Quality Education and Teaching Mode of Higher Mathematical Education in Liberal Art

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Abstract. Quality education greatly improved higher education of China in the past twenty years. Humanities courses are open to students majoring in science and engineering, science courses are also open to liberal arts majors. However, there are some problems in the science education of liberal arts majors, especially in mathematics education. In order to improve scientific literacy and reasoning ability of liberal arts majors, we need to pay more attention to mathematics education and try some new teaching modes, and then we can achieve the purpose of quality education.

Introduction

In the 1990s, higher education of China has started the process of the quality education, which was focused on cultural quality education. As we know, the purpose of quality education was to develop qualified personnel of the students and which is opposite to examination. In the early 1990s, Chinese middle schools and universities attached importance to science and professional knowledge education, but paid few attention to the humanistic spirit, moral cultivation and interdisciplinary knowledge education [1].

With the increasing reorganization of quality education, the content of quality education has become more and more diverse. Generally, it was believed that higher education should train student with four aspects of quality, namely, ideological and moral quality, cultural quality, professional quality, physical and psychological quality. During the process of quality education reform, Chinese universities have gradually adopted the general education, liberal arts education emerging from western countries and training of scientific research, innovation, entrepreneurship [2]. Compared with the reform of quality education in science and engineering fields, quality education for liberal arts majors has not received enough attention. To be more exact, cultivation of scientific and rational spirits of liberal arts majors has not received enough attention. We believe that it is harmful to the sustainable and healthy development of China.

Mathematics is an effective way to improve scientific quality of students. In China, mathematics education for liberal arts students has been in actual practice for more than 10 years. However, few educational administrators, teachers and arts students attributed mathematics education to category of quality education. At the same time, a new generation of educational technology provides more and more options for mathematics teaching in university, we believe that it is necessary to reconsider the mode of mathematics education in university to meet the requirements of quality education.

Both Humanistic Quality and Scientific Quality are Important

The development of quality education ideology in Higher Education in China shows that the starting point was to strengthen cultural quality of college students. In the 1980s, China's exam-oriented education system was notoriously stressful for students and their families. Lots of people believed that science and engineering education were far more important than cultural education. In order to change this situation, Chinese education departments aggressively advocated
the quality-oriented education. Middle schools and universities were encouraged to teach students how to be a man as well as how to do things.

In the past 20 years, a large number of professional courses in general education have been set up in Chinese universities, including humanities, social economy, natural science and so on [3]. Generally, the focus was on knowledge, but not rational thinking, scientific and creative spirits, especially in the general education of liberal arts. For example, few Chinese universities added college physics, chemistry and computer courses to the course list of arts students. Affected by reducing class hours, some universities even removed math from the course list of arts students. This trend is harmful to the cultivation of scientific quality of arts students.

In the past few years, the opposition to genetically modified crops, chemical industry and communication facilities have been much more overt. Meanwhile, lots of pseudoscientific concepts were popular in health, medicine and other fields, that is, people's science levels needed to be improved, even for those with higher education. According to *The Outline of the 13th 5-year Plan for National Economic and Social Development of China* and *The Outline of the Implementation of the National Scientific Literacy Action Plan (2016-2020)*, China is going to increase the scientific literacy ratio to more than 10%, that is, higher education industry should participate in the work of public science and try to make up for the deficiencies of the scientific quality education of liberal arts. Therefore, quality education in China should focus on both of cultural quality of science and engineering students and science quality of arts students.

**Present Situation of Math Education of Liberal Arts in China**

In China, most of middle schools have humanity and science divisions. This resulted in the lack of science education of arts students. In addition, humanities teachers also did not pay enough attention to logical thinking trains. In fact, Chinese research in arts falls behind foreign advanced level for the lack of quantitative analysis. There would be no chance to catch up with foreign counterparts if Chinese universities continue to ignore science education of liberal arts.

Math education is the main way for Chinese arts students to accept logic thinking and science trains. This is because mathematics is a high abstract summary of characteristics and laws of things, which is very helpful to develop the students’ ability to analyze and solve problems. Moreover, math helps people to understand things with scientific and rational views. The German mathematician Eberhard Zeidler wrote [4]: “Mathematics is an organ of knowledge, man’s mental eye that allows him to venture into areas of knowledge extraordinarily remote from his everyday world of experience.” In fact, one who has not learnt elementary knowledge of college mathematics even cannot understand daily news and events in the correct way.

Math education of arts students should play an important role in five aspects [5], says Gu Pei, a National Teaching Master who is also a professor at Nankai University. Math education helps students to understand mathematics culture and improve their mathematics quality, and arts students also need mathematical tools to solve the problems in their own fields. Math education helps develop students’ abstract and logical thinking, understand beauty of mathematics and establish a perfect aesthetic sentiment. Finally, math education is very helpful to the further study of arts students.

However, for a long time, the math education of arts students does not match the demands of quality education. Part of Chinese universities offer mathematics to meet the requirements of the follow-on classes and postgraduate entrance exam, the others consider math education of liberal art as a burden. In fact, math classes of liberal arts have been neglected or even canceled in some Chinese universities during the past few years. On the other hand, people can find that math courses of liberal arts and engineering are very similar in teaching methods and content by analyzing the teaching materials. This largely explains the attitudes of liberal arts teachers and students toward math courses.

In China, the primary purpose of math textbook of arts is to introduce fundamentals and applications of calculous, linear algebra, probability and statistics, mathematical experiments, operation research [6]. Considering the particularity of liberal arts, some math textbooks provide
historical stories and cultural connotations. For example, legends of mathematicians, the application of mathematics in classical Chinese gardening and music. However, the focuses of these textbooks are still mathematical theory, while the cultural connotation is just a rhetoric frill or ornament and has a small role in stimulating students learning enthusiasm.

**Problem-based Learning and Teaching Models**

The problems in math education of arts student are rooted in people's mind, especially teachers and administrators of liberal arts colleges and teachers who teach liberal arts math. The ideas of the teachers and administrators affect their students and lead to the students’ lack of learning interest. To change the present situation, we must promote the natural science education of liberal arts, including math education, to the level of quality education and face up to the importance of this kind of education to improve the national scientific quality.

Every year, Chinese liberal arts education has carried lots of supernal quality-oriented talents to media industry, cultural dissemination, economic management, administration, education, arts, and so on. Some of these industries seem to have little to do with math. However, there always are connections between the objective things. In fact, arts students will benefit from their experience of math education while they deal with interdisciplinary issues. On the other hand, practitioners of media industry, cultural dissemination, economic management, administration have great influences on public opinion, improvement of the scientific quality of them is helpful to improve civilian science level and curb part of the generation and spread rumors.

Chinese universities are still exploring the approaches to reform of liberal arts math education, therefore it is quite natural to encounter obstacle or difficulty. At present, the math education of liberal arts should shift from knowledge-orientated learning to problem-based learning and improve efficiency by using massive online open courses (MOOC).

We believe that the objectives of math education should be refined according to the different specialties. Some of liberal art majors involve little use of math, and then problem-based teaching and learning would be more appropriate. In this circumstance, the purpose of math education is to training science spirit and thinking rather than knowledge or skills. For others, the problem-based method can be used in conjunction with knowledge-orientated method.

Introducing rich problems is very helpful to encourage liberal arts students to explore solutions, explain their reasoning and justify their solutions [7], says Barbara Glass.

On choosing problems or cases, mathematical model course will enlighten and inspire us. Here problems related to the specialty and social hot and important issues are all perfect, while we need to arrange the order based on the teaching process of mathematics.

On the other hand, problem-based math education of liberal arts should simplify the technique of calculation and accept imperfection of knowledge system. That is, the students learn knowledge around the problems, but not discuss the problems around mathematics. With this method, the students will learn how to analyze and solve problems.

Finally, MOOC is an important complement to classroom teaching. In China, lots of universities are exploring different approaches to use MOOC in general courses [8], all these experiences are helpful to the reform of math education of liberal Arts. By using MOOC, arts students can learn how to understand elementary knowledge and how to use mathematical software to verify the knowledge, while the teachers can spend more time interacting with students in class. This is a method now widely referred to as the flipped classroom.

Applying the method above, liberal arts students will be able to understand the basic logic and idea of mathematics, and then have the capacity to solve some real problems by using rational and logical reasoning.

**Summary**

The objective of quality education is to make up the disadvantages of technical and professional
education and give the students overall development, especially the training of the students’ ability. Therefore, science-engineering students need humanistic education, while liberal arts students need science education, especially math education. This is not about knowledge or skill, it is about logical thinking and science spirit. To this end, we need to change people's mind and promote the natural science education of liberal arts, including math education, to the level of quality education. Meanwhile, problem-based teaching is appropriate to be used to train science spirit and thinking of liberal arts students. Finally, MOOC is very complementary to the problem-based teaching.

References


