Analysis of SPOC in Local Engineering Universities

--Taking the online course of Qingdao University of Science and Technology as an example

DanZhang[1]
Qingdao University of Science and Technology
Shandong，China
e-mail: 503554114@qq.com

YingWang[1]
Qingdao University of Science and Technology
Shandong，China
e-mail: wangying@qust.edu.cn

（&These authors contributed equally to this work and should be considered co-fist authors.）

ZheWang[2]
Qingdao University of Science and Technology
Shandong，China
e-mail: 386241470@qq.com

***Abstract*—This article used SPSS software to analyze the excellent rate of the Erya spring courses of Qingdao University of Science and Technology. First, the independent sample's T test was used to detect and analyze the correlation of the excellent rate, and then the single factor variance method was used to analyze the impact of objective factors such as course pass rate, average grade, and class hour on the excellent rate of the courses. The results showed that the passing rate and class hour have a significant impact on the excellent rate.**

Keywords-Engineering universities SPOC; one-way variance; SPSS objective factors; independent sample's T test

"Data has penetrated every industry and business function area today and become an important production factor. People's excavation and application of vast data indicate a new wave of productivity growth and the arrival of consumer surplus trend." The Internet has generated and accumulated massive user network behaviour data in daily operations. Using data mining methods to collect and analyze these data in a targeted manner, making it information, concentrating and extracting the information hidden in the disordered data, and finding out the inherent law of the research object constitute a way of selection to apply the value of data [5]. With the advent of the information age, many local engineering universities are now offering SPOC, or Small Private Online Course. SPOC was first proposed and used by Armando Fox, professor with the University of California, Berkeley. The three SPOC courses including the Architectural Imaginary that Harvard Graduate School of Design opened for graduate students have achieved good results. Now, the courses are widespread globally. It is especially important that a data analysis on student-oriented SPOC could be done. This article used the statistical software SPSS22.0 to scientifically analyze the excellent rate of the Erya spring courses of Qingdao University of Science and Technology.

I. RESEARCH OBJECT AND METHOD

A. Research object

Studying the excellent rate of the Erya spring courses of Qingdao University of Science and Technology, this article used the statistical data of SPOC after sorting to conduct a rational, scientific analysis on the factors that affect the student's excellent rate.

B. Research method

TSPSS 22.0 was used to conduct descriptive statistics, normal test, T-test, and one-way variance analysis on the excellent rate of the Erya spring courses of Qingdao University of Science and Technology.

II. BASIC DATA INFORMATION ABOUT THE ERYA SPRING COURSES OF QINGDAO UNIVERSITY OF SCIENCE AND TECHNOLOGY

According to the data provided by Erya Platform, there are a total of 30 Erya spring courses of Qingdao University of Science and Technology, including 19 arts courses and 11 science courses. Among them, there are 7 courses requiring 20 class hours or below, 11 requiring 21~30 class hours, and 12 requiring 30 class hours or above; 8 courses with an average score of 96 points or below, 10 with 96 to 97 points, 8 with 97 to 98 points, and 4 with 98 points or more; 5 courses with a pass rate of below 95% , 5 from 95% to 97%, 13 from 97% to 98%, and 7 over 98%.

III. DESCRIPTION OF COURSE EXCELLENT RATE

A. Statistical description

SPSS was used to input the excellent rate data from Erya platform into the software, so as to generate a frequency distribution histogram, and make a virtual normal distribution curve. The data obtained is as shown in the following.

TABLE I. OVERALL EXCELLENT RATE

Case Processing Summary

	Observed value					
	Valid		Missing		Total	
	N	Percentage	N	Percentage	N	Percentage
Excellent rate	30	100.0%	0	0.0%	30	100.0%

a. 100 observed values before limit

2473-3636/22/$31.00 ©2022 IEEE
DOI 10.1109/DCABES57229.2022.00017

TABLE II. OVERALL EXCELLENT RATE

Descriptive statistics							
		Statistics	Standard error	Repeated samplinga			
				Deviation	Standard error	95% confidence interval	
						Lower limit	Upper limit
Excellent rate	N	30		0	0	30	30
	Min.	76.82					
	Max.	96.84					
	Avg.	87.8453		.0084	.9265	86.0295	89.6826
	Standard deviation	5.10420		-.15970	.58514	3.80729	6.16796
	Kurtosis	-.283	.833	-.075	.511	-1.347	.782
Valid N (listwise)	N	30		0	0	30	30

a. Repeated sampling results will be based on a 1000-repeat sampling standard unless otherwise stated

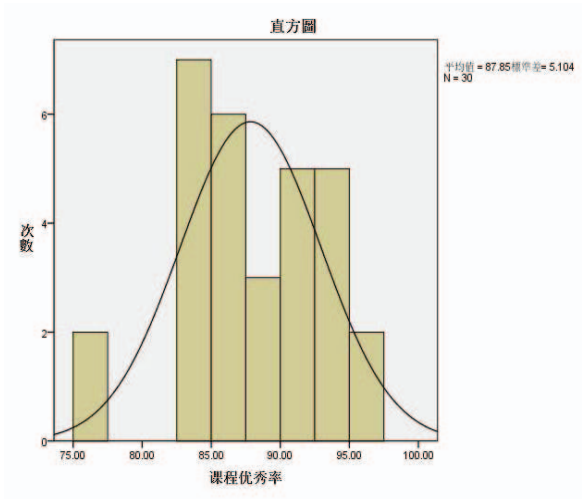

Figure 1. Distribution of excellent rate

Content analysis: From the statistical description of the excellent rates for the 30 courses, it can be seen that the minimum value is 76.82, the maximum value is 96.84, and the average number is 87.8453, most of which is between 85.00 and 95.00. The normal curve is consistent with the histogram.

B. Normality test

One of the conditions for one-way variance analysis is the normality of data. In this part, a normality test wasperformed on the excellent rate. The results are shown in table 3 below:

TABLE III. SINGLE SAMPLE TEST

Single sample Kolmogorov-Smirnov test		
		Excellent rate
N		30
Normality parameter[a,b]	Avg.	87.8453
	Standard deviation	5.10420
Most extreme difference	Absolute	.111
	Positive	.071
	Negative	-.111
Test statistics		.111
Progressive significance (two-tailed)		.200[c,d]

a. The testing distribution is normal.

b. Calculated from data.

c. Lilliefors significantly corrected.

d. This is the lower limit of true significance.

From the data in Table 3, it can be seen that the progressiveness is significantly greater than 0.05, so the course excellent rate is in a normal distribution.

IV. ANALYSIS RESULTS

A. Relationship between the excellent rates of arts and science courses

Using the T-test of the opposite sample for analysis, the results are shown in Table 4 below. The correlation between the excellent rate and arts and sciences did not reach significance. The p values were all greater than 0.05, and the absolute t-values were all less than 1.96. Although there is no significance betweenthe the excellent rate and arts & sciences, the absolute t-value was -3.11, close to 1.96, indicating a weak correlation between the excellent rate and arts & sciences.

TABLE IV. INDEPENDENT SAMPLE'S T TEST FOR EXCELLENT RATE AND ARTS & SCIENCES

	T test of mean equality						
	t	Degree of freedom	Significance	Average difference	Standard error difference	95% confidence interval of difference	
						Lower limit	Upper limit
Excellent rate	-1.31	28	0.19	-0.41	0.31	-1.06	0.23
	-1.33	21.857	0.19	-0.41	0.31	-1.06	0.23

B. Relationship between class hour and excellent rate

Based on the results of one-way variance analysis, Table 5 showed a significant difference (F=33.08, Sig=0.00<0.05) between the class hour and excellent rate

in this article. As can be seen from the posterior multiple comparisons in Table 6, there were significant differences among 20 hours and below, 21 to 30 hours and 31 hours above, and there were also significant differences between 21 to 30 hours and 31 hours above, and the p values were all less than 0.05. That showed a significant difference in the relationship between different class hours and excellent rates.

TABLE V. CLASS HOUR'S ONE-WAY VARIANCE ANALYSIS

Variable	Sum of squares	df	Mean square	F	Sig
Between groups	14.700	2	7.35	33.08	0.00
Intra-group	6.000	27	0.22		
Total	20.700	29			

TABLE VI. POSTERIOR MULTIPLE COMPARISONS OF CLASS HOURS

(I) Class hours		Average difference (I-J)	Standard error	Significance	95% confidence interval	
					Lower limit	Upper limit
20 hours and below	21~30 hours	-1.00	0.23	0.00	-1.59	-0.41
	31 hours above	-2.00	0.25	0.00	-2.64	-1.36
21~30 hours	20 hours and below	1.00	0.23	0.00	0.41	1.59
	31 hours above	-1.00	0.20	0.00	-1.51	-0.49
31 hours above	20 hours and below	2.00	0.25	0.00	1.36	2.64
	21~30 hours	1.00	0.20	0.00	0.49	1.51

C. *Relationship between average score and excellent rate*

Based on the results of one-way variance analysis, Table 7 showed a significant difference (F=190.67, Sig=0.00＜0.05) between the average score and excellent rate in this article. As can be seen from the posterior multiple comparisons in Table 5, there were significant new differences among 96 points below, 96 to 97 points, 97 to 98 points, and 98 points above, with p values all less than 0.05; between 96 and 97 points, 97 to 98 points and 98 points above, with p values all less than 0.05. There was no significant difference between 97~98 points and 98 points above, with p values greater than 0.05.

TABLE VII. AVERAGE SCORE'S ONE-WAY VARIANCE ANALYSIS

Variable	Sum of squares	df	Mean square	F	Sig
Between groups	19.80	3.00	6.60	190.67	0.00
Intra-group	0.90	26.00	0.03		
Total	20.70	29.00			

TABLE VIII. AVERAGE SCORE'S ONE-WAY VARIANCE ANALYSIS

(I) Average score		Average difference (I-J)	Standard error	Significance	95% confidence interval	
					Lower limit	Upper limit
96 points below	96 to 97	-0.90	0.09	0.00	-1.16	-0.64
	97 to 98	-2.00	0.09	0.00	-2.28	-1.72
	98 above	-2.00	0.11	0.00	-2.34	-1.66
96 to 97	96 points below	0.90	0.09	0.00	0.64	1.16
	97 to 98	-1.10	0.09	0.00	-1.36	-0.84
	98 above	-1.10	0.11	0.00	-1.43	-0.77
97 to 98	96 points below	2.00	0.09	0.00	1.72	2.28
	96 to 97	1.10	0.09	0.00	0.84	1.36
	98 above	0.00	0.11	1.00	-0.34	0.34
98 above	96 points below	2.00	0.11	0.00	1.66	2.34
	96 to 97	1.10	0.11	0.00	0.77	1.43
	97 to 98	0.00	0.11	1.00	-0.34	0.34

D. *Relationship between pass rate and excellent rate*

Based on the results of one-way variance analysis, Table 9 showed a significant difference (F=27.61, Sig=0.00＜0.05) between the average score and excellent rate in this article. As can be seen from the posterior multiple comparisons in Table 10, there were significant new differences among the pass rates of below 95%, 97%~98% and above 98% , with p values all less than 0.05. Significant new differences also existed among the pass rates of 95%~97%, 97%~98% and above 98%, with p values all less than 0.05, and between 97%~98% and above 98% , with p values all less than 0.05. However, no significant differences existed between 95% and 95%~97%, with p values all greater than 0.05, and no significant difference existed between 97%~98% and above 98% , with p values all greater than 0.05.

TABLE IX. AVERAGE SCORE'S ONE-WAY VARIANCE ANALYSIS

Variable	Sum of squares	df	Mean square	F	Sig
Between groups	15.75	3.00	5.25	27.61	0.00
Intra-group	4.95	26.00	0.19		
Total	20.70	29.00			

TABLE X. POSTERIOR MULTIPLE COMPARISONS OF PASS RATE

(I) Pass rate		Average difference (I-J)	Standard error	Significance	95% confidence interval	
					Lower limit	Upper limit
Below 95%	95%~97%	-0.43	0.26	0.44	-1.19	0.33
	97%~98%	-1.54	0.23	0.00	-2.22	-0.85
	Above 98%	-2.00	0.28	0.00	-2.82	-1.18
95%~97%	Below 95%	0.43	0.26	0.44	-0.33	1.19
	97%~98%	-1.11	0.20	0.00	-1.72	-0.50
	Above 98%	-1.57	0.26	0.00	-2.33	-0.81
97%~98%	Below 95%	1.54	0.23	0.00	0.85	2.22
	95%~97%	1.11	0.20	0.00	0.50	1.72
	Above 98%	-0.46	0.23	0.28	-1.15	0.22
Above 98%	Below 95%	2.00	0.28	0.00	1.18	2.82
	95%~97%	1.57	0.26	0.00	0.81	2.33
	97%~98%	0.46	0.23	0.28	-0.22	1.15

V. ANALYSIS RESULTS

The following conclusion has been drawn based on the data from the Erya spring courses of Qingdao University of Science and Technology and the use of T test and one-way analysis method: First, the course excellent rate is not significantly correlated to arts & sciences, but to the average score and class hour. Therefore, in order to better improve the student's course excellent rate, the university should allocate the class hours as reasonably as possible and appropriately adjust the difficulty of the online courses, formulating the teaching plans in a realistic way, seeking for new teaching materials and new ideas, and implementing the "effective teaching" into practice. The improvement of excellent rate will not only encourage students to sign up for the courses and learn in a more active way, but also will bring more effective learning effects, realizing the real value of SPOC on the university campus, helping universities improve their teaching quality and reflecting their success in education.

ACKNOWLEDGMENT

This work was funded by the special research of Shandong Social Science Planning (Grant no. 21CLYJ18), and the Key research of the postgraduate teaching case base of Qingdao University of science and technology (Grant no. 2021YAL12), which is gratefully acknowledged.

REFERENCES

[1] *Chamidy T, Degeng INS, Saida U. The effect of problem based learning and tacit knowledge on problem-solving skills of students in computer network practice course[J]. Journal for the Education of Gifted Young Scientists, 2020, 8(2): 691-700.*

[2] Liu L, Wang Y, Ma C. The Cultivating Strategies of Pre-Service Teachers' Informatization Teaching Ability Oriented to Wisdom Generation[J]. International Journal of Emerging Technologies in Learning (iJET), 2021,16(6): 57-71.

[3] Fitton IS, Finnegan DJ, Proulx MJ. Immersive virtual environments and embodied agents for e-learning applications[J]. PeerJ Computer Science, 2020, 6: e315.

[4] JAIN N. KNOWLEDGE MANAGEMENT SYSTEM THROUGH ICT[D]. DELHI TECHNOLOGICAL UNIVERSITY, 2020.

[5] Si Miao, Li Xianshuai. Influence and Discussion of Objective Factors on Achievements of Students in Independent Medical Colleges Based on SPSS Analysis -- A Case Study in Kangda College of Nanjing Medical University [J]. Contemporary Educational Practice and Teaching Research, 2018 (03): 177-178+181.