The International Conference on Interdisciplinary Humanities and Communication Studies
DOI: 10.54254/2753-7048/4/2022276

# *The Effect of Gender on Math Performance*

## *-- Research based on College Advanced Mathematics Scores*

**Herong Ji[1,a,*,†], Siyu Li[1,b,†]**

[1]*College of Culture and Communication, Institute of Disaster Prevention, Langfang, Hebei, China*
[2]*College of Foreign Languages, Sias University, Zhengzhou, Henan, China*
*a. 100830@yzpc.edu.cn, b. 15000340227@xs.hnit.edu.cn*
**corresponding author*
*†These authors contributed equally.*

***Abstract:*** The influence between gender difference and mathematics achievement has always been a concern of scholars at home and abroad. Many scholars have conducted investigations on this issue, and most of them conclude that gender has no direct influence on mathematics learning. In order to verify this conclusion, this study collected the scores of advanced mathematics and family background of 300 college students from all over the country through an online questionnaire, and conducted research on the possible influencing factors of college students' mathematics scores in the college entrance examination, mainly including gender, learning level, parents' education background and other regression analysis. The results showed that there was no correlation between gender and advanced mathematics achievement, but school level, the frequency of learning mathematics, the mother's education level and the average monthly income of the family had an influence on advanced mathematics achievement. Therefore, girls should eliminate their fear of higher mathematics and devote more time to it. Teachers and parents should change the stereotype of girls and encourage girls to study more.

***Keywords:*** gender difference, math score, higher education

## 1. Introduction

In higher education, the gender difference in higher mathematics learning has gradually become one of the important issues in the field of education and is an important topic in international mathematics education research. Many scholars at home and abroad constantly pay attention to the influence of gender differences in math, and from the innate factors, social environment and non-intelligence factors conducted a lot of research [1]. Some results show that the boys have a natural advantage in mathematics, and girls' mathematical ability is weaker than the boys' [2]. But this might not be true. The study of gender difference is beneficial to further understand the thinking mode and behavior habits of different genders in learning mathematics, which is beneficial to teachers' teaching according to students' characteristics in teaching activities and contributes to students' own development.

DOI: 10.54254/2753-7048/4/2022276

In the field of university education, the relationship between the gender of male and female students and the performance in the higher mathematics has been a concern by scholars at home and abroad. A large number of scholars have investigated and studied the relationship between them.

Most scholars have found that gender has no significant effect on math performance, and the difference in math performance between boys and girls is not caused by gender. For example, the researches of domestic scholars such as Haiyan Yang, Yujian Zhou, Dongmei Zhang and Xinguang Wang all show that girls are not born with a weak position in mathematics, and gender has no direct impact on math performance [3-5]. There are also relevant examples in the literature of foreign scholars. The research results of Colleen M. Ganley and Marina Vasilyeva and others all show that there is no significant gender difference in the two mathematical results [6].

Some researchers found that men's and women's gender is influential in math. Wei Zhu and Jianliang Wang found that there is a difference between men and women in mathematics learning, and the boy is generally better than girls in math. It is worth mentioning they mentioned girls' math anxiety phenomenon more than boys '. This is also the main reason why girls' math scores are lower than boys' [7]. On the contrary, some studies have confirmed that girls' math scores are actually higher than boys'. For example, Zhaoli Kong research suggests that girls are 7.89 points above the average in math than boys, and girls' classroom performance and completion of assignments are higher than boys' [8]. Lihua zhang, Xuefang Dai , Zhiqiang Liu, Changshui Yu and Yuhai Bao found that gender has a significant influence on the failure of college mathematics, and the failure rate of male students is higher than that of female students [9].

Some scholars did not give a specific conclusion on whether boys scored higher or girls scored higher in math, but summarized and analyzed the possible reasons for the difference in boys' math [10-11]. For example, Yunkun Liu and Sha Tao analyzed the reasons for the difference between male and female math scores from the perspectives of age, heredity and evolution, stereotype and social justice [10]. In addition, scholars Bo Yu , Yan Xia and Yukun Zhang showed that there was a weak correlation between the scores of the college entrance examination and the scores of advanced mathematics, because the two subjects had different assessment purposes and methods [11].

It can be seen that domestic and foreign scholars have different research results on the relationship between male and female gender differences and math scores, and most of the research results show that there is no effect between gender differences and math scores. This study will explore and analyze the relationship between gender and performance. Considering that most of the relevant data are too old and the diversity of the reference results, this study conducts empirical and further exploration on the relevant research results through the collection and analysis of new data in the past two years.

Through the investigation of college students' learning and the analysis of their family background, this study studies whether there are gender differences in students' mathematics learning. It also analyzes the relationship between male and female gender differences and the high and low scores in advanced mathematics, and verifies that there is no correlation between gender and higher mathematics scores.

## 2. Research Method

### 2.1. Data Sample

The data of this study are from the online questionnaire Star. 302 college students (including 150 boys and 152 girls) from 31 provinces (excluding Taiwan Province, Hong Kong Special Administrative Region and Macao Special Administrative Region) were collected in the form of convenient sampling data collection. 302 Chinese mathematics majors and non-mathematics majors' mathematics achievements in different school levels (the school level is classified in the questionnaire as: college, second tier university, non- Project 985 Project 211 first tier universities,

DOI: 10.54254/2753-7048/4/2022276

non-Project 985 Project 211 double first-class initiative universities, Project 211 universities and Project 985 universities, a total of six types of universities) and their family background are collected. Among them, two (2 female students) are invalid data, because the full score of the math score of the college entrance examination in their place is not 150 or 120, so they are excluded. After excluding the invalid data, the final sample size of this study is 300, including 150 boys and 150 girls.

## 2.2. Variable Declaration

### 2.2.1. Dependent Variable

The explained quantity (dependent variable) of this study is the achievement of college students in higher mathematics. In this study, the scores directly answered by the college students themselves (question 6 of the questionnaire on the factors affecting college students' mathematics scores: "your higher mathematics examination scores") were used to measure. In order to keep the order consistent and display more intuitively, this study sets the scores from low to high: below 60 points, 61-75 points, 76-90 points and above 90 points (Table 1).

Table 1: Gender and academic status of college students.

| Background | | Male | Female |
|---|---|---|---|
| College Entrance Examination Achievement | 136-150（109-120） | 44 | 55 |
| | 113-135（90-108） | 92 | 85 |
| | 112 and below（89 and below） | 14 | 10 |
| University Level | Project 985 | 2 | 4 |
| | Project 211 | 9 | 6 |
| | non-Project 985Project 211 Double First-Class Initiative Universities | 6 | 12 |
| | non- Project 985 Project 211 First Tier Universities | 49 | 72 |
| | Second Tier University | 58 | 51 |
| | College | 26 | 5 |
| Major | Mathematics Majors | 108 | 79 |
| | non-Mathematics Majors | 42 | 71 |
| Higher Mathematics Score | 90 or above | 60 | 72 |
| | 75-90 | 79 | 60 |
| | 60-75 | 10 | 17 |
| | 60 and below | 1 | 1 |
| Frequency of Learning Math | five to seven days a week | 42 | 32 |
| | three to five days a week | 79 | 73 |
| | one to four days a week | 22 | 39 |
| | study exclusively before exams | 7 | 6 |
| Study Communication | Often | 88 | 78 |
| | Occasionally | 51 | 57 |
| | Never | 9 | 12 |
| | People ask me question most of the time | 2 | 3 |

DOI: 10.54254/2753-7048/4/2022276

### 2.2.2. Main Independent Variable

The key explanatory variable (independent variable) of this study is the gender of college students. The sample size is 300 college students, including 150 boys and 150 girls.

### 2.2.3. Control Variable

There are many factors affecting the difference between male and female college students, such as learning attitude, family background and so on. To control the influence of other variables on math performance, 12 relevant questions were put forward in the questionnaire. According to college students' own learning situation and family background, the study selected students' parents' educational background, the level of the university they studied, and the major they studied (mathematics major and non-mathematics major) as control variables. Table 1 shows the data statistics of students' own learning situations. To control more factors, the family background of students is also statistically analyzed, as shown in Table 2.

Table 2: Gender and family background of university students.

| Family Background | | Male | Female |
|---|---|---|---|
| Fathers' Education Level | Postgraduate | 2 | 1 |
| | Bachelor Degree | 34 | 36 |
| | Associate Degree | 55 | 57 |
| | Senior High School and Technical Secondary School | 57 | 53 |
| | Junior High School and below | 2 | 3 |
| Mothers' Education Level | Postgraduate | 0 | 1 |
| | Bachelor Degree | 19 | 14 |
| | Associate Degree | 52 | 38 |
| | Senior High School and Technical Secondary School | 66 | 70 |
| | Junior High School and below | 13 | 27 |
| Family Structure | Two-Parents Family | 118 | 67 |
| | One-Parents Family | 8 | 17 |
| | Divorce Family | 9 | 19 |
| | Blended Family | 15 | 47 |
| Average Monthly Earnings | 12000 and above | 4 | 2 |
| | 8001 to 12000 | 15 | 12 |
| | 4001 to 8000 | 87 | 90 |
| | 2001 to 4000 | 43 | 44 |
| | 2000 and below | 1 | 2 |

## 2.3. Research Hypothesis

The hypothesis of this experiment is that gender has no significant effect on higher mathematics scores.

## 3. Research Results

To study the relationship between each variable and advanced mathematics scores, the authors first conducted regression analysis on each variable, and the results are shown in Table 3 below. Later, to

DOI: 10.54254/2753-7048/4/2022276

verify the results of regression analysis, the authors conducted correlation analysis on gender and advanced mathematics scores.

Table 3: Regression analysis of control variables.

| | B | Beta | t | P |
|---|---|---|---|---|
| Constant | 2.166 | - (0.335) | 6.466 | 0.000** |
| Sex | 0.046 | 0.035 (0.079) | 0.591 | 0.555 |
| College Entrance Examination Achievement | 0.058 | 0.051 (0.064) | 0.896 | 0.371 |
| University Level | 0.136 | 0.214 (0.038) | 3.559 | 0.000** |
| Major | 0.14 | 0.102 (0.08) | 1.74 | 0.083 |
| Frequency of Learning Math | 0.233 | 0.276 (0.049) | 4.763 | 0.000** |
| Study Communication | 0.062 | 0.057 (0.063) | 0.992 | 0.322 |
| Fathers' Education Level | 0.037 | 0.046 (0.046) | 0.819 | 0.413 |
| Mothers' Education Level | -0.125 | -0.162 (0.043) | -2.882 | 0.004** |
| Family Structure | 0.076 | 0.109 (0.04) | 1.915 | 0.056 |
| Average Monthly Earnings | -0.119 | -0.123 (0.054) | -2.199 | 0.029* |
| $R^2$ =0.166 | Adjusted $R^2$=0.138 | | | |
| F (10,289)=5.771 | | | | |

Dependent variable: high score

Note: ** and * represent 1% and 5% significance levels respectively

The regression results show that the influence coefficient of gender on the performance of high mathematics is 0.046, but the p-value is 0.555, greater than 0.1. Therefore, the regression results are not significant, that is, gender has no significant effect on the performance of high mathematics.

In addition, the influence coefficient of school level in the control variable is 0.136, and the p-value is 0.000, less than 0.01. Therefore, the significant relationship between school level and higher mathematics performance is 1% significance levels.

The influence coefficient of mathematics learning frequency in the control variable is 0.233, and the p-value is 0.000. It is also less than 0.01, so the significance between mathematics learning frequency and higher mathematics achievement is 1% significance levels.

The influence coefficient of the mother's education in the control variable is -0.125, and the p-value is 0.004. It is also less than 0.01, so the significance between a mother's education level and higher mathematics achievement is 1% significance levels.

The influence coefficient of the average monthly earnings of the family in the control variable is -0.119, and the p-value is 0.029, which is less than 0.05. Therefore, the significance between the

DOI: 10.54254/2753-7048/4/2022276

average monthly income of the family and the performance in higher mathematics is 5% significance levels.

In addition, in order to verify the results of the regression analysis, the authors also conducted a correlation analysis on gender and higher mathematics scores. The result shows that the correlation coefficient between the performance of higher mathematics and gender is 0.025, and the p-value is 0.666, more than 0.05. Therefore, there is no correlation between the average score of higher mathematics and gender.

## 4. Discussion

The result of this study is that the gender of college students has no significant effect on their higher mathematics scores. Specifically, there was no significant correlation between gender and math performance, and both boys and girls could do well in advanced math. In higher education, this research has contributed to the relationship between gender and math performance, for example by updating and improving data and reproving hypotheses.

There are maybe some reasons besides the influence of the data. First of all, with the popularization of higher education, the chances of school-age young people entering universities have increased, and the possibility of learning higher mathematics has increased. Secondly, with the progress of society, people's ideology of son preference has been improved, which makes girls and boys equal educational opportunities, and they are exposed to the same frequency of mathematics learning. Thirdly, the students' family background has a certain impact on the results, such as parents' educational background (educated parents have knowledge reserves to help and tutor their children to learn higher mathematics) and economic level (children can invite excellent teachers to teach the difficult points in higher mathematics learning); Finally, in addition to objective reasons, what is more important is the learning habits and attitudes of students themselves. In class, girls are more serious than boys in listening to the teacher [8], and after class, girls are more active in asking the teacher for answers, which is also the reason for narrowing the gap between girls and boys.

Female college students should increase their enthusiasm and confidence in learning mathematics and maintain a positive attitude. Teachers should pay more attention to girls' math learning, divergent their math thinking, and help them make some math improvement plans. Some parents' ideas will affect girls' views and cognition of learning mathematics. Therefore, in the future life, parents should change their own ideological prejudice, encourage their children's enthusiasm and attitude toward learning mathematics, and give them help in learning mathematics.

## 5. Conclusion

The objective of this study is to explore whether and to what extent the gender of college students has an impact on the performance of advanced mathematics. This study concluded that gender is not related to higher mathematics achievements, but the control variables do. The school level, frequency of learning mathematics, mother's education and monthly average income all have a certain influence. This study provides the latest data and results for higher education in the field of gender and mathematics achievement. It has played a role in promoting higher education, students' personal learning and family education. Firstly, this study has provided a powerful result for teachers in charge of higher mathematics education to eliminate the differences in performance due to gender differences, so that teachers can treat male and female students with a correct and equal attitude and educational concept, and even give more care and encouragement to poor students, promoting the innovation and innovation of higher mathematics teaching. Secondly, it helps students with poor performance in higher mathematics to overcome the problem of gender affecting their performance, which is conducive to building the confidence of college students to learn higher mathematics well, improving

DOI: 10.54254/2753-7048/4/2022276

their discipline quality and improving their comprehensive discipline quality. Thirdly, it helps parents get rid of the shackles of traditional concepts and actively encourage their children to learn. Fourthly, it helps female college students face up to the study of higher mathematics. And female college students should discuss more exercises with their classmates and teachers in the process of learning mathematics and treat the study of Higher Mathematics with a positive attitude.

The main contribution of this study is to update and improve the research data on gender and performance in higher education and to further prove the results of related research. The study is helpful to the reform and improvement of higher mathematics teaching policy and method in higher education, and to promote the harmonious development and common progress of classrooms and students. Compared with other studies, this study has some innovations. The test rate of control variables is relatively comprehensive. In addition, this study adopts regression analysis instead of the t-test method used in other studies to verify the previous experimental results, which is clear and easy to understand. However, the study also has some shortcomings. Although the sample size of the data is sufficient, the national representativeness is not considered, and more comprehensive and representative sample information data should be collected. In future research, people can improve the shortcomings of sample data.

## References


[1] *Dongkui Shen. (2001). Discussion on the Non-intelligence View of Gender Difference in Mathematics Achievement. Mathematics Teaching Research, 6, 2-4.*

[2] *Linxi Shi.(2012). Influence of Gender Stereotype Threat on Male and Female Mathematics Performance and Countermeasures. China Science and Education Innovation Guide, 14, 147.*

[3] *Haiyan Yang. (2012). Investigation and Research on Mathematical Literacy of Mathematics Majors. Northeast Normal University.*

[4] *Yujian Zhou. (2013). An Empirical Study on the Influence of Gender on Mathematical Skills and Ability. Science and Education Literature Collection (last issue), 4, 56-59.*

[5] *Dongmei Zhang., Xingang Wang. (2018). Research on Gender Differences in Mathematics Learning of College Students. Education modernization, 52, 316-317.*

[6] *Colleen M. Ganley., Marina Vasilyeva. (2011). Sex Differences in the Relation Between Math Performance, Spatial Skills, and Attitudes, Journal of Applied Developmental Psychology, Volume 32, Issue 4, 235-242.*

[7] *Wei Zhu., Jianliang Wang. (2006). An Analysis of the Influence of Gender Differences in Anxiety on the Mathematical Performance of American Examinees. Hubei enrollment examination, (12), 51-54.*

[8] *Zhaoli Kong. (2016). Analysis of Influencing Factors on College Students' Mathematical Performance -- Taking Sanya University As an Example. Education and Teaching Research, 30, 9, 106-112.*

[9] *Lihua Zhan., Xuefang Dai., Zhiqiang Liu., Changshui Yu., Yuhai Bao. (2014). Empirical Analysis of the Reasons for Failing College Mathematics Based on Logistic Model. Journal of Inner Mongolia Normal University (EDUCATION SCIENCE EDITION), 27, 9, 135-138.*

[10] *Yunkun Liu., Sha Tao. (2012). Gender Differences in Mathematical Achievement. Progress in Psychological Science. 1980-1990.*

[11] *Bo Yu., Yan Xia., Yukun Zhang. (2011). Analysis of Weak Correlation Between Mathematics Scores and High Mathematics Scores in College Entrance Examination -- a Case Study Based on University. Journal of Chuzhou University,13, 5, 15-17.*