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Analysis and Study on Mathematical Modeling Classroom Learning Behavior of Higher Vocational Students

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ABSTRACT. *The purpose of this study is to analyze the learning behavior of vocational students in the mathematical modeling classroom through the classroom observation scale, and to provide teachers with the necessary cognitive experience and cognitive starting point for mathematical modeling teaching. This paper will class study based on relevant literature. The behavior is divided into five aspects: listening behavior, speech behavior, thinking behavior, practical behavior, and irrelevant learning behavior. Through the development of classroom observation tables, record and statistics the specific behavioral performance of higher vocational students in the classroom. There are obvious differences in the learning behavior in the modeling classroom. The research proposes that interdisciplinary selection of teaching content, appropriate addition of pre-mathematics knowledge, and enhancement of the "long thinking" ability of higher vocational students, and the strengthening of multiple representation teaching is an improvement of mathematical modeling for higher vocational students. Effective means of teaching.*

KEYWORDS: *higher vocational students, mathematical modeling, classroom observation, learning behavior*

1. Introduction

At present, with the development of vocational education and the deepening of curriculum reform, how to learn mathematics for professional services is an important issue in higher vocational education. Mathematics is the basic curriculum of higher vocational education, and mathematical modeling is exactly the professional learning and Tools that combine life and production practice, the quality of mathematical modeling learning affects the success of the entire vocational professional study. Higher vocational students are the main body of learning, and the classroom is the main place for higher vocational students to learn. Classroom learning behavior can reflect Higher vocational students' learning initiative, thinking mode, and understanding level. Different learning levels,

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different mathematical modeling course content, and the external performance of classroom learning behavior are different. Based on this starting point, this article studies mathematical modeling In the classroom, the rules, characteristics, and influencing factors of the vocational students' learning behaviors provide the necessary cognitive experience and starting point for teachers to carry out mathematical modeling teaching, and at the same time provide an empirical basis for the teaching of mathematical modeling courses in higher vocational stages.

2. Collection of research data

2.1 Design of "Observation Scale for Mathematics Modeling in Higher Vocational Colleges"

According to the explicit behavior of higher vocational students in the classroom, and the inherent abstraction and logical characteristics of the mathematical modeling classroom, the vocational mathematics modeling classroom learning behavior is divided into five first-level dimensions, namely listening behavior and speech Behaviors, thinking behaviors, practical behaviors, and irrelevant learning behaviors. Listening behaviors are divided into listening teachers and classmates, speech behaviors include questioning, answering, and communicating, thinking behaviors include meditation, conception, practical behaviors include taking notes, doing exercises, and irrelevant learning behaviors. That is, behaviors that are not related to classroom learning, such as silence, small movements, dozing, gossiping, etc. The classroom observation scale consists of two levels, of which five are first-level dimensions, which are defined as a, b, c, d, e, there are 13 secondary dimensions, which are defined as a1, a2, b1, b2, b3, c1, c2, d1, d2, e1, e2, e3, e4.

2.2 Reliability of Observation Scale for Mathematical Modeling Classroom Learning in Higher Vocational Colleges

This classroom observation study asked two vocational mathematics teachers as observers, recorded as A and B, and the two teachers respectively used the classroom observation scale to teach the Gaussian model in the classroom-model construction (25th minute to 30th minutes) "Listening teacher", "Listening student", "Meditation", "Thinking", "Quiet", and "Chat chat" are the 6 most likely to confuse classroom learning behaviors to observe and record. Then use SPSS 24.0 analysis: A The Pearson correlation with Teacher B is 0.996, the tau_b correlation coefficient of Kendall is 0.962, and the rho correlation coefficient of Spearman is 0.982. The significance value of each observation point is 0.001, all of which are less than 0.01, indicating that the observation scale is relatively Good reliability.

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2.3 Validity of Observation Scale for Mathematical Modeling Classroom Learning in Higher Vocational Colleges

The analysis of the validity statistical results is shown in Table 1:

Table 1 KMO and Bartlett tests

KMO Sampling suitability measure.		.812
Bartlett sphericity test	Approximate chi-square	98.323
	Degrees of freedom	10
	Saliency	.000*

The test result p = 0.000 <0.001 can indicate that the observation scale has good structural validity [1]. From Table 2, it can be seen that the measurement value of KMO is 0.812> 0.5, indicating that this observation index is suitable for factor analysis. Therefore, it is considered that the observation scale designed by this research is effective.

2.4 Records of the Observation Scale for Mathematical Modeling Classroom Learning in Higher Vocational Colleges

The research object is a class of class 2 of the first grade of a marine technology major in a general private higher vocational college, with a total number of 46. The students in this class have an average score of about 69.32 in the college entrance examination mathematics. The teachers are the same person and have guidance to college students nationwide First-line teachers with experience in mathematical modeling competitions. The two lessons recorded in the classroom observation are the linear programming model and the dynamic programming model. The main teaching method is the teaching method. Two observers firstly conducted 46 higher vocational education at the same time and the same interval. Students make judgments about their learning behaviors, then count the number of learning behaviors, enter them into statistical software, and form corresponding data record tables. Each row in the table represents the number of five-dimensional learning behaviors every 30 seconds. The column indicates 45 minutes of a class. At the beginning of class observation, record the first horizontal line, then the second horizontal line, and so on, and there will be 1,170 numbers in 45 minutes.

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3. Statistical test of research results

3.1 Statistical test of learning behavior in the first dimension

From the average of the number of learning behavior statistics, the average values of "listening behavior" in the two lessons of the linear programming model and dynamic programming model are 31.83 and 37.36, and the average values of "speech behavior" are 9.20 and 19.21, respectively, and "thinking behavior" The averages are 6.56 and 5.21, the averages of "practical behaviors" are 15.28 and 14.43, and the averages of "irrelevant learning behaviors" are 19.31 and 21.42. Next, the author corresponds the above-mentioned vocational students' classroom learning behaviors as two independent samples. Through Explorer Normality Test [2]. Statistics: The results of the Kolmogorov-Smirnovb and Shapiro-Wilk tests of the five first-dimensional learning behaviors are all greater than 0.05, which are consistent with the Explorer normal distribution [3]. "Explorer normality test as an example, the relevant results of normality test are shown in Table 2.

Table 2 Explorer Normality Test for "Speech Behavior"

Normality test [a]

	subject	Kolmogorov-Smirnovb			Shapiro-Wilk		
		Statistics	df	Sig.	Statistics	df	Sig.
Speech act	Linear programming	.176	82	.000	.843	79	.000
	Dynamic programming	.197	75	.000	.874	81	.000

a. When subject = .000, there are no valid cases of speech acts. Statistics for this level cannot be calculated.

b. Lilliefors significant level correction

Furthermore, the T test is performed on two independent samples. The experimental result is: The Levene test F value of the statistical variance equation of "speech behavior" is 3.310, and the corresponding confidence level is 0.212, indicating that there is no significant difference between the two independent sample variances. The independent sample uses the equal variance T test [4], whose corresponding t value is 3.020, the degree of freedom is 152, the 95% confidence interval is (0.072, 6.450), and the critical confidence level is 0.037, which is less than 5% [5]. There are significant differences in the "speech behavior" of the lessons. The independent sample test results of "speech behavior" are shown in Table 3.

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Table 3 Independent sample tests for "speech behavior"

Independent sample test										
		Levene test of variance equation		T-test for the mean equation						
		F	Sig.	t	df	Sig. (Both sides)	Mean difference	Standard error	95% confidence interval of the difference	
									Lower limit	Cap
speech behavior	Assuming equal variances	3.310	.212	3.020	152	.045	3.307	1.637	.072	6.450
	Assuming variances are not equal			2.452	162.41	.042	3.314	1.632	.112	6.152

In the same way, we get the experimental results of the remaining first-level learning behaviors. The critical confidence level of "listening behavior" is 0.013, which is less than 5%, indicating that the learning behaviors of the two lessons are significantly different. "Operational behavior" and "thinking" The critical confidence levels of "behavior" and "irrelevant learning behavior" were 0.131, 0.152, and 0.122, respectively, indicating that there was no significant difference in these learning behaviors in the two lessons.

3.2 Statistical test of learning behavior in the second dimension

Statistics show that the average number of people in the second dimension of learning behavior in dynamic programming classrooms is basically higher than the average number of people in linear programming classrooms about learning behaviors. For example, the average value of "listening teachers" is 42.56 and 34.03, and the standard deviations are 6.325 and 8.452. The average values of "communication" are 26.45 and 19.66 respectively. At the same time, the average number of people with irrelevant learning behaviors in dynamic programming classrooms is slightly smaller than the average number of irrelevant learning behaviors in linear programming classrooms. The numbers were 523 and 532.

The study obtained 13 Kolmogorov-Smirnov b and Shapiro-Wilk statistics of the second-level learning behaviors of greater than 0.05, consistent with the Explorer normal distribution [3]. Two independent sample T tests were also performed for the 13 second-dimensional learning behaviors. The T test of variance not equal to the two samples, the statistical results are: the critical confidence levels of "listening teacher", "questioning", "answering", and "communication" of the two classes are less than 5%, indicating these learning behaviors of the two classes There are

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obvious differences; critical confidence levels for "listening to classmates", "meditation", "conceiving", "taking notes", "doing exercises", "silence", "doing small moves", "dozing off" and "chatting" More than 5%, indicating that there is no significant difference in these learning behaviors between the two classes.

4. Conclusion

The above two courses are representative, linear programming is a component of high school function modules, and dynamic programming is a multi-dimensional solution tool linked to reality. From the analysis of research data, we can get some inspiration and suggestions.

(I) Select teaching content across disciplines

Although the function has been exposed to learning from junior high school, higher vocational students are relatively familiar and have a certain learning interest, but dynamic programming seems to be able to build a bridge between the major and mathematics to solve problems. Experiments show that the interdisciplinary dynamic programming model is obviously better than Traditional linear programming models are more attractive to students' explicit behavior, and they can also motivate students to learn.

(II) Appropriate supplementary mathematical knowledge

Even though the students are very different in the content of the two lessons, the research results found that the critical confidence levels of “silence”, “doing little movements”, “dozing off” and “chat” that are irrelevant to learning behavior are greater than 5%, indicating that the two lessons are There is no significant difference in irrelevant learning behaviors. This phenomenon is worth noting, meaning that regardless of whether or not you are interested in the content of the classroom, irrelevant learning behaviors exist and are not a minority. Through interviews with some students, it was found that due to differences in mathematics, some students may I am interested in the content of the course, but for the reason that the basics of mathematics are general, so I have no sense of the content of the course. This requires mathematics teachers to take more difficult mathematical modeling courses, in addition to selecting the content that students are interested in, they should also Pay attention to the supplement of students' prior mathematical knowledge, so as to better teach mathematical modeling.

(III) enhance students' "thinking" ability

From the perspective of the "thinking behavior" of the two courses, the number of students thinking more than 30 seconds, regardless of whether they are interested in the content of the course, has dropped significantly, maintaining a low level. On the one hand, it shows that the long-term teacher-led math class has decreased. Students' expectations of thinking about problems; on the other hand, based on the mathematical modeling courses that solve practical production and life, our mathematical modeling class should let students learn "long thinking". Such mathematical modeling teaching is fruitful.

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(IV) In-depth understanding of mathematical modeling through multivariate representation

In the "Internet +" era, the widespread application of information technology is having a profound impact on mathematical modeling education. Teachers should pay attention to the deep integration of information technology and mathematical modeling courses, and use multivariate representations to enable higher vocational students to understand mathematical modeling in depth. Use it flexibly.

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