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Correlation Analysis between College Entrance Examination Mathematics Achievement and Higher Mathematics Achievement

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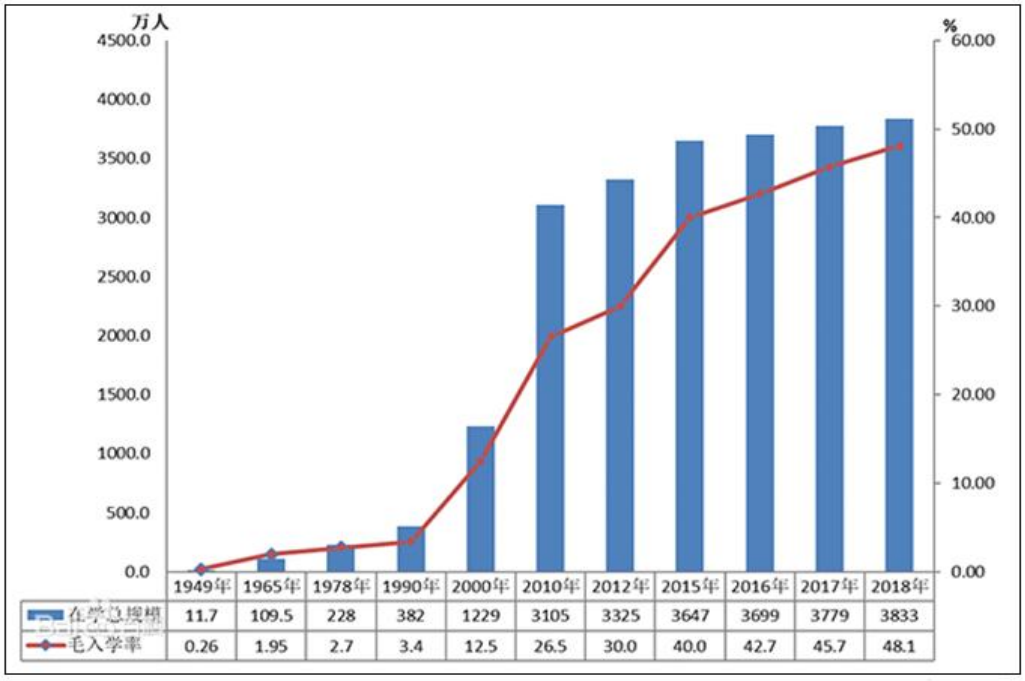
Abstract **Original Research Article**

This paper sorted out the college entrance examination mathematics scores and higher mathematics scores of the class of 2017 students who study in Chengdu university of information technology. Chi-square test was performed on the samples using contingency tables to analyze the correlation between college entrance examination mathematics score and higher mathematics. It is concluded that there is a significant difference between both, providing an empirical basis for the implementation of stratified teaching.

Keywords: Contingency table; Math scores; Dependency.

INTRODUCTION

Higher education refers to the professional education and vocational education obtained by students after they have completed secondary education, it is an important part of the whole education system. In order to cater to the development of the whole society and meet the demand for talents from all walks of life, China has developed from the elitism of higher education to the popularization of higher education. In 2002, the gross enrollment rate in China reached 15 percent [1]. Figure-1 shows the school scale and gross enrollment rate from the founding of the People's Republic of China to 2018.



	1949年	1965年	1978年	1990年	2000年	2010年	2012年	2015年	2016年	2017年	2018年
在学总规模	11.7	109.5	228	382	1229	3105	3325	3647	3699	3779	3833
毛入学率	0.26	1.95	2.7	3.4	12.5	26.5	30.0	40.0	42.7	45.7	48.1

Fig-1

The popularization of higher education poses a challenge to the quality of higher education.

The first, the average level of the quality of higher education has fallen. The passing rate of each course is relatively stable, but the excellence rate is extremely low and polarization is severe [2]. For example, The passing rate of college physics has been stable at 50% for the last five years in Chengdu university of information technology (hereinafter referred to as our school), the highest score is: 98, Minimum score: 20.

The second, the higher mathematics achievement in the higher education process is not ideal. The total score of higher mathematics in our school is a combination of the usual score (30 percent) and the examination score (70 percent). In the 2017-2018 (2) semester, the passing rate of the overall high scores is approximately 90%, but the passing rate was only 79%. And the highest score is 100 points, the lowest score is 0 points. See Table-1 for details.

Table-1

Elective students		**1609**	**Students to take the examination**	**1552**	**Included in the student count**		**1430**
project		Fail	Pass	Fair	Good	Excellent	Average
Test scores	Number	295	243	350	368	174	71.4
	Proportion	20.6	17	24.5	25.7	12.2	
Total	Number	134	273	446	461	116	74.7
	Proportion	9.4	19.1	31.2	32.2	8.1	

The third, take an examination of mathematics achievement is not ideal. In recent years, taking the postgraduate entrance exam has become a way for most undergraduate graduates to improve themselves, with the number of students taking the exam increasing from 2004 to 2017. The admission ratio is about one third of the number of applicants.

In recent years, from the examination of the postgraduate mathematics [3], the difficulty of the questions is in a stable stage, but the average score in the postgraduate entrance examination from 2011 to 2018 is around 65. The full score in the postgraduate entrance examination is 150 points, and the average score is far lower than the passing score, which also indicates that students' mathematical foundation is not very solid. Higher mathematics is a part of mathematics in the entrance examination. Whether there is a correlation between higher mathematics scores and students' mathematics scores in the college entrance examination [4] is of great significance to the reform of education system in colleges and universities.

The majority of students have changed from the cramming learning mode in high school to the active learning mode in university, which indicates that the basic courses such as mathematics and physics involved in higher education are difficult, and the teaching pace is too fast for teachers to think better. As the saying goes, "learn math, physics, and chemistry, and you won't be afraid to go anywhere", mathematics, physics and other basic subjects play a very important role in all major fields [5]. As the mainstay of social development, college students are the propellers of national development. Studying the correlation between college entrance examination mathematics and higher mathematics results can enable educators to better combine the actual situation of students for teaching, which is conducive to cultivating more high-quality [6] and application-oriented mathematical talents [7].

In this paper, by taking the students of the lass of 2017 in Chengdu university of information technology of photoelectric technology mathematics and advanced mathematics, the correlation between the two was explored through contingency table analysis and chi-square test to understand the students' mathematics foundation and the learning situation after entering the university can provide targeted help to students' learning [8]. It improves the quality of higher education to provide some theoretical basis.

Data Source and Processing

Sample Source

There are many literatures about mathematics education in colleges and universities, which can help us understand the current situation of higher mathematics education more objectively. The sample information in this paper comes from the school of optoelectronic engineering of our school. Due to the abnormal student status and the loss of individual college entrance examination scores, 273 of the sample information are valid. The reasons for choosing this college are as follows:

1. As a part of Chengdu university of information technology, college of optoelectronic engineering has certain research significance. A small, in-depth study is a necessary supplement to Chengdu university of information technology and even current higher education research. Our study of student achievement in the school of optoelectronic engineering illustrates the importance of small scales and provides empirical examples.
2. College of optoelectronic technology has

undertaken the university physics courses of science and engineering in our university. Both physics and mathematics are common basic courses.

3. In addition to the above reasons, I investigated and analyzed that the college of optoelectronic technology also has special convenience. I graduated from the college of optoelectronics technology, and I have some contacts with my junior classmates, so I can have a detailed and in-depth understanding. At present, I also work in the college of optoelectronics technology, and have certain contact with the new students, so I can learn about the students' current learning status and problems in the learning process.

The Data Processing

In terms of data processing, since the total score of mathematics in college entrance examination (d) is 150 points, students' mathematics score in college entrance examination is more than 100 points. This paper adopts the formula:

$$f = (d/150)*100 \quad f \text{ represents the converted higher mathematics score}$$

The mathematical results of each sample in college entrance examination are converted to make the mathematical results of college entrance examination and higher mathematics both under the condition of 100-percent system. The essay is divided into three parts: weak foundation, medium level and good achievement. The specific sections are as follows:

$$[0,60),[60,80),[80,100]$$

In the process of statistics, we made the following processing: the average value (g) was calculated by adding the scores of two semesters of advanced mathematics. This classification method can be used to visually see whether there is a correlation between college entrance examination mathematics score and higher mathematics score. In the process of data processing, we must pay attention to the one-to-one correspondence between the two scores of each sample to avoid the occurrence of wrong or missing records.

THE RESEARCH METHODS

Chi-Square

This paper mainly adopts the chi-square test method to test the independence of each sample's college entrance examination results and high scores, seeing if there's a bias between the two. Chi-square test is a very useful method of hypothesis testing is often used to compare the actual number and expected number if there is a correlation between number (or theory), or need to research object or experiment with the expected result of the null hypothesis of significant differences between namely test between the close degree observation value with the theoretical value.

Independence Test

The independence test [9] is a significant test to compare whether there is a difference between two sample rates. When the difference between samples is caused by its internal factors and has nothing to do with the sampling error, the chi-square value is large, and then "significant difference" is said to exist between samples; otherwise, "no significant difference" is said to exist between samples [10].

In the actual statistical process, we use the two-dimensional contingency table for preliminary statistics. Set row R and column C as shown in Table-2.

Table-2

Group / Level	1	2	...	C	Total
1	f_{11}	f_{12}	…	f_{1c}	g_1
2	f_{21}	f_{22}	...	f_{2c}	g_2
...	...	...	...	...	...
R	f_{R1}	f_{R2}	...	f_{RC}	g_R
total	N_1	N_2	...	N_C	N

In the table,

f_{RC} represents the frequency of the horizontal sample in group R

C_R represents the sum of the frequencies of the horizontal samples in group R

N_C represents the sum of the frequencies of samples at level C in each group

The formula for calculating the chi-square value is as follows:

$$\chi^2 = N\left(\sum_{i=1}^{R}\sum_{j=1}^{C}\frac{f^2_{ij}}{G_i N_j} - 1\right)$$

After you calculate the chi square, according to its degrees of freedom [11]:

$$m = (R-1)*(N-1)$$

And the given level of significance, Quering the chi-square value table. The calculated chi-square value is compared with the corresponding chi-square value of the degree of freedom to determine whether there is a significant difference between the samples. If the calculated value is large, there is a significant difference; if it is small, there is no significant difference.

THE EMPIRICAL ANALYSIS

Data Distribution Characteristics

Table-3 lists the specific distribution of the math scores and high scores of 273 students in the college entrance examination of 2017 of college of optoelectronics technology.

Table-3

f d	[0,60)	[60,80)	[80,100]	Total
[0,60)	11	31	1	43
[60,80)	20	107	9	136
[80,100]	3	83	8	94
Total	34	221	18	273

It is found by fitting test whether there is significant difference between them, At the significant level $\alpha = 0.05$, $\chi^2 = 15.822 > \chi^2_{0.05} = 9.488$.

RESULT ANALYSIS

From the results of chi-square test, it can be seen that there is a correlation between math scores in college entrance examination and high scores.

CONCLUSIONS AND SUGGESTIONS

From the results of chi-square test, we can see that there is a significant influence between the two, indicating that there is a correlation between the math scores in college entrance examination and the scores of high numbers. Although college is a new stage for students, their level of mathematics is a process of knowledge accumulation. At present, our school divides classes into administrative classes according to student Numbers and the number of students in each class. At present, the classes are divided into two administrative classes. With the popularization of higher education, the number of students increases and the difference between students increases [12]. This means that there will be more co-classes in the teaching process, which also poses challenges to the control of education quality and students' learning status.

According to the different foundation of students, we can improve or improve the teaching quality of "higher mathematics" from the following two aspects.

Start with the students

1. We can adopt stratified teaching for students with different admission levels [13]. Under the background of popularization education, it is the training principle of universities to export high-quality practical talents for the society. Stratified teaching is an embodiment of the idea of "teaching students according to their aptitude" proposed by Confucius, an ancient Chinese educator. It means that when students enter school, we can adopt public basic courses and stratify them according to their grades, and make different teaching plans for students at different levels.
2. For students do not take the initiative to learn problems, we can give the right guidance to students when they enter the school, the instructor teachers can strengthen the psychological counselors for students, let students learn to actively accept the new learning style, let them from passive learning to actively find problems, and dare to solve problems. At present, our school arranges outstanding seniors of higher grades for new students as their class guides, giving them some guidance and help in life and study.
3. Each college strengthens the study exchange, helps the college in the peer development for the whole school. The study of higher mathematics is not only to pass the exam, but also to lay a solid foundation for the future professional study.

From the teacher's side

1. Most of our teachers are graduate students with master's degree or doctor's degree, We can use the new mentoring system to guide young teachers. But young teachers in the course of teaching more or less will appear the situation of self-confidence. Schools can encourage full-time teachers to continue their studies and achieve good results in both research and teaching.
2. Teachers in the course of teaching, strengthen professional contacts.
3. In the teaching process of higher mathematics set up auxiliary elective courses, so that students can find the beauty of high number.

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