

Analysis of the Influence of College Mathematics Basic Courses on Mathematics for Postgraduate Entrance Examination

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Abstract

Objective: To explore the impact of college mathematics courses on the mathematics scores of postgraduate entrance examinations, and to put forward suggestions on the teaching and learning of college mathematics courses. **Methods:** Select the scores of 234 basic mathematics courses and mathematics for postgraduate entrance examinations of a college in Chongqing, and take the average of the scores of students who have not participated in any course, and then establish a multiple linear regression model for evaluation and analysis, and get any the influence of basic mathematics course scores on the math scores of the postgraduate entrance examination and the influence of all basic mathematics course scores on the math scores of the postgraduate entrance examination. **Results:** The total amount of explanation for the mathematics results of the postgraduate entrance examination for university mathematics basic courses is 12.5%, Advanced Mathematics (Volume II), linear algebra, probability theory and mathematical statistics is greater than 0.05, and Advanced Mathematics (Volume I) is less than 0.05. **Conclusion:** The mathematics score of the postgraduate entrance examination is most closely related to Advanced Mathematics (Volume I), and the other three courses also have an impact on it but not significant.

Keywords

College mathematics foundation course; Mathematics for postgraduate entrance examination; Multiple linear regression analysis; Teaching plan.

1. Introduction

In higher education, college mathematics basic courses such as advanced mathematics, linear algebra, probability theory and mathematical statistics are compulsory basic mathematics courses for science and engineering majors in colleges and universities, which are vital for students' subsequent courses or further study (postgraduate entrance examination). This article uses the method of multiple linear regression analysis to quantitatively analyze the impact of college mathematics basic courses on mathematics for postgraduate entrance examinations, and puts forward suggestions on the teaching and learning of college mathematics basic courses. It not only stimulates students' interest in studying university mathematics courses and improves the learning effect, but also has important reference significance for university mathematics teachers to further explore the teaching reform of university mathematics basic courses and improve teaching quality.

2. Research object

Select the scores of the mathematics basic courses (including Advanced Mathematics (volume I), Advanced Mathematics (volume II), Linear Algebra, Probability Theory, and Mathematical Statistics)

and mathematics for postgraduate entrance examination of 234 students from a college in Chongqing. And take the average of the scores of students who have not participated in any course to achieve the replacement of missing values.

3. Model establishment and solution

Let Y be the dependent variable (representing the mathematics results of the postgraduate entrance examination), and X_i ($i=1,2,3,4$) as the independent variable (representing advanced mathematics (volume I), advanced mathematics (volume II), linear algebra, probability theory, and mathematical statistics), we establish the following multiple linear regression equation ^[2] to analyze the impact of college mathematics courses on the mathematics results of the postgraduate entrance examination:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4$$

The above regression model is solved by using MATLAB to write an algorithm, and the results are as follows:

Table 1 The β_i coefficient value of the regression equation

Coefficient	β_0	β_1	β_2	β_3	β_4
Value	-4.9379	0.7854	0.2595	-0.0568	-0.0535

Based on this, the preliminary regression equation established is as follows:

$$Y = -4.9379 + 0.7854x_1 + 0.2595x_2 - 0.0568x_3 - 0.0535x_4$$

4. Model verification and optimization

In a multiple regression model, many independent variables are usually selected from a professional perspective, but not all independent variables have a significant relationship with the dependent variable, and some independent variables can be ignored. Therefore, it is necessary to use mathematical methods from them to filter out a significant subset of independent variables. The stepwise regression method is a commonly used method in practical problems. The basic idea is to introduce variables one by one. The condition for introducing variables is that the partial regression sum of squares is significant after testing. At the same time, after each new variable is introduced, the selected variables must be tested one by one, and insignificant variables are eliminated. This ensures that all variables in the final subset of variables are significant. In this way, after several steps, the "optimal" variable subset is obtained ^[1].

We used SPSS 23.0 statistical software to analyze and test the above regression equation, and optimized it. Take the mathematics results of the postgraduate entrance examination as the dependent variable, and the four basic university mathematics courses as the independent variables, carry out multiple linear stepwise regression analysis, and use the T test as the criterion for screening variables (significance greater than 0.05 is eliminated, and significance less than 0.05 enters the regression equation) ^[3].

The results are as follows:

Table 2 Model Summary

Model	R	R ²	R ² after adjustment	Durbin Watson
1	.359	.129	.125	1.851

It can be seen from Table 2 that from the adjusted R² = 0.125, the four factors of the basic college mathematics courses can explain 12.5% of the change of the mathematics results of the postgraduate

entrance examination; Durbin Watson=1.851 is relatively close to 2, indicating that the autocorrelation between the four basic mathematics courses is not obvious.

Table 3 Coefficient

Model	Unstandardized coefficient		Standardized coefficient	t	Significance	Collinearity statistics	
	B	Standard error	Beta			Tolerance	VIF
(constant)	-4.368	13.269		-.329	.742		
Advanced Mathematics (Volume I)	.915	.156	.359	5.851	.000	1.000	1.000

It can be seen from Table 3 that according to the variable selection rules of the T test, the significance of Advanced Mathematics (volume I) is less than 0.05, indicating that it has a significant impact on the mathematics results of the postgraduate entrance examination and has statistical significance. VIF: 0<VIF<10, indicating that there is no multicollinearity relationship between the four basic mathematics courses, and it is excluded that if such a relationship exists, the model estimation will be distorted or difficult to accurately estimate.

Table 4 Excluded variables

Model	enter Beta	t	Significance	Partial correlation	Collinearity statistics		
					Tolerance	VIF	Minimum tolerance
Advanced Mathematics (Volume II)	.110 ^b	1.477	.141	.097	.673	1.487	.673
Linear algebra	.001 ^b	.012	.990	.001	.732	1.365	.732
SMEAN(Probability Theory mathematical statistics)	-.005 ^b	-.074	.941	-.005	.943	1.061	.943

Table 4 reflects the testing of variables that did not enter the regression model during the process of multiple linear regression fitting models. Stepwise regression is used here. According to the variable selection rules of the t-test: Advanced Mathematics (Volume II), Linear Algebra, Probability The significance of theoretical and mathematical statistics is greater than 0.05, that is, they are considered to have no significant effect on the dependent variable, and they are excluded by stepwise regression. In the end, the "optimal" equation we get is:

$$Y = -4.368 + 0.915X_1$$

5. Model analysis

Among the effects of college mathematics basic courses on the mathematics scores of the postgraduate entrance examination, only Advanced Mathematics (Volume I) is more closely related to it, but it can only explain 12.5% of the change, and the remaining courses have no obvious linear relationship with the mathematics scores of the postgraduate entrance examination.

Based on the relevant data obtained from the research objects, we selected 97 students with four basic mathematics scores greater than 70 points, analyzed their mathematics scores for postgraduate entrance examinations, and collected relevant information about the mathematics scores for postgraduate entrance examinations over the years. The following chart:

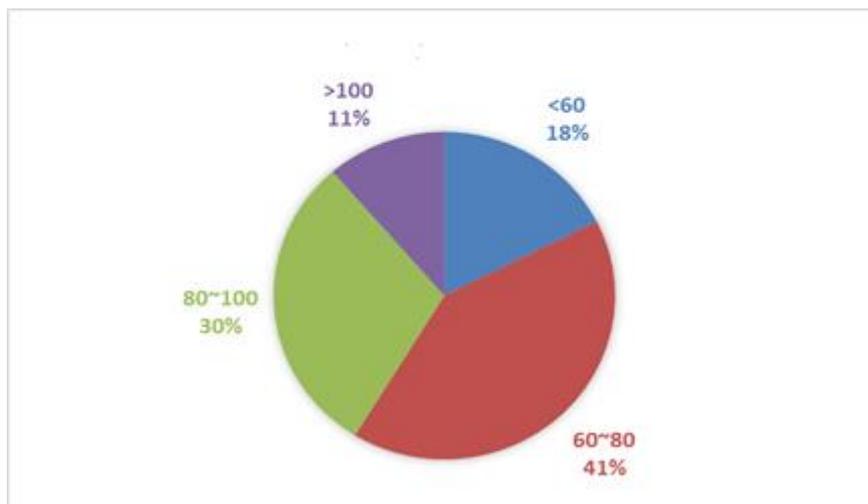


Fig. 1 Mathematics score distribution map

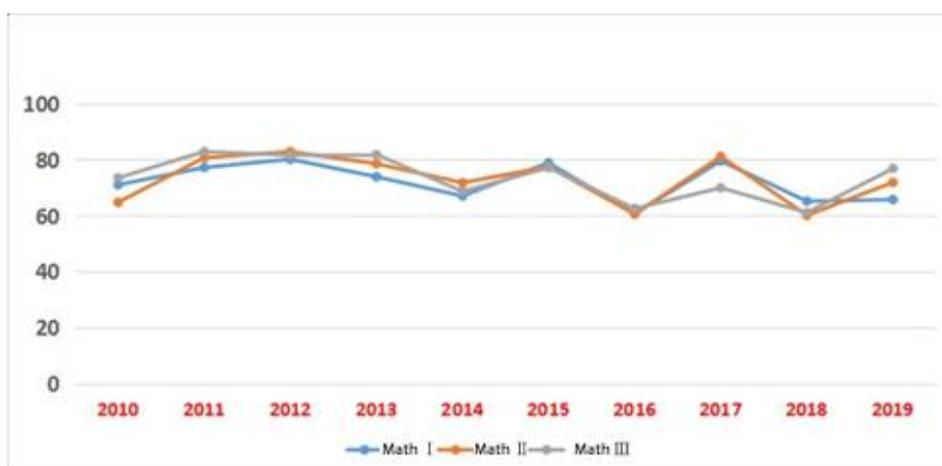


Fig. 2 Average scores in mathematics for postgraduate entrance examinations over the years

Based on this, we give suggestions based on the teaching and learning of university mathematics basic courses and postgraduate entrance examination mathematics:

(1) Teaching suggestions: The teaching of advanced mathematics (Volume I) should be more detailed and in-depth, and the knowledge points of the postgraduate entrance examination in the course should be supplemented in more detail; the basic explanations of the remaining three subjects should also be rigorously in place, and these four subjects should be jointly given comprehensive explanations, so that students learn to draw inferences from one another, and can think of corresponding knowledge points to answer questions.

(2) Study suggestion: For students who intend to take the postgraduate entrance examination, they need to study advanced mathematics (Volume I) hard. This subject accounts for the largest proportion in the postgraduate entrance examination mathematics, but the results of this subject should not be used as the basis for the mathematics entrance examination results. Since the other three subjects in the postgraduate entrance examination also have a proportion, what is examined is the comprehensive application ability, rather than a single knowledge point. You should study all subjects in the postgraduate entrance examination mathematics carefully, and learn to draw inferences from one another, and link the various knowledge points together, must not be taken lightly.

6. Summary

6.1 Advantages of the model

Based on university mathematics courses, this article uses multiple linear regression analysis methods to establish, analyze and optimize regression equations for different follow-up courses and postgraduate mathematics, and summarize the influence of different basic mathematics courses on subsequent courses and postgraduate mathematics. In this paper, the method of multiple linear regression can accurately measure the degree of correlation between various factors and the degree of regression fitting, which improves the accuracy of the prediction results. From a rational point of view, this article combines the actual situation to give suggestions for the teaching and learning of university mathematics basic courses, which are of reference.

6.2 Disadvantages and improvements of the model

We have adopted the method of replacing some of the data with the average value of the sequence, but this method may cause some abnormal points of research significance to be covered; therefore, we are looking for more powerful algorithms to replace missing values to simulate the most realistic situation.

The regression analysis algorithm is relatively simple. Which factor to choose and which expression to use is just a guess, which affects the diversity of factors and the uncertainty of some factors, making them restricted in some cases. Therefore, Finding more optimized methods for data analysis is the direction of model improvement.

References

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