INVESTIGATION AND ANALYSIS OF CURRICULUM SATISFACTION OF MATHEMATICS NORMAL STUDENTS IN LOCAL UNIVERSITY IN CHINA

[1]Hanxiao Sheng, [1*]Bo Yu, [1]Ning Dong, [2]Li Chen, [3]Wei Zhang

[1]School of Science, Hunan University of Technology

[2]School of Civil Engeneering[2] , Hunan University of Technology

[3]School of Foreign Language[2] , Hunan University of Technology

(* the corresponding author, boyu_hut@126.com)

Abstract:

With the rapidly increasing scale of normal students in Chinese local universities, the higher quality of education of normal students is required urgently. As the base of cultivating normal students, curriculum offered by university plays an extremely important role in the entire training process. By taking a local university in China --- Hunan University of technology, as an example, this paper establishes the related indexes of curriculum satisfaction in the questionnaire, and explores the factors affecting normal students' curriculum satisfaction. Especially for normal students with different gender, statistical analysis on their difference to the satisfaction of curriculum configuration, structure and evaluation is subsequently made to provide practical countermeasures for improving the current mathematics normal curriculum system.

Key-words: Curriculum satisfaction; Normal students; Local university; T-test;

Introduction

Curriculum satisfaction evaluation in higher education mainly refers to constructing the evaluation indexes under the guidance of certain concepts, quantitatively evaluating some curriculum through comprehensive or individual approaches in mathematics, obtaining the related rank. In 2020, the British University rankings published are mainly based on course satisfaction, teaching satisfaction, teaching feedback satisfaction, student-faculty ratio, student per capita spending, employment situation etc (László, Csaba 2020).

The evaluation of educational satisfaction has mainly focused on quantitative research since the 1970s. The traditional model aims at constructing the influencing factors through empirical analysis and then completing student satisfaction measurement. For example, the Board of Education of United States was the first to employ CIRP (Cooperative Institutional Research Program) to measure student satisfaction (Dey et.al. 1987). Subsequently, Serin B. N. et.al drew on the research results of life satisfaction and then developed a student satisfaction questionnaire to conduct research on anxiety and depression (Serin et.al. 2010). McCollough established a related student satisfaction evaluation model to study the impact of graduate student satisfaction on instructions (McCollough 2010). Debnath R. M. et al. designed a conceptual evaluation model based on teaching, scientific research, library, student service to improve the effects on student satisfaction (Debnath et al. 2015).

For different curriculums, many scholars' researches are mostly based on case studies. They construct the course satisfaction model case by case to derive its influencing factors. Walid and Ansari selected the nursing students of Oxford Brookes University as the survey object (Ansari, 2002). Through the satisfaction measurement, the influencing factors of the course satisfaction level were analyzed and discussed, and finally the three factors - academic level, learning methods and

learning goals, were obtained, showing an important impact on course satisfaction. Paechter et al. selected 29 universities in Austria as the samples, totally 2196 students, to conduct a course satisfaction survey through questionnaires and interviews (Paechter et al. 2010). The obtained results were processed and analyzed, finding out that students' expectations and experience of learning are the most important factors affecting course satisfaction.

On the other hand in the mid-1990s, Noel Levitz began to formulate the SSI scale (Noel Levitz 1995), through which the American graduate education satisfaction model was incorporated into the student satisfaction evaluation research. Meanwhile, British universities started to set up an indicator system based on the basic conditions of universities. For example, in the student satisfaction survey conducted by the University of Central England in 2002, seven first-level indexes were employed including the curriculum teaching, curriculum organization and evaluation, learning and teaching (Douglas et.al 2006). Zhao X. believed that universities should always be prepared to meet the challenges of a hyper-competitive environment and pay more attention to service quality, education satisfaction and behavioral tendencies (Zhao 2012).

In order to explore the degree of satisfaction of normal students majoring in mathematics with the courses offered, this paper, by taking a local university in China- Hunan University of Technology as an example, mainly constructs evaluation indicators to conduct a questionnaire survey on current normal students, and analyzes the current state of construction of professional courses for mathematics normal students in local universities through the obtained results.

Research Methodology

Research objects

The subjects of the survey are divided into two parts. One is from the normal students of the grade of 2019. A total of 102 questionnaires were distributed and 98 valid questionnaires were returned, including 66 female students and 36 male students. The second part comes from 16 mathematics instructors (10 from university and 6 from middle school), mainly interviewed by researchers on discipline knowledge, as Table 1 shows.

Table 1
Information of mathematical instructors

Source	Title	Male	Female
University	Professor	4	2
	Asso. Prof.	2	2
Middle School	Senior Instructor	1	3
	Junior Instructor	1	1

Study tool

To analyze the satisfaction of the courses of mathematics for normal students, a questionnaire based on the curriculum configurations specified in the professional curriculum arrangement of the university was developed and designed. The first-level and second-level indexes of survey satisfaction are as follows.

Table 2
Investigated index of survey satisfaction

First-level index	Second-level index
Curriculum configuration	Credits
	Starting semester
	Degree of difficulty
Curriculum structure	Ratio of public and majored courses
	Ratio of compulsory and alternative courses
	Ratio of theoretic and practiced courses
Curriculum evaluation	Assessment method
	Course effects

The questionnaire surveyed the satisfaction degree of 63 courses (related to mathematics and mathematical education) for normal students in Hunan University of Technology. The questionnaire employs a five-level scale by assigning values "5, 4, 3, 2, 1" for degrees of "very satisfied", "relatively satisfied", "general", "relatively dissatisfied" and "very dissatisfied" respectively. Participants make a selection in the scale according to their satisfaction degree with each course. Some suggestions can also be provided for improvement when marking unsatisfaction. Meanwhile, interview evaluation of instructors were also embedded into the questionnaire, with the purpose of analyzing the reasonability of the listed courses according to their teaching experience and professional quality.

Reliability test
The Likert scale was used to test the reliability of the questionnaire via the "Cronbach α" coefficient which estimates the internal consistency of the items in the scale (Cronbach 1965). Generally, the higher the Cronbach coefficient implies the greater the correlation between the indexes, and the higher the reliability of the scale. When $\alpha > 0.9$, the reliability is considerably good; when $0.7 < \alpha < 0.9$, it also stands for the high reliability. The following table lists the reliability results obtained in SPSS 22.0.

Table 3
Reliability test for different indexes

Dimension	Cronbach α	Normalized Cronbach α
Total	0.958	0.958
Curriculum configuration	0.921	0.923
Curriculum structure	0.833	0.829
Curriculum evaluation	0.881	0.889

Obviously, the reliability of the total questionnaire is 0.958, indicating that the overall reliability is remarkably good. Furthermore, the reliability values of the curriculum configuration, curriculum structure and curriculum evaluation are 0.921, 0.881 and 0.833, indicating the relatively good reliability of the firs-level indexes and the investigation can be carried out reasonably.

Results Analysis and Discussion

Correlation analysis of course satisfaction
The Pearson correlation coefficient (lying in [-1, 1]) is utilized for analyzing and testing the correlation of different indexes in course satisfaction. The greater the absolute value of the coefficient, the stronger the degree of correlation. Especially, the correlation coefficient shows a strong correlation between 0.8 and 1.0; and indicates a relatively high correlation between 0.6 and 0.8. We implemented the two-way correlation test in the SPSS22.0 and listed the results in the following table.

Table 4

Pearson correlation test for three first-level indexes

	Curriculum configuration		Curriculum structure		Curriculum evaluation	
	Sig.	Pearson	Sig.	Pearson	Sig.	Pearson
Curriculum configuration	0.000	1	0.000	0.776**	0.000	0.648**
Curriculum structure	0.000	0.776**	0.000	1	0.000	0.633**
Curriculum evaluation	0.000	0.648**	0.000	0.633**	0.000	1

It can be seen from the Table 4 that the correlation coefficients between any two lie in 0.6 and 0.8, showing a significant positive correlation between the three first-level indexes --- curriculum configuration, curriculum structure, and curriculum evaluation. and the correlation coefficients between the two are between 0.6 and 0.8. In particular, there is a stronger correlation between satisfactions of the curriculum configuration and the curriculum structure.

The overall satisfaction status of subject courses

As 98 valid questionnaires were collected, the sum of the actual points of each course will be distributed in intervals [98,196], [196 , 294], [294,392] and [392,490]. The higher the overall score implies the higher the degree of satisfaction to the course. According to the data analysis of the results of the questionnaire, the average score given by mathematics normal students to all courses is 315 points (the degree of the satisfaction is 3.21), reflecting that the participating normal students have a positive attitude towards the courses offered in the plan. The overall degree of satisfaction lies between grades "relatively satisfactory" and "general".

Concretely, the course "Mathematical Analysis A1" scored the highest, and the successively decreasing ones were "Advanced Algebra A1" (406 points, degree of satisfaction 4.14), "Mathematical Analysis A2" (395 points, degree of satisfaction 4.03). The distribution of these courses were between "very satisfied " and "relatively satisfied", indicating that the participating normal students are relatively satisfied with these offered courses. On the other hand, the lowest scoring value for the single course is "Selected Topics in Complex Analysis" (299 points, degree of satisfaction 3.05), followed by "Selected Topics in Differential Geometry" (307 points, degree of satisfaction 3.13). This reflects that the involved normal students bear a relatively low overall satisfaction to these arranged courses.

● Overall satisfaction evaluation by normal students of different genders.
The analysis was also conducted from different genders, the average degree of satisfaction is 4.05 for male students and 3.68 for female students, respectively. As a contrast, one can see that there is a certain gap in the overall satisfaction in gender, i.e. the satisfaction of male students is slightly higher than that of female students. To further explore this gap is significant or not on gender, the homogeneity of variance was validated and followed by the independent T-test in SPSS22.0.

Table 5

Independent T-test of overall satisfaction on gender

Gender	Number	Average	Std.	Levene test		t-test	
				F	Sig.	T	p
Male	35	3.28	0.88	21.342	0.258	4.634	0.000**
Female	63	3.17	0.78				

**p<0.01

It is seen from Table 5 that the p-value for homogeneity of variance is 0.258 (p>0.05), showing the variances can be admitted to be equal, and the independent T-test with can be employed. By taking the gender and the overall satisfaction of courses as the as the independent variable and dependent variable, respectively, the independent T-test was implemented in SPSS22.0 to show that the overall satisfaction of the course is significant on the gender variable with p value 0.000. In other words, at the 99% confidence level, there is a significant difference in overall satisfaction evaluations of various genders.

Analysis of the satisfaction of normal students with curriculum modules and second-level curriculum indexes

● Description statistics of normal students' satisfaction degree with course modules.

The whole mathematical courses of Hunan University of Technology are divided into various modules--- general education courses, basic discipline courses, majored discipline courses and concentrated practice courses. Since general education courses are mainly based on humanities courses, such as politics, English, sports, military, etc., and arranged for all majors of undergraduates, they cannot be adjusted and the corresponding evaluation can be ignored.

The compulsory part of the basic discipline courses includes "Mathematical Analysis", "Advanced Algebra", "Analytic Geometry", "Probability Theory and Mathematical Statistics", "Ordinary Differential Equations", and "C Language". The overall average score is 412 and the derived degree of satisfaction is 4.21, indicating that normal students are relatively satisfied with the compulsory part of the basic discipline courses, and the grade is between "very satisfied" and "relatively satisfied". Meanwhile, 8 normal students suggested that the assessment way of "General Physics" should be changed from the test to the examination; 12 normal students advised that the "C language" might be substituted for the more popular "Python language"; additional 8 students suggested that the final score of some courses operated on computers should be composed of the operated score and the final-exam score, with each accounting for 50%.

The majored discipline courses are also divided into compulsory courses and elective courses. There are 13 compulsory courses in total, and the overall average score is 399 (satisfaction is 4.08), indicating that normal students are satisfied with the compulsory part of the majored discipline courses. However, there are 12 normal students think the "differential geometry" can be appropriately reduced, 22 normal students think the "Probability Theory and Mathematical Statistics" should be opened in two semesters. For the 12 elective courses (choosing any three) in the majored discipline courses, normal students gave the overall average score 308 and the corresponding degree of satisfaction is 3.15. Some students recommended that the assessment methods of "Selected Topics in Complex Analysis", "Topology", "Differential Geometry", and "Partial Differential Equations" would better change from the test to the examination. Moreover, some contents in elective courses "Modern Mathematics Education Technology", "Mathematics Education Research Methods" are somewhat overlapped with some in compulsory courses "Modern Educational Technology" and "Introduction to Educational Research".

● Satisfaction degree of normal students of different genders with second-level indexes

To explore whether there are significant differences in the degree of satisfaction of normal students of different genders on the second-level index--- curriculum configuration, one can take gender as the independent variable and the credits, the starting semester, and the degree of difficulty as the dependent variables for independent T-test. The derived results calculated in SPSS22.0 are shown in the following table.

Table 6
T-test of different indexes in curriculum configuration

	Gender	Number	Average	Std.	T	p
Credits	Male	35	4.03	0.91	5.032	0.000**
	Female	63	3.74	0.75		
Starting semester	Male	35	3.87	0.86	6.422	0.000**
	Female	63	3.69	0.78		
Degree of difficulty	Male	35	3.93	0.95	5.012	0.000**
	Female	63	3.64	0.83		

$**p<0.01$

From the results in Table 6, it can be seen that the p-values are all 0.000 and $p<0.01$, indicating that at the 99% confidence level, different genders have significant differences in the three second-level indexes of curriculum configuration--- credits, the starting semester, and the degree of difficulty.

We also studied whether there are significant differences in the degree of satisfaction of the curriculum structure among normal students of different genders. Similarly, taking gender as the independent variable and the proportion of compulsory courses and elective courses, the theoretical courses and practical courses, and the public courses and majored courses as the dependent variables, the independent T-test was carried out in SPSS22.0 and the obtained results were listed as follows.

Table 7
T-test of different indexes in curriculum structure

	Gender	Number	Average	Std.	T	p
Ratio of public and majored courses	Male	35	3.55	0.86	3.554	0.001**
	Female	63	3.32	0.65		
Ratio of theoretic and practiced courses	Male	35	3.20	0.94	3.185	0.003**
	Female	63	3.14	0.80		
Ratio of compulsory and elective courses	Male	35	3.89	1.05	3.754	0.000**
	Female	63	3.39	0.89		

$**p<0.01$

It can be seen from the results that the gender-significant values p are 0.001, 0.003 and 0.000 for the ratio of public and majored courses, the ratio of theoretical and practiced courses and the ratio of compulsory and elective courses, respectively. That is, at the 99% confidence level, there are significant differences in the three second-level indexes of the curriculum structure.

Finally, we also explored whether there are significant differences in the second-level indexes of curriculum evaluation among normal students of different genders. Analogously, taking gender as the independent variable, and taking the assessment method and learning outcomes as the dependent variable, implementation of independent T-test , the following results can be obtained.

Table 8
T-test of different indexes in curriculum evaluation

	Gender	Number	Average	Std.	T	P
Assessment Method	Male	35	3.76	0.65	3.432	0.002**
	Female	63	3.43	0.45		
Learning Outcomes	Male	35	3.85	0.74	5.302	0.000**
	Female	63	3.42	0.68		

$**p<0.01$

It can be seen from the results obtained that the significant p values are 0.002 for assessment method and 0.000 for learning outcomes, respectively. This implies that at the 99% confidence level, different genders are of significant differences in two second-level indexes of curriculum evaluations.

Interviews with mathematics instructors from the university and the middle schools

As stated before, total 16 instructors from the university and the middle school were interviewed on topics of the understanding of the role of the majored courses, the understanding of the relationship between the discipline knowledge and the subject professional curriculum.

In terms of the status and role of mathematics majored courses, instructors both from the university and the middle school affirmed the importance of mathematics subject knowledge and the majored courses. They all regard the knowledge of the discipline as the basis of professional normal knowledge and the study of majored courses is an important prerequisite for mastering professional knowledge. As for the relationship between the knowledge of discipline and the majored courses, instructors from university have a more consistent viewpoint, i.e. the importance of majored curriculum lies in the emphasis on deepening the understanding of the discipline knowledge. While instructors form the middle school take the viewpoint that the educational psychology and technology are more important as they believe that teachers should transfer discipline knowledge in a way students familiar with.

Conclusion
● For all the courses in the questionnaire, the overall recognition of each course lies in grades "very satisfied", "relatively satisfied" and "general", reflecting that curriculum arrangement in Hunan University of Technology for normal students is of a relatively high recognition. Meanwhile, normal students tend to pay more attention to the benefits brought by the majored courses at initial learning stage, lacking the overall planning and understanding of professional development. This implies that current normal students mainly concern about the learning outcomes and benefits from the offered courses, and the tendency of utilitarianism is obvious.

● The degree of satisfaction of mathematics normal students for the various curriculum module is in a descending order of the compulsory part of the basic discipline courses, the compulsory part of the majored discipline courses, the elective part of the basic discipline courses, and the elective part of the majored discipline courses. From the perspective of curriculum modules, the basic discipline courses are paid more attention by normal students, but from the nature of the curriculum, the compulsory courses are more concerned. Therefore, it seems that normal students more cline to the study of basic course content, especially on the learning benefits and the assessment method. Contrarily, the degree of recognition of the majored curriculum module is relatively consistent, i.e. the quality of mathematics teachers depends heavily on the comprehensiveness and development of mathematical knowledge. Meanwhile, most interviewed instructors seem not to approve of some majored courses of deep professional background and some irrelevance to mathematical teaching in middle schools. Especially, a high degree of recognition of courses concentrate on ones closely to

middle school mathematics, such as " Teaching Design in Middle Schools", "Research on Solving Problems in Middle School Mathematics" and " Research on Elementary Mathematics".

● Normal students of different genders bear significant differences in the degree of satisfaction with the curriculum configuration, curriculum structure, and curriculum evaluation. From the perspective of course satisfaction evaluation, female students are more careful and demanding in the evaluation of the second-level indexes of various courses. The smaller standard deviation in Tables 6-8 also validates that the facts that female students are more consistent with the degree of satisfaction. This also corresponding to the fact that more and more female students regard teachers as relatively stable occupation, with the economic development and the shortage of teachers in elementary education in recent years. On the other hand, as the salary of basic education is not high, male students may focus on other higher-paying industries in addition to their own normal majors. Therefore, they might be careless about the evaluation on offered courses and this has been reflected from the relatively large standard deviation of the evaluation in Tables 6-8. However, regardless of gender, normal students pay more attention to the practiced courses. At present, traditional teaching methods are adopted in the classroom teaching methods of teachers' majors. This teaching method is conducive to the "output" of teaching knowledge and is more efficient, but it is not helpful to the "acceptance" of students. Nowadays, governments are calling for reforms in classroom instruction, advocating students as the main body in learning activities, and stimulating students' sense of active participation and forming a good educational habits. Therefore, it is necessary in the initial stage for normal students to be exposed to more teaching modes, and cultivate the qualities that the excellent teachers are required in practices.

References

1. László C., Csaba. T. (2020), *University rankings from the revealed preferences of the applicants.* European Journal of Operational Research, 286(1):309-320.
2. Dey E. L., Astin W. A., Korn W. S. (1987), *The American Freshman: Twenty Year Trends, 1966-1985. Cooperative Institutional Research Program.* University of California, Higher Education Research Institute, Graduate School of Education, Los Angeles, CA 90024.
3. Serin B. N., Serin O., Ozbas L. F. (2010), *Predicting university students' life satisfaction by their anxiety and depression level.* Procedia Social & Behavioral Sciences, 9, 579-582.
4. McCollough M. (2010), *Service Guarantees: A Review and Explanation of their Continued Rarity.* Journal of Management, 2014.
5. Debnath R. M., Kumar S., Shankar R. Roy R., (2005), *Students Satisfaction in Management Education: Study and Insight.* Decision, 32(2):139-155.
6. Ansari W E (2002), *Student nurse satisfaction levels with their courses: Part I – effects of demographic variables.* Nurse Education Today, 22(2):159-170.
7. Paechter M , Maier B , Macher D. (2010), *Students' expectations of, and experiences in e-learning: Their relation to learning achievements and course satisfaction.* Computers & Education, 54(1):222-229.
8. Noel-Levivtz. (1995), *Student Satisfaction Inventory Institutional Summary*: Jefferson Community College, Fall.

9. Douglas J., Douglas A., and Barnes B. (2006), *Measuring Student Satisfaction at a UK University*, Quality Assurance in Education 14(3):251-267.
10. Zhao X. (2012), *A review on Service Quality and Student Satisfaction of Higher Education*, Soft Computing inn Information Communication Technology, 115-122.
11. Cronbach L. J., Schonemann P. , Mckie D. (1965), *Alpha Coefficients for Stratified-Parallel Tests*. Educational & Psychological Measurement, 25(2):291-312.

Article received 2022-01-11