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The Design and Discussion of Elite Education in College Mathematics

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Abstract

With the development of human civilization, higher education has undergone a change from elite education to mass education. In China, this change is particularly obvious, and higher elite education has been impacted greatly. While Chinese middle school students have kept excellent performs in the International Olympic Mathematics Competition, no Chinese mathematician from main land won the Fields Medal. How to train creative talents and train mathematicians with historical mission? We think that one of the important ways is to develop elite education. This paper discusses the elite education of the United States, and compares the teaching tools, teaching books and other aspects of higher mathematics education between China and the United States. We propose in this paper four concrete solutions to elite education under mass education. They are of reforming the teaching tools, enhancing students' innovative abilities, expanding international academic exchange and adopting the tutorial system to undergraduate students. Through the four solutions, it can serve as a reference for the development of elite education in mathematics and promote the organic integration of elite education and mass education.

Key words: Elite education, elite mathematics, mass mathematics

I. Elite Education

The concept of "elite" originated from Pareto, a famous sociologist and economist in Italy, which was produced in the traditional stage of elite education. In the elite education stage, the traditional elites, especially those who live in the upper class or have profound knowledge, are political talents and academic talents. They focus on the external attributes such as status and position, with obvious class bias.

With the deepening of the division of labor in modern society and refinement, the popularization of higher education of the modern "elite" has been given new meaning and requirements, it is no longer a level bound, but a relatively broad concept, in a certain society has intrinsic properties better than ordinary people or have good external attributes in some areas. In certain areas, through their leadership functions can make the value of the whole society to be added or maintained. In determining the structure of the whole society, they play a leading role and the backbone, in short, that is, all walks of life have outstanding talent and a small number of talented people.

A. The connection and difference between elite education and mass education

To study the inevitability of college elite education in the context of the popularization of higher education, we must first make clear the connotation of the popularization of higher education and the elitism of higher education.

Fundamentally speaking, popularization is socialization. We exist in this society. Facing the society and serving the society is the value orientation of our popularization and the direction of the popularization of higher education. As a result, the popularization of higher education originated from the social needs. With the development of society, people's demand for knowledge is getting bigger and bigger. We have moved from elite education to popular education. Nowadays, with the development of science and technology, higher education has become popular, and we must pay attention to elite education, all of which are the result of social development. Representative of higher education popularization theory, the famous American educational sociologist Martin Trop clearly pointed out the theoretical content of the development of higher education. He divided higher education into three stages: elite education with a gross enrollment rate below 15%, mass education with a gross enrollment rate of 15% -50%, and universal education with a gross enrollment rate of over 50%.

However, the existence and development of higher elite education are the inevitable requirements of today's society. Especially in the era of knowledge-based economy, social-economic development depends more and more on profound knowledge. The extreme core high-tech has become increasingly prominent in the knowledge-based economy. Therefore, the higher education in the popular stage cannot relax the elite education. In addition to the popularization of higher education, there should also be a high standard of elite education. This is a need for economic and social development. It is also a need for the development of higher education. We must establish such a consensus.

B. American elite education history of higher education

The 1950s and 1960s is an important period for the popularization of American higher education. At the close of World War II, a large number of U.S. soldiers in the World War II are about to retire and form a tense employment situation. In order to alleviate this tension, the U.S. federal government promulgated the "Bill of Rights for Military People" in 1944, stipulating that every soldier who served more than 90 days in World War II will have 1-4 years' education and training rights after the war. The military Rights Act stimulated the demand of post-war American higher education and

injected a strong impetus for the expansion of colleges and universities. What is particularly concerned is that community colleges, as a variant of early junior college form, have been fully flourished because of this rare opportunity to develop and become the most dynamic growth point of the American higher education system thereafter. It is the main force in the process of realizing the popularization of higher education in the United States [1].

In 1947, the president of the United States Higher Education Commission published the report on "higher education in the democratic society of the United States". The overall goal of this report is to expand educational opportunities and move towards mass higher education [2]. This is a clear expression in the form of the United States federal legislation and a call for the people of the United States to achieve the popularization of higher education.

Social and political changes. The expansion of federal financial aid has opened the doors of university to the general public. More women, minorities, part-time staff and intermittent learners, as well as people of more than traditional age, have entered university. The increase in enrollment has increased the number of universities. The massive injection of US dollars has contributed to the increase of academic research and the training of research universities and specialized institutes. It can be said that any type and size of college can be found in the United States [3].

During this period, the two superpowers of the United States and the Soviet Union engaged in various forms of an arms race that began to shift to science, technology and education after the 1950s. In 1957 the Soviet Union successfully launched Sputnik, and later successfully manned space flight, while the U.S. space program failed, which led to the American government and the public outcry. American politicians and people of insight are deeply aware of their backwardness in science and technology. All of these are attributed to their low quality higher education and have not made their due contributions to the country's high technology and talent training.

Under such circumstances, the United States promulgated the most important and far-reaching National Defense Education Act of 1958 whose main contents are: strengthening the teaching of natural sciences, mathematics and modern foreign languages and other important subjects; strengthening vocational and technical education; Emphasize "genius education.". The act also authorizes the federal government to allocate an additional 280 million dollars in education funds to state schools to provide loans to undergraduate, graduate students and students aspiring to work as primary and secondary school teachers, providing "national defense scholarships" to 1,500 graduate students annually. This bill solves many key problems for students, but also fosters students' self-reliance and self-reliance, especially for the great development of postgraduate education.

The promulgation of the National Defense Education Act of 1958 has enabled many key universities in the United States to set up many research institutes and centers and has made tremendous achievements in basic theories and cutting-edge scientific research. With Stanford University as the center, formed the nation's first science park Silicon Valley, with Harvard University and Massachusetts Institute of Technology as the center established the Boston Cambridge Science Center, the New Jersey-New Jersey Science Center was established around Columbia University, Yale University, New York University and Princeton University. The establishment of close relationship between universities and industry has not only improved the position of universities in the economic and technological development of the country, but also brought great impetus and vitality to scientific research and teaching in universities [4]. In addition, with the intensification of political and ethnic conflicts in some European countries and the advent of World War II, a large number of European scientists and technicians immigrated to the United States, especially senior scientists, so that the overall strength of American scientists rapidly It is the American research universities that have benefited most from this enhancement. As we are familiar with "Father of Relativity" Einstein, "Father of the atomic bomb" Fermi and so on. Due to the role of universities in the training of elite talents, especially the important role of research universities in postgraduate education, research universities have gained huge profits and made outstanding contributions. This enabled universities to train a large number of scientific and technological elites and become the main bases of American technological innovation, making the United States the birthplace of the third technological revolution [5].

The federal government of the United States promotes the development of higher education, especially the elite education of research universities, through a series of legislation and funding, which is beneficial to the great interests of the whole American society. For university funding, government appropriation is the main source of higher education funding, because the biggest beneficiaries of higher education are state and individual, and government funding is essentially for the interests of the state [6]. The federal research funds are focused on the main research universities, mainly due to the competition mechanism, and the federal scientific research funds are allocated according to the "principle of excellent quality". Because research universities have concentrated the world's most elite, they naturally get the greatest support from the federal government. In addition, the Federation has formulated a tax preferential policy to encourage foundations, businesses and individuals to donate to universities. These donations are also mainly obtained by research universities. For example, the Stanford University only had a $1 billion 100 million donation for only one hundred year school celebrations. It is precisely because the research universities in the United States have sufficient funds for scientific research as a guarantee that they will continue to make significant contributions in the research and training of qualified personnel. On the other hand, funding is coming because of their continuous contribution. This "Matthew Effect" has enabled them to maintain their position as a world-class university [7].

II. Mathematics Higher Education Reform and Innovation

Mathematics education plays an important role in China's education system and has trained a large number of students who are good at calculation and problem solving in middle school mathematics education. But in the middle school

mathematics education, the use of calculator, network and other comprehensive means to solve the actual problems are not many cases. Taking high school textbooks for example, an example of using a calculator is not more than 2.4%, while the United States is over 13%, the use of the Internet is not more than 3.6%, and the United States is over 40%. On the one hand, this gap in educational philosophy is reflected in the super strong and solid skills of Chinese students. On the other hand, they are not as good as British and American students in asking questions, analyzing problems and designing overall solutions.

The Programme for International Student Assessment (PISA) is an annual test conducted by the Organization for Economic Co-operation and Development (OECD) for 15- and 16-year-old students in math, reading and science and technology. A PISA survey found that Shanghai students spent almost 35 hours of extra-curricular class time per week, more than 10 hours in the United States and Finland. In other words, students in the Chinese-speaking regions have strong math ability and computational ability, but this is at the expense of learning confidence and increasing intensive learning time.

The International Olympic Mathematics Competition (IMO) can be used as an example to see the impetuous atmosphere in the high mathematics field. IMO is the oldest level discipline competition in middle school, with the aim of cultivating and promoting teenagers' interest in mathematics. Many top foreign mathematicians who won the Fields Medal ever shown the excellent performs in the International Mathematical Olympiad Medal in their teens. There are a lot of IMO winners will eventually make great achievements in mathematics, such as Russian / Soviet nine fields medal winner, five won medals IMO; Australia famous mathematician Terence Chi-Shen Tao participated in three IMO, he won the Fields Medal in 2006.

However, a very small percentage obtained awards such as the Fields Medal and the Wolf Prize in subsequent mathematical studies. Among modern international mathematicians, there are only a handful of Chinese mathematicians with Shiing Shen Chern and Shing-Tung Yau. Every year, China has a lot of participation in the IMO, and won the award, but compared with the IMO obtained, China cultivates very few mathematicians. This requires reform in college mathematics education, which requires the elite education in mathematics in the context of mass education.

Chen-Ning Franklin Yang, a Nobel Laureate, believes that China's educational attitude is quite different from that of the United States. The biggest difference is that China focuses on inculcation education. This is an advantage, but there are also disadvantages. Chinese students are always cautious about new things. Compared with American students, their innovative awareness is poor. Chen-Ning Franklin Yang believes that for college students, especially those who are particularly smart to allow him to encourage him to leap forward development.

III. The model of mathematical elite education under the background of mass education

A. Reform teaching tools

In China's university mathematics education, we must cultivate elite mathematics talents and explore elite mathematics education. We must differentiate management between teaching materials and teaching tools. In today's mathematics teaching system, especially in the teaching of advanced mathematics, the difference between teaching materials and teaching tools is not very large. No matter what students are at the level, they use a set of teaching tools to teach. The subject of mathematics is one of the most difficult subjects to learn with its abstractness and complexity. The achievement in the field of mathematics is often the "genius" that has shown the talent very early. And mass education does not match the teaching needs of these "genius". Most of the mathematics teaching materials and teaching management systems cannot promote the development of these elites, and may also have a hindrance. Therefore, we must systematically divide the mathematics textbooks, and add the necessary elective chapters on the basis of mass education, so that elite talents can better develop.

B. Enhance the student's innovative ability

Mathematical innovation consciousness refers to having curiosity about the mathematics phenomenon in nature and society, constantly pursuing new knowledge and thinking independently, discovering and asking questions from the perspective of mathematics, and conducting exploration and research. In mathematics education, students' sense of innovation mainly refers to curiosity, inquiry heart, constant pursuit of new knowledge, independent thinking, deepening, extending or promoting certain theorems and formulas of mathematics phenomena in nature and society. For example, the International Mathematical Contest in Modeling , such as Mathematical Contest in Modeling（MCM）, provides a very good platform for the cultivation of innovative abilities of college students. Unlike everyday classroom teaching, it is easier for students to spark creative thinking in this platform. Therefore, In the process of college mathematics modeling competition, students' innovative ability is improved. The most important way to cultivate the creative ability of college students is practice. In the mathematical modeling competition of college students, students face the real scene of actual problems and improve their creative ability and awareness of innovation in practice.

The rapid development of science and technology has made it difficult for anyone to master or to get involved in many fields of science and technology. If we want to make progress on the basis of existing science and technology, teamwork and cooperation will become an important choice. Mathematical Modeling Contest in modeling is made up of many people to form a team to complete the competition. Therefore, in addition to personality development, it also develops teamwork consciousness. Students fully communicate with each other, be good at listening, tolerant of different opinions, and learn to gain inspiration in the discussion, learn to team together to complete the problem-solving program. To develop a good cooperative consciousness for the students to engage in scientific research in the future.

C. Expand international academic exchange

Implement the development strategy of "going out and inviting in" to train international talents with a global perspective. First, to employ well-known foreign mathematicians to work or give lectures in universities, the

introduction of high-quality international education and teaching resources courses, the most important university is the teachers and students, if there is enthusiasm for mathematics students, if there is no outstanding mathematician to guide, these students may also be mediocre. Teachers are crucial to the success of students. We must also select outstanding teachers to go abroad for further studies so as to speed up the training of the quality of teachers and improve the internationalization of teachers' teams. Second, we have signed cooperation agreements with well-known international majors in universities, exchanged students for exchange. In particular, to match the outstanding students to well-known foreign math colleges to learn. Students in the more cutting-edge academic atmosphere to better stimulate their own sense of innovation, more opportunities to make some significant achievements.

D. Adopt the tutorial system to the undergraduate students

In the cultivation of math talented undergraduates, we can learn from the tutorial system of postgraduate education and give more attention to the gifted and creative elite students. Outstanding professors and associate professors and lecturers are as an undergraduate tutor, elected between students and tutors. Through the establishment of tutorial system, outstanding students can reach out to the frontier knowledge in the field of mathematics earlier and shorten the training period of outstanding talents. Driven by tutorial programs, students will also be able to apply more knowledge they have acquired while stimulating greater interest in learning. The tutorial system training of elite undergraduates can effectively promote the emergence of elite talents. In the process of academic and ideological exchanges between tutors and students, students' academic level and life values are further enriched.

IV. Conclusion

There is no contradiction between elite education and mass education, especially in College Mathematics. In this paper, by analyzing the history and background of the development of mathematics education for elite higher education, aiming at the lack of elite education in China's higher education. This paper puts forward some concrete solutions to elite education under mass education, reforming teaching tools, enhancing the student's innovative ability, expanding international academic exchange and adopting the tutorial system to undergraduate students. Through four specific solutions, it can serve as a reference for the development of elite education in mathematics and promote the organic integration of elite education and mass education.

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