

중국 고등학생의 그릿이 학습몰입을 경유하여 학업성취에 미치는 영향에서 젠더의 조절된 매개효과

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The moderated mediating effect of gender in the impact of Chinese high school students' grit on academic achievement through learning engagement

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요약 본 연구는 중국 고등학생을 대상으로 그릿이 학습몰입을 경유하여 학업성취에 미치는 영향에서 젠더가 조절하는지를 확인하는 데 연구의 목적이 있다. 자료는 중국 광둥 지역의 한 고등학교에서 유의표집한 고등학생 345명을 대상으로 온라인 설문조사를 통하여 수집하였다. 수집한 자료는 SPSS PC+ Win ver. 25.0과 SPSS PROCESS macro ver. 4.2를 활용하여 분석하였다. 적용된 통계방법은 빈도분석, 신뢰도 분석, 상관분석 및 조절된 매개효과 분석이었다. 연구의 결론은 다음과 같다. 첫째, 그릿은 학습몰입, 행복과 유의한 정적인 상관관계가 있었으나, 젠더와는 유의미한 상관관계가 없었다. 학습몰입은 젠더 및 학업성취와 정적인 상관관계를 보였다. 둘째, 그릿이 학습몰입을 경유하여 학업성취에 미치는 영향을 젠더가 조절 매개하였다. 즉, 그릿이 학습몰입을 경유하여 학업성취에 미치는 조건부 간접 효과는 여자보다 남자가 높았다. 이러한 결과를 토대로 본 연구는 고등학생들의 학업성취 증진을 위하여 그릿과 학습몰입의 활용을 젠더에 따라 다르게 활용할 수 있는 방안을 제시하였다.

주제어 그릿, 학습몰입, 학업성취, 젠더, 조절된 매개효과

Abstract This study aims to determine whether gender moderates the impact of grit on academic achievement through learning engagement among Chinese high school students. Data were collected through an online survey targeting 345 high school students purposively sampled from a high school in Guangdong, China. The collected data was analyzed using SPSS PC+ Win ver. 25.0 and SPSS PROCESS macro ver. 4.2. The applied statistical methods were frequency analysis, reliability analysis, correlation analysis, and moderated mediation effect analysis. The conclusion of the study is as follows. First, grit had a significant positive correlation with learning engagement and academic achievement but no significant correlation with gender. Learning engagement showed a positive correlation with gender and academic achievement. Second, gender moderated the effect of grit on academic achievement through learning engagement. In other words, the conditional indirect effect of grit on academic achievement through learning engagement was higher for men than for women. Based on these results, this study proposed ways to utilize grit and learning engagement differently according to gender to improve the academic achievement of high school students.

Key Words grit, learning engagement, academic achievement, gender, and moderated mediation effect

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1. Introduction

Academic achievement is the process or result of acquiring knowledge and skills. It refers to the general term for learning results such as knowledge, intellectual ability, attitudes, and values learned through school education. Academic achievement is an important basis for learners to evaluate their abilities and has great meaning for students, including forming a positive self-concept[1]. Given this importance, research to improve academic achievement is endlessly needed.

Recently, many studies have been conducted on grit as a variable predicting success. Grit, one of the non-cognitive characteristics, is defined as passion and persistence for long-term goals[2]. People with high grit are said to set long-term goals, have sustained interest in achieving them, make continuous efforts, and do not give up or give in no matter what difficult situations they face[3]. It has been reported that grit affects academic achievement[2,4], so more in-depth research is needed.

Meanwhile, studies on variables that mediate in the relationship between grit and academic achievement are still lacking. In this study, we attempted to use learning engagement as a mediating variable based on previous research. Based on previous studies showing that grit affects learning engagement[5,6] and learning engagement affects academic achievement[7,8], this study sought to determine whether learning engagement mediates in the relationship between grit and academic achievement. There is no prior research on learning engagement as a mediator in the relationship between grit and academic achievement, so research on this is needed.

Furthermore, identifying whether there are gender differences when grit affects academic achievement through learning engagement is important in establishing strategies to improve academic achievement across genders. This analysis is possible by identi-

fying the moderated mediating effect of gender in the path from grit to academic achievement through learning engagement. Therefore, this study aimed to confirm whether gender moderates the path of grit → learning engagement → academic achievement among Chinese high school students.

To achieve this research purpose, this study set the following research questions. First, what is the correlation between grit, gender, learning engagement, and academic achievement? Second, does gender moderate the effect of grit on academic achievement through learning engagement?

2. Theoretical background

2.1 The relationship between grit and academic achievement

Academic achievement is a concept that includes all abilities acquired through learning, that is, knowledge or skills acquired through learning through continuous changes in behavior that occur as a result of practice or experience[9]. These academic achievements include not only learning results in intellectual areas but also learning results in non-intellectual areas[10]. Therefore, academic achievement is the process or result of acquiring knowledge and skills and refers to the general term for learning results such as knowledge, intellectual ability, attitudes, and values learned through school education.

Such academic achievement is a better predictor of self-concept than intelligence quotient[11], and students with high academic achievement have a positive self-concept and perceive themselves as valuable, desirable, and capable people[1].

Grit was first proposed by Angela Duckworth in 2007 and is defined as passion and perseverance for long-term goals[2]. This grit is a non-cognitive characteristic and is reported to predict the achievement of many people[2]. People with these personality traits are good at overcoming internal and external

obstacles and ultimately achieve high performance by maintaining effort and interest[12].

Grit has been reported in many studies to affect academic achievement. Grit significantly predicted the academic achievement of high school students even after controlling for intelligence and personality factors[2,4]. Therefore, grit appears to affect academic achievement, so there is a need to study this relationship in more depth.

2.2 Mediating effect of learning engagement

The concept of learning engagement was presented by Csikszentmihalyi and Robinson[13], who defined learning engagement as a state of optimal functioning by being completely immersed in one's task or a state of oneness with oneself felt when an individual is completely immersed in a specific activity. Additionally, learning engagement is defined as the quality of effort a learner puts in to achieve the learning outcome they want to achieve[14].

Previous research was reviewed to determine whether learning engagement plays a mediating role in the relationship between grit and academic achievement. First, this study examined the impact of grit on learning engagement. It was found that grit had a significant positive effect on learning engagement among Korean language learners from China, Kyrgyzstan, and Thailand[5]. It was verified that grit has a significant positive effect on emotional engagement among members of domestic public institutions [6]. The reason for this was believed to be that people who are immersed have a clear goal and make efforts to achieve that goal[13].

Next, this study examined the impact of learning engagement on academic achievement. Learning engagement is the best experience in which a learner is fully immersed in learning and feels enjoyment. In the learning process, learning engagement is an

important factor that affects academic achievement[7]. It was reported that as learning engagement deepens, one can feel psychological enjoyment and experience a high level of concentration, thus having a positive effect on academic achievement[8].

As a result of reviewing previous research, it was predicted that grit affects learning engagement, and learning engagement affects academic achievement, so learning engagement mediates in the relationship between grit and academic achievement. Based on this, this sought to determine whether learning engagement mediates in the relationship between grit and academic achievement among Chinese students.

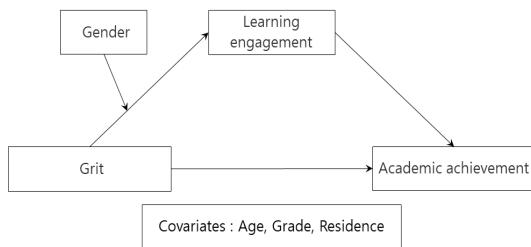
2.3 Moderating effect of gender

Through previous research, this study examined whether gender moderates the relationship between grit and learning engagement and moderates the effect of grit on academic achievement through learning engagement. Research results showing that learning engagement differs depending on gender are confused. In a study targeting high school students, male students reported better learning engagement than female students[15]. Additionally, research results showing that female students are more immersed[16] were also reported. Additionally, in a study targeting teachers, there was a study showing that there was no statistically significant difference between men and women in engagement[17]. As such, various research results on learning engagement are mixed depending on gender, so research is needed on whether gender moderates the relationship between grit and learning engagement. Furthermore, this study sought to determine whether grit moderates and mediates the effect of grit on academic achievement through learning engagement among Chinese high school students.

3. Methods

3.1 Research model

To confirm whether gender moderates the effect of grit on academic achievement through learning engagement, model number 7 of the SPSS PROCESS macro proposed by Hayes[18] was applied, and the research model was set up as shown in [Fig. 1], high school students' age, grade, and residence, which affect the mediating and dependent variables, were controlled.



[Fig. 1] Research model

3.2 Participants and data collection

The Guangdong region in China was the study area, and the survey subjects of the study were high school students. The purposive sampling method was applied to the sampling of the Chinese high school students. Data was collected through an online survey for one month of November, 2023. Excluding insincere responses, the total number of subjects used in the final analysis was 345. Those surveyed were 48.1% male and 51.9% female. By grade, 40.6% were first graders, 59.4% were second graders. The place of residence was 83.5% in metro cities, 14.5% in small and medium-sized cities, and 2.0% in rural areas.

3.3 Research tools

3.3.1 Grit

To measure grit, this study used the Grit Short Scale developed by Duckworth and Quinn[19] and used by Hwang and Lee[20]. This scale is designed to

measure grit such as “No matter what I do, from the beginning to the end” and “Even if I have a goal, I will find another one soon(reversed item)”, and consists of a total of 8 questions. The measurement was done on a 5-point Likert scale, with higher scores indicating higher grit. In this study, the reliability of this scale, Cronbach's α , was suitable at .611.

3.3.2 Learning engagement

To measure Learning engagement, this study used the Schaufeli's Study Engagement Scale developed by Schaufeli[21]. This scale is designed to measure Learning engagement such as “When studying, I am full of energy” and “I think learning is very valuable and meaningful”, and consists of a total of 17 questions. The measurement was done on a 5-point Likert scale, with higher scores indicating higher Learning engagement. In this study, the reliability of this scale, Cronbach's α , was high at .976.

3.3.3 Academic achievement

To measure academic achievement, this study used the academic performance scale developed by Carson Birchmeier, Emily Grattan, Sarah Hornbacher, and Christopher McGregory from Saginaw Valley State University and used by Esht et al.[22]. This scale is designed to measure academic performance such as “I made myself ready in all my subjects” and “I pay attention and listen during every discussion”, and consists of a total of 8 questions. The measurement was done on a 5-point Likert scale, with higher scores indicating higher academic achievement. In this study, the reliability of this scale, Cronbach's α , was high at .919.

3.3.4 General characteristics and control variables

Gender, age, grade, and residence were investigated as general characteristics, and age, grade, and residence, which were predicted to affect the media-

ting and dependent variables, were controlled during the analysis.

3.4 Data analysis

The data was analyzed using SPSS PC+ Win, Ver. 25.0 and SPSS PROCESS macro Ver. 4.2. Frequency analysis was performed, and Cronbach's α was calculated to determine reliability. Pearson's bivariate correlation analysis was conducted to identify the correlation between major variables, and model 7 of the SPSS PROCESS macro was performed to analyze the moderated mediating effect. For the verification of the moderated mediating effect, the bootstrap method was used, the confidence level was 95%, and the number of samples was set to 5,000. Independent variable was mean-centered.

4. Research Results

4.1 Correlation between main variables

The results of the Pearson correlation analysis are shown in Table 1. Grit had a significant positive correlation with learning engagement ($r=.541, p<.01$) and academic achievement ($r=.528, p<.01$) but no significant correlation with gender ($r=-.031, p>.05$). Learning engagement showed a positive correlation with gender ($r=.200, p<.01$) and academic achievement ($r=.190, p<.01$). Learning engagement had a significant positive correlation with academic achievement ($r=.876, p<.01$). Since the correlation coefficient between learning engagement and academic achievement was over .7, multicollinearity was suspected. As a result of checking multicollinearity through regression analysis, it was found that there was no problem.

As a result of calculating the average of the main variables through descriptive statistics, all averages were higher than 3 points except for gender, and among them, academic achievement was the highest at $M=3.6373$.

<Table 1> Correlation between main variables

	1	2	3	4
1. Grit	1			
2. Gender	-0.031	1		
3. Learning engagement	.541**	.200**	1	
4. Academic achievement	.528**	.190**	.876**	1
M	3.2807	0.4812	3.5304	3.6373
SD	0.5939	0.5004	0.9207	0.8472

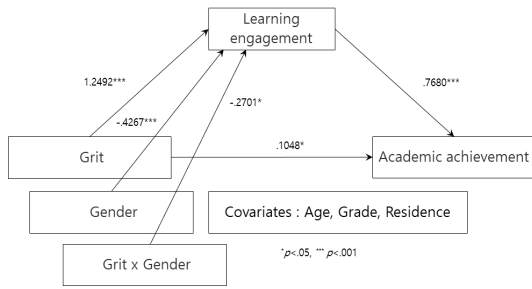
** $p<.01$

4.2 Moderated mediating effect of gender

To verify the moderated mediating effect of gender in the impact of grit on academic achievement through learning engagement, Hayes's PROCESS macro model No. 7[18] was applied and analyzed, and the analysis results were Fig. 2 and Fig. 3, Table 2, and Table 3. The bootstrap method was used to verify the moderating effect and the moderated mediation effect, the number of samples was set to 5,000, and the confidence interval was set to 95%. The conditional effect was analyzed based on three conditions ($M, M\pm SD$), and the independent variables were mean-centered when analyzing the moderated mediation effect.

In the mediating variable model, grit had a positive effect on learning engagement ($B=1.2492, p<.001$), and in the dependent variable model, learning engagement had a significant positive effect on academic achievement ($B=.7680, p<.001$). Therefore, learning engagement mediated in the relationship between grit and academic achievement.

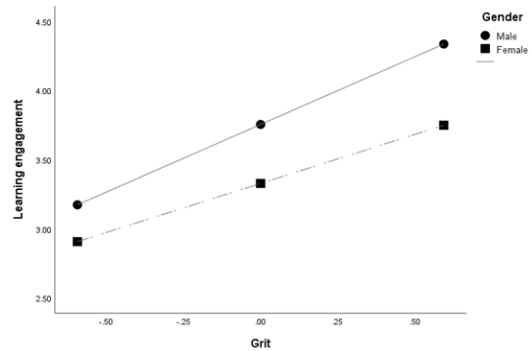
As a result of checking whether gender moderates the relationship between grit and learning engagement in the mediating variable model, the effect value of the interaction term between grit and gender was significant at $B=-.2701 (p<.05)$. Additionally, the increase in R^2 due to the addition of the interaction term ($\Delta=.0075, p<.05$) was also significant, indicating that gender moderates the relationship between grit and learning engagement.



[Fig. 2] Statistical model of moderated mediation effect

Looking at the conditional effect of grit on learning engagement according to the value of the moderating variable, gender, the conditional effect was significant for both male and female subjects. When male, the conditional effect was $B = .9791$ (.7802~1.1781), and when female, it was $B = .7090$ (.5292~.8888). So men had a higher conditional effect than women.

[Fig. 3] shows the moderating effect of gender on the impact of grit on learning engagement. For both men and women, learning engagement increased as



[Fig. 3] Moderating effect of growth mindset

grit increased. However, as men's grit increased, learning engagement increased steeply. For women, learning engagement increased gently as grit increased.

The direct effect and conditional indirect effect were analyzed in the path from grit to academic achievement. The direct effect between grit and academic achievement was $B = .1048$ (.0167~.1930), which was significant because there was no 0 included between the lower bound of the bootstrap (BootLLCI)

<Table 2> Moderating effect of gender

Classification		Mediating variable model (DV: Learning engagement)			Dependent variable model (DV: Academic achievement)		
		Coeff.	SE	t	Coeff.	SE B	t
Constant		4.4522	.2319	19.2707***	.9646	.1406	6.8593***
IV	Grit	1.2492	.2199	5.6812***	.1048	.0448	2.3403*
Moderator	Gender	-.4267	.0816	-5.2278***			
Interaction	Grit × Gender	-.2701	.1346	-2.0063*			
Highest order test	R ² change		.0075				
	F		4.0251*				
Mediator	Learning engagement				.7680	.0288	26.6826***
Covariates	Age	-.0946	.0790	-1.1968	.0048	.0432	.1105
	Grade	.1689	.1112	1.5193	-.0194	.0617	-.3145
	Residence	-.2838	.0933	-3.0421**	-.0153	.0520	-.2952
Model Summary	R ²		.3710			.7720	
	F		33.2212***			229.6205***	
Conditional effects of grit at values of the gender							
Gender	Effect(B)	SE	t value	LLCI	ULCI		
Male	.9791	.1011	9.6813***	.7802	1.1781		
Female	.7090	.0914	7.7562***	.5292	.8888		

* $p < .05$, ** $p < .01$, *** $p < .001$

and the upper bound (BootULCI) of the bootstrap within the 95% confidence interval. The conditional indirect effect was significant within the 95% confidence interval for both men ($B=.7520, .6323\sim.8860$) and women ($B=.5446, .3914\sim.6854$) because 0 was not included between the lower bound of the bootstrap (BootLLCI) and the upper bound (BootULCI). Additionally, the moderated mediation effect index was significant at $-.2075 (-.3889\sim-.3889)$. Therefore, the moderated mediating effect of gender was verified in the path of grit to academic achievement through learning engagement in Chinese high school students.

〈Table 3〉 Conditional indirect effect of gender

Direct effect (Grit → Academic achievement)				
Effect(B)	SE	t value	LLCI	ULCI
.1048	.0448	2.3403*	.0167	.1930
Conditional indirect effect (Grit → Learning engagement → Academic achievement)				
Gender	Effect(B)	BootSE	BootLLCI	BootULCI
Male	.7520	.0645	.6323	.8860
Female	.5446	.0749	.3914	.6854
Index of moderated mediation				
Gender	Index	BootSE	BootLLCI	BootULCI
	-.2075	.0887	-.3889	-.0399

* $p<.05$

5. Discussion and conclusion

The discussion focusing on the results of the study is as follows.

First, grit had a significant positive correlation with learning engagement and happiness, but had no significant correlation with gender. Learning engagement showed a positive correlation with gender and academic achievement. These results were consistent with research showing that grit is closely related to academic achievement[2,4] and learning engagement[5]. In addition, it is in line with research showing that learning engagement is related to academic achievement[8]. These results suggest that

academic achievement is related to various variables and that various methods can be used to improve academic achievement.

Second, this study confirmed whether gender moderates the effect of grit on academic achievement through learning engagement. This was confirmed by analyzing the conditional indirect effect. The results of the analysis showed that gender moderated the effect of grit on academic achievement through learning engagement. Furthermore, whether there was a difference in the conditional indirect effect between men and women was confirmed by analyzing the moderated mediation index. As a result, the moderated mediation index of gender was $-.2075$, which was a significant difference as there was no 0 between the lower limit ($-.3889$) and upper limit ($-.0399$) of the bootstrap. In other words, the conditional indirect effect for men was significantly higher than the conditional indirect effect for women. These results suggest that since the impact of grit on academic achievement through learning engagement varies depending on gender, different methods should be applied depending on gender when trying to improve academic achievement using grit and learning engagement.

Based on these results, the limitations of the study and suggestions for further research are as follows.

First, as a result of the correlation analysis, the correlation coefficient between learning engagement and academic achievement was high. In future studies, it is necessary to carefully examine the questions on the two variables and design a research plan that prevents multicollinearity by preventing overlapping questions. Second, this study analyzed the conditional indirect effect of gender. The development of programs to promote academic achievement using grit and learning engagement was not addressed in this study. In terms of the practicality of the research, it is recommended that research on program development be conducted in the future.

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