A Comparative Study of Chinese and American Calculus Courses

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Abstract. There is a big difference in the teaching objectives, teaching mode, teacher-student relationship and teaching effect between Chinese and American universities in calculus teaching. Through some comparisons and discussions on mathematics teaching between Chinese and American universities, this paper analyzes the different characteristics of the two kinds of university mathematics teaching in many aspects. Some excellent experiences in mathematics teaching, in order to make Chinese university mathematics teaching more effective, give some suggestions on calculus teaching**.**

Introduction

From October 2018 to September 2019, I conducted a one-year visit to the Michigan State University, USA, and listened to a semester calculus course with the class, participated in the correction of the homework and the assessment of the test paper. We found that there are many similarities and differences in the teaching of American calculus courses. Therefore, it is necessary to compare the teaching of calculus courses in two universities, and then map out the commonalities and differences between Chinese and American calculus courses. The reforms helped. Michigan State University was founded in 1855. It is a public university in East Lansing, Michigan, and a state-level comprehensive research university offering bachelor's, master's, and doctoral degrees. Capital University of Economics and Business approved in 1956, it is one of most important universities with speciality in economics and management all over China, also offering undergraduate, master's and doctor's programs. The following is a comparison of calculus courses between Chinese and American universities

Comparison of calculus course teaching

We compare the teaching of Chinese and American calculus courses in terms of class form, teaching qualifications, teaching materials, teaching forms, teaching content, after-school Q&A, and testing forms.

Comparison of class forms. Michigan State University does not teach in the form of a natural class. Instead, students from all majors in the school are jointly selected on the Internet. They choose different levels of calculus according to their own foundation. The number of students in each class is not fixed, at least 5 people. The average situation is around 30. For first-year freshmen, the first semester is not professional, so the students in the calculus class will be subject to different majors in physics, chemistry, mathematics, etc. The points course is divided into 1-5 grades for students of all majors in mathematics and other sciences and engineering departments, and Pre-Calculus courses will be offered in the first semester of the university, mainly to teach elementary mathematics. Relevant knowledge, preparing for the calculus course for those who have a weak primary mathematics foundation after entering the university, while Capital University of Economics and Business is in the class according to the natural class, or 1-2 classes, large class According to the different undergraduate majors, the high number is divided into three categories: A, B, and C, that is,

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the high number of science and engineering, the high number of economics, and the high number of literature and history C. From this point of view, the American calculus class The formation of the level is based on the student's own level, and has nothing to do with the profession. The formation of classes in China is divided into classes.

Comparison of teaching qualifications. The professors of calculus at the Michigan State University in the United States are also taught by full-time teachers in the Department of Mathematics. Most of them are taught by teachers with tenured qualifications (basically with a Ph.D.). The general instructors are equipped with TA, which is the teaching assistant. Most of them are doctoral students, help professors to change exam papers, homework, invigilation, and tutoring students after class. Individual classes also have TA direct classes. Teachers of Capital University of Economics and Business who teach calculus courses have master's degree or above and have middle and senior titles. The full-time teacher of the mathematics department teaches.

Comparison of teaching materials. The classic textbooks of American calculus are mostly "Thomas Calculus"[1,2]. The calculus textbooks in the United States are often illustrated and illustrated in the following aspects: First, the textbooks are well-organized, easy to use, and interesting; second, textbooks are designed for after-school exercises. The coverage is wide, and the layout level is from shallow to deep. The textbooks often arrange many cross-disciplinary topics for students to innovate and study, and are generally common examples in life and graphic problems that are effectively combined with basic concepts and important theorems. There are a lot of exercises in the textbook combined with computer technology, such as letting students use Matlab to write programs and give images of certain kinds of functions, so as to study the various properties of the functions by means of graphics. In the actual lecture, each lecture Teachers are not subject to the unified syllabus, and will increase or decrease the content of the textbooks. The universities in China generally use the "Advanced Mathematics" written by the Department of Applied Mathematics of Tongji University[3], and Capital University of Economics and Business also adopts "Advanced Mathematics" for statistics and engineering, for the economic students to use "calculus" [4]. These textbooks emphasize rigor theoretical concepts, are generally the first theory, to cite an example, to be taught in accordance with the general principles of special. Calculus textbooks there are a number of topics related to economic management major cost problems. Teachers teach according to the general syllabus.

Comparison of teaching styles. Both Chinese and American colleges and universities use traditional board books to assist in computer teaching. Many teachings in the United States use learning groups to learn cooperatively. Teachers can report on certain aspects of the problem according to the situation, such as summarizing the methods for seeking limits. Etc. Teachers of Capital University of Economics and Business also added multimedia teaching during calculus teaching, which enriched the teaching resources. However, due to the large capacity and speed of multimedia courseware, students are easily indigested, which is not conducive to students' development of creative thinking. Multimedia teaching is used as an auxiliary means. For example, when explaining the definition of points, multimedia teaching is used to enhance the intuitiveness and image of the teaching, which makes it easier for students to understand. Compared with the teaching form, American colleges and universities pay attention to students' practical ability. Chinese colleges and universities focus on the ability of students to accept.

Comparison of lecture contents. American universities have characterized calculus courses as experimental science courses, emphasizing practical problems, practical operations, and discovery-based learning. In the process of calculus teaching, the application of new technologies has been strengthened, such as CAS, using computer to show the relationship between function variables and describing images. Exercise, giving three-dimensional space three-dimensional graphics, revealing various methods such as concept formation process, making classroom teaching more clear. Our school's calculus teaching is based on basic teaching, emphasizing that calculus is the basis of various science and engineering studies, students should focus on mastering basic knowledge. Emphasis on the application of mathematics has a focus on different majors, and specific application

and application. For example, undergraduates of the School of Economics and Management have increased many material costs and best benefits when learning calculus. Applying the topic to practice, not only highlights the close relationship between mathematics and professional courses, but also shows the importance of learning mathematics. Compared with the emphasis on thinking innovation in American teachers, Chinese teachers mostly originate from traditional teaching concepts and attach importance to theoretical teaching. And the method of problem-solving, pay attention to the test, such as the focus of the requirements for students to take the postgraduate exam explain

Comparison of questions and answers after class. After-school in America follow-up is very perfect. After each lecture, there are half an hour of after-school Q&A. Students usually go to the teacher's office to ask questions, or give their own opinions on certain issues. The answer to the integral course is basically a question and answer. After the chapter is over, the class will be arranged to answer questions. There are many teachers who also set up the class WeChat group, and also answer questions in the group. Compare the effect of Chinese and American students' questions and answers, set a specific time. Answering questions can inspire students to think about problems and follow up with the class.

Comparison of test forms. The American school calculus operation is controlled by a complete computer system. Students answer questions on the system. Each class can show the time for students to complete the homework. After the teacher corrects the homework, the system can automatically count the student's score rate, so the teacher can be very good. Master the progress of the students. American teachers basically do a small test in the content of each chapter, and these test scores will be included in the final test scores. The test of our school is basically based on the test and the final two exams. There are a large number of students, and the amount of grading teachers in our school is very large. It is basically a correction in each chapter. Obviously, the detection form of the calculus course in the United States is more convenient, but in view of the large number of students in the calculus course in China, a large number The test will increase the workload of teachers, but the method of online answering in colleges and universities in the United States is worth learning.

Conclusion

After years of development, our calculus teaching has formed a relatively mature teaching material and teaching mode. The calculus teaching also strengthens the computer-assisted teaching and attaches importance to application innovation. But compared with the calculus teaching in American universities, we still have a lot of worthwhile. The places borrowed, such as the rational placement system, the reform of teaching materials, the degree of freedom of teachers in the teaching process, and the modernization of American calculus teaching test, are worthy of our exploration and practice in the future calculus teaching reform.

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References

[1] George B. Thomas Jr., Maurice D. Weir, Joel R. Hass, Thomas’ Calculus, 13th Edition, Pearson Publishing Ltd, 2014

[2] James Stewart, Calculus, 5th Edition, Thomson Learning, Brooks Cole, 2003.

[3] Department of Mathematics in Tongji University, Higher Mathematics, 7th Edition, Higher Education Press, Beijing, 2010.

[4] Rubin Sui, Gang Wu, Xingyun Yang, Calculus, 2nd Edition, Science Press, Beijing, 2012

[5] Chuanda Qi, Juan Wang, Junjie He, Yuefen Chen, College Mathematics for Liberal and Arts Specialty, Science Press, Beijing, 2014