

Investigation on the Influencing Factors of College Students' Math Scores in Higher Vocational Colleges

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Abstract: Higher vocational colleges play an important role in the national economy, and higher vocational students are the backup force for the country to cultivate higher vocational technology and applied technology. However, there is a certain distance between the actual mathematical level of vocational college students and social expectations. Students generally have problems such as weariness, truancy, and lack of concentration in learning, which are mainly reflected in their poor mathematical performance. Performance influencing factors play a crucial role in students' learning, so mathematics performance influencing factors are also a topic that has been widely concerned and discussed. This paper proposed to use analytic hierarchy process to evaluate the influencing factors of mathematical performance. Students' mathematical performance was influenced by both internal and external factors, including teachers, families, society, and so on. The most basic factor was the internal factors of students, so people needed to conduct in-depth research on internal reasons in order to better promote the development of students. The experimental results of this article indicated that 65 students believed that their cooperative ability was very weak, accounting for 46.4% of the total. It could be seen that poor cooperative ability was also an important factor affecting mathematical performance.

1. Introduction

In human rational thinking, mathematics plays a unique and irreplaceable role. It is an important subject that can measure a person's intelligence quotient. Most students from primary school to high school have a strong interest in this subject, and they have invested a lot of time and energy in this subject. However, not everyone's performance is excellent. Many students who have achieved excellent results in mathematics in senior high schools have not been optimistic about their math scores after entering the higher vocational stage. Although they are eager to learn mathematics well, their math scores have never been able to improve.

In today's concept of comprehensive development, mathematical performance has become increasingly important. Spagnolo Francesco Schirripa found that random effect regression represented an interesting method for modeling multilevel data. The proposed method was applied

to an Italian sample from the 2015 International Student Assessment Program survey to study the gender gap in mathematics with different quantile conditional distributions. These findings provided a possible explanation for the low proportion of women in the science, technology, engineering, and mathematics sectors [1]. Iqbal M. found that in Pakistan, traditional mathematics teaching methods mainly focused on a single deductive method of teaching, while collaborative teaching actually had more advantages than a single deductive method of teaching. His research aimed to compare collaborative teaching with deductive teaching, and finally found that collaborative teaching was more conducive to improving students' math scores [2]. Tokac Umit investigated the impact of math video games on students' math scores compared to traditional classroom teaching methods. Research results showed that math video games could help achieve higher learning outcomes. For students, games were an effective teaching strategy [3]. Yu Rongrong studied the relationship between classroom practice, student motivation, and math performance of high school teachers. His research data was derived from the baseline year data of the 2009 high school longitudinal study. The results showed that teacher support indirectly affected students' math scores through their math self-efficacy, and also affected students' interest in math courses [4]. Gunderson Elizabeth A. believed that entrance math scores were a powerful predictor of high school math scores. He explored whether the interrelationship between math scores, math anxiety, and physical motivation frameworks could help explain these persistent individual differences. Analysis showed that there was a correlation between math anxiety and math performance, as well as between motivation frameworks. A positive math attitude might put children on a lasting and positive track in math [5]. The math scores of vocational college students had a significant impact on their academic performance and future development. Therefore, how to improve their math scores was an urgent problem to be solved. What factors could affect students' math scores? This article would comprehensively and systematically analyze various factors that affected students' learning effectiveness, and formulated effective teaching strategies based on these factors to achieve the improvement of teaching effectiveness.

2. Evaluation of Influencing Factors on Mathematical Performance

2.1 Misalignment of “Quantity” and “Quality” in Mathematics Scores

Compared with ordinary universities, higher vocational colleges pay more attention to students' application and practical abilities. However, in this case, mathematical learning of theoretical knowledge is still a major factor affecting students' employment. Therefore, for higher vocational colleges, students' math scores are also very important [6-7]. In today's increasingly competitive society, students pay less and less attention to mathematics, and there is a disconnect between “quantity” and “quality” in mathematics scores [8]. In terms of “quantity”, students' math scores would not be very poor. Currently, students' enthusiasm for learning is not high, and classes are basically a lazy attitude. That is to say, they do not listen to the teacher's lectures and do not listen to classmates' questions. They do not participate in class discussions. They come to class mainly to cope with exam attendance. Therefore, the current learning situation of students is high attendance in class and low attendance in class, which results in low learning enthusiasm among students. The role of mathematics is shown in Figure 1:

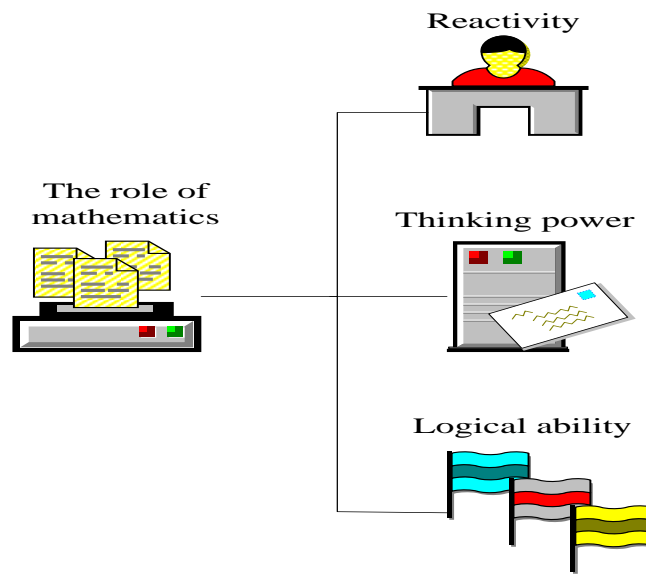


Figure 1: The role of mathematics

As shown in Figure 1: Generally speaking, students with good math scores would have more outstanding reaction and thinking abilities, which is often referred to as “smarter”. Indeed, mathematics focuses on cultivating students’ logical thinking. People with fast logical thinking speed would have better performance in many aspects [9-10]. Mathematics is a headache for both parents and children. Some children, while clearly doing well in Chinese and English, do poorly in math, which makes parents very distressed [11-12]. In the process of guiding students, it is found that improving math scores is not a simple matter. Basic knowledge can be strengthened in a short time, while thinking is a long process. The formation of thinking patterns and habits can be influenced by many factors. From the perspective of “quality”, the “quality” level of students’ math scores is relatively low [13]. Many students do not listen carefully in class and just cram before exams. Although they can achieve higher learning outcomes, the “quality” level of their outcomes is very low.

2.2 Analytical Hierarchy Process

Using critical language in the classroom can create a harmonious classroom atmosphere. Positive evaluations can increase students’ concentration and interest in learning, while negative evaluations can reduce their enthusiasm for learning. Therefore, skillfully using evaluation methods is an effective method for teachers to grasp the classroom and mobilize students’ enthusiasm for learning. Analytic hierarchy process is a decision-making method that combines qualitative and quantitative analysis. Its basic idea is roughly the same as the thinking and judgment process of humans when facing a complex decision-making problem. It decomposes the elements that are always related to decision-making into levels such as goals, criteria, and plans, and compares them to obtain weights to help people make a rational decision.

(1) Establishing a progressive hierarchy

For the problem to be solved, basic cognition is conducted to straighten out the interrelationships among the influencing factors. According to their nature, the influencing factors are layered from top to bottom, thereby forming a hierarchical evolution from top to bottom.

(2) Constructing pairwise comparison judgment matrix

According to the importance, the next indicator that has an impact on a certain indicator is judged, and then compared in pairs to build a matrix. In this general case, the expert scoring method and the 1-9 scale value method are used to construct a comparison matrix. The expert scoring method is used to determine the relative advantages and disadvantages of each evaluation index, and a judgment matrix of evaluation indicators is constructed based on this.

(3) Calculating the comprehensive weight coefficient of the corresponding evaluation index

The calculation of the comprehensive weight coefficient requires the introduction of two indicators: the maximum feature root λ_{\max} and the feature vector. At the same time, it is necessary to pay attention to the normalization process to facilitate calculation. The formula is as follows:

$$N_o = \sqrt[m]{\prod_{k=1}^m s_{ok}}, (o = 1, 2, \dots, m) \quad (1)$$

Normalization:

$$u_o = \frac{u_o}{\sum_{o=1}^m u_o} \quad (2)$$

$$\lambda_{\max} = \frac{1}{m} \sum_o \left(\frac{(SU)_o}{u_o} \right) \quad (3)$$

(4) Consistency check of each constructed matrix

Consistency check mainly checks the coordination between the importance of various elements, so the established matrix at each level must undergo consistency testing.

The consistency of the matrix is checked first, and then its logic is judged. In the event of a logical error, it is necessary to reconstruct the matrix. In this part of the calculation, three indicators need to be introduced: consistency indicator CI , average random consistency indicator RI , and random consistency ratio CR . The formulas are as follows:

$$CI = \frac{\lambda_{\max} - m}{m - 1} \quad (4)$$

$$CR = \frac{CI}{RI} \quad (5)$$

When the values of CI and CR are both less than 0.1, it is judged that the consistency of the two matrices meets the requirements.

3. Investigation on Factors Affecting Vocational Students' Academic Performance

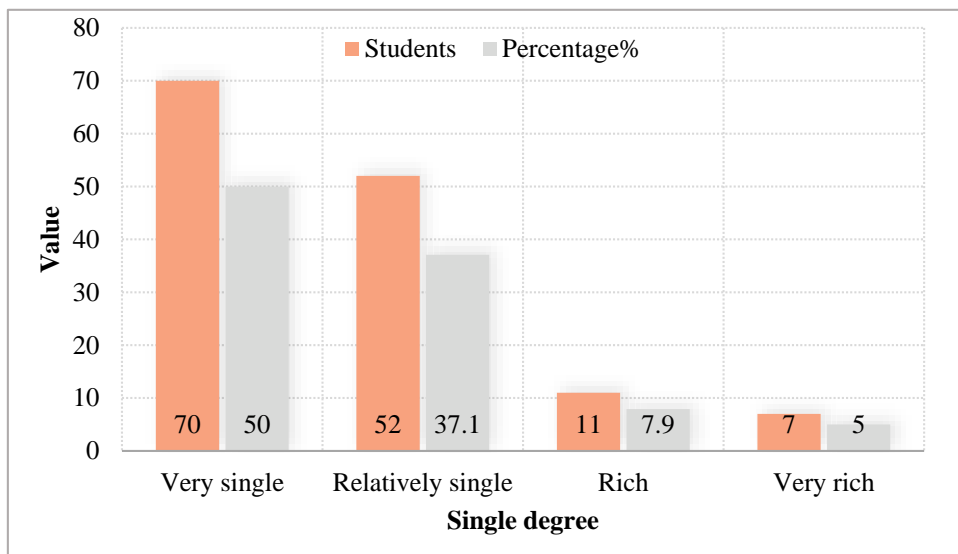
There are many factors that affect students' math scores. Students in the overall teaching environment would have their results affected by both internal and external factors [14]. The object of this survey was 140 freshman vocational students and 70 math teachers from a certain college. The main factors influencing students' math performance were analyzed from two aspects: external factors from the perspective of teachers and internal factors of students' own learning.

3.1 External Factors from the Perspective of Teachers

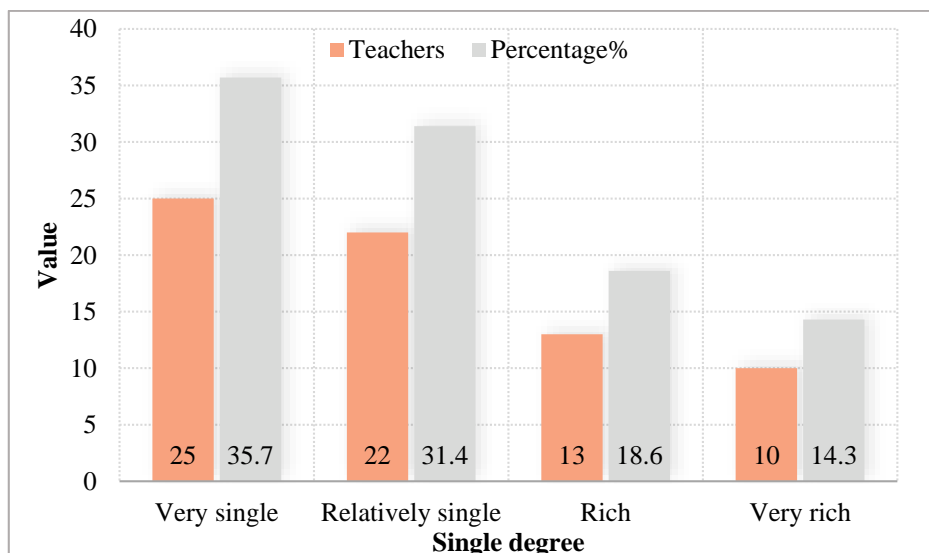
Classroom is a two-way interaction between teachers and students, which is a platform for learning knowledge and discussing issues together. Its operational effectiveness would greatly

affect students' academic performance. Therefore, teachers are the main factor that affects students' learning. To a large extent, they would have an impact on students' learning outcomes.

In traditional teaching methods, teachers play an absolutely dominant role in teaching. Students are passively receiving new knowledge, which results in low learning efficiency and lack of interest in new courses, thus leading to poor learning outcomes [15-16]. If the main role of students is fully played in the classroom, it can usually fully stimulate students' enthusiasm for learning, thus allowing them to actively absorb what they have learned, thereby achieving higher learning outcomes, higher interest in learning, and higher academic performance. Therefore, a teacher's teaching style can have a significant impact on students' math scores. The single degree of teaching method is shown in Figure 2:



(a) Students' views on the single degree of teaching methods



(b) Teacher's view of the single degree of teaching methods

Figure 2: Single degree of teaching methods

As shown in Figure 2: In (a), it could be seen that 70 students felt that the current mathematical teaching method was very simple, accounting for 50% of the total number of students, which already reached half of the total number.

In (b), it was found that 25 teachers believed that the current mathematical teaching method was very simple, accounting for 35.7% of the total. 22 teachers believed that the current mathematical teaching method was relatively simple, accounting for 31.4% of the total. The total number of teachers who believe that the teaching method was very simple and relatively simple exceeds half. This showed that the single mathematical teaching method was still common.

In the practice of mathematics teaching in higher vocational colleges, the traditional teaching method is still very popular, which is mainly led by teachers. Students are completely passive in accepting. There is no room for them to think, and their learning remains in the classroom. This has affected their learning enthusiasm and their creativity [17]. In addition, there are still shortcomings in the teaching methods of some vocational colleges. Many network technologies have not been fully utilized, which limits the development of students' personality. This is not conducive to teaching students in accordance with their aptitude, which cannot better adapt students to the needs of various majors and has a negative impact on the selection and cultivation of talents.

3.2 Internal Factors from the Student's Perspective

The level of students' academic performance is not only related to the teacher, but also related to the students themselves. Students' self-consciousness, self experience, and self emotions all have a significant impact on their academic performance. In addition to being influenced by innate factors such as intelligence, academic performance is also related to their own acquired factors.

(1) The influence of students' self-consciousness

Students with strong self-awareness have higher learning motivation, better learning outcomes, and excellent results. Each student's growth environment is different, and their personal experiences are also different, which leads to their different self-awareness in learning. Some students with rich experience would understand more about the philosophy of life, and have a strong sense of self in learning. They can usually use their time to the maximum extent. However, students with low self awareness are not diligent and diligent in learning. Their learning initiative is relatively poor, and they lack a sense of competition. The learning attitudes of students are shown in Table 1:

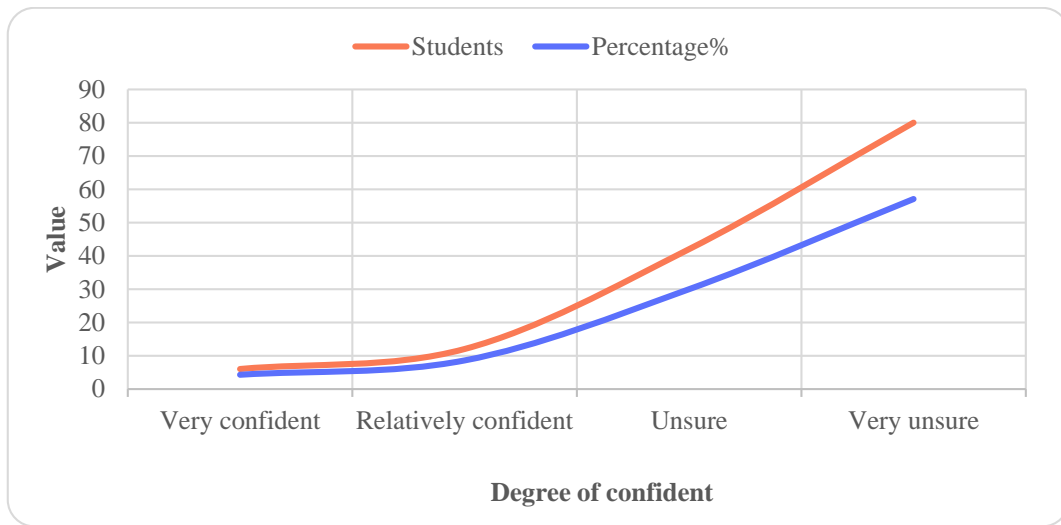
Table 1: Student's learning attitudes

Interest level	Students	Percentage
Very positive	9	6.4%
Relatively positive	16	11.4%
Negative	48	34.3%
Very negative	67	47.9%

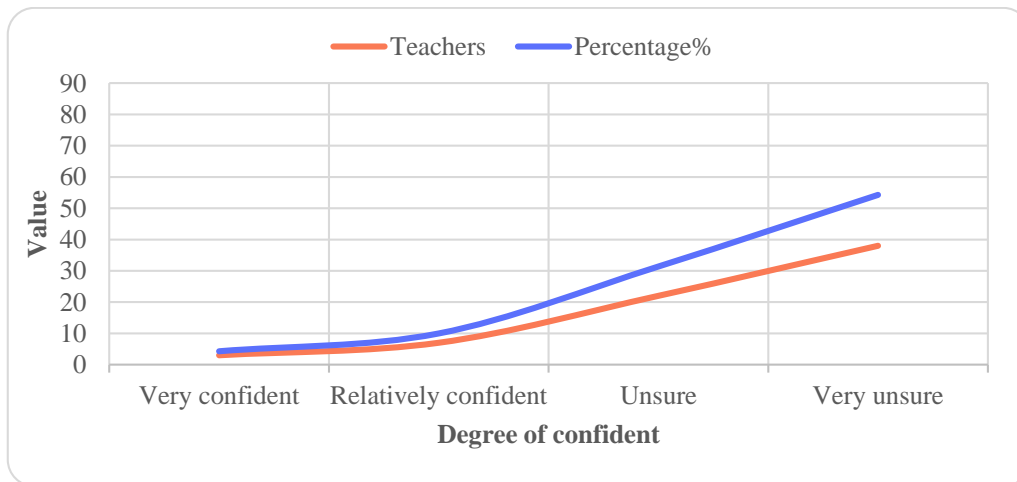
As shown in Table 1, there were only 9 students who were very active in mathematics learning, accounting for 6.4%. There were 67 students who were very passive in mathematics learning, accounting for 47.9%. The result showed that students' learning enthusiasm was not high. If students had a positive learning attitude and interest, they would have a strong learning will, which was their effective motivation and guarantee for learning.

(2) The influence of students' self emotions

Students' own emotions are stable, and their emotional quality can have a significant impact on their learning outcomes. Students with stable emotions can often overcome the negative impact of emotions and focus on learning without distractions, thereby achieving higher learning outcomes. Positive emotions can often promote students' learning, thereby improving their academic performance. The confidence level of students is shown in Figure 3:



(a) Student's perception of their level of self-confidence



(b) Teacher's perception of students' confidence level

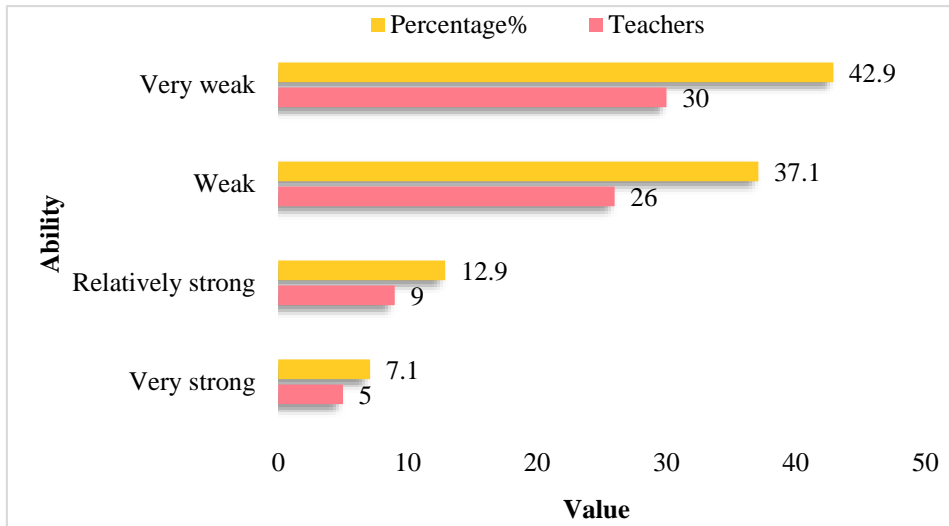
Figure 3: Student confidence level

As shown in Figure 3: According to (a), there were 6 students who felt very confident, accounting for only 4.3%. There were 80 students who felt very self-confident, accounting for 57.1%. According to (b), three teachers felt that their students were very confident, accounting for only 4.3%. 38 teachers felt that their students were very unsure, accounting for 54.3% of the total.

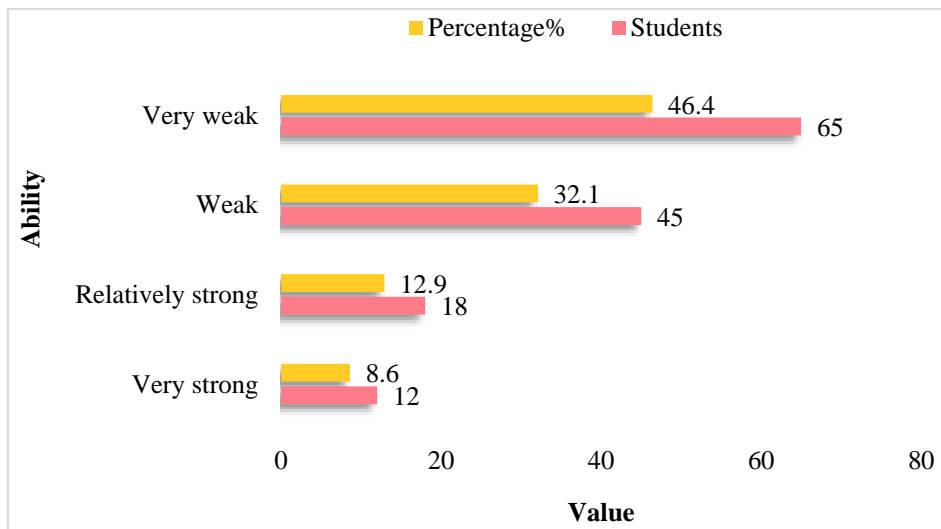
In recent years, due to the continuous expansion of the enrollment scale of ordinary colleges and universities, the enrollment rate of students has also been continuously increasing. Some students with excellent grades were admitted to key universities, while some students with better grades were selected for regular undergraduate courses. However, the enrollment of higher vocational colleges is the last batch of enrollment, with poor quality of students and a serious bias among students. Especially in mathematics, there is a great difference between them and those who have passed the college entrance examination. These students have significant problems in learning habits, abilities, methods, and other aspects. When they enter school, they have a bad mentality and often have inferiority complex due to their poor college entrance exam scores. They always feel that they have been eliminated. This would lose the motivation for learning and have a significant impact on students' academic performance [18-19].

(3) Autonomous learning ability

Scheduling learning time is one of the learning abilities of students, and cooperative learning is also a learning ability in addition to autonomous learning. The cooperative ability of students is shown in Figure 4:



(a) Teacher's views on students' cooperative ability



(b) Students' perceptions of their ability to collaborate

Figure 4: Students' cooperative ability

As shown in Figure 4, it was observed through (a) that 30 teachers believed that students' cooperative ability was very weak, accounting for 42.9%. Only 5 teachers believed that students' cooperative ability was very strong, accounting for 7.1%.

According to (b), 65 students felt that their cooperation ability was very weak, accounting for 46.4%. Only 12 students felt very strong in their ability to cooperate, accounting for 8.6%.

The survey results show that students' cooperative learning ability is not strong, and some students mistakenly turn cooperative learning into dependent learning. Cultivating students' cooperative learning ability can optimize their initiative and effectively avoid experiential learning. By cultivating students' cooperative learning ability in mathematics, they can maximize their subjective initiative, thus effectively avoiding experiential learning [20]. To cultivate students'

sense of cooperation, the following aspects can be started: First, students must clearly understand the meaning of cooperative learning. Cooperative learning refers to students supervising each other. In the conditions that the other party can achieve, their own problems are solved, while they can also solve doubts for others. Secondly, teachers and class teachers can divide students into different groups according to different levels, or arrange students with similar grades into support groups, which can prevent those who perform poorly from using cooperation as an excuse to do things that have nothing to do with learning.

4. Conclusions

After entering the new century, due to the increasingly high requirements of the economy for high-quality workers and tens of millions of highly skilled professionals, higher vocational education has become an important component of China. It bears the responsibility of developing high-quality workers and high-tech applied professionals required for economic construction. The overall mathematics level of students in vocational colleges is still at a relatively low level, and their academic performance is not satisfactory. Therefore, educators have been striving to find a suitable path for mathematics teaching in current vocational colleges, in order to improve students' mathematical literacy. The article deeply analyzed the factors that affect students' math scores in higher vocational colleges. This article used a questionnaire survey to investigate the influencing factors of mathematical performance, and the conclusion was that there were mainly external factors and internal factors. In the survey of external factors among teachers, it was found that teachers' teaching methods were the main influencing factor of mathematical performance. In the survey of internal factors among students, it was found that students' self-awareness, emotions, and cooperative ability were important influencing factors.

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