

Elementary Exploration on the Reform of Mathematics Teaching in Higher Vocational and Technical Education with Chinese Characteristics

Heqiong Zhang
Chengdu Polytechnic
Chengdu, China

Abstract—According to the current situation and development trend of mathematics teaching reform in higher vocational and technical education in the world, our college takes the existing higher vocational students as research object and takes the improvement of student's core literacy as the "dissolving agent" of discipline barriers. In theory, this paper expounds the importance, necessity and urgency of mathematics teaching reform in higher vocational education from multiple perspectives for the first time. In practice, it regards improving students' core literacy as the key point to enhance the core literacy of higher vocational students, and puts forward for the first time several characteristic methods of cultivating and improving students' emotional intelligence and core literacy in mathematics education and teaching. The purpose is to play the role of enlightenment, reference and radiation in promoting the mathematics teaching reform and scientific research in higher vocational and technical education.

Keywords—Chinese characteristics; Higher vocational mathematics; Teaching reform; Theory and practice; Preliminary exploration

I. INTRODUCTION

At present, due to the differences among countries, regions, nations, cultures and national conditions, the demand for high-tech and highly skilled personnel for economic development is different in the world [1-2]. From the perspective of Australia, Germany, the United States, the United Kingdom, Singapore and other countries where higher vocational and technical education is at a leading international level, a lot of experience has been gained in course teaching and professional practice. Due to various reasons, at present, in the theoretical and practical aspects of mathematics teaching reform in higher vocational and technical education in China, very little research has been conducted around the project. In recent years, our college has taken improving students' core literacy as a "dissolving agent" for discipline barriers, and carried out theoretical and practical research on this project aiming at the key points [3-5], difficulties and key problems in mathematics teaching of higher vocational and technical education in the world.

II. CHINA'S HIGHER VOCATIONAL EDUCATION MUST STAND AT THE FOREFRONT OF INTERNATIONAL HIGHER VOCATIONAL EDUCATION AND OBSERVE THE CHANGING WORLD FROM DIFFERENT PERSPECTIVES.

(1) From the perspective of China's education needing to be in line with international education. Socialism with Chinese characteristics has entered a new era. Upholding and developing socialism with Chinese characteristics is the core of Xi Jinping Thought on Socialism with Chinese Characteristics for a New Era. China's education needs to keep pace with the times, reflecting the distinctive characteristics of the times. From a worldwide perspective, China's education is in urgent need to be in line with international education to narrow the gap with the United States, Britain and other developed countries [6-8]. To build a strong country in higher vocational and technical education and improve the international competitiveness of China's higher vocational education, we must take the road of reform and development of higher vocational education and teaching with Chinese characteristics.

(2) From the perspective of China's education needing to serve the national strategy. To build a moderately well-off society in an all round way, the state needs to implement the strategies of "rejuvenating the country through science and education", "strengthening the country through human resources", "revitalizing the countryside", "coordinated regional development" and "sustainable development". The socialist modernization with Chinese characteristics needs hundreds of millions of high-quality technical and skilled talents. The traditional vocational education mode is unable to cultivate the real scientific spirit any longer, not to mention the creation of future talents. According to the characteristics of higher vocational education, it is necessary to update the concept of education and conscientiously implement the national education policy into every link of teaching. In order to give full play to the advantages of human resources in a country with a large population and realize the "Chinese dream" of the great rejuvenation of the Chinese nation, we must take the road of reform and development of higher vocational education and teaching with Chinese characteristics.

(3) From the perspective of realizing the teaching objectives and tasks of higher vocational education. Education quality is the life of higher vocational and technical education. It is the fundamental task of China's higher vocational and technical education to cultivate high-quality technical and skilled talents suitable for production, construction, management and service. To innovate educational approaches and methods, adhere to the principle of "equal emphasis on knowledge, ability and character", and accelerate the pace of talent training, we must take the road of reform and development of higher vocational education and teaching with Chinese characteristics.

(4) From the perspective of current employment of higher vocational students. In recent years, although the employment situation of higher vocational graduates in China is stable, it is not optimistic and needs further improvement. Modern society is a diversified society, which needs talents with not only high skills, but also high emotional intelligence. In the new era of socialism with Chinese characteristics, the quality requirements for higher vocational education talents are also increasingly high. In order to further optimize the employment probability of higher vocational graduates, we must take the road of reform and development of higher vocational education and teaching with Chinese characteristics. E. From the perspective of long-term development of higher vocational students. In the new era of socialism with Chinese characteristics full of opportunities and challenges, higher vocational graduate students should have higher skills and emotional intelligence, higher core literacy and core competitiveness, and take the road of reform and development of higher vocational education with Chinese characteristics in order to win in the fierce international competition and lifelong development.

III. HIGHER VOCATIONAL EDUCATION IN CHINA MUST KEEP PACE WITH THE TIMES AND SOLVE THE KEY, DIFFICULT AND CRUCIAL PROBLEMS OF HIGHER VOCATIONAL EDUCATION

A. Several measures to improve the quality of education by enhancing students' emotional intelligence as a breakthrough point to enhance students' self-confidence

Emotional intelligence plays a key role in one's success. According to the characteristics of higher vocational students' psychological immaturity, lack of comprehensive understanding of various things, high excitement and fluctuation of emotions, in view of the psychological "inferiority", ideological "weariness", knowledge "shortage", action "fear of difficulties", emotional "impulse", employment "ambitiousness" and other difficult problems, we take the following measures to enhance students' self-confidence by enhancing students' emotional intelligence as a breakthrough point: 1) Make good use of the main position of mathematics classroom teaching in higher vocational colleges, and adhere to the "eight SHOULDs": First, we should improve students' emotional intelligence in classroom teaching of mathematics. Second, we should make organic integration of the teaching contents of mathematics to improve students' emotional intelligence. Third, we should introduce the history of mathematics to improve students' emotional intelligence. Fourth, we should use stories of scientists to enhance students' emotional intelligence. Fifth, we should use the basic theory

teaching of mathematics to enhance students' emotional intelligence. Sixth, we should use the basic knowledge teaching of mathematics to enhance students' emotional intelligence. Seventh, we should use the practice activities of mathematics to enhance the students' emotional intelligence. Eighth, we should use the elective courses of mathematics to enhance students' emotional intelligence. 2) Optimize the college's teaching and education environment conditions to enhance students' emotional intelligence, and strive to achieve "seven GRASPs": First, change the inherent concept of education. We should not only teach but also educate the students, and attach importance to both intelligence and emotional intelligence. Second, build a campus culture that is conducive to the cultivation of students' emotional intelligence. Third, incorporate emotional intelligence into the teaching plan. Fourth, improve the emotional intelligence of teachers. Fifth, carry out a variety of emotional intelligence practical activities. Sixth, give full play to the role of psychological counseling and guidance. Seventh, establish and improve the emotional intelligence evaluation reward mechanism. 3) Stimulate students' cognition, give full play to the main role of students, require students to take the initiative to improve emotional intelligence, and consciously achieve the "nine LEARNs": First, learn to recognize their own emotions, and face their own advantages and disadvantages. Second, learn to demarcate psychological boundaries, and treat people properly. Third, learn to control their emotions, not too ambitious. Fourth, learn to eliminate things that waste energy. Fifth, learn to resist distractions and setbacks and stay motivated. Sixth, learn to choose the living examples around as their own forward benchmark. Seventh, learn to recognize the emotions of others and be "empathetic". Eighth, learn the skills of building harmonious relationships. Ninth, learn positive and beneficial things from the diverse social and family environment.

B. Several measures to improve the core competitiveness of students by focusing on improving students' core literacy to break the discipline barriers

core literacy is the basic quality necessary for a person to develop and improve himself, integrate into society and be competent in work, the necessary character and key ability to adapt to the needs of personal lifelong development and social development, and the quality and self-restraint that an individual should have to play the role of foundation and support^①. Luogeng HUA, a famous Chinese mathematician, said: "From the large universe, to minute particles, fast rockets, ingenious chemical industry, changeable earth, mysterious biology and frequent daily use, mathematics is used everywhere." Galileo, the famous Italian mathematician, physicist and astronomer and founder of modern experimental science, said: "The great book of nature is written in the language of mathematics." Surveys of adults' knowledge and skills in OECD countries show that the lack of mathematical skills severely limits people's access to better pay and better jobs. In emerging markets, people proficient in mathematics earn, on average, 40% more than others. Thus, it can be seen that mathematics plays an important basic leading role in improving students' core literacy and core competitiveness in all courses offered in higher vocational colleges.

①. Wensen YU, Core Literacy Oriented Classroom Teaching [M] Shanghai Educational Publishing House 2017.7.

(1) To improve students' core literacy, mathematics teaching should be changed from narrow sense teaching to broad sense teaching. To expand the scope of cultural literacy, we need to achieve "four NEEDs". First, we need to take curriculum resources as the teaching object. Course resources are not limited to textbooks and schools. Textbooks should be open and serve as a bridge and link between students and others, life, society and nature. From the perspective of professional application, the content of the textbook should strive to achieve "one connection" and "three enrichment": That is to say, the compilation of higher mathematics teaching materials should strengthen the connection with secondary vocational, secondary technical and regional teaching materials. Enrich application cases and exercises in teaching; Enrich professional experiment questions and practice questions; Enrich the content of employment and emotional intelligence. Second, we need to break through the traditional concept of "teaching is in the classroom". Broad sense teaching is a life-oriented teaching with the goal of developing students' core literacy. It leads the teaching content from books and classes to the colorful life world of students. The space of students' learning activities is no longer limited to the classroom, but expanded to all areas of life and society. The object of students' learning activities is no longer limited to the textbooks with characters, but extended to the "living" wordless book of the whole nature and society. Third, we need to establish the concept of "letting students educated through knowledge". Mathematics teaching is not "the education of knowledge", but the education and edification of patriotism, collectivism, morality, humanities and other contents to students through knowledge teaching, finally forming the ability and subject literacy higher than mathematics knowledge. Fourth, we need to command the overall situation with the big idea of crossing disciplines. Core literacy is both discipline-based and transdisciplinary. Mathematics teaching must start from enhancing students' mathematical awareness, mathematical language, mathematical skills, mathematical thinking, and help the students to expand knowledge and horizon, form a "mastery" knowledge framework, guide students to learn "necessary" knowledge "flexibly", and enable them to use with high proficiency in the future employment.

(2) Improve students' core literacy. Mathematics teaching should be changed from teacher-centered to student-centered, and help students achieve the "five MUSTs" in their independent development. First, a good atmosphere for communication must be established. Paul Freire, the famous Brazilian educator once said: "Without love for the world and others, a dialogue is difficult to continue. Love is the basis of dialogue and the dialogue itself." In order to effectively carry out the teaching of "students' independent learning as the main task", the teacher must be full of love for all students in the process of teaching, eliminate the psychological barriers of students, and pay attention to the equal dialogue and communication between the teacher and students. Second, the learning ability of all students must be cultivated. We should start from the current situation of students' thoughts, knowledge, interests and abilities, and carry out teaching from multiple channels and perspectives for all students, make each student really learn something, and cultivate their awareness of cooperative learning and ability of active learning. Third, the

basic status of learning situation must be attached great importance to. Mathematics teaching should fully understand the students' thought, knowledge, ability, teaching material and other actual situations. The content selection of lesson preparation should be based on the characteristics of students, the content arrangement should focus on the development of the industry, and the content implementation should contribute to the development of students. The scope of lesson preparation should be extended to students' learning and living space, and the emphasis of lesson preparation should be shifted from how teachers teach to how students learn effectively. Fourth, the subject status of students must be highlighted. In teaching, we should strive to make teaching serve learning and change "want me to learn" to "I want to learn". What students need to learn and how to learn are all explored by students independently. Fifth, the core status of learning must be clearly defined. Teaching should, from beginning to end, adhere to the student learning as the core, and teachers' lesson preparation, teaching, practical guidance, etc., should be centered on students. We must pay attention to the whole process of students' problem generation, practice, operation, thinking transformation and problem solving, and focus on guiding students to take the initiative to learn from the shallower to the deeper, from the outside to the inside.

(3) Improve students' core literacy. The mathematics teaching should change from knowledge center to ability center, and the students' social participation should be guided to achieve "five IMPROVES". First, improve students' self-learning ability. Stephen Stogatz, professor of Department of Applied Mathematics at Cornell University, USA, said: "If you want to go into high tech, healthcare or finance, you have to be good at math. If you gave up math, you wouldn't have these opportunities." From the perspective of teaching reform, mathematics classroom teaching should strive to achieve "one improvement" and "three docking": That is, we should attach importance to the improvement of students' core literacy; We should pay attention to the connection between higher mathematics knowledge and secondary vocational and technical mathematics knowledge. We should pay attention to the connection between the abstractness of basic theory of higher mathematics and the visualization of practical problems in life. We should pay attention to the connection between the flexibility and diversity of teaching methods and the orientation of educational quality evaluation. Teaching activities should guide students to actively learn mathematical knowledge and skills, so that students gradually have the ability to propose problems, analyze problems, solve problems, classify and summarize, and flexibly apply mathematical knowledge. Second, improve students' cultural literacy. In order to change the current situation that too much emphasis is placed on the teaching of subject knowledge and weaken the transformation from knowledge to subject literacy, teachers' teaching should make full use of the subject knowledge system, transform students' mathematical knowledge into transferable data application, computer application and professional technology application ability, gradually expand from improving students' mathematical literacy to language literacy, science and technology and information literacy, aesthetic and humanistic literacy, etc., thus guiding students to master various achievements of applying human wisdom and civilization.

Third, improve students' innovation ability. General Secretary Xi Jinping pointed out: "To grasp innovation is to grasp development, and to seek innovation is to seek the future. If we do not innovate, we will lag behind. If we slow down, we will also lag behind." In teaching, students should be guided to transcend the limitation of absorbing human knowledge from school textbooks and classroom teaching, and understand that knowledge learning cannot be completed in school education at one time. They must work and learn alternately, study and renew knowledge unremittingly for decades, and always insist on technological innovation. Fourth, improve students' emotional ability. The "living" textbooks of ancient and modern schools or the society should be used organically to educate and guide students to have a correct understanding of the society, including knowing themselves and others, motivating themselves and respecting others, learning to have equal dialogue and friendly exchanges. Learn to handle the relationship between oneself and others, individuals and groups, society and the state, have the ability to cooperate with others in work, and management and development ability, and form sound personality and higher emotional ability. Fifth, improve students' ability of resource integration. In teaching, we should fully explore and utilize mathematical elements, have the ability to discover, appreciate and express the unique subject beauty provided by mathematics, guide students to master the social mathematics of "mutual benefit and win-win" and gradually improve students' ability to integrate resources, thus forming the general ability and professional ability that can be used for a lifetime.

(4) Improve students' core literacy. The teaching of mathematics should be transformed from moral education to character education, and the students' personality charm should be optimized to achieve "four STRENGTHENS". First, strengthen the moral education needed by the times. General Secretary Xi Jinping pointed out: "No country can thrive without morality, no man can stand without morality". "Young people are in the period of value formation and establishment, so it is very important to cultivate the values in this period. Just like buttoning the clothes, if the first button is wrong, the rest will be all wrong. The button of life should be buttoned well from the very beginning." The Chinese nation is a land of rites and ceremonies, and advocating morality is a fine tradition of the Chinese nation. China attaches great importance to moral education since the ancient times. From "cultivating one's morality, regulating one's family, governing a country, and ruling the world" to "everyone is responsible for the fate of his country", from "worrying ahead of the people, and enjoying the fruits after the people" to the current "An Outline for the Implementation of Civil Moral Construction" issued by the Party Central Committee, they all emphasize the importance of "cultivating one's morality and governing the country with morality". In teaching, we should guide the students to set up the socialist morality firmly, and learn from the countless moral models of ancient and modern times that are praised and admired by the world, know the great virtue, defend the public morality, strictly abide by private morality, have the social care and the national feelings, and be citizens loving the party and the country, observing disciplines and obeying laws. Second, strengthen the education of values needed by the times. The socialist core values are the concentrated embodiment of the

spirit of contemporary China, the values of national identity, international understanding and the needs of the times, and the value pursuit that every practitioner must have. In teaching, we should guide the students to firmly establish the values that combine the ideals of the individual with the needs of the nation, take "rejuvenating China and making it strong and prosperous" as their social responsibility, dedicate their whole life to the realization of the "two centenary goals" and strive to realize the value of life. Third, strengthen the vocational spirit education needed by the times. To uphold and develop socialism with Chinese characteristics, we need to inherit, develop and innovate the country's expertise in all fields. In higher vocational learning stage, students need to firmly establish the sense of urgency and the sense of responsibility in pursuit of excellence and continuous innovation, and form a necessary professional spirit. Fourth, strengthen the vocational character education needed by the times. In teaching, we should fully tap and utilize the elements of character education, guide students to strictly abide by professional ethics, abide by professional discipline and fulfill their professional responsibilities in the process of improving their professional practice ability and professional adaptability, gradually develop the professional character necessary to uphold and develop socialism with Chinese characteristics, and conscientiously optimize their personality charm.

It is a long way to explore the reform and development of mathematics teaching in higher vocational and technical education with Chinese characteristics. Our college has just taken the first step in the reform of mathematics teaching, which takes the improvement of students' emotional intelligence as the breakthrough point and the improvement of students' core literacy as the focus. The purpose of writing this article is to attract valuable ideas, and I sincerely invite experts and scholars to give me their advice, so as to write a new chapter for the reform of mathematics teaching in higher vocational and technical education.

ACKNOWLEDGMENTS

I would like to express my heartfelt thanks to the experts and scholars of the references.

Footnotes: ① . Wensen YU, *Core Literacy Oriented Classroom Teaching* [M] Shanghai Educational Publishing House 2017.7.

About the author:

Heqiong ZHANG (born in 1980), female, native place: Lezhi County, Sichuan Province, is a lecturer at Chengdu Polytechnic, Master of Mathematics, Sichuan University. Main research direction: Higher mathematics education and teaching. She has been teaching basic mathematics for 16 years and has published many papers in national and provincial journals, and has won the thesis award.

REFERENCES

- [1] Shihong DAI, Curriculum Teaching Reform in Vocational Education [M] Beijing. Tsinghua University Press, 2007.6.1 Version 1
- [2] Gang DONG, Research on the Quality of High-quality Technical and Skilled Personnel Training in Higher Vocational Education [M] doc88.com 2015.3.5
- [3] Yizhi WANG. Dawei LI. Gang DONG, Vocational and Technical Education at Home and Abroad (co-authored by Chinese and foreign authors) [M] Tianjin University Press 2011.11.1 Chapter 11-12
- [4] Qi DONG, Yongsheng REN, The Core Literacy of Chinese Students' Development General Framework [M] Beijing Normal University 2016.9.13.
- [5] Wensen YU, Core Literacy Oriented Classroom Teaching [M] Shanghai Educational Publishing House 2017.7.
- [6] Guangliang LI, The Cultivation of Students' Core Literacy in Vocational Colleges and the Development of Teaching Materials for Vocational Quality Education, [J] Chinese Vocational and Technical Education, 2018. Issue 23, pp. 83-86-89.
- [7] Bin ZHOU, Research on Classroom Transformation Directed at Core Literacy [JJ]. Teacher Education Research, 2018.3 Volume 30, Issue 2, pp. 94-99.
- [8] Lei XIE, Cultivate Good Character to Create a Wonderful Life [N] Special Edition of Guangming Daily, 2014.7.