

Study on the Mechanism of the Impact of Non cognitive Abilities on Academic Achievement: The Chain Mediating Role of Teacher Support and Parent Participation

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Abstract: Based on the China Education Tracking Survey (CEPS) data, a structural equation model was used to study the mechanism of non cognitive abilities on academic achievement of middle school students. The results showed that: (1) there was a significant correlation between non cognitive ability, parental involvement, teacher support, and academic achievement variables; (2) Non cognitive abilities have a significant positive impact on student academic achievement, with pleasant traits in non cognitive abilities having a greater direct impact on academic achievement compared to learning perseverance traits; (3) Parental involvement plays an independent mediating role in the impact of non cognitive abilities on the academic achievement of junior high school students; (4) Teacher support and parental involvement play a chain mediating role in the impact of non cognitive abilities on the academic achievement of middle school students. The results of this study indicate that non cognitive abilities not only have a significant positive impact on the academic achievement of middle school students, but can also have an indirect impact on their academic achievement through two pathways: the mediating effect of parental involvement and the chain mediating effect of teacher support and parental involvement.

Keywords: Non cognitive ability; Academic achievements; Chain intermediary.

1. Introduction

Under the traditional framework of human capital theory, the term "ability" is limited to understanding as cognitive ability, referring to the individual's ability to solve abstract problems, including basic reading, writing, logical operations, production technology, etc.. As the explanatory power of cognitive abilities in terms of individual income and employment patterns is limited, scholars have proposed a new theory of human capital, which emphasizes the positive role of non cognitive abilities in improving individual education attainment, wage income, health, and social living standards. At present, the emphasis of domestic school education on the cultivation of students' non cognitive abilities is not high, and the uneven development of non cognitive abilities is an important reason for the differences in academic achievement among middle school students. Therefore, how to improve the non cognitive abilities of middle school students is a powerful measure to narrow the gap in student academic achievement and an important research topic to promote educational equity.

This article uses data from the China Education Tracking Survey (CEPS) and adopts a structural equation model to explore the following question: Does non cognitive ability have a direct and significant impact on the academic achievement of middle school students? As important roles in student growth, does parental involvement and teacher behavior have a mediating effect on the impact of non cognitive abilities on academic achievement? Exploring these issues is of great significance for schools and parents to deeply understand the relationship between non cognitive abilities and academic achievement, establish a more reasonable educational perspective, and build a high-quality

home school collaborative education model; At the same time, it is also beneficial for the government to formulate and improve relevant education policies, further promote the development and progress of basic education in China, and promote educational equity.

2. Research Review and Hypotheses

2.1. Research on the Definition and Measurement of Non cognitive Abilities

To explore the impact of non cognitive abilities on academic achievement, it is first necessary to clarify the concept of non cognitive abilities and determine their measurement methods. Non cognitive ability is relative to cognitive ability, and domestic and foreign scholars have formed relatively standardized terms and measurement methods for cognitive ability, which generally includes factors such as literacy and reading and writing abilities, computational and reasoning abilities. But so far, there is still no consensus in the domestic and foreign academic circles on the definition of non cognitive ability, and its measurement indicators are also diverse.

Economists tend to define non cognitive abilities through the opposite of cognitive abilities, emphasizing that non cognitive abilities are personality traits that are "not related to intelligence or weakly correlated", specifically operationalized as control points and self-esteem. Sociologists interpret non cognitive abilities as cultural capital, specifically referring to various habitual behaviors, which are operationalized in empirical research as learning habits and learning behavior patterns; Psychologists emphasize treating personality traits such as personality and

emotional intelligence as non cognitive abilities. Many domestic scholars mostly use the General Self Efficacy Scale and the Rosenberg Self Esteem Scale to measure non cognitive abilities. In recent years, some scholars have also used relevant items from the China Family Tracking Survey (CFPS) and the China Education Tracking Survey (CEPS) databases to comprehensively measure non cognitive abilities.

2.2. A Study on the Factors Influencing Academic Achievement

Scholars at home and abroad mainly discuss the influencing factors of student academic achievement from four levels: individual student, family background, peer effect, and school environment. The theory of individual differences suggests that individual factors such as student intelligence, self-efficacy, learning motivation, and the level of diligence in learning have an impact on academic performance; From the perspective of learning environment and family socio-economic status, the family background theory points out that on the one hand, as the most primitive and important environment for children's growth, parental educational participation and behavioral support will have a subtle impact on children's learning behavior, thereby having an impact on learning development. On the other hand, children living in families with higher socio-economic status often have higher quality educational opportunities, which can have an impact on their academic achievements. The peer effect theory suggests that the interaction between student peers, including conceptual influence, behavioral compliance, and imitation, can subtly form a certain learning and social atmosphere, which will have an indirect impact on students' emotional attitudes and behaviors, ultimately affecting academic performance. The school environment theory believes that school educational resources will have a certain impact on student performance. It is not only important to emphasize tangible educational resources in schools, but also to pay attention to the construction of intangible educational resources such as learning atmosphere. Some scholars also believe that there is no obvious causal relationship between standardized construction in compulsory education and student performance.

2.3. The impact of non cognitive abilities, teacher support, and parental involvement on academic achievement

Most existing studies have shown that non cognitive abilities have a significant positive effect on academic achievement. After controlling for variables such as student cognitive ability levels and family socioeconomic status, the relationship between the two still exists, and there are significant urban-rural and family background differences in this effect. Scholars explore the relationship between non cognitive abilities and student academic achievement from different dimensions. Perseverance in learning and high levels of self-efficacy have played a positive role in promoting student attendance and homework completion, which is beneficial for improving student academic performance. Compared to cognitive abilities, non cognitive abilities, including achievement motivation, competitiveness, learning

purpose, and emotional stability, have a greater impact on student performance. Self control can affect student academic performance, and this effect varies by gender. Non cognitive abilities not only directly affect academic achievement, but scholars have also found that non cognitive abilities, along with teacher support and parental involvement, have multiple mediating effects on academic achievement. Psychological research has found that teacher support has a significant impact on the development of non cognitive abilities in students, including self-esteem, social skills, adaptability. Research has shown that teachers can promote positive emotional development and help students grow healthily by establishing good cooperative relationships with them, thereby improving non cognitive abilities such as self-efficacy. There is currently no unified academic consensus on the definition of parental involvement. It is generally believed that parental involvement refers to the behavior of parents within the family or outside the family environment, including schools, aimed at supporting their children's educational progress. Research has shown that parental involvement can promote the formation of children's self-efficacy, and self-efficacy plays a certain moderating role in the impact of parental involvement on children's academic performance. Parental involvement can encourage children to develop good habits and have strong self-control abilities, which in turn enhances their children's adaptability during school, and stimulates their level of autonomous learning motivation. It is not difficult to see that parents and teachers, as important roles of others in the family and school environment, have a significant impact on student performance, and there is a significant interaction between the two. The more support students receive from their parents and teachers, the higher their motivation to learn and improve their academic performance. Therefore, based on the above analysis, this study proposes the following hypotheses:

H1: Non cognitive abilities have a significant positive effect on the academic achievement of middle school students.

H2: Teacher support and parental involvement play a partial mediating role in the impact of non cognitive abilities on academic achievement.

H3: Teacher support and parental involvement play a chain mediating role in the impact of non cognitive abilities on academic achievement.

3. Data Sources and Processing

3.1. Data source

Using the CEPS database data from the China Survey and Data Center of Renmin University of China. This study focuses on examining the impact of non cognitive abilities on the academic achievement of junior high school students. Firstly, a sample of students who were successfully followed up in the follow-up data was selected and their academic performance and other information were obtained. Then, demographic information, family background, and other information of students were obtained from baseline data, and samples with missing values, incorrect filling, and non compliant key variables were removed. The final effective sample size is 5296. The main characteristic information of the sample is shown in Table 1.

Table 1. Description of Sample Feature Information

variable	option	quantity	Proportion (%)
Gender	female	2649	50.02
	male	2647	49.98
Age	11 years old	105	1.98
	12 years old	2877	54.32
	13 years old	2035	38.43
	14 years old	250	4.72
	15 years old	26	0.49
	16 years old	2	0.04
Household registration type	17 years old	1	0.02
	Agricultural household	2603	49.15
	urban residence	2693	50.85
health condition	Very bad	30	0.57
	Not very good	176	3.32
	commonly	1029	19.43
	Better	1836	34.67
Only child	very good	2225	42.01
	No, it's not	2732	51.59
	yes	2564	48.41
Mother's job type	Non elite group	4423	83.52
	Elite group	873	16.48
Father's job type	Non elite group	4113	77.66
	Elite group	1183	22.34
	Very difficult	48	0.91
Subjective understanding of family economic status	It's quite difficult	474	8.95
	secondary	3986	75.26
	Relatively affluent	738	13.94
	Very wealthy	50	0.94
	Not participating	2532	47.81
Tutoring class	Participated in	2764	52.19
	I haven't been on it before	832	15.71
Preschool classes	I have been there before	4464	84.29

3.2. Variable Setting and Description

3.2.1. The dependent variable

This article measures student academic achievement by constructing two variables: academic performance and cognitive level.

3.2.1.1 Academic performance

Generally speaking, the more specific the definition and measurement of learning outcomes, the easier it is to conduct empirical analysis. Scores for specific disciplines are more desirable and effective compared to GPA and aptitude test scores. Therefore, the academic performance of this study was directly obtained from the data of the surveyed schools, including the eighth grade high school entrance examination scores in three subjects: Chinese, mathematics, and English. Given that the full score values and difficulty levels of exams vary among schools, this study first standardizes the original scores of each subject, converting them into Z-scores with a mean of 0 and a standard deviation of 1, then converting them into values distributed from N to (70, 10), and finally adding up the values in the range of 1-100 obtained from the mean to represent the variable of "academic performance".

3.2.1.2 Cognitive ability

Cognitive ability is measured by the standardized score of the cognitive ability test in the second round of the survey (using the 3PL model). The content of the CEPS designed cognitive ability test questions does not involve specific memorization knowledge taught in school courses. It mainly measures students' logical thinking and problem-solving abilities. It includes three dimensions: language, graphics,

computation, and logic, and has the characteristics of international comparability and national standardization.

3.2.2. Explanatory variables

The explanatory variable of this study is non cognitive ability. Based on relevant research and combined with questionnaire content, the following three dimensions are measured, including learning perseverance, emotional stability, and agreeableness.

3.2.2.1 Learning perseverance

Learning perseverance. Learning perseverance refers to the persistence and enthusiasm of learning. In learning, learners should regulate their learning cognition, learning emotions and behaviors, overcome setbacks and difficulties, in order to achieve long-term learning goals with high quality. Students with a high level of learning perseverance will maintain their enthusiasm for learning and continue to work hard even in the face of setbacks and difficulties when completing challenging learning tasks. Drawing on existing research, learning perseverance is measured using the following three questions from the CEPS questionnaire: "Even if I feel a bit unwell or have other reasons to stay at home, I will still try my best to go to school; even if it's homework that I don't like, I will still do my best; even if it takes a long time to finish, I will still do my best.". The corresponding answers are completely disagree, not very disagree, somewhat agree, and completely agree, with values 1, 2, 3, and 4 assigned in sequence. The higher the score, the higher the level of student's learning perseverance.

3.2.2.2 Emotional stability

Emotional stability is an individual's ability to manage

emotions, indicating their ability to effectively eliminate negative emotions such as anxiety and depression. Emotional stability was measured using the following five questions from the CEPS questionnaire: "Have you felt depressed, depressed, unhappy, uninteresting, and sad in the past seven days?" The corresponding answers were always, often, sometimes, rarely, and never, and they were reverse scored with values of 1, 2, 3, 4, and 5. The higher the score, the higher the emotional stability of the student.

3.2.2.3 Agreeableness

In the Big Five personality traits, agreeableness belongs to the interpersonal relationship orientation, representing a delicate and soft mind, a friendly personality, and a tendency to trust others. Drawing on existing research, agreeableness was measured using the following three questions from the CEPS questionnaire: "My classmates are very friendly to me, I think I am easy to get along with, and I often participate in school or class activities." The corresponding responses were completely disagree, disagree, somewhat agree, and completely agree, with values assigned as 1, 2, 3, and 4. The higher the score, the better the student's interpersonal relationships and the higher their level of agreeableness.

3.2.3. Mediating variables

3.2.3.1 Teacher support

This study refers to the existing classification of teacher support dimensions and divides teacher support into two

aspects: teacher emotional support and teacher learning support. Teacher emotional support is measured using the following three questions in the CEPS questionnaire: "Mathematics, Chinese, and English teachers often praise me", and teacher learning support is measured using the following three questions in the questionnaire: "Mathematics, Chinese, and English teachers often ask me questions". The corresponding answers are completely disagree, somewhat disagree, somewhat agree, and completely agree, with values assigned as 1, 2, 3, and 4, respectively. The higher the score, the higher the level of support from the teacher.

3.2.3.2 Parental involvement

This article adopts Coleman's definition and simplifies parental involvement as the companionship of parents in their children's daily lives. The following four questions from the CEPS questionnaire are used to measure: "The frequency of you and your parents frequently doing the following things - reading books; doing sports; visiting museums, animal parks, science museums, etc.; and going out to watch movies, performances, sports competitions, etc." The corresponding answers are: never done before, once a year, once every half a year, once a month, once a week, and more than once a week, with values assigned as 1, 2, 3, 4, 5, and 6, respectively. The higher the score, the higher the level of parental involvement. Table 2 reports descriptive statistical information for the main variables.

Table 2. Descriptive Statistics of Main Variables

variable	mean value	standard deviation
Academic achievements	Academic performance score	70.44
	Cognitive ability score	0.45
		3.38
	Learning perseverance	3.43
		3.53
Non cognitive abilities		3.85
		4.14
	Emotional stability	3.81
		4.35
		4.04
		3.34
	agreeableness	3.24
		2.87
		3.66
		2.034
Parental involvement	Daily activities	3.79
		2.47
	Non-daily activities	2.54
		2.53
		0.92
Teacher support	Teacher learning support	2.58
		2.61
		2.77
	Teacher emotional support	2.81
		2.92

3.2.3.3 Reliability test

The main variables in this article are measured in the form of scales, so testing the data quality of the measurement results is an important prerequisite for ensuring the significance of subsequent analysis. The internal consistency of each dimension was mainly analyzed through the reliability

test method of the Cronbach coefficient. Table 3 reports the results of this reliability test. From Table 3, it can be seen that the overall reliability coefficients of non cognitive abilities and various secondary dimensions are 0.7 and above. The overall reliability coefficients of teacher support and its secondary dimensions are between 0.8-1, and the reliability

coefficients of parental participation dimensions are close to 0.8. Therefore, it indicates that the scales used in this article

have good internal consistency and high reliability.

Table 3. Reliability test results for each variable

Variables	Cronbach's alpha	Number of items
Learning perseverance	0.700	3
Emotional stability	0.849	5
agreeableness	0.712	3
Non cognitive abilities	0.777	11
Parental involvement	0.700	3
Emotional support	0.849	5
Learning support	0.712	3
Teacher support	0.777	11

3.2.3.4 Validity testing

Table 4 further reports on the adaptability of the non cognitive ability scale CFA model. The test results show that the model fits well, except for the chi square test. Among

them, RMESA=0.047 is within the excellent range of <0.05, and the test results of GFI, AGFI, IFI, and TLI all reach an excellent level of 0.9 or above.

Table 4. Model Adaptation Test Results

index	Adaptation standards	Model results	Evaluation
RMESA	<0.05 is excellent, <0.08 is good	0.047	excellent
GFI	>0.9 is excellent, >0.8 is good	0.992	excellent
AGFI	>0.9 is excellent, >0.8 is good	0.986	excellent
IFI	>0.9 is excellent, >0.8 is good	0.989	excellent
TLI	>0.9 is excellent, >0.8 is good	0.985	excellent
CMIN/DF	1-3 is excellent, 3-5 is good	6.09	Over sized

When evaluating the model, the smaller the value of CMIN/DF, the better. This time, CMIN/DF=6.09, the data is too large. The reason is that the value of CMIN/DF is easily affected by the sample size, and even slight differences in large samples can make its value very significant. Therefore, the chi square test value is not an important index to measure the degree of model fitting under the conditions of this large sample. Based on the above, it can be concluded that the

model fits well.

Table 5 reports the convergent validity (AVE) and combined reliability (CR) values for each dimension of the non cognitive ability scale. It can be seen that in the validity test of the non cognitive ability scale, the AVE values of each dimension were all above 0.6, and the CR values were all above 0.7. Overall, the above indicates that each dimension has good convergent validity and combinatorial reliability.

Table 5. Convergence validity and combined validity tests for various dimensions of the non cognitive ability scale

Latent variable	Observing variables	Standardized factor load	CR	AVE
Learning perseverance		0.497	0.719	0.673
		0.754		
		0.768		
		0.75		
Non cognitive abilities	Emotional stability	0.758	0.85	0.729
		0.757		
		0.647		
		0.731		
agreeableness		0.806	0.751	0.698
		0.82		
		0.469		

Meanwhile, according to the results of the discriminant validity test in Table 6, it can be seen that in this discriminant effect test, the standardized correlation coefficients between

each dimension are less than the square root of the AVE values corresponding to the dimension, indicating that each dimension has good discriminant validity.

Table 6. Validity test results for the differences in various dimensions of non cognitive abilities

variable	Learning perseverance	Emotional stability	agreeableness
Learning perseverance	0.673	/	/
Emotional stability	0.191***	0.191***	/
agreeableness	0.233***	0.233***	0.295***
AVE value square root	0.820	0.854	0.835

In summary, the variables selected in this study conform to scientific and effective characteristics and can be used for research.

4. Research Results

4.1. Correlation testing

The significant correlation between variables is an important basis for conducting mediation analysis. This article explores the correlation between various variables

through the Pearson correlation analysis method. Table 7 reports the Pearson correlation results between each variable. It can be seen that there is a significant correlation between each variable in this analysis, and it has passed the significance test at the 1% level. At the same time, the correlation coefficients between each variable are all greater than 0. The above analysis indicates that there is a significant positive correlation between the variables in this analysis, making it suitable for subsequent mediation analysis.

Table 7. Pearson correlation analysis results between various variables

dimension	Learning perseverance	Emotional stability	agreeableness	Teacher support	Parental involvement	Academic achievements
Learning perseverance	1					
Emotional stability	0.149**	1				
agreeableness	0.190**	0.248**	1			
Teacher support	0.199**	0.190**	0.359**	1		
Parental involvement	0.070**	0.209**	0.266**	0.272***	1	
Academic achievements	0.140**	0.121**	0.206***	0.112**	0.128**	1

Note: * * There is a significant correlation at the 0.01 level (bilateral).

4.2. Causal relationship

Previous studies have fully demonstrated that non cognitive abilities can affect student academic achievement, while teacher support and parental involvement can also influence non cognitive abilities. Therefore, in this article, we will no longer repeat the testing of these related relationships, but directly explore more complex causal mechanisms. Therefore, this article establishes the following set of structural equation models, attempting to explore the complete pathway of the impact of non cognitive abilities on the academic achievement of middle school students. For the convenience of browsing the analysis results, the explicit variables and error terms in the model are not shown in the model graph (Ma Deyong and Lu Yizhou, 2019) [44].

In Model 1, on the one hand, teacher support and parental involvement are set as two independent mediating variables that play a parallel role in academic achievement, and on the other hand, three dimensions of non cognitive ability, namely learning perseverance, emotional stability, and agreeableness, are set to have a direct impact on academic achievement. However, the model fitting results show that the direct impact coefficients of emotional stability and teacher support on academic achievement are 0.02 and 0.06, respectively. The direct impact coefficient of learning perseverance on parental companionship is 0.02, and the direct impact coefficient of

emotional stability on teacher support is 0.09. The above direct path impact coefficients are close to 0. Existing literature suggests a significant interaction between parental involvement and teacher support on student academic development. and it is reasonable to speculate that teacher support may also play a mediating role in the impact of parental involvement on academic achievement. Therefore, Model 2 added the influence path of teacher support on parental participation on the basis of Model 1, while deleting the direct influence path of emotional stability and teacher support on academic achievement. However, under this setting, the direct impact of learning perseverance on parental companionship and emotional stability on teacher support is still very weak. It is speculated that there may not be a direct causal relationship between learning perseverance and parental companionship, as well as emotional stability and teacher support. Therefore, after removing these two paths, Model 3, the final causal mechanism model, is obtained.

The fitting results of the final model are shown in Table 8, with CMIN/DF=5.800; RMSEA=0.030; GFI=0.981; AGFI=0.974;IFI=0.980; TLI=0.975. Except for the chi square test, the fitting indices of other models all showed excellent fit, indicating that the standardized structural equation model coefficients in the model have significant statistical significance.

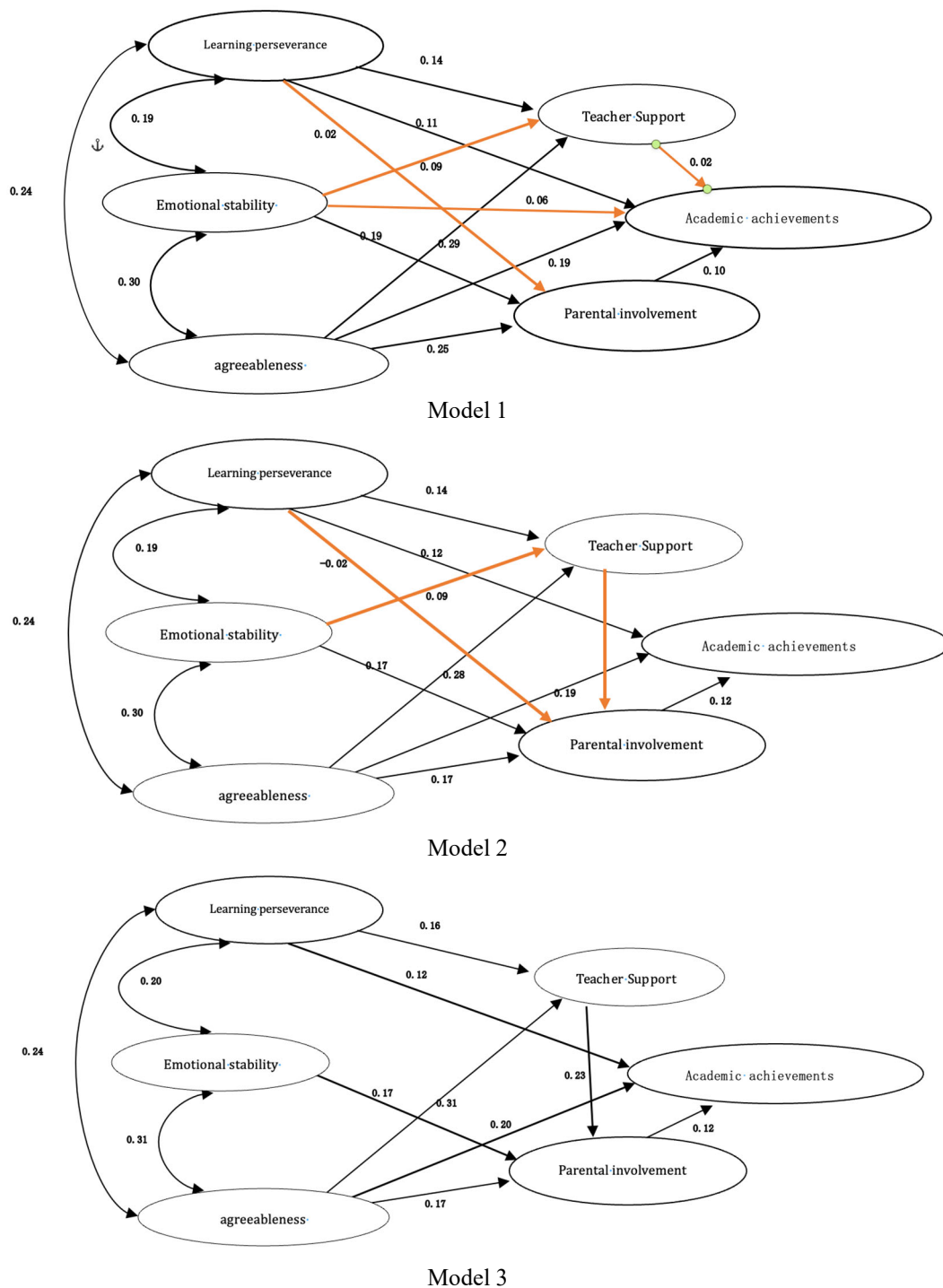


Figure 1. A causal mechanism model for the impact of non cognitive abilities on academic achievement

Table 8. Model Adaptation Test Results

index	Adaptation standards	Model results	Evaluation
RMESA	<0.05 is excellent, <0.08 is good	0.030	excellent
GFI	>0.9 is excellent, >0.8 is good	0.981	excellent
AGFI	>0.9 is excellent, >0.8 is good	0.974	excellent
IFI	>0.9 is excellent, >0.8 is good	0.980	excellent
TLI	>0.9 is excellent, >0.8 is good	0.975	excellent
CMIN/DF	1-3 is excellent, 3-5 is good	5.800	Over sized

4.3. Hypothesis testing

Calculate multiple mediating effects using the bias corrected percentile Bootstrap method. The results showed

that the path significance of all mediator variables in the mediation model reached the standard of $P < 0.01$, and the upper and lower 95% confidence intervals of each mediator path did not include 0, indicating that the effects of each

mediator path were significant.

From the perspective of direct effects, the better students perform in terms of agreeableness and learning perseverance, the higher their academic achievement level will be directly

improved. The direct effects are 0.193 and 0.099, respectively, accounting for 66.093% and 33.904% of the direct effects. Hypothesis H1 holds, indicating that non cognitive abilities have a significant positive impact on academic achievement.

Table 9. Normalized analysis results of direct effects and multiple mediating effects

Path relationship	Effect value	Effect quantity	95% confidence interval
Total effect: Non cognitive ability ->academic achievement	0.333	/	/
Total indirect effects	0.041	12.312%	[0.027,0.065]
Mediation Path 1: Learning Perseverance ->Teacher Support ->Parent Participation --->-Academic achievements	0.003	7.317%	[0.002, 0.005]
Mediation pathway 2: Emotional stability ->parental involvement ->academic achievement	0.012	29.268%	[0.007,0.020]
Mediation path 3: Pleasant ->Teacher support ->Parent involvement ->Academic achievement	0.007	17.073%	[0.004,0.011]
Mediation path 4: Pleasant ->Parental involvement ->Academic achievement	0.018	43.902%	[0.011,0.030]
Total direct effect	0.292	87.688%	/
Path 5: Personability ->Academic Achievements	0.193	66.096%	/
Path 6: Learning Perseverance ->Academic Achievement	0.099	33.904%	/

From the perspective of indirect effects, in pathways 2 and 4, the emotional stability and agreeableness dimensions in non cognitive abilities will increase parental engagement, thereby enhancing academic achievement levels. Among them, the mediating effect value of parental involvement between emotional stability and academic achievement is 0.012, accounting for 29.267% of the total indirect effect; The mediating effect value of parental involvement between agreeableness and academic achievement is 0.018, accounting for 43.902% of the total indirect effect. There is a significant difference in the magnitude of these two mediating effects. Therefore, the research hypothesis H2 holds that parental involvement plays a significant mediating role between non cognitive ability and academic achievement.

In paths 1 and 3, the 95% confidence interval of the chain mediated effect of teacher support and parental involvement on non cognitive ability and academic achievement does not include 0. The chain mediated effect is significant, with effect values of 0.003 and 0.007, accounting for 7.317% and 17.073% of the total indirect effect, respectively. Therefore, teacher support and parental involvement play a chain mediating role between non cognitive abilities and academic achievement, assuming H3 holds; At the same time, it was found that in hypothesis H2, there is no significant mediating effect of teacher support between non cognitive abilities and academic achievement. Based on previous research analysis, there may be two reasons why the mediating effect is not significant: firstly, the mediating effect of teacher support may be heterogeneous, and it performs differently in different groups. Secondly, this may be related to the measurement methods supported by teachers. In this study, teacher support consists of three questions on teacher emotional support and three questions on teacher learning support, and is limited to three teaching teachers in mathematics, Chinese, and English. These six questions cannot contain all the connotations of teacher support. Therefore, the research results show inconsistent results.

5. Conclusion and Discussion

This study investigated the impact of non cognitive abilities on academic achievement of middle school students through a large sample survey. The results indicate that non cognitive abilities not only have a direct and significant positive impact on student academic achievement, but can also have an indirect impact on the academic achievement of middle school students through two pathways: the mediating effect of parental involvement and the chain effect of teacher support and parental involvement.

5.1. The direct effect of non cognitive abilities on academic achievement of middle school students

This study first confirms that non cognitive abilities have a direct and significant positive effect on the academic achievement of middle school students, which is consistent with many published research findings. But more importantly, this study found that pleasant traits in non cognitive abilities have a greater direct impact on academic achievement compared to learning perseverance traits, accounting for 66.096% of the total direct effect, which has not been investigated in previous studies. Specifically, in non cognitive abilities, the improvement of students' interpersonal communication skills has a greater impact on academic achievement compared to the quality of learning perseverance. Therefore, in improving student academic performance, attention should be paid to the cultivation of their interpersonal communication skills. The communication, teamwork, self-awareness, and innovation abilities that students develop in the process of interpersonal communication can transfer their advantages during the learning process, which is conducive to the improvement of academic achievement.

5.2. The mediating role of parental involvement

This study supports the mediating role of parental involvement in the relationship between non cognitive abilities and academic achievement, where parental involvement can serve as a mediating variable to explain some of the effects of non cognitive abilities on academic achievement differences. The high level of emotional stability and agreeableness traits of children will attract parents to actively and frequently participate in their own learning and life, and children are more likely to receive high-quality educational opportunities, which is conducive to improving their academic level. The more children open their hearts to their parents and actively establish good parent-child relationships with them, the easier it is for parents to communicate with them. They can also discover the difficulties they encounter in their studies in a more timely manner, take quick and effective measures to guide them, help them overcome difficulties, and improve their academic development.

5.3. The chain mediating role of teacher support and parental involvement

The research results confirm that teacher support and parental involvement have multiple mediating effects. The results of the structural equation model indicate that teacher support and parental involvement are important reasons for the impact of non cognitive abilities on academic achievement differences among students. This study confirms that the learning perseverance and agreeableness traits in non cognitive abilities of students can have an impact on the level of teacher support, which in turn affects the level of parental involvement and ultimately affects students' academic achievement. In other words, when students exhibit higher levels of learning perseverance and agreeableness traits, they are more likely to receive attention from teachers. Therefore, when communicating with their parents, teachers will actively lead parents to supervise and guide their children's studies, establish more efficient home school cooperation models, and help students achieve higher academic achievements.

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