Analysis of Covariance in Researching on Influence of the Dormitory Academic Atmosphere on Achievement

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Abstract

The construction of the academic atmosphere is directly related to the quality of talents. The approaches of variance analysis and the covariance analysis method of mathematical statistics method are applied in this paper. And the relations of achievement and the academic atmosphere is quantitatively analyzed in terms of the data, which provides a basis of decision-making for university to enhance the academic atmosphere construction.

Keywords: The academic atmosphere, Achievement, Variance analysis, Covariance analysis

1. Introduction

The learning atmosphere is important for the students' grown - up .The academic atmosphere on the quality of talents can be reflected by student achievement. Dormitory is an important place where college students study and live. The construction of the dormitory style is an important facet of the construction of study style in university. We can often see a phenomenon that the student achievements in the same dormitory are all high or lower. So does the dormitory style have significant effect on student achievement? If have, what laws are the emergence and development of effect.

This paper takes 99 students of18 dormitories of 05 grade telecom special of tianjin polytechnic university as an example, taking student achievement in three academic years as the research object,

The data is provided by teaching section and it is veritable and exact.

Tianjin polytechnic university implements credit hour as academic assessment system. Credit hour of each student can be calculated according to the formula

$$y = \frac{\sum_{i=1}^{k} s_i c_i}{\sum_{i=1}^{k} s_i}$$

s_i represents the its curriculum credit ,c_i represents result of final examination of exon I curriculum. y is credit hour . s_i comes from teaching plan, c_i comes from teaching section .We can calculate credit hour of the first semester, the second term ,the second academic year and the third academic year.

2. Establishment of mathematical model

The analysis of various table 1 can indicate that the dormitory factor has no significant influence on college entrance examination achievement, that is to say ,the arrangement of dormitory is random.

In order to study the relations of scholastic achievement and the style of dormitory study, the style of dormitory that can be looked as a factor of influence on students' achievement denote A,m dormitory can be looked as m levels. dependent variable is the student credit hour .Where the credit hour of exon i dormitory exon j student denote by y_{ij} .Because not only the dormitory style study but also foundation differential have influence on credit hour ,covariance analysis model can be introduced. We denote college entrance examination achievement (based scores)of exon j student in exon i dormitory by z_{ij} as

covariate .let α_i to be effect of exon dormitory , μ is   the total effect of m dormitory, r is regression coefficient of covariance, the number student of exon dormitory is n_i ,covariance analysis model can be established as follows

$$\left[\begin{array}{l} y_{ij} = \mu + a_i + rz_{ij} + \varepsilon_{ij} \\ \sum_{i=1}^{m} n_i a_i = 0 \\ \varepsilon_{ij} \ \square \ N(0,\sigma^2), i = 1,2,......m; j = 1,2......n_i \end{array}\right.$$

we have now illustrated model parameters estimation and hypothesis testing of parameters.the detailed derivation he detailed derivation has been studied previously (Li,fang.Analysis of covariance in appraising teaching quality*)*,the result is

$$\left[\begin{array}{l} \hat{\mu} = \bar{y} - \hat{r}\bar{z} \\ \hat{\alpha}_i = (\bar{y}_{i.} - \bar{y}) - \hat{r}(\bar{z}_{i.} - \bar{z}) \ . \\ \hat{r} = \dfrac{L_{yzw}}{L_{zzw}} \end{array}\right.$$

$$where \quad L_{yzw} = \sum_{i=1}^{m}\sum_{j=1}^{n_i}(y_{ij} - \bar{y}_{i.})(z_{ij} - \bar{z}_i), \quad L_{zzw} = \sum_{i=1}^{m}\sum_{j=1}^{n_i}(z_{ij} - \bar{z}_{i.})^2$$

$$\bar{y} = \frac{1}{n}\sum_{i=1}^{m}\sum_{j=1}^{n_i} y_{ij}, \quad \bar{z} = \frac{1}{n}\sum_{i=1}^{m}\sum_{j=1}^{n_i} z_{ij}, \quad \bar{y}_{i.} = \frac{1}{n_i}\sum_{j=1}^{n_i} y_{ij}, \quad \bar{z}_i = \frac{1}{n_i}\sum_{j=1}^{n_i} z_{ij},$$

Whether m levels of factor A has significant differences can transform into problems of hypothesis testing of parameters

$H_0 : a_1 = a_2 = ... = a_r = 0$ against all alternative hypotheses.

the test statistic is

$$F = \frac{SSA / f_A}{SSE / f_E} = \frac{\left[(L_{yyT} - \dfrac{L_{yzT}^{\ 2}}{L_{zzT}}) - (L_{yyw} - \dfrac{L_{yzw}^{\ 2}}{L_{zzw}})\right]/(m-1)}{(L_{yyw} - \dfrac{L_{yzw}^{\ 2}}{L_{zzw}})/(n-m-2)}$$

When hypothesis H_0 is true

$$F \ \square \ F(m-1, n-m-2)$$

The rejection region under significant level α is

$$w = \{F > F_a(m-1, n-m-2)\}$$

to test significant of covariance ,that is to say ,to test hypothesis

$$H_{0r} : r = 0 \leftrightarrow H_{1r} : r \neq 0$$

the test statistic is

$$F = \frac{SS_r / f_r}{SSE / f_E} = \frac{\dfrac{L_{yzw}^2}{L_{zzw}}}{(L_{yyw} - \dfrac{L_{yzw}^2}{L_{ZZW}})/(n-m-2)}$$

When hypothesis H_{0r} is true

$$F \square F(1, n-m-2)$$

he rejection region under significant level α is

$$w = \{F > F_a(1, n-m-2)\}$$

When we use higher mathematic 1s as dependent variable, an analysis of covariance table can be listed

The analysis of various table 2 could indicate that the achievement of higher mathematic 1 is no significant in different dormitory .College entrance examination achievement has significant influence on the achievement of higher mathematic 1.

When we use higher mathematic 2s as dependent variable, an analysis of covariance table can be listed.

The above analysis of various table 3could indicate that the achievement of higher mathematic 2 is significant in different dormitory .College entrance examination achievement has significant influence on the achievement of higher mathematic 2.

When we use credit hour of the first semester as dependent variable, an analysis of covariance table can be listed

The above analysis of various table 4 could indicate that credit hour of the first semester is no significant in different dormitory .College entrance examination achievement has significant influence on credit hour of the first semester

When we use credit hour of the second semester as dependent variable, an analysis of covariance table can be listed

The analysis of various table 5 could indicate that credit hour of the second semester is significant in different dormitory .college entrance examination achievement has significant influence on credit hour of the second semester

When we use credit hour of the second academic year as dependent variable, an analysis of covariance table can be listed

The analysis of various table 6 could indicate that credit hour of the second academic year is significant in different dormitory .college entrance examination achievement has significant influence on credit hour of the second academic year

When we use credit hour of the third academic year as dependent variable, an analysis of covariance table can be listed.

The analysis of various table 7 could indicate that credit hour of the third academic year is significant in different dormitory. College entrance examination achievement has significant influence on credit hour of the third academic

3. Result

From what has been discussion above, we can see that arrangement of dormitory is random when they entered college .dormitory factor has no significant influence on both single curriculum and credit hour at the first semester, the dormitory factor begin to have significant influence on both single curriculum and credit hour at the second semester. We can see that the situation has further developed in the second academic year and in the third academic from the value of p. Many reasons can be account for this phenomenon as follows .Students are not acquaint with each other at the first semester, with the passage of time, the students among the same dormitory influence on each other .The students in the same dormitory are often have the same fancies .We can seen that the dormitory style study have significant influence on student achievement. The construction of the dormitory style should manage as an important key of the construction of study style in university.

References

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Table 1.

Source	Type III Sum of Squares	df	mean Square	F	p
Corrected model	616.623(a)	17	36.272	.637	.853
Intercept	451657.232	1	451657.232	7926.193	.000
dormitory	616.623	17	36.272	.637	.853
Error	4615.613	81	56.983		
Total	461269.090	99			
Corrected Total	5232.235	98			

a R Squared = .118 (Adjusted R Squared = -.067)

Table 2.

Source	Type III Sum of Squares	df	mean Square	F	p
Corrected model	5914.370(a)	18	328.576	2.452	.003
Intercept	1032.105	1	1032.105	7.703	.007
dormitory	2984.856	17	175.580	1.310	.208
Based scores	2099.600	1	2099.600	15.670	.000
Error	10719.267	80	133.991		
Total	619886.000	99			
Corrected Total	16633.636	98			

a R Squared = .356 (Adjusted R Squared = .211)

Table 3.

Source	Type III Sum of Squares	df	mean Square	F	p
Corrected Model	11688.339(a)	18	649.352	2.579	.002
Intercept	122.921	1	122.921	.488	.487
dormitory	8375.332	17	492.667	1.957	.024
Based scores	2395.974	1	2395.974	9.517	.003
Error	20139.843	80	251.748		
Total	391114.000	99			
Corrected Total	31828.182	98			

a R Squared = .367 (Adjusted R Squared = .225)

Table 4.

Source	Type III Sum of Squares	df	mean Square	F	p
Corrected Model	2425.284(a)	18	134.738	3.934	.000
Intercept	2199.758	1	2199.758	64.232	.000
dormitory	1350.597	17	79.447	2.320	.006
Based scores	805.770	1	805.770	23.528	.000
Error	2739.780	80	34.247		
Total	571130.434	99			
Corrected Total	5165.064	98			

a R Squared = .470 (Adjusted R Squared = .350)

Table 5.

Source	Type III Sum of Squares	df	mean Square	F	p
Corrected model	9315.774(a)	18	517.543	3.883	.000
Intercept	386.532	1	386.532	2.900	.092
dormitory	5957.939	17	350.467	2.629	.002
Based scores	2112.926	1	2112.926	15.853	.000
Error	10662.626	80	133.283		
Total	448987.304	99			
Corrected Total	19978.400	98			

a R Squared = .466 (Adjusted R Squared = .346)

Table 6.

Source	Type III Sum of Squares	df	mean Square	F	p
Corrected Model	8062.818(a)	18	447.934	3.476	.000
Intercept	1146.524	1	1146.524	8.898	.004
dormitory	6608.093	17	388.711	3.017	.000
Based scores	1112.547	1	1112.547	8.634	.004
Error	10308.639	80	128.858		
Total	470840.262	99			
Corrected Total	18371.457	98			

a R Squared = .439 (Adjusted R Squared = .313)

Table 7.

Source	Type III Sum of Squares	df	Mean Square	F	p
Corrected model	11062.575(a)	18	614.587	3.233	.000
Intercept	479.880	1	479.880	2.524	.116
dormitory	9047.644	17	532.214	2.800	.001
Based scores	1704.355	1	1704.355	8.965	.004
Error	15208.775	80	190.110		
Total	424020.782	99			
Corrected Total	26271.350	98			

a R Squared = .421 (Adjusted R Squared = .291)