square residual [SRMR] = 0.060), suggesting that common method variance is unlikely to be a serious concern in the current study.

Correlation analyses

Table 1 displays the mean (M) and standard deviation (SD) values for academic grit (M = 3.85, SD = 0.71), self-efficacy (M = 3.36, SD = 0.61), educational expectations (M = 4.40, SD = 1.20) , and academic engagement (M = 5.59, SD = 1.08). Academic grit exhibited significant correlations with academic self-efficacy (r = 0.73, P < 0.001), educational expectations (r = 0.27, P < 0.001), and academic engagement (r = 0.72, P < 0.001). Additionally, academic engagement demonstrated significant correlations with academic self-efficacy (r = 0.75, P < 0.001) and educational expectations (r = 0.32, P < 0.001).

Parallel mediating analyses

In this study, a structural equation model (SEM) was employed to examine the parallel mediating model. The following settings were applied to the variables in constructing the model: Academic grit, academic self-efficacy, and academic engagement were treated as multidimensional variables, with their respective dimensions serving as measurement indicators. Educational

Table 1: Correlation among variables

Item	AG	ASE	SEE
AG	-	0.73*	0.27*
ASE	0.73*	-	0.29*
SEE	0.27*	0.29*	-
AE	0.72*	0.75*	0.32*

N = 1178. *P < 0.001. AG, academic grit; ASE, academic self-efficacy; SEE, self-education expectation; AE, academic engagement.

expectations, however, consisted of a single question and were directly used as an observational indicator. Subsequently, we tested the mediating effect model with academic grit as the independent variable, academic engagement as the dependent variable, and academic self-efficacy and educational expectations as the mediating variables. To estimate the CI of the mediation effect, we utilized a bootstrap algorithm (Cheung & Lau, 2008; Preacher, 2015). The results indicated that the mediating effect was statistically significant and acceptable, χ^2/df= 6.18, RMSEA= 0.07, CFI= 0.99, TLI = 0.98, SRMR = 0.02.

As observed in Figure 2, academic grit significantly predicted academic engagement (β = 0.36, standard error [SE] = 0.06, P < 0.001); as well as self-efficacy (β = 0.80, SE = 0.02, P < 0.001) and educational expectations (β = 0.29, SE = 0.03, P < 0.001). Additionally, both academic self-efficacy (β = 0.50, SE = 0.05, P < 0.001) and educational expectations (β = 0.09, SE = 0.02, P < 0.001) significantly predict academic engagement. The mediating effect of academic self-efficacy between academic grit and academic engagement was statistically significant (Estimated = 0.40, SE = 0.04, 95% CI= [0.32, 0.49]), accounting for 51% of the total effect. Furthermore, the mediating effect of educational expectations between academic grit and academic engagement was also statistically significant (Estimated= 0.03, SE = 0.01, 95% CI= [0.01, 0.04]), explaining 3.8% of the total effect. Detailed results are presented in Table 2.

DISCUSSION

The present study aimed to address a fundamental question in psychology: The influence of academic grit on academic engagement, along with the mechanisms underlying this relationship. Specifically, this research explored the relationships between academic grit, academic engagement, and the mediating roles of educational expectations and academic self-efficacy. Through empirical analysis, the research hypotheses were confirmed. These findings extend the field of grit research within the educational domain and offer insights into the influential role of academic engagement from a positive psychology perspective. Furthermore,

Table 2: Mediating effects of academic self-efficacy and self-education expectation

Path	Estimated (standardization)	Self-education	BC (95%)	
			Lower	Upper
AG → ASE → AE	0.40*	0.04	0.32	0.49
AG → SEE → AE	0.03*	0.01	0.01	0.04
AG → AE	0.36*	0.06	0.25	0.46

N = 1178. *P < 0.001. AG, academic grit; ASE, academic self-efficacy; SEE, self-education expectation; AE, academic engagement; BC, bias-corrected bootstrap confidence interval.

the results provide empirical support for developing targeted interventions aimed at enhancing adolescent academic engagement through the cultivation of grit, self-efficacy, and educational expectations.

The relationship between academic grit and academic engagement

Our analysis reveals a significant positive relationship between adolescent academic grit and academic engagement (β = 0.36, SE = 0.06, P < 0.001). Higher levels of academic grit correspond to greater levels of academic engagement, corroborating previous findings (Hodge *et al.*, 2018; Jiang *et al.*, 2023), which demonstrate that adolescents with elevated academic grit exhibit increased commitment to their academic pursuits. They are more inclined to dedicate additional time to practicing tasks, driven by a determination to achieve better academic outcomes (Duckworth *et al.*, 2007). Furthermore, individuals with higher levels of academic grit display greater optimism when facing academic challenges (Lucas *et al.*, 2015).

This positive relationship may be attributed to the cognitive and emotional states associated with high levels of grit. For example, cognitive stability, as demonstrated in experimental memory research, suggests that individuals with high grit maintain sustained attention and are less distracted by external cues (Kalia *et al.*, 2018). Moreover, those with greater grit tend to possess higher self-esteem and enhanced self-efficacy when faced with academic challenges (Lin & Liu, 2017). These positive emotional states enhance individual motivation to engage in academic activities (Pekrun *et al.*, 2002).

The mediating roles of academic self-efficacy

The current study reveals the mediating role of academic self-efficacy in the relationship between academic grit and academic engagement. The indirect effect through self-efficacy was statistically significant (Estimated = 0.40, SE = 0.04, 95% CI [0.32, 0.49]), accounting for 51% of the total effect. These findings align with previous research, emphasizing the importance of this

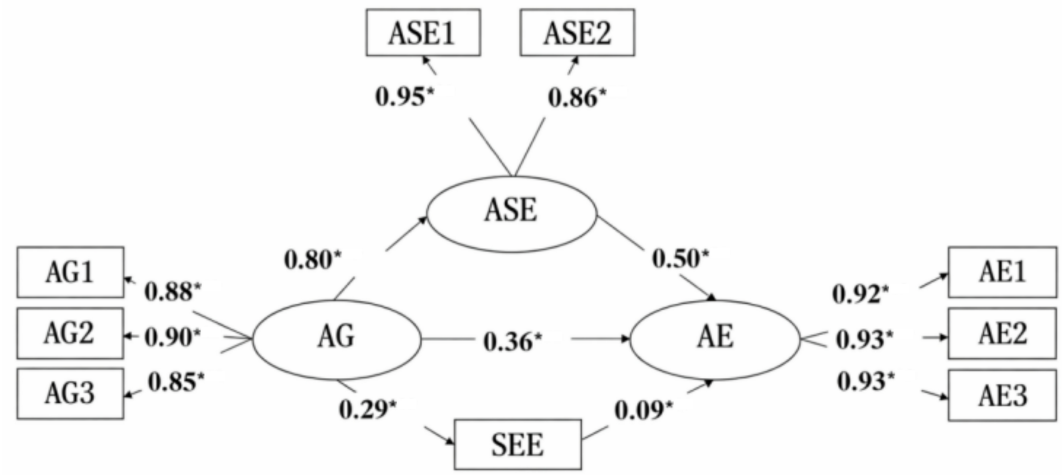

Figure 2. Results of SEM for the mediating model for academic grit and academic engagement. AG, academic grit; ASE, academic self-efficacy; SEE, self-education expectation; AE, academic engagement; SEM, structural equation model. $^{*}P < 0.001$.

mediating factor in shaping the link between academic grit and engagement (Jiang *et al.*, 2023).

The relationship between academic grit and self-efficacy, and their subsequent effects on academic engagement, corresponds with previous research (Lavasani *et al.*, 2009; Usher *et al.*, 2019). Adolescents with higher levels of academic grit are inclined to invest more effort in their academic pursuits, consistent with the determination to attain better academic outcomes (Duckworth *et al.*, 2007). Positive academic experiences enhance their sense of accomplishment, further reinforcing academic self-efficacy (Usher *et al.*, 2019). Increased self-efficacy, in turn, directly promotes greater engagement ($\beta = 0.50$, SE = 0.05, $P < 0.001$; S. Jiang, *et al.*, 2019). This process aligns with self-determination theory (Deci & Ryan, 1985; Ryan & Deci, 2020), which posits that adolescents with substantial academic grit receive positive feedback from their successful experiences, fulfilling their competence needs, and further enhancing their active engagement in their studies.

The mediating roles of educational expectations

Similarly, educational expectations also play a significant mediating role between academic grit and academic engagement (Estimated = 0.03, SE = 0.01, 95% CI [0.01, 0.04]), in line with self-determination theory (Deci & Ryan, 1985) and existing research (Steinmayr *et al.*, 2018; Zhang *et al.*, 2020). As autonomous goals, educational expectations provide a clear direction for individual behavior (Zhang *et al.*, 2020). Adolescents with higher levels of academic grit set more ambitious educational goals for themselves (Fite *et al.*, 2017) and exhibit a stronger commitment to these goals (Tang *et al.*, 2019). These elevated expectations motivate greater effort toward learning, ultimately resulting in enhanced academic performance (Li & Yuan, 2019). However, it is noteworthy that the indirect effect *via* educational expectations accounted for only 3.8% of the total effect, which was relatively small compared with the mediating role of academic self-efficacy. This pattern suggests that educational expectations may function as a more distal and cognitively abstract motivational factor, whereas academic self-efficacy is more proximal and task-oriented, directly shaping students' day-to-day persistence, strategy use, and engagement in learning activities. In other words, beliefs about future educational attainment may primarily motivate long-term planning, but immediate confidence in one's learning capability is more strongly tied to daily academic engagement.

From the perspective of self-determination theory, educational expectations may serve as a future-oriented source of motivation, whereas competence-related beliefs such as academic self-efficacy represent a more proximal driver of students' day-to-day engagement.

Limitations and future prospects

Despite its contributions, this study has several limitations that highlight areas for future research. The cross-sectional design limits the ability to establish causal links between academic grit and engagement, necessitating future studies to employ longitudinal or experimental designs. Additionally, the single-item measure of educational expectations limits the reliability and validity of this variable. Future studies should develop more comprehensive instruments to assess educational expectations, enhancing the understanding of their mediating role. Addressing these limitations will provide a clearer perspective on the relationship between academic grit and engagement.

Moreover, future research should incorporate longitudinal designs to better establish causal relationships and explore how academic grit, self-efficacy, and educational expectations evolve over time. Research across different cultural and educational contexts would also help determine the generalizability of these findings. Additionally, exploring other mediating and moderating variables, such as social support and intrinsic motivation, could offer a more nuanced understanding of the factors influencing academic engagement.

CONCLUSION AND RESEARCH SIGNIFICANCE

In summary, the study reveals that academic self-efficacy and educational expectations effectively mediate the relationship between academic grit and engagement, supporting the proposed hypotheses. The mediation model, grounded in self-determination theory, highlights how the combination of volitional traits and basic psychological needs satisfaction can drive academic performance. The findings underscore the importance of academic grit in promoting engagement, and suggest that interventions focusing on building self-efficacy and enhancing educational expectations may foster deeper academic involvement.

This study provides initial evidence for enhancing adolescent academic engagement through the cultivation of grit, self-efficacy, and educational expectations. Educators and policymakers could leverage these insights to design interventions aimed at strengthening students' resilience and fostering a supportive learning environment. For instance, resilience-focused programs can incorporate mastery-oriented activities, like scaffolded tasks with timely formative feedback, to build day-to-day competence and persistence, while schools can pair future-oriented guidance (*e.g.*, goal-setting workshops or mentoring that breaks long-term aspirations into short-term plans) with an autonomy-supportive classroom climate that offers meaningful choice and acknowledges students' difficulties. Furthermore, the research contributes to the growing literature on grit by offering a domain-specific framework for understanding its role in academic settings. Future studies can build on this foundation, expanding our understanding of how to foster academic success in adolescents.

DECLARATION

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None.

Author contributions
Yilei Wu: Conceptualization, Methodology, Investigation, Formal analysis, Writing—Original draft, Writing—Review and Editing; Xi Chen: Conceptualization, Methodology, Investigation, Writing—Original draft; Wanru Lin: Conceptualization, Methodology, Data interpretation, Writing—Review and Editing, Supervision. All authors have read and approved the final version of the manuscript.

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Ethical approval
This study was conducted in accordance with relevant ethical standards and approved by the Ethics Committee of Hanshan Normal University (Approval No. 2024042902).

Informed consent
Informed consent was gained from each participant before their participation.

Conflict of interest
The authors declare no competing interest.

Use of large language models, AI and machine learning tools
This study used GPT-4 to polish the English expressions and improve the readability of the text. The authors take full responsibility for the content and interpretations.

Data availability statement
The data used and/or analysed during the current study are available from the corresponding author on reasonable request.

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