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THE RELATIONSHIP BETWEEN MATHEMATICS ATTITUDE, LEARNING ENGAGEMENT AND ACADEMIC ACHIEVEMENT

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Abstract

In this study, 312 junior high school students are tested on their mathematics learning engagement and achievement. This research will also find out the connection between the students' mathematics learning engagement with their mathematics academic performance. The results of this research show that junior high school students' mathematics learning engagement is closely related to their mathematics academic performance in which cognitive engagement has the highest correlation and emotional engagement has the lowest correlation with students' mathematics academic performance. The result also shows that when there is a higher mathematics academic achievement, the mathematics learning engagement will also be higher. This research also shows that gender factor doesn't really affects the students' mathematics learning engagement but their geographic factor does affect the learning engagement.

Keywords: Academic performance, Learning engagement, Mathematics

Abstrak

Penelitian ini meneliti keterlibatan dan capaian belajar matematika dari 312 siswa SMP. Penelitian ini juga mencari hubungan antara ketertarikan belajar matematika siswa dengan prestasi akademik matematika mereka. Hasil dari penelitian ini memperlihatkan bahwa keterlibatan belajar matematika siswa SMP berhubungan erat dengan prestasi akademik matematika mereka di mana keterlibatan kognitifnya memiliki korelasi tertinggi dan keterlibatan emotionalnya memiliki korelasi terendah dengan prestasi akademik mereka. Capaian akademik matematika dan keterlibatan belajar matematika mereka juga tinggi. Dalam penelitian ini, faktor gender tidak mempengaruhi keterlibatan belajar matematika siswa tetapi faktor geografi mempengaruhi keterlibatan belajar mereka.

Kata Kunci: Prestasi Akademik, Keterlibatan Belajar, Matematika

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INTRODUCTION

Learning engagement refers to the intensity of students' behavior involvement and the quality of emotional experience when they start and perform learning activities（乔晓熔&赵俊峰，2010）. There are 3 important indicators that is used to measure the degree of students' learning engagement which are the students' cognitive, emotional and behavioral engagement （张娜，2012）. Over the years, students' learning engagement has attracted the attention of scholars both at home and abroad, not only because it can affect academic performance（Wang, M.-T., & Holcombe, R.，2010）, but also because it is a value-added process（迟翔蓝，2017）, which can help students to have a more positive learning experiences, such as higher self-efficacy（廖友国，2011）, positive academic emotions and correct learning values（刘在花，2019）, so as to further promote the improvement of students' academic performance and individual development, and provide a new perspective for improving the quality of education.

People gradually turn their attention to the specific field of learning engagement. Exploring the specific field of learning engagement has a theoretical and practical significance for promoting teaching and learning（柴晓运&龚少英，2015）. Mathematics is an important field that has also been a concern. Students' mathematics learning engagement refers to students' cognitive, emotional and behavioral engagement in the process of mathematics learning（周琰&谭顶良，2010）. Mathematics learning engagement is a key indicator to measure students' academic quality, which is of great significance in gender difference analysis to improve individual mathematics academic performance（Fredricks, J. A., Hofkens, T., Wang, M.-T., Mortenson, E., & Scott, P. ，2017）. According to the theory of self-determination, students generate mathematics learning motivation based on their own needs（迟翔蓝，2017）. While both internal and external motivation will be further transformed into the external behavior of mathematics learning engagement. Students then improve their academic performance by establishing achievement goals（迟翔蓝，2017）, to promote the influence of mathematics learning engagement on academic performance to become a self-determined behavior. The higher the individual's engagement, the greater the growth of their mathematics achievement and classroom participation which has a great impact on the growth of students' achievement（Robinson, K., & Mueller, A. S.，2014）.

For a long time, subject stereotype has existed in people's mind, such as boys are better at science, girls are more inclined to liberal arts, etc. This inevitably causes the study of gender subject stereotype. In the mathematics subject, learning engagement generally appears in mathematics textbooks, teachers' attitudes and students' peer groups（袁丽，2011）. Some scholars put out their suggestion to eliminate the subject stereotype which has achieved some improvement. But in addition to external factors, learning subjects will also use the subject stereotype to enhance their motivation or avoid learning tasks. For girls, the reflection of mathematics depends on their beliefs and whether they understand the content to succeed in this field. When the learning is difficult, they often show frustration and give up. While for boys, they think they have the ability to adhere to and have in-depth learning strategies（Fredricks, J. A., Hofkens, T., Wang, M.-T., Mortenson, E., & Scott, P. ，2017）. At the moment, the explanation on this matter are divided into two views where in some believe that because men and women have different talents, therefore their mathematical ability can also differ. They believe that men have a better mathematical ability compared to women. While some other believe that the difference is mainly due to the gender role socialization where there is some social influence（王晓芹，2015）. Due to these different views, a further research should be done on the gender stereotype on mathematics learning engagement.

Various studies show that there is an inseparable relationship between mathematics learning engagement and academic performance（Sciarra, D T & Seirup, H J.，2008；Robinson, K., & Mueller, A. S. ，2014）. Most studies only focus on the relationship between the antecedent variables and the consequence variables (including external and internal factors), and are limited to the analysis of the prediction effect of mathematics learning engagement on academic performance under the influence of other factors. It is believed that the research on the relationship between mathematics learning engagement and academic performance needs to be more in depth which is why this research explores more deeply on the topic of relationship between mathematics learning engagement and the academic performance. Not only that, this research will also explore the impact on the students' academic performance after improving and refining the learning engagement so that it would be more favorable for the students.

METHOD

Participant and Procedure

The sample of this research are 343 junior high school students from the 1st and 2nd grade from a junior high school in Guangxi. The sampling method that will be use is questionnaire. After explaining the research, the subjects were tested at the same time. After they answered the questionnaire, there were only 339 questionnaires answered but the valid rate is 98.8%. After sorting out the valid questionnaires, there were only 312 valid ones and it is 91.0% effective. From the 312 students, 154 of them are boys and 158 others are girls with a percentage of 49.4% and 50.6% respectively.

Tools

SPSS 22.0 software will be use to analyze the research data including the reliability test, correlation analysis, regression analysis and independent sample t-test.

Based on Liu rude’s （Liu R D , Zhen R , Ding Y , et al，2018）, Xie Ting’s（谢婷，2018）, etc., research, the mathematics learning engagement scale for junior high school students has been compiled for this research. There were 38 questions in the questionnaire that use a scale. The questions use the Likert's 5-point scoring method in which 1 is for “very inconsistent” and 5 is for “very consistent”. The higher the score, the higher students' mathematics learning engagement would be. The internal consistency coefficients of behavioral engagement, emotional engagement and cognitive engagement are 0.948, 0.863 and 0.924 respectively, and the Cronbach coefficient of test data is 0.969, which indicates that the reliability of the scale is high.

Mathematics academic achievement can be divided into 2 factor which are broad thinking and narrow thinking. This research will focus on the narrow thinking of mathematics academic achievement. There is one question about this that use a scale for student to evaluate their mathematics academic performance. The question uses a five-point scoring method where 1 means “very bad”, 2 means “bad”, 3 means “average”, 4 means “good” and 5 means “very good”. The higher the score, the better the academic performance of the students.

RESULTS AND DISCUSSION

Results

From table 1 we can see that there is a significant correlation between mathematics academic performance and various dimensions of mathematics learning engagement ($P<0.001$), and the correlation coefficients are 0.486, 0.457 and 0.491 respectively. It shows that there is a close relationship between mathematics learning engagement and mathematics academic performance, and mathematics academic performance has a significant positive correlation with behavioral engagement, emotional engagement and cognitive engagement, among which the correlation with cognitive engagement is the largest, and the correlation with emotional engagement is the smallest.

Table 1. The correlation analysis of junior high school students' mathematics learning engagement and mathematics academic achievement

		mathematics learning engagement	behavioral engagement	emotional engagement	cognitive engagement
mathematics academic performance	Pearson Correlation	1	.486**	.475**	.491**
	Sig.(2-tailed)		.000	.000	.000
	N	312	312	312	312

Take junior high school students' mathematics learning engagement as the independent variable and mathematics academic performance as the dependent variable for regression analysis, the results are shown in Table 2. It can be seen from table 2 that the correlation coefficient between mathematics learning engagement and mathematics academic performance is 0.521, and the determination coefficient is 0.271 (P<0.001), that is, the explanatory variable of mathematics learning engagement to mathematics academic performance has reached 27.1%, indicating that 27.1% of the change in mathematics academic performance is caused by learning engagement.

Table 2. Regression analysis of junior high school students' mathematics learning engagement and mathematics academic achievement.

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics					Durbin-Watson
					R Square Change	F Change	df1	df2	Sig. F Change	
1	.521a	.271	.269	.9742	.271	115.377	1	310	.000	1.080

a. Predictors: (Constant), mathematics learning engagement
b. Dependent Variable: mathematics academic performance

As shown in Table 3, the test model of ANOVA, F(1310)=115.377, P<0.001, indicating that the regression model is significant, the fitting effect is good, and the equation has certain representativeness. Table 4 shows the regression coefficient and the significance level of each coefficient. The coefficient of independent variable mathematical learning engagement is 0.701 (P<0.001), the constant is 0.337, not significant (P=0.065>0.05), but Table 3 shows that the whole regression equation is significant and the constant is not the key observation variable in the study, so it can be retained. Then the equation of regression equation model is: y=0.701x+0.337. This shows that junior high school students' mathematics learning engagement has a predictive effect on mathematics academic performance, and it has a direct effect.

Table 3. ANOVA test model

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	109.492	1	109.492	115.377	.000b
	Residual	294.188	310	.949		
	Total	403.679	311			

a. Dependent Variable: mathematics academic performance

b. Predictors: (Constant), mathematics learning engagement

Table 4. Regression coefficient and significance level of each coefficient

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.337	.182		1.852	.065
	mathematics learning engagement	.701	.065	.521	10.741	.000

a. Dependent Variable: mathematics academic performance

The independent sample t-test of mathematics academic performance in high and low groups

It can be seen from table 5 that the significant (sig = 0.279 > 0.05) indicates the homogeneity of variance. Select the row of "assumed homogeneity of variance" as the test result. At this time, SIG = 0.000 < 0.05, so there is a significant difference in mathematics academic performance in the high and low groups of mathematics learning engagement. The average value of junior high school students' mathematics learning engagement is 2.655, and the standard deviation is 0.846, which is in the middle level as a whole. The average value of mathematics academic performance of the high group is 3, and the average value of the low group is 2, indicating that the high group is higher than the low group. It can be seen from Figure 1 that students with higher mathematics academic performance have higher mathematics learning engagement level, but students with "good" mathematics academic performance have lower learning engagement, which may be caused by limited sample size or lack of representativeness, or may be related to genetic factors(Rimfeld Kaili，Kovas Yulia，Dale Philip S，& Plomin Robert，2016)

Table 5. The independent sample t-test of junior high school students' mathematics academic performance in high and low groups

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
mathematics academic performance	Equal variances assumed	1.177	.279	9.941	166	.000	1.4524	.1461	1.1639	1.7408

	Equal variances not assumed	9.941162.064	.000	1.4524	.1461	1.1639	1.7409

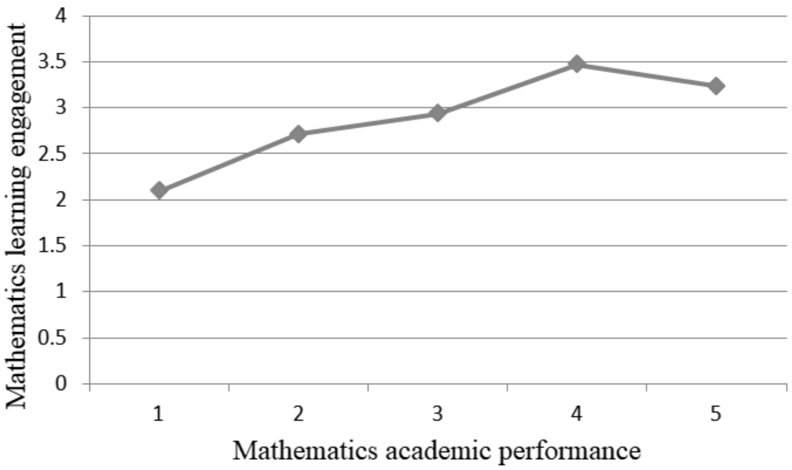

Figure 1. The relationship between mathematics academic achievement and mathematics learning engagement

Single variable analysis of junior high school students' mathematics learning engagement

The scores of junior high school students' mathematics learning engagement (the average of the scores of three dimensions of cognitive engagement, emotional engagement and behavioral engagement) were analyzed by 2 (gender) × 2 (location) single variable (Two factor analysis of variance).The results showed that the main effect of gender was not significant, F=0.805, P= .370 > 0.05, and the partial ETA square was 0.003, so there was no significant difference in gender in mathematics learning engagement; the main effect of local landowners is significant, F=15.711, P=0.000<0.001, and the partial ETA square is 0.049, indicating that there is a significant difference in the level of mathematics learning engagement between rural and urban junior high school students. As shown in Figure 2, the level of mathematics learning engagement of urban students is significantly higher than that of rural students; the interaction effect of gender and location is not significant, F=0.090, P=0.764>0.05, partial ETA square is 0.000, indicating that is there is no interaction between gender and location in mathematics learning engagement.

The scores of junior high school students' mathematics learning engagement (the average of the scores of three dimensions of cognitive engagement, emotional engagement and behavioral engagement) were analyzed by 2 (gender) × 2 (location) single variable (Two factor analysis of variance).The results shows that the effect of gender difference was not significant, F=0.805, P= .370 > 0.05, and the partial ETA square was 0.003, so there was no significant difference in gender in mathematics learning engagement; the main effect of local landowners is significant, F=15.711, P=0.000<0.001, and the partial ETA square is 0.049, indicating that there is a significant difference in the level of mathematics learning engagement between rural and urban junior high school students. As shown in Figure 2, the level of mathematics learning engagement of urban students is significantly higher than that of rural students; the interaction effect of gender and location is not significant, F=0.090, P=0.764>0.05, partial ETA square is 0.000, indicating that is there is no interaction between gender and location in mathematics learning engagement.

Table 6. The test of intersubjectivity effect

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Gender	.552	1	.552	.805	.370	.003
Location	10.770	1	10.770	15.711	.000	.049
Gender * Location	.062	1	.062	.090	.764	.000

Dependent Variable: mathematics learning engagement
a. R Squared = .051 (Adjusted R Squared = .042)

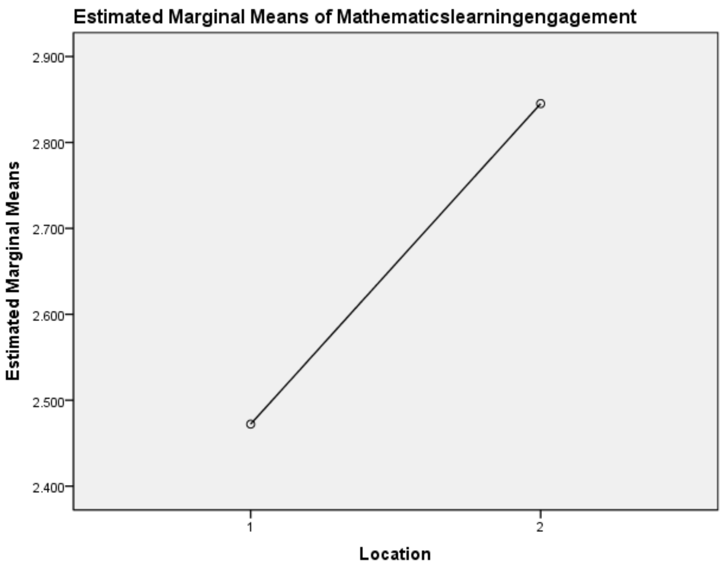

Figure 2. Level chart of mathematics learning engagement in different places

Discussion

The results show that junior high school students' mathematics learning engagement is closely related to mathematics academic performance, among which cognitive engagement is the most related to mathematics academic performance, and emotional engagement is the least. This is consistent with the research results of Yu Rongrong（余蓉蓉，2019）. School life is an educational activity based on the teaching of students' basic knowledge. Homework, academic examination, classroom learning and parents' educational expectation lead to the increase of students' learning time, and the acquisition of mathematical knowledge expands the mathematical cognitive engagement to a certain extent. The higher the level of students' cognitive engagement, the greater their efforts to master mathematics knowledge, and the higher their mathematics scores（余蓉蓉，2019）. Research shows that students who can actively communicate with teachers and classmates in the learning process can perform better in academic performance（Fincham F D，Hokoda A，& Sanders R，1989）. There are many reasons for the low emotional engagement. The researchers of emotional engagement think that learning engagement is essentially students' emotional engagement to learning activities, and both positive and negative emotional experience need to be concerned. From the perspective of lifelong learning, it is also equally important for their future learning and development to let students obtain positive emotional experience in learning and learn to learn and love learning（张娜，2012）. Some studies have shown that even if students have deep cognitive engagement and lack of emotional engagement, their behavioral engagement will be unstable and hard to last, which is also one of the main reasons for students' insufficient classroom participation（黄杏芳，2006）. However, the lack of students' participation in the classroom is inseparable from teachers' classroom management, which can significantly affect students' mathematics performance. When the teacher can carry on the effective classroom management and the student abides by the classroom order, students can participate in the classroom study and the discussion positively and complete the teacher's teaching goal well, which will make them have the good mathematics result. On the contrary, if teachers can't effectively maintain the classroom order, allocate classroom time and deal with classroom emergencies, their teaching tasks can't be completed effectively, and students can't study at ease, which will eventually affect students' learning effect（余蓉蓉，2019）. Junior high school stage has always been the most concerned period of compulsory education stage, which is the key period for the development of students' emotional attitude and the golden period for the cultivation of students' good behavior habits. Mathematics is an important medium to achieve this goal, which needs reasonable guidance for students. Therefore, we should pay attention to the emotional development of students while maintaining their cognitive engagement in mathematics learning. By observing the emotional experience of students in the process of learning mathematics, we can enhance their sense of belonging and identity, arouse their affirmation of mathematical value, and establish a correct mathematical view.

The research found that junior high school students' mathematics learning engagement has a direct impact on mathematics academic performance and can significantly predict academic performance. This is consistent with the research of Wei Jun and Connell（魏军，刘儒德，何伊丽，唐铭，邸妙词，& 庄鸿娟. 2014；Connell J.P., Spencer M.B. & Aber J.L，1994）. There is a strong correlation between learning engagement and academic performance（Skinner E A，& Belmon M J.，1993）. Specifically, in terms of cognitive engagement, deep-seated engagement and reflection habits determine the level of test scores. The more deep-seated engagement and reflection habits, the higher the students' math scores; in terms of behavioral engagement, concentration in class and after-school research are important factors affecting math academic performance; emotionally, a strong interest in learning and a strong sense of success is the key to driving students to invest in learning so as to get a better math score situation（乐晓莺，2011）. From this perspective, learning engagement has a positive impact on academic performance（Skinner E.A., Wellborn J.G.，& Connell J.P.，1990）, and learning engagement can predict students' academic performance（Skinner E A，& Chi U．，2012）. How to make full use of external resources to promote the generation of students' internal motivation and then affect their learning engagement to improve their mathematics academic performance has become a concern of scholars. According to Xie Ting's research, the school mathematics learning atmosphere, mathematics teachers, students' self-efficacy and subject stereotype are closely related to students' learning engagement and academic performance. In the process of mathematics teaching, we should pay attention to stimulate students' interest in mathematics learning and improve their sense of self-efficacy. Only when students believe that they can achieve the expected learning goals through their efforts, can they have the determination and motivation to overcome difficulties in front of them（谢婷，2018）. According to the development stage environment theory, when an individual is in a stage environment where the basic psychological needs match the opportunities provided by the environment, they can obtain the optimal development（Eccles，J.S．，Midgley，C，Wigneld，A．，Buchman，C.M．，Reuman，D．，Flanagan，C，＆ Mac Iver，D．，1993）. Therefore, family and teachers are very important to the development of students' mathematics academic performance. When parents often express their hope that their children can compete for the top and receive a higher level of education by language or action, their children are more likely to firmly believe in learning and pay more attention to learning（王玲晓，张丽娅，&常淑敏，2018）. In practical education, teachers' emotional support and independent support for students are equally important. The quality of emotional support reflects the quality of the relationship between teachers and students. A good relationship between teachers and students is one of the important conditions to promote students' academic self-efficacy, investment, efforts and academic achievements. In terms of independent support, students should be informed of the importance of learning. Only when students understand the importance of learning for whom, can they fundamentally stimulate their internal motivation for learning（柴晓运，& 龚少英，2015）.

The research shows that there are significant differences between the high and low groups in mathematics academic performance, and the average level of mathematics academic performance in the high group is significantly higher than that in the low group. It is also found in the study that students with high learning engagement have higher academic performance, and will get higher scores in standardized tests（Skinner E A，& Belmon M J.1993）.But junior high school students' mathematics learning engagement tends to be more progressive than their academic performance, which indicates that there is a certain gap between junior high school students' mathematics learning engagement and mathematics learning achievement. This shows that there is still a certain gap between junior high school students' mathematics learning engagement and mathematics learning achievement, and further explains that junior high school students' mathematics learning engagement is not fully reflected in their learning achievement（谢婷，2018）. So whether low mathematics academic performance means that students keep low learning engagement is not always true. In actual teaching, there is often such a phenomenon: a student works hard to learn mathematics and pays time and energy for it, but his mathematics academic performance is not ideal. There are many reasons for this, such as improper learning methods, low learning efficiency, etc. These are all popular terms, and the essence of the problem is not really found. Research shows that students' basic psychological needs are closely related to their learning engagement and academic performance（Carmona-Halty Marcos, Schaufeli Wilmar B, Llorens Susana，& Salanova Marisa，2019）. When their basic psychological needs are not met, they will promote people to find those who can meet the needs, and then generate behavioral motivation. According to the theory of self-determination, people have three basic psychological needs (autonomy, ability and relationship). Only when people's needs are met, can people's motivation be more internalized, make behavior more self-determination, and lead to greater behavioral engagement and better performance（乔晓熔，2006）. Reflected in mathematics education, when students' mathematics academic performance is not improved, students may have incorrect attribution, such as ascribing academic failure to low ability（蒋舒阳，刘儒德，甄瑞，洪伟 & 金芳凯，2019）, students fail to meet their ability needs, they will change the status quo by prolonging learning time, mechanical memory formula and other ways. In the long run, students will have low self-efficacy and self-evaluation. This negative cognitive model will make individuals lose interest in mathematics and get tired of academic tasks（蒋舒阳，刘儒德，甄瑞，洪伟 & 金芳凯，2019）. Therefore, in mathematics teaching, we should try our best to meet the basic psychological needs of students, pay attention to the students' academic emotions in the process of learning mathematics, and promote the level of mathematics learning engagement by helping them to correctly attribute, so as to further improve their mathematics academic performance.

The results show that junior high school students' mathematics learning engagement is less affected by gender factors. This is consistent with the research of Zhou Yan and Tan Dingliang（周琰&谭顶良，2010）. Mathematics, as one of the most important courses in middle school, has been widely concerned by teachers and parents, but the stereotype of gender is always deeply engraved in people's hearts. Under the influence of stereotype, people generally think that boys' mathematics learning ability is better than girls'（傅海伦，李丛 & 吕冰冰，2018）, and in junior high school, with the increase of grade, this stereotype will become stronger and stronger（宋淑娟，2015）. Gender stereotype is not only the object's prejudice to the subject, but also exists in the subject. Some boys think that they have greater advantages than girls in mathematics learning, which will make their potential in mathematics learning more and better play. Some girls think that mathematics is not their advantage. When they encounter difficulties in mathematics, they will use the excuse of "they are not good at" and so on loss of learning motivation（傅海伦，李丛 & 吕冰冰，2018）. When the stereotype of mathematical gender is activated, the score of girls' mathematics examination is lower than that of no activation, and this kind of influence has a long-term nature. It will increase girls' mathematics anxiety, reduce girls' mathematics self-confidence, and also affect girls' mathematics attitude, mathematics engagement, mathematics motivation and mathematics identification, etc., thus forming a vicious circle. The stereotype of mathematical gender will lead to no mathematics score good, bad math scores further strengthen the stereotype of math gender（王晓芹，2015）. In mathematics class, teachers will give more opportunities to boys to exchange and interact, and boys can get more opportunities to participate in mathematics class. However, there is no gender difference in junior high school students' mathematics learning engagement, which shows that girls' mathematics learning engagement in their spare time is more than boys'. In the process of education, teachers should guide boys to encourage girls to participate in mathematical discussions in class, stimulate girls' intrinsic motivation to learn mathematics, reduce their escape psychology when facing mathematical challenges, and gradually build up their confidence in mathematics. In addition, teachers should guide girls to more urge boys to complete mathematical learning tasks after class. Based on the satisfaction of relationship needs, we should establish a gender complementary system in class, give full play to the advantages of boys and girls, and learn from each other.

The engagement level of rural mathematics learning is lower than that of urban, and the achievement of urban mathematics learning is higher than that of rural. This is consistent with Xie Ting's study（谢婷，2018）. This may be related to the environment in which the students live. First of all, most of the left behind children in rural areas are working outside. As many fathers work outside and their mothers take care of them at home, the students are lack of fatherly love for a long time. Their psychological problems are gradually formed and violations such as being late, fighting and so on occur from time to time. The students even feel tired of learning. Most of the left behind children's learning achievements are concentrated below the middle level（许敏怡 & 刘华，2020）. Secondly, the higher the socio-economic status of the family（王玲晓，张丽娅&常淑敏，2018）, the higher the education level, the better the parents will get the resources, and the parents will "invest" these resources to their children（毕馨文，魏星，王美萍，陈亮 & 张文新，2018）. Compared with the rural areas, the urban areas have more abundant resources, complete educational materials and relatively wide information sources. Parents will pay more attention to their children and prepare for their future education. Finally, the school infrastructure in the town is perfect, which can create a better school atmosphere for students. The higher the school atmosphere is, the stronger the social adaptability is(杨飞龙，李翔&朱海东，2019), which is conducive to students' better investment in mathematics learning.

CONCLUSION

Junior high school students' mathematics learning engagement is closely related to mathematics academic performance, among which cognitive engagement is the most related to mathematics academic performance, and emotional engagement is the least. Junior high school students' mathematics learning engagement has a direct impact on mathematics academic performance and can significantly predict academic performance.

There are significant differences between the high group and the low group in mathematics academic performance, and the average level of mathematics academic performance in the high group is significantly higher than that in the low group. The higher the academic achievement of mathematics is, the higher the engagement of mathematics learning is.

Junior high school students' mathematics learning engagement is less affected by gender factors, and the level of rural mathematics learning engagement is lower than that of urban.

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REFERENCES

Carmona-Halty Marcos,Schaufeli Wilmar B,Llorens Susana,Salanova Marisa(2019). Satisfaction of Basic Psychological Needs Leads to Better Academic Performance via Increased Psychological Capital: A Three-Wave Longitudinal Study Among High School Students.[J]. Frontiers in psychology,10.

Connell J.P., Spencer M.B., Aber J.L(1994). Educational risk and resilience in African-American youth: context, self, action, and outcomes in school[J].Child Development, 65(2 Spec No):493

Eccles, J．S．，Midgley，C，Wigneld，A．，Buchman，C．M．，Ｒeuman，D．，Flanagan，C，& Mac Iver,D．(1993)． Development during adolescence: The impact of stage-environment fit on young adolescents′ experiences in schools and in families． American Psychologist，48 (2)，90 － 101.

Fincham F D，Hokoda A，Sanders R(1989)．Learned helplessness, test anxiety, and academic achievement: a longitudinal analysis[J]．Child Development，60（1）：138-145．

Fredricks, J. A., Hofkens, T., Wang, M.-T., Mortenson, E., & Scott, P. (2017). Supporting girls' and boys' engagement in math and science learning: A mixed methods study. Journal of Research in Science Teaching, 55(2), 271–298.

Liu R D , Zhen R , Ding Y , et al(2018). Teacher support and math engagement: roles of academic self-efficacy and positive emotions.Educational Psychology,38(1):3-16.

Rimfeld Kaili, Kovas Yulia,Dale Philip S,Plomin Robert(2016). True grit and genetics: Predicting academic achievement from personality. Journal of personality and social psychology, 111(5).

Robinson,K., & Mueller, A. S. (2014). Behavioral Engagement in Learning and Math Achievement over Kindergarten: A Contextual Analysis. American Journal of Education, 120(3), 325–349.

Sciarra, D T, Seirup, H J(2008). The Multidimensionality of School Engagement and Math Achievement among Racial Groups. Professional School Counseling, (4) .

Skinner E A, Belmon M J.(1993). Motivation in the classroom: Reciprocal effects of teacher behavior and student engagement across the school year.Journal of Educational Psychology, 154

Skinner E A，Chi U(2012). the Learning － Gardens Educa- tional Assessment Group. Intrinsic motivation and engagement as “Active Ingredients” in garden － based education: Examining models and measures derived from self － determination theory . Journal of Environmental Education，43(1) : 16 － 36

Skinner E.A., Wellborn J.G., Connell J.P(1990). What it takes to do well in school and whether I've got it: A process model of perceived control and children's engagement and achievement in school[J]. Journal of Educational Psychology, 82

Wang, M.-T., & Holcombe, R. (2010). Adolescents' Perceptions of School Environment, Engagement, and Academic Achievement in Middle School. American Educational Research Journal, 47(3), 633–662.

毕馨文,魏星,王美萍,陈亮,张文新.父母受教育水平与青少年学业适应的关系:父母教养与亲子沟通的中介作用.心理科学,2018,41(02):330-336.

迟翔蓝. 基于自我决定动机理论的教师支持对大学生学习投入的影响机制研究.天津大学,2017.

柴晓运,龚少英.中学生数学学习投入:感知到的数学教师支持与数学自我概念的作用.中国特殊教育,2015(06):78-85.

傅海伦,李丛,吕冰冰.性别刻板印象对数学学习的影响及策略分析[J].教学与管理,2018(09):32-34.

国内外学习投入及其学校影响因素研究综述.心理研究,2012,5(02):83-92.

黄杏芳. 数学后进生课堂参与不足情况研究.华东师范大学,2006.

蒋舒阳,刘儒德,甄瑞,洪伟,金芳凯.高中生数学能力实体观对数学学习投入的影响:学业自我效能感和消极学业情绪的中介作用.心理发展与教育,2019,35(01):48-56.

廖友国.大学生自我效能感对学习价值观与学习投入关系的调节作用.宁波大学学报(教育科学版),2011,33(05):50-54.

刘在花.学习价值观对中学生学习投入影响的多重中介模型研究.中国特殊教育,2019(01):84-88.

乔晓熔. 中学生数学学习自我决定及其与数学学习投入的关系.河南大学,2006.

乔晓熔,赵俊峰.中学生数学学习投入状况的调查研究.中国电力教育,2010(35):83-85.

宋淑娟.中学生数学-性别刻板印象威胁与消解.中国教育学刊,2015(01):88-92.

王晓芹.数学性别刻板印象对高中女生的影响与应对策略.中小学心理健康教育,2015(22):30-31.

王玲晓,张丽娅,常淑敏.中考生家庭社会经济地位与学习投入的关系:父母教育期望和父母教养行为的多重中介作用.中国特殊教育,2018(12):75-81.

魏军,刘儒德,何伊丽,唐铭,邸妙词,庄鸿娟.(2014). 小学生学习坚持性和学习投入在效能感、内在价值与学业成就关系中的中介作用.心理与行为研究,12(3),326-332.

谢婷.初中生数学学习投入与学业成绩的关系研究.西南大学，2018.

许敏怡,刘华.农村留守儿童生活现状的调查分析.中国市场,2020(03):40-41.

袁丽.课堂中的“性别刻板印象”解析.软件导刊(教育技术),2011,10(11):9-11.

余蓉蓉.教师课堂教学行为、学生学习投入与数学成绩的关系——基于 PISA 上海测试[J].教育测量与评价,2019(08):29-36.

乐晓莺. 初中生数学学习投入现象的调查研究.扬州大学,2011.

杨飞龙,李翔,朱海东.学校氛围和青少年社会适应的关系:一个有调节的中介模型.中国临床心理学杂志,2019,27(02):396-400.

周琰,谭顶良.初中数优生、数困生的数学学习投入研究.中国特殊教育,2010(12):53-57+94.