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The influence of positive parenting and positive teacher-student relationships on learning engagement of Korean middle school students-the mediating role of grit

Yumin Liu¹, Gyupan Cho² and Xiaomin Liu^{1*}

Abstract

Background The prevalence of “education fever” in South Korea has subjected students to the pressures of intense academic competition. Consequently, educators face significant challenges in reducing academic burnout and enhancing learning engagement among students. This study aims to explore the influencing factors and internal mechanisms of learning engagement among South Korean middle school students, considering both external factors (parents and teachers) and internal factors (grit).

Methods This study surveyed 2,590 Korean middle school students (1,405 boys and 1,185 girls) to explore the mediating effect of grit (including Grit - PE and Grit - CI) between positive parenting style, positive teacher - student relationships, and learning engagement. Participants were assessed with the Positive Parenting Scale, the Positive Teacher - Student Relationships Scale, the Grit Scale, and the Learning Engagement Scale. Correlations between variables were analyzed by Pearson correlation analysis, and mediation analyses were performed with AMOS 21.0 software.

Result Positive parenting and positive teacher-student relationships significantly predicted learning engagement. Grit played a fully mediating role between positive parenting and learning engagement, and a partial mediating role between positive teacher-student relationships and learning engagement. Grit-PE and Grit-CI each played a partial mediating role between positive parenting and student engagement. The predictive power of Grit-PE for learning engagement is significantly greater than that of Grit-CI.

Conclusion The findings of this study suggest that to improve Korean middle school students' learning engagement, interventions could consider factors such as the external environment of family and school, as well as the internal development of a gritty personality.

Keywords Positive parenting, Positive teacher-student relationships, Grit, Learning engagement, Korean middle school students

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Introduction

Korea has a long-standing and deeply-rooted tradition where education and academic achievements are regarded as the primary pathways to attaining social and economic advantages. This education fever prevalent among Koreans can be traced back to Confucianism, which was introduced from China [1]. The traditional test-centered education system, coupled with high parental expectations and the widespread prevalence of after-school tutoring, exerts substantial pressure on Korean students [2]. In this highly competitive environment, a great number of Korean students experience varying degrees of academic burnout during their learning process. As a result, they rarely get the chance to experience the true joy and meaning of learning. Consequently, it is inherently challenging for them to maintain a high level of learning engagement.

Learning engagement, which is the antithesis of academic burnout, not only predicts academic success but also contributes to the development of an individual's physical and mental health [3]. Learning engagement is defined as a persistent, positive, and affective state characterized by vigor, dedication, and absorption that students demonstrate throughout the learning process [4]. It serves as an important metric for assessing student academic performance and overall educational quality. Studies show that learning engagement can positively predict student outcomes and reduce dropout rates [5], while also enhancing school adjustment, subjective well-being, and psychological health [6]. Since learning engagement is a core mechanism of knowledge building in and out of educational contexts [7], exploring its influencing factors is crucial for preventing academic burnout and fostering academic advancement.

The ecological systems theory posits that the family and school, serving as the critical micro-environments for adolescents' lives, play a vital role in their growth and development [8]. This clearly demonstrates the significant influence of the micro-environment on individuals. The self-determination theory, on the other hand, emphasizes that a supportive environment can meet individuals' basic psychological needs. Once these needs are satisfied, it can effectively boost intrinsic motivation and promote the continuity and positive experience of learning [9]. This theory provides a more profound understanding of how a positive environment affects students' internal drive for learning. Taking into account that environmental factors are of crucial importance in students' development, and that parents and teachers are key constructors of these environments, it becomes essential to first explore how parental and teacher - related factors impact students' learning engagement.

Parenting style reflects parents' educational beliefs and behaviors, greatly influencing children's psychological

development. Positive parenting styles such as the democratic and supportive ones can boost children's learning interest, reduce burnout, and enhance engagement [10]. In contrast, negative parenting styles such as interference and rejection can harm learning engagement [11, 12]. Positive parenting styles provide an appropriate level of autonomy support, care, and encouragement, which are conducive to children's forming stable confidence in learning and self-discipline. Particularly when they encounter academic difficulties, the necessary assistance and emotional support from parents can provide more positive psychological resources to cope with learning challenges, which contributes to enhancing academic self-efficacy, promoting academic adaptation, and improving learning engagement [13]. Empirical studies have shown that parental involvement, affection, monitoring, and support all promote student engagement with school [14, 15]. Therefore, we proposed the following hypothesis(H1): Positive parenting significantly predicts Korean students' learning engagement.

The teacher - student relationship serves as a predictor of students' learning engagement [16]. As the "Extended model of attachment" points out, individuals are capable of forming attachment relationships with a wider array of people, including teachers, peers, and even media or fictional figures, rather than being restricted to caregivers such as parents [17]. Within the school context, a positive teacher-student relationship is of particular significance as it establishes a secure and favorable environment for students to explore and engage in the learning process [18]. Multiple studies have verified that a positive relationship is positively correlated with students' learning engagement [19]. Such positive relationships can stimulate students' learning behaviors, enhance their learning confidence and enthusiasm, promote positive self-assessment, and boost their intrinsic learning motivation. A meta-analysis reveals that students with positive teacher - student relationships are more inclined to participate in classroom activities and exhibit greater commitment and dedication to learning [20]. Therefore, we propose the following hypothesis(H2): Positive teacher-student relationships significantly predict Korean students' learning engagement.

As mentioned above, parents and teachers may serve as environmental protective factors and can be considered significant learning resources for students. The Study Demands- Resources(SD-R model) describes various psychological, social, and environmental demands and resources that can either hinder or promote engagement. Demands are factors that often challenge students' learning or hinder their engagement, such as study - related stress and difficult assignments. Resources, on the other hand, are typically factors that support students' learning and engagement, such as parental and teacher support

[21]. Therefore, the more sources of autonomy support one has, the lower one's school burnout and the higher one's engagement [22]. It is clear that positive parenting styles and teacher - student relationships can predict student engagement in learning. However, the precise mechanisms underlying this influence remain unclear.

Nakamura and Csikszentmihalyi (2002) emphasized that the interplay of environmental factors and individual characteristics has a significant influence on the formation and development of learning engagement [23]. Previous studies have discovered that parenting styles and teacher - student relationships can indirectly influence students' learning engagement through factors such as self - esteem, psychological resilience, locus of control, academic self - efficacy, and achievement goal orientation [24, 25]. Nevertheless, these studies have not yet completely uncovered the full range of influence mechanisms.

Influenced by positive psychology, scholars have begun to explore the impact of personality traits on individuals from the perspective of character strengths. The Character strengths theory emphasizes focusing on the positive aspects of individuals, believing that discovering and leveraging one's own character strengths is the key to achieving happiness and success [26]. Grit is considered one of the positive traits that may result in higher levels of learning engagement and academic achievement [27]. Duckworth et al. (2007) explain grit as an ambition for long-standing objectives or consistency of interest (CI) and persistence for it or perseverance of effort (PE) [28]. The grittier an individual is, the more stamina that individual possesses to strive for achievement. Studies on grit show its worthwhile effect on educational factors such as motivation [29], goal achievement [28], self-efficacy [30], learning engagement [31], and emotion regulation [32].

Grit as a personality trait is closely related to an individual's external growth environment, especially parenting styles. Research has shown that parenting styles are significantly related to the shaping of an individual's personality and can even influence an individual's psychology and behavior through certain personality traits [33]. A Tehran survey found a correlation between parenting styles and children's resilience [34]. Parents' warmth, understanding, and positive encouragement support children's stress coping, enhancing resilience and frustration tolerance [35]. A South Korean survey showed that parenting styles promoting autonomy positively impact children's grit, affecting learning engagement and feelings of helplessness [36]. A Chinese study also indicated that parenting styles influence children's grit and learning engagement [37]. Therefore, grit serves as a critical bridge between parenting styles and children's learning engagement. As mentioned above, we proposed the following hypothesis(H3): Grit mediates the relationship between positive parenting and learning engagement.

In addition, teachers play a role in cultivating students' grit. A positive teacher-student relationship helps enhance students' sense of self-worth and develop their grit [38]. In such a relationship, teachers' affirmation and encouragement boost students' learning confidence, sense of competence, and courage to overcome difficulties. This, in turn, prompts students to mobilize more psychological resources to face learning challenges. Through self-challenge in this process, students can develop grit [39]. Moreover, individuals with high-level grit are more likely to achieve their goals. When teachers offer timely positive feedback, students' self efficacy is further improved, making them more willing to take on new learning challenges and thus creating conditions for the development of grit [40]. It is evident that a good teacher-student relationship facilitates the development of students' grit, and grit has a positive impact on learning engagement. As mentioned above, we propose the following hypothesis(H4): Grit mediates the relationship between positive teacher - student relationships and learning engagement.

In the context of the widespread education fervor in South Korea, learning engagement is highly valued as it serves as a reliable indicator of students' academic achievements. This study aims to explore the interplay among positive parenting, positive teacher-student relationships, and learning engagement among Korean students, with a particular emphasis on the mediating role of grit. By integrating these constructs into a unified framework, we aim to deepen our understanding of how family and school resources influence students' learning engagement via personal internal resources. We hope to offer valuable insights into the underlying mechanisms of learning engagement and provide practical suggestions for enhancing it among students. The theoretical model outlining these relationships is presented in Fig. 1.

Methods

Participants

The data utilized in this study were sourced from the Korean Children and Youth Panel Survey 2018 (KCYPs 2018), which was carried out by the National Youth Policy Institute and made public in 2021. The KCYPs 2018 was designed to establish panel data that could comprehensively track changes in the growth and development of children and teenagers, thereby providing fundamental information for child - and youth - related policies and academic research [41]. After obtaining formal ethical approval from the institutional review board affiliated with the National Youth Policy Institute, interviewers conducted the student survey in classrooms. Employing a multi - stage sampling method, the survey was administered to 2,607 first - year middle school students from 171 schools. A total of 2,590 valid questionnaires were

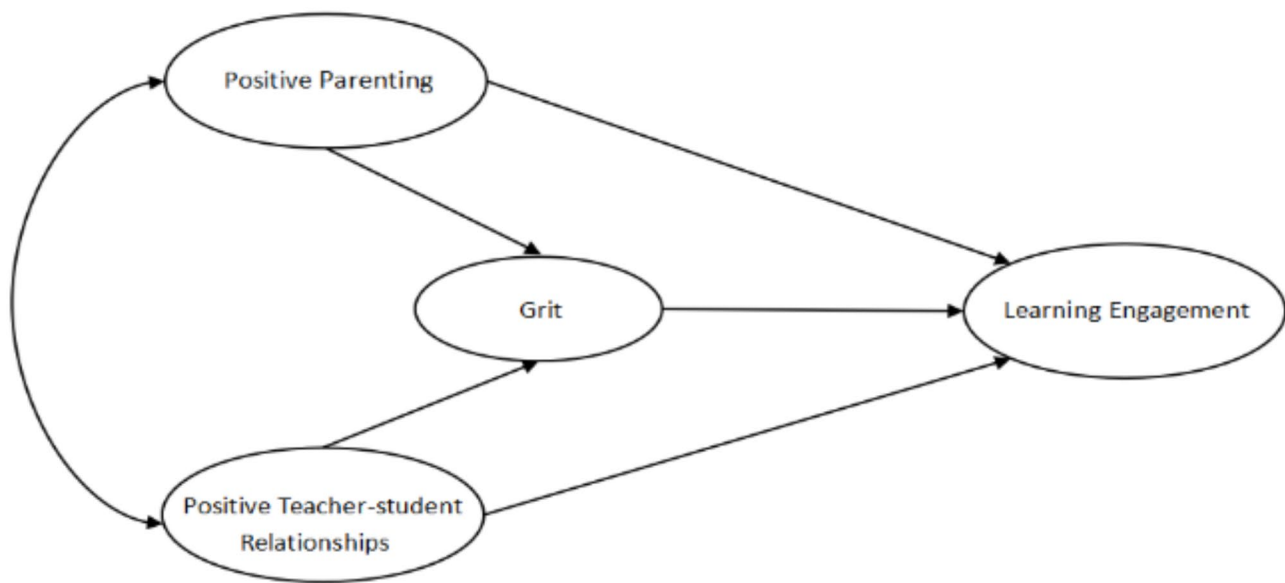


Fig. 1 The theoretical model diagram

retrieved, resulting in an effective response rate of 91.6%. Among the respondents, 1,405 were boys (54.3%) and 1,185 were girls (45.7%). Informed consent was obtained in writing from all participants.

Measures

Positive parenting scale

The Parenting Styles Scale developed by Kim & Lee (2017) [42] was used to measure positive parenting. The scale comprises 24 items that assess positive parenting (emotional warmth, autonomy support, and structural support) and negative parenting (coerciveness, rejection, and inconsistency). Items are rated on a 4-point Likert scale ranging from 1 (completely incorrect) to 4 (completely correct). For this study, only the positive parenting scale was utilized, with a Cronbach's alpha of .87. CFA results supported its construct validity: $\chi^2/df = 13.78$, CFI = 0.95, TLI = 0.93, RMSEA = 0.044, SRMR = 0.030.

Positive teacher-student relationship scale

The positive teacher-student relationship Scale developed by Kim & Kim (2009) [43] was used to measure positive teacher-student relationships. The scale comprises 24 items, covering four dimensions: trust, sensitivity, tolerance, and approachability. Items are rated on a 4-point Likert scale ranging from 1 (completely incorrect) to 4 (completely correct). Scores are averaged to determine the level of positive teacher-student relationships. Cronbach's alpha was .87 in this study. CFA results supported its construct validity: $\chi^2/df = 13.23$, CFI = 0.95, TLI = 0.91, RMSEA = 0.040, SRMR = 0.031.

Grit scale

To measure grit, we used the 8-item self-report measure developed by Kim & Hwang (2015) [44]. The scale consists of two dimensions: perseverance of effort and consistency of interests. Items are rated on a 4-point Likert scale ranging from 1 (completely incorrect) to 4 (completely correct). Scores are averaged to determine the level of learning engagement. Cronbach's alpha was .71 in this study. CFA results supported its construct validity: $\chi^2/df = 12.48$, CFI = 0.93, TLI = 0.94, RMSEA = 0.032, SRMR = 0.028.

Learning engagement scale

To measure learning engagement, we used the 16-item self-report measure developed by Lee & Lee (2012) [45]. The scale consists of four dimensions: vigor, dedication, efficacy, and absorption. Items are rated on a 4-point Likert scale ranging from 1 (completely incorrect) to 4 (completely correct). Scores are averaged to determine the level of learning engagement. Cronbach's alpha was 0.94 in this study. CFA results supported its construct validity: $\chi^2/df = 14.15$, CFI = 0.95, TLI = 0.92, RMSEA = 0.036, SRMR = 0.030.

Data analysis

Data were collated and analyzed using SPSS 22.0 and AMOS 21.0. Confirmatory factor analysis (CFA) was conducted before establishing the structural equation model to determine the goodness-of-fit of the questionnaires employed and of a multiple mediating effect model. The model was tested using χ^2/df , RMSEA, GFI, TLI, CFI, and SRMR [46]. Structural model analysis was

Table 1 Discriminant validity

Models	$\Delta\chi^2$	Δdf	χ^2/df	CFI	GFI	TLI	RMSEA
Four-factor model: PP, PTR, GR, LE PT, GR, LE	-	-	12.73	0.955	0.957	0.941	0.067
Three-factor model: PP, PTR + GR, LE	536.79	3	20.77	0.921	0.923	0.900	0.087
Two-factor model: PP + PTR, GR + LE	2933.05	5	57.56	0.766	0.754	0.715	0.148
One-factor model: PP + PTR + GR + LE	5662.12	7	97.17	0.589	0.690	0.515	0.193

* PP: positive parenting, PTR: positive teacher-student relationships, GR: grit, LE: learning engagement.

Table 2 Descriptive statistics and Correlation($n = 2590$)

Variables	M \pm SD	gender	positive parenting	positive teacher-student relationships	grit	learning engagement
positive parenting	2.98 \pm 0.44	-0.38	1			
positive teacher-student relationships	2.81 \pm 0.50	0.11*	0.44***	1		
grit	2.66 \pm 0.44	-0.12	0.34***	0.38***	1	
learning engagement	2.48 \pm 0.55	-0.09	0.36***	0.45***	0.49***	1

*** $p < 0.001$, * $p < 0.05$

undertaken if the variables exhibited good discriminant validity.

Results

Common method Bias

The Harman single-factor method was used to test the common method deviation. The variance explained by the maximum factor variance was 23%, less than the critical value of 40% [47]. The statistical test results showed that there was no significant common method bias in the measurement.

Discriminant validity analysis

Confirmatory Factor Analysis(CFA) was utilized to evaluate the discriminant validity of positive parenting, positive teacher-student relationships, grit, and learning engagement, as shown in Table 1. Among them, the four-factor model exhibited the best fit for the data ($\chi^2/df = 16.10$, CFI = 0.956, GFI = 0.956, TLI = 0.941, RMSEA = 0.076). The differences in chi-square values were all statistically significant, indicating that the four latent variables in this study have good discriminant validity.

Descriptive and correlational analysis

Table 2 contains the descriptive statistics and Pearson correlations. The results indicated that the correlation coefficients among positive parenting, positive teacher-student relationships, grit, and learning engagement ranged from 0.34 to 0.49, which were moderate correlations. This suggests that there are no issues of multicollinearity. The existence of significant correlations

between the variables complies with theoretical expectations and meets the basic requirements for hypothesis testing in structural equation modeling.

Structural equation modeling analysis

Direct effects model testing

Initially, a direct effects model was constructed to examine the impact of positive parenting and positive teacher-student relationships on learning engagement. With gender as control variables, the results showed that except for the $\chi^2/df = 12.73$, which was above the acceptable range due to sample size effects, all other model fit indices met the criteria (CFI = 0.955, GFI = 0.957, TLI = 0.934, RMSEA = 0.067). Both positive parenting ($\beta = 0.22$, $p < 0.001$) and positive teacher-student relationships ($\beta = 0.41$, $p < 0.001$) significantly and positively predicted learning engagement. These two variables explained 30% of the variance in learning engagement.

Mediation effect test of grit

To further examine the mediating role of grit, the mediating variable grit was incorporated into the model based on the direct effect model. The results showed that the model fit indices were good ($\chi^2/df = 12.73$, CFI = 0.955, GFI = 0.957, TLI = 0.934, RMSEA = 0.067). From Fig. 2; Table 3, we can see that grit played a full mediating role between positive parenting and learning engagement, and a partial mediating role between positive teacher-student relationships and learning engagement.

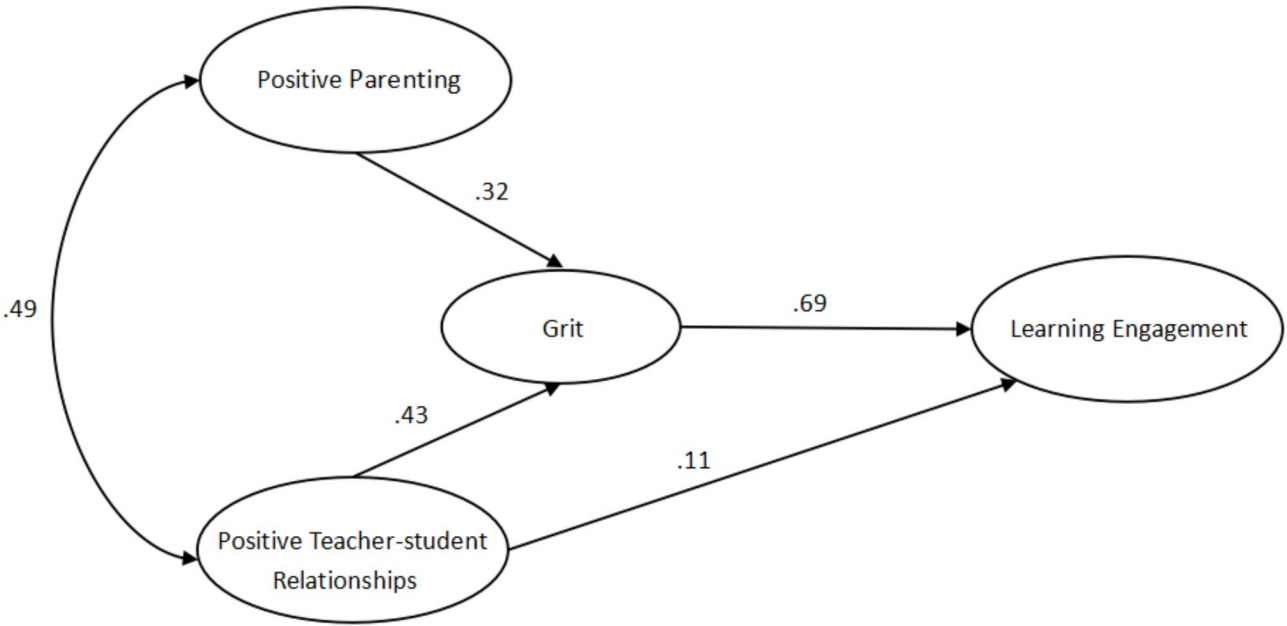


Fig. 2 The mediating model of grit(standardized)

Table 3 Summary of indirect effects using the bootstrapping method

Path	Effect	Boot SE	95% CI
Positive Parenting→Grit→Learning Engagement	0.22	0.02	[0.179, 0.270]
Positive Teacher-Student Relationships→Grit→Learning Engagement	0.30	0.04	[0.227, 0.381]

Mediation effect test of grit-PE and grit-CI

As research on grit has advanced, scholars have found that the two factors of grit, perseverance of effort (PE) and consistency of interest (CI), play different roles and have different significances. Some researchers claimed both CI and PE contributed to engagement, but PE made the largest contribution among the two [48]. Additionally, some studies confirmed that the predictive power is only contained in PE [49]. As the two factors of grit would result in inconsistent results for engagement, grit researchers recommended treating the two sub-factors separately in analyses [49, 50].

So in our study, we further examined the mediating effects of PE and CI (Fig. 3). With gender and school serving as control variables, the results showed that the overall simulation indicators of the structural equation model were good ($\chi^2/df=10.34$, CFI=0.943, GFI=0.943, TLI=0.924, RMSEA=0.060). Further analysis of the path coefficients revealed that all direct paths reached a significant level. PE and CI each played a partial mediating role between positive parenting and student engagement.

We used the Bootstrap method to further test the significance of the mediating effects. The results showed

(Table 4) that the confidence intervals for all paths did not include 0, confirming the aforementioned mediating effects. Among them, the mediating effect of PE accounted for 65.71% (28.57% + 37.15%) of the total indirect effects, while the mediating effect of CI accounted for 34.29% (14.29% + 20.00%).

Discussion

Relationship between positive parenting, positive teacher-student relationships and learning engagement

Our findings indicate that positive parenting and positive teacher-student relationships significantly predict Korean students’ learning engagement, H1 and H2 were verified. This result supports the Study Demands-Resources(SD-R model), which posits that social support from parents and teachers serves as study resources capable of enhancing positive study performance [51].The SD-R model proposes two processes: a motivational process that leads from resources to engagement and well-being, and an energetic process that starts from high demands and results in exhaustion and burnout [52]. High study demands heighten the risk of student burnout and lead to negative outcomes, whereas high study resources play a motivational role, stimulate student engagement, and foster positive outcomes [51]. Given that Korean students are severely burdened by the intense pressure of academic competition, placing them in highly demanding situations, strong environmental support becomes crucial. It can reduce academic stress, mitigate the risk of burnout, and encourage students to engage in learning.

Previous research has shown that students with multiple support sources, especially from teachers, parents,

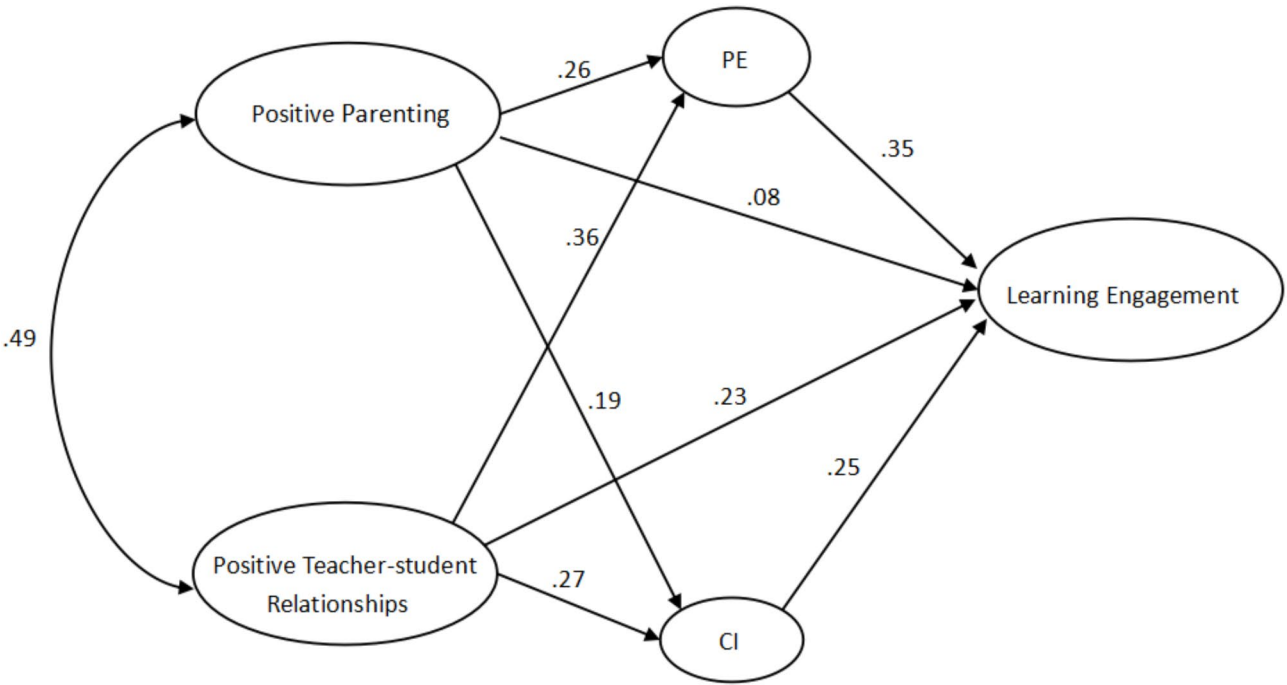


Fig. 3 The mediating model of Grit-PE and Grit-CI (standardized)

Table 4 Summary of indirect effects using the bootstrapping method

Path	Effect	Boot SE	95%CI	Relative mediation effect
Positive Parenting→PE→Learning Engagement	0.10	0.02	[0.281, 0.460]	28.57%
Positive Parenting→CI→Learning Engagement	0.05	0.02	[0.014, 0.033]	14.29%
Positive Teacher-Student Relationships→PE→Learning Engagement	0.13	0.04	[0.260, 0.421]	37.14%
Positive Teacher-Student Relationships→CI→Learning Engagement	0.07	0.02	[0.013, 0.034]	20.00%

and peers, exhibit high motivation and learning engagement [53]. Positive parenting behaviors can create a relaxed family atmosphere. When students receive emotional support and warmth from their parents, it enhances their intrinsic motivation to learn. Consequently, they show greater initiative in learning and become more engaged in schoolwork [54]. In the school setting, teachers’ instructional support, as a valuable classroom resource, directly influences students’ learning engagement [55]. Positive feedback from teachers helps students develop a positive academic self-concept, stimulates their learning interest, and boosts their engagement.

It is noteworthy that after introducing grit as a mediating variable, the direct effect of positive parenting on students’ learning engagement is no longer significant. This could be because, as adolescents enter puberty and shift their focus more towards school, teachers’ influence becomes more prominent. Additionally, positive parenting environments may not always remain stable, and excessive parental involvement can lead to conflicts. Therefore, parents may exert influence on their children more by affecting internal factors. This conclusion is consistent with the findings of Khu & Lee (2015) [2], suggesting that the impact of parental rearing styles on learning engagement might not follow a simple linear relationship but rather involve other mediating variables.

The mediating effect of grit

We found that grit fully mediates the relationship between positive parenting and learning engagement, and partially mediates the relationship between positive teacher-student relationships and learning engagement. H3 and 4 H4 were verified. When students enter middle school, their lives gradually shift the focus from home to school. In the school environment, teachers, as authority figures, start to have an influence that increasingly surpasses that of parents. Moreover, middle school students’ sense of independent self - awareness continues to strengthen, which may result in parents’ influence on students’ learning being exerted more through internal factors acting on the individual [2]. This is the reason why grit fully mediates the relationship between positive

parenting and learning engagement and partially mediates the relationship between positive teacher-student relationships and learning engagement.

Grit is often characterized as a psychological strength resource. Research indicates that both effort and interest are pivotal in fostering student engagement [56], a finding that aligns seamlessly with the inherent traits of grit. Gritty students are more likely to stick to their goals and interests, study hard despite difficulties, and thus enhance learning engagement and academic achievement [57]. In the SD - R model, personal resources like grit can promote engagement and prevent burnout. As Tang et al. (2019) suggested, grit acts as a mediator between environmental factors and student engagement [58].

The role of grit in learning engagement can be understood as follows: Firstly, in learning activities, interest is more likely to spark sustained enthusiasm, inspiring self - directed learning behaviors and demonstrating greater focus and commitment. Secondly, consistent effort is the key to achievements and progress. Gritty individuals pursuing personal growth actively engage in challenging tasks to achieve self - improvement and focus on current learning tasks [40]. Students with high - level grit have higher learning engagement, intrinsic motivation, and self - efficacy [30]. They can adjust their efforts and use cognitive strategies to face learning challenges. In contrast, students lacking grit may struggle with negative emotions and low resilience, making it hard to maintain high - level engagement [32].

Grit can be shaped by the living environment. For middle - school students, family and school support are vital for grit development [59]. Autonomy and supportiveness in these environments stimulate curiosity, help students explore hobbies, and lay the foundation for building grit [28, 60]. According to the self - determination theory, the autonomous support from parents and teachers satisfies students' psychological needs, positively influencing their psychology and personality [61]. Their affirmation and encouragement provide emotional support, motivating students to achieve learning goals through persistent effort.

In conclusion, a positive family and school environment can cultivate students' grit, and grit, in turn, promotes learning engagement.

The mediating role of grit-PE and grit-CI

Considering that the two sub - factors of grit, perseverance of effort (PE) and consistency of interest (CI), may have different predictive strengths for learning engagement, our study also explored the mediating effects of grit-PE and grit-CI. We found that both PE and CI partially mediate positive parenting styles and positive teacher-student relationships on learning engagement.

Notably, PE has significantly greater predictive power for learning engagement than CI. This finding aligns with previous research [27, 44, 48], further corroborating the superior predictive role of PE in students' learning engagement. Several factors may account for this. Firstly, the widespread phenomenon of long-duration and high-intensity after-school tutoring in the Korean education system may have partly diminished students' intrinsic motivation and interest in learning. Facing a highly competitive educational environment, students must maintain a high level of academic effort to ensure their competitiveness in schoolwork. Secondly, Korea is deeply influenced by collectivist culture, where individual behavior is often guided by authority and social expectations [62]. Unlike Western humanistic cultures that emphasize personal interests and self - actualization, individuals in collectivist cultures tend to adjust their behavior to fit social norms and authoritative expectations, placing more emphasis on personal effort [29]. In this cultural context, personal interests may need to be compromised in certain situations to meet broader social aspirations. Additionally, the study's results may be influenced by the item design and discriminant validity of the Consistency of Interest dimension in grit scales [63]. Further research may re-examine the grit conceptual framework and enhance the psychometric properties of the CI sub-scales [49].

Theoretical implications

This research reveals the multi-factor mechanism of learning engagement, focusing on how external supportive environments (family and school) influence students' learning engagement through positive parenting styles and teacher-student relationships. By using grit as a mediating variable, the study explains how these environmental factors stimulate students' internal resources, thereby enhancing learning engagement. The study also clarifies the roles of different grit dimensions in learning engagement, deepening our understanding of grit traits. Grit, regarded as a positive character strength, is crucial for academic success. Therefore, families and schools should create a supportive environment to cultivate children's grit. Although grit is a relatively stable personality trait, it is not immutable, especially during middle school when personality is still in the process of development. Cultivating grit requires collaboration between home and school. Specifically, by helping students set and pursue appropriate long-term educational goals and providing a supportive environment for achieving those goals, students' grit levels can be enhanced. In turn, this enhanced grit can promote students' engagement and performance at school. Furthermore, students should be encouraged to adopt a growth mindset and actively face academic setbacks and failures.

This study has shown that positive parenting, positive teacher-student relationships, and grit are important learning resources during students' learning process, all of which have a positive impact on learning engagement. It provides a scientific basis for educational practice, suggesting that optimizing the external supportive environment and cultivating grit traits are effective ways to enhance students' learning engagement.

Limitations

However, this study has certain limitations. Firstly, it adopts a cross-sectional design, which restricts our ability to establish causal relationships. Future studies could consider employing longitudinal and experimental designs. Secondly, despite the relatively large sample size, it is limited to first-year middle school students. Future research could expand the sample to include students from different grade levels. Thirdly, self-reporting methods may lack comprehensiveness and objectivity. Future studies could incorporate reports from teachers and parents to complement the data. Lastly, this study only focused on factors associated with parents and teachers. Nevertheless, peer relationships can significantly impact students' academic development. Future research could integrate these factors to gain a more comprehensive understanding of the influencing factors and mechanisms of learning engagement.

Conclusion

(1) Positive parenting and positive teacher-student relationships significantly predicted learning engagement. (2) Grit played a fully mediating role between positive parenting and learning engagement, and a partial mediating role between positive teacher-student relationships and learning engagement. (3) Grit-PE and Grit-CI each played a partial mediating role between positive parenting and student engagement. (4) The predictive power of Grit-PE for learning engagement is significantly greater than that of Grit-CI.

Acknowledgements

We sincerely thank all the staff and students from the participating schools, and especially thanks the Korea Youth Policy Institute for their invaluable data support.

Author contributions

Yumin Liu wrote the main manuscript text and prepared all tables and figures; Xiaomin Liu has completed the data analysis and reviewed the manuscript. Gyupan Cho was responsible for revising and proofreading the entire text.

Funding

This research was funded by the 14th Five-Year Plan Project of Shandong Provincial Education Science (2023QY010).

Data availability

The data that support the findings of this study have been deposited in Korea Youth Policy Institute (KCYPs 2018), which are publicly available for download (<https://www.nypi.re.kr/archive/board?menuId=MENU00220&siteId=null>).

Declarations

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

Ethical approval

This study was performed in strict accordance with the ethical standards of the Declaration of Helsinki (2013) and was approved by the Institutional Review Board of Weifang University (Weifang, Shandong, China, 261061). The dataset from the South National Youth Policy Institute (<https://www.nypi.re.kr/archive>) was accessed under an ethical data sharing agreement that ensures participant confidentiality and anonymity.

Received: 18 August 2024 / Accepted: 8 April 2025

Published online: 21 April 2025

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