The Demonstration of Mathematical Logic Ability and Control Consciousness of Higher Vocational Students

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Abstract—**Math is upmost basic for working and learning. It exists for solving some problems. The authors focus on that only by combining the students' problem-solving control consciousness in vocational education we can enhance the mathematical logic ability. This paper discusses the best way to solve the paper's key point, that is connotative relationship between various factors of learners, how to sort out the control consciousness, improve the mathematical logic ability, and then build a practical logic thinking way, to form a system of students' mathematical self-added value, and put forward new possibilities for the scientific cultivation of the quality of mathematical education talents. This paper emphasizes the effective role of mathematical logic ability and regulation awareness in the application of information technology in higher vocational education learning. Given many examples to demonstrate how to get the useful abilities to solve the problems facing in the future.**

Keywords—**mathematical logic ability control consciousness, the development of mathematical science education**

I. ANALYSIS ON THE TRAINING OF MATHEMATICAL LOGIC ABILITY IN HIGHER VOCATIONAL EDUCATION

It is not reasonably interesting to teach and learn math for the high vocational college teachers and students. Why do we start to focus on the detailed problems themselves? The abstract thing is difficult to understand, and the abstract inference and theorem are expanded repeatedly and repeatedly on the difficult to understand abstract. So mathematics became a boring subject. If changing another thinking-way, to think in another view like: (That may be amazing and helpful) Area of circle: $S=\pi R^2$. How does the outcome come out? Because of the use of calculus thinking-way, the area of a circle is transformed into a rectangular area. The first step: Infinitely split into sectors with the center of the circle as the midpoint. The second step: Continually split, as long as it is infinitely divided into a rectangle, the area of the circle is equal to the area of the circle. Rectangular area=length multiplied by width. $S=\pi R \times R=\pi R^2$

That tells us that math stimulates our thinking-way to solve the problems, to return to point the problems and interesting demonstrations here are just to make this goal difference. So how to solve the key of the point of the so-called problems is very important. This is calculus thinking, logical thinking way. In the period of digital transformation, higher vocational students should have a new understanding of learning, that is, to improve their ability to solve mathematical problems, they need to sort out the overall problem, solving and regulation consciousness, and also increase their self-regulation ability, so as to adapt to the innovative development of society. The link of solving mathematical problems is generally four steps. Step 1: What is it? Step 2 Focusing on and planning Step 3 Implementation Plan, Carrying on Step 4 Review Overview. Mathematics is full of the whole world. To find and solve problems in everything still requires mathematical logic ability and regulatory awareness.

In higher vocational education, we should constantly increase our awareness of self-regulation. Before making a study plan, we should make clear what kind of questions we need to do to enhance our logical thinking ability. We must have a sense of regulation, that is, we need to know what can be done, what conditions we already know, what the results are, and then understand by analogy. We should review whether we have done similar but different questions, should form a complete logical chain. It is necessary to train one's own logical thinking and problem-solving control consciousness in this way.

At present, higher vocational students generally rely on mobile phones to collect information, forming one-sided and fragmented knowledge modules, and the situation of fragmentation is obvious Moreover, most students lack the necessary logical thinking ability. In this case, they quite need to equip this ability. Digital media is transforming the original learning mode to help students get information independently at any time, and at the same time, they can communicate with their peers in a timely manner. Therefore, in the learning process of higher vocational students, it is necessary to establish the

necessary platform and intelligent learning field, which requires the platform-based learning mode to have the goal content orientation and continuity of logical connection, On this basis, a theme learner function centered on higher vocational students is generated, and then a necessary logical learning system is created. Especially in mathematical logic training, this model can best reflect its value.

$$\text{MCME} \longrightarrow$$
$$\text{MP(Basis)} + \text{MSLF(Soft Power)} + \text{MLA(Hardcore Conditions)} = \text{MCME}$$

Note: 1. MP: Math Platform 2. MSLF: Math Smart Learning Field 3. MLA: Mathematical Logic Training Series 4. MCME: Math Course Measure Evaluation.

With the goal of constructing the development of higher vocational students' mathematical education ability according to this model, through the traction of mathematics teaching curriculum -- mathematics teaching and learning measurement -- mathematics overall evaluation (MCME). It is undoubtedly ideal to synthesize the comprehensive ability with careful logical thinking and finally form a scientific system of self-education for students' sustainable development. In the whole stage of higher vocational education, 60% of the students should be self-education that is consciously and independently corrected, while math classroom activities and teacher education account for only 10%, the remaining 10% are more family influenced, and more than 10% are social education. From this point of view, higher vocational students' self-worth, self-learning ability, and logical thinking at the level of math education, the regulatory consciousness and self-education system need to form an effective organic combination.

Therefore, under such an idea and digital concept, building such a student-centered learning platform model is to highlight the dominant position of students, practice the concept of follow-up education, establish such a platform model that integrates independent support, multiple evaluations, and all-round guarantee as the sustainable driving force, and finally form a lifelong learning mechanism for sustainable personal development, which is the real road to scientific development of education.

Based on this internal subjective development logic, build a logic system of mathematical lifelong learning development that conforms to the logic law. The logic system should be built based on mathematical culture, mathematical education science, mathematical ideological and political education, social mathematics related practice and various intelligent mathematical logic and digital space logic of control consciousness and regulation consciousness. If the logic main line leads to the weight value of self-education, In the development of higher vocational mathematics education, more attention should be paid to the students' mathematical logic ability in the design of their math study. The proportion is 60%, which should be jointly created by teachers and students. Classroom prompts and homework, online questions and offline answers should all focus on the students'

mathematical logic training and regulation awareness training. The correct way to be student-centered is to take students' mathematical logic ability and control consciousness as the leading role in learning activities. Ideally, students should design mathematical logic training questions themselves, create their own community control consciousness training questions, and teachers & students should jointly discuss the problem solving ideas and the best solution path, such as independently designing courses and homework and independently increasing various changes in mathematical problems, thus, they can derive the added value of the great and small role of mathematical logic ability and control consciousness in the construction of self-education added value creation system.

II. LITERATURE REVIEW

Technically the authors find out that the higher vocational students are most lacking of the mathematical logic ability through their more than twenty years observation through the teaching process for these students. So the title was raised in this way. Presently, few researchers focus on these two points, some aims at logic ability and some for consciousness fewer for control consciousness. The authors are researching on the connections and relative influence for the higher vocational students through these two factors. It is quite important for the development of the students.

Zhu's [1] transforming abstraction is changed into image, the author strengthens mathematics consciousness, but without talking training on overall Control Consciousness.

Yan [2] discussed only on the cultivation of mathematics application consciousness of engineering students in higher vocational college, application consciousness is quite different with control consciousness, the roles they are playing differently and make much difference with each other. These two qualifications are the necessities for their growing mentally. Ref. [3] is limited in the circle of math teaching, but not helpful for the application world. He said that logical thinking is crucial to the formation of students' mathematical concepts and the "discovery" and demonstration of mathematical propositions. His article, through examples, guides teachers to guide students to form mathematical concepts by abstracting their essential attributes in time from in-depth analysis of the research object, but does not look at their specific development factors and the self-value mining and social value re-creation of such problems from the perspective of students.

Xu [4] addressed that mathematics is a subject with strong logic and abstraction. It is widely used in daily life and work. Especially in modern society, people's pragmatic views are increasingly strengthened. But she does not mention the detailed mathematical logic abilities and consciousness. Only discussing mathematical application awareness and mathematical application ability, without linking logical ability and regulatory awareness is not helpful for their logical minds 'growth.

Li [5] said that consciousness is an important part of math, but does not mention why and how.

Chen [6] is combined with the teaching practice of calculus in higher vocational mathematics, through the transformation of contradictions between "straight and curved", "approximate and accurate", and "general and special", this paper discusses how to cultivate students' dialectical thinking ability. Jiang [7] emphasizes the awareness of independent learning in mathematics. If we add their views to those of the authors, it will certainly enable the comprehensive development of social practice application ability of higher vocational students. This should be said to be a very forward-looking and strategic attempt. In this respect, the authors choose the main two important abilities to discuss, analyze, and develop. So the new point should be emphasized by the relative researchers. This research is quite making sense for the development of the higher vocational students

III. MATERIALS AND METHODS

Used ways are conducted by the authors like:
- Interviewing about more than 1000 students through every new student entering the school, because all the admitted students
- Second-handed information reviewed from Journals and newspapers.
- Solons and conferences are helpful for this research theoretically.

IV. RESULT AND DISCUSSION

A. Demonstration of MLA Activities in Mathematics Learning

Logic training and regulation awareness exercise require a lot of teaching and self-study practice activities. They are exercises to improve self-added value in this special digital age [8]. Before mathematical problem solving, the first regulation awareness is formed, that is, to build a logical idea for problem solving based on known information:

For example, given function $g(x)=ax \ln x$, where $a \in R$:

When $a=1$. Find the tangent equation of $g(x)$ at point $(1, g(1))$, and judge the number of intersection points of tangent and $g(x)$ image;

Answer: $a=1$, $g(x)=x-\ln x$, $g'(x)$

Generate and form the first consciousness, namely consciousness 1: if there is zero point in $g(x)$, what can be considered to calculate the value range of a? To find out the problem, we can study the intersection of the image of function $g(x)$ and x axis, or consider whether it can be separated by parameters.

The logic of the consciousness is that we must find the known information before we can construct the whole idea of solving problems. However, this is just one of the logical cognitive components of meaning - consciousness. The high vocational school-students really need this kind of ability.

Regulatory consciousness 2: If the tangent equation is $y = 1$, is there only one intersection point with the $g(x)$ image? Then the logical point is to focus on the key points to solve the problem. This is mainly to train students to grasp the node of the problem to make a breakthrough, and it is an exercise to improve the training of control awareness.

When $0 < x < 1$, $g'(x) < 0$, $g(x)$ decreases monotonically; When $x > 1$, $g'(x) > 0$, $g(x)$ monotonically increases. Therefore: $g(x) \geq g(x)$ min$=g(1) = 1$, so the image of tangent $y = 1$ and $g(x)$ has only one intersection point.

Regulatory consciousness 3: The logical composition in front of the base forms the following question: In the process of problem solving, is the molecular formula a class? $a \in R$, so a should be discussed'.

(1) When $a = 0$, $g(x) = \ln x = 0$, and $x = 1$ is the zero point of $g(x)$.

(2) When $a < 0$, so $x > 0$, so $g'(x) < 0$ is constant, so $g(x)$ decreases monotonically.

(3) Constitute the molecular class first-order model and lead to the next logical problem point. Does the zero exist? (Training like this is a good way to raise up the students' consciousness). This is mainly to strengthen students' ability to think deeply and carefully, which in itself improves students' awareness of regulation in logical thinking.

Regulatory consciousness 4: How to explain the existence of zero point? That is, in the logical thinking of solving problems, it is to find the key of the problems.

Is there any intersection point between $g(x)$ image of monotone function and x axis? How to explain the existence of zero point?

When $X \rightarrow 0$, $g(x) \rightarrow +\infty$, and $g(1) = a < 0$, So $g(x)$ must have a zero point on the interval $(0, 1)$.

This is mainly to train students' ability to find the key points of the problem, and it is the key point that needs to be excavated when the logic ability and control consciousness are combined [9].

B. Uniformity Helps Improving the Awareness of Regulation

In the process of mathematics teaching in higher vocational colleges, the question of identity plays a great role in improving the awareness of regulation and control, which can be applied through the design of mathematics homework in this area. Some teachers often ignore the importance of mathematical homework design link, and do not know what is appropriate exercise, review, and examination questions. In fact, what are their design methods and functions, and how to design more conducive to the scientific development of students' regulatory awareness and logic ability, which is what many of our mathematics teachers lack. These are the basic elements of homework training throughout mathematics teaching.

For example, a student's room is 4 meters long and 3.2 meters wide. His father is going to paint the south interior wall with color paint. The window area on this wall is 2.8 square meters. Calculate, how many kilograms of color paint does the father need to buy at least? (About 0.4 kg color paint is used per square meter.)

The other problem is very similar to a classical mathematical problem, that is, the captain's age.

A ship carried how many cattle and how many sheep, and finally asked the captain how old he was. The main idea of this topic is to guide students to understand the problem of identity in the logic of thinking. In the process of mathematics learning, or in the process of people's thinking, formal logic is very important. It emphasizes a very basic way of thinking, that is, identity. That is to say, in a thinking process, concepts and judgments must be used in the same sense, but not in different meanings, including the unity of thinking objects, concepts and judgments, or it will lead to confusion and errors.

This is the basic requirement for mathematics ability of students in mathematics vocational colleges, and also the basic condition for good mathematics learning. It is very helpful for the final formation of mathematical logic and control ability. This question asks how much color paint the wall needs after deducting the area of the window, but the condition given by the question is the area of the room. Obviously, its design violates the identity of formal logic in mathematics. Through this problem, students will pay attention to the consistency of units and concepts in mathematical problems when doing homework in the future, and then constantly grasp the sameness in logic, so as to more fully train the mathematical learning content under the changeable and complex conditions.

So training vocational students to have the same problem solved must be achieved through the above similar repeated and effective training programs: then we should recognize that mathematical logic ability is one of the basic ways of scientific requirements of vocational education. It is very important to design or develop a good teaching mode for improving mathematical logic, which can help students learn mathematics, understand and master some complex and abstract mathematical concepts easily, directly promote the integration of mathematical logic and mathematical education practice in higher vocational education, and play a direct and obvious guiding role in improving the quality of higher vocational education.

C. Demonstrations of Mathematical Logic Ability Training

As a modern vocational college student, the more rigorous the logical ability is, the more practical the contribution will be. The ability to generate logical analysis will enable the professional being-educators to know what they should know, how to identify and be able to do a good job in overall regulation and overall planning logically. In many cases, they are using the rational coordination of regulation awareness and overall planning. Students in the tourism management class can consciously carry out logic training and often do mathematical logic exercises in this way. It is quite helpful for their management ability [10].

For example, there is a tourist group of 80 people, including 50 men and 30 women. Their hotel has three kinds of rooms, including 11, 7, and 5 people. Men and women live in different rooms. How many rooms should they reserve at least? The purpose of logical thinking is to reserve as few rooms as possible so as to save the team's expenses. The logical starting point is to arrange as many rooms as possible first, that is, 11 rooms. Under the guidance of this logic, 50 men will be arranged with three 11 rooms. Thinking about the problem as a whole, this is the largest digital logical arrangement, and the largest number of people will be arranged. 33 people will be arranged, followed by two five rooms. Another large number of people will be arranged. In general, 43 people will be arranged, and another seven people will be arranged. Then all the boys will be arranged. Girls can be divided easily. One is 11 people, two are 7 people, and one is 5 people [11].

This reflects the comprehensive analysis method of mathematical logic. Having learned this logical analysis method, it is possible to improve the ability of mathematical logical thinking. Teachers need to use scientific and logical thinking methods to build logical thinking ability: (They are mutually raised up in terms of these useful abilities).

(1) First, providing appropriate sensory materials, and then organizing higher vocational students to know the abstract and generalized activity process from sense, so as to establish a new concept.

(2) By using the divergent expansion of the transformation from learned knowledge to new knowledge, the organic connecting factors of learned knowledge points are excavated.

(3) Promoting the application from general to individual, understanding concepts, understanding principles, and master methods, from individual to general and from general to individual.

(4) Establishing the integrity of thinking, recognizing the connection and difference between concepts, and at the same time assimilate concepts, dividing the old and new concepts, understanding mathematical concepts again, and understanding mathematical concept methods, essence and core.

(5) The guidance of divergent thinking, drawing inferences from one instance and understanding by analogy, is a kind of thinking of seeking differences. It starts from one point and achieves the goal of improving logical thinking ability in multiple directions.

D. The Significance of Mathematical Logic Ability and Control Consciousness (or Regulation)

For liberal arts students, the golden rule should be established through the level of logical ability and regulatory awareness mentioned above: Why (purpose, idea): what's your purpose in doing this; How (method, measure): What method will you use to complete this matter; What (phenomenon, result): What kind of result will you get. There is only one ideal development trend: the idea of analyzing problems meets the requirements of objective analysis, which will improve the efficiency of solving problems. This is different from the logic of story deduction and development in literary creation. What, what, when, and where the story takes place, the former is based on facts, while how and why it takes place require general logic and comprehensive analysis, I also have the

ability of logical reasoning. The mathematical logic ability and control consciousness in higher vocational education are very important to the talent quality training mode of higher vocational education:

(1) Based on the awareness of regulation, we can coordinate and regulate multiple systems, use rational data for basic analysis, achieve the best overall arrangement, establish a logical path system for transformation from "innovation technology oriented" to "intelligent learning oriented", give play to the advantages of the Internet and the Internet of Things. With the intervention of artificial intelligence and human-computer interaction mechanism, we should break through the limitations of time and space, make full use of the information platform, gradually promote the reform of "ubiquitous, mobile and personalized" learning methods, and let teaching and learning achieve effective, orderly and interesting learning effects through platform docking. The key is that the test results will be most close to the best value area, that is, all abstract systems should be based on specific data analysis.

(2) The integration ability of information technology application ability and mathematical logic ability can be further improved on this basis. It is quite necessary to take the improvement of information literacy ability as an important indicator of teacher evaluation, and strengthen the work of information teaching contest, information literacy ability and information training. Then the exertion of the same level of logical ability further promotes the higher control of the control consciousness. After repeatedly applying mathematical logic and control consciousness to the information technology system, the final logical application, the application of information technology and the awareness of regulation and control will continue to fuse, so that the combined force of the three and the self-built integration ability of each other will be further improved. All technical data are the basis for the generation of information applications, and the application of maximum value requires the combined force of logical thinking and awareness of regulation and control.

(3) By using the basic elements of informatization and logic+regulation awareness, the application innovation system of "Internet plus+resource base+statistical database" established thereby will have an impact on the future development of higher vocational education.

In the information age, the construction of a large number of educational resources should adapt to the teaching resource database, database and network comprehensive information database required by the development of vocational schools. In the basic education of higher vocational education, emphasis is placed on the construction of logical ability and control awareness. In particular, higher vocational colleges are encouraged to follow the rule of logical knowledge accumulation and control awareness skills cultivation according to their own conditions, supplement and build a unique school level characteristic teaching resource system, and form a rational and in-depth, major situation of the overall control awareness. Obviously, this is extremely beneficial to the construction of the education structure of higher vocational students. To form the school-based characteristics of each higher vocational school, the logical rationality and control consciousness system established thereby will avoid the duplication and abuse of teaching resources as a whole.

E. The Abilities and the Development of Mathematical Education Science

The development of mathematics education science in higher vocational education actually needs to be constructed in multiple ways and modes, which is a systematic construction mode of comprehensive development of students' abilities. Under such a mode of construction, we should cultivate vocational students who have regulatory awareness, logical thinking ability, rigorous scholarship, and ability to analyze and solve problems. Its possibility and reliability are very large.

When it comes to the development of mathematical education science, it involves two aspects: the first is the transformation of mathematical language, which is flexible from abstract generalization to specific numerical operation. Sometimes mathematics teaching requires some abstract and general abilities, which are just the basic elements of the level of logical ability. However, if we want to develop this mathematics education science and combine theory with practice, we need a transformation from abstract to concrete and vivid. Therefore, a large number of mathematical logic ability training should be constantly reflected and tested in the entire mathematical education activities.

The second is called the logical transformation of mathematical morphology, which forms the grasp and inference conclusion of macro mathematical theory from concept to image. In this respect, teachers need to use the scientific laws of teaching to enable students to have such a logic conversion ability. From some conceptual expressions, teachers can use some visualized disintegration methods to deduce and express them. Teachers can explain and elaborate the theory and laws of mathematical education and open up the creative thinking logic for students through easy to understand mathematical language and mathematical problem-solving ideas of deduction, solution, and correction, If it is not limited to the existing conditions, in geometry class, you can remove auxiliary lines, or hide auxiliary lines, increase or decrease conditions, create complex conditions, and gradually improve the students' logical level of thinking. This concept needs to echo a theoretical basis mentioned at the beginning of this article, that is, the construction of students' mathematical self-added value and its improvement model.

Therefore, the comprehensive application [12] of logical thinking ability and control consciousness is an important form of mathematics education science, and also the embodiment and basic characteristics of the specialization of higher vocational mathematics education. In fact, the mathematics education theory of high-level higher vocational education itself should be specific, vivid and interesting, highly logical, an effective link and development form formed under the control of the overall system, and an important symbol reflecting the quality of the development of mathematics education theory and practice.

After the combination of theory and practice, all the vivid factors should be demonstrated, like logical thinking ability, regulatory awareness and the ability to comprehensively use information technology are all essential basic abilities for higher vocational students [13]. In another abstract way, it's a beautiful feeling to design, perceive, recognize, think, and feel mentally on the beautiful Miss Math [14]. This is what we call a kind of Mathematical Aesthetics.

V. CONCLUSION

The resulting series of systematic student self-added value systems are all born for the development and application of higher vocational mathematics education science. They are necessary means and contents to ensure the scientific development of mathematics education. These examples above mentioned are just guided for the math-teaching and learning in terms of high vocational school. We should be used to use math as a good tool to solve problems simply and interestingly.

Next to add integration and simple logic ability and equip these rethinking methods, self-added value consciousness, control consciousness and logic ability up with the higher college students, in this way, their comprehensive abilities for their all-around development are quite necessary for their career.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

AUTHOR CONTRIBUTIONS

For many years, the authors prepared this paper's writing. Accordingly, Qilun Zhang and Jinglong Cao started thinking of this theory, and later on conducted the research; Zhiyong Xu wrote the literature review; Qilun Zhang and Jinglong Cao wrote the paper main contents, it is suggested that Jinglong Cao should be the Corresponding Author. All authors had approved the final version.

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