

The Problems and Solutions of Talent Cultivation in Experimental Class

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Abstract: The training mode of "experimental class" refers to the special training of a small number of students. Dating back to the "Junior Class" before the reform and opening up, the experimental class has been through more than 40 years. So what are the problems of the experimental class at present? On the basis of the reform background and development process, the status quo and problems of experimental classes are analyzed and summarized from the aspects of objectives, curriculum, teaching methods, scientific research and practice, assessment and external environment, and suggestions are put forward for current mechanism of the experimental classes.

Introduction

Innovation is the soul of a nation and the driving force for a country's prosperity and development. The key to innovation lies in talents and that can be realized by education. General Secretary Xi Jinping once said, "It is necessary to strive to become the major center of science and innovation over the world." [1] It is not only a new requirement put forward by the science and technology, but also for the field of higher education, the reform of which is the demand of the development of economy and society. The experimental class is undoubtedly an important innovation and breakthrough in higher education. The training mode of "experimental class" refers to the special training of a small number of students. The special classes like "innovational class", "experimental class", "all-English class" and "excellent class" nowadays can all be called "experimental class". Dating back to the "Junior Class" before the reform and opening up, the experimental class has been through more than 40 years. Is there any obstacle in the experimental class at present? If so, how can we break through the barriers for further development?

Reform Background of the Experimental Class

The Response to the Country's Appeal to Cultivating Talents

At the end of the "Cultural Revolution", the nation is facing a severe situation that everything ends in ruin and the society is needed to be reconstructed, under which a large number of talents are needed. In order to adapt to the situation of cultivating talents quickly and early, in March 1978, the "junior class" is first established in the University of Science and Technology of China (USTC) after an elaborate preparation with the suggestions of many celebrities and the support of the leaders in the country. USTC has become the first university of the cultivation of junior college students and taken an extremely important step in exploring new training modes of talents. [2] It is regarded as a major reform and innovation in the history of higher education over the nation and an educational experiment with the strategic significance of rejuvenating the country through science and education. Later, with the strong support and extensive attention of the whole society, the junior class has had a great influence throughout the country and has become a place that youngsters in the whole country strive for.

The Need That Dissolves Homogeneous Talents Training

From the beginning of the expansion of universities in 1999, by 2005, higher education has basically entered the stage of mass education. Due to the development of the economy and

technology, the demand for various talents is becoming more and more pressing including innovative talents, compounded talents, globalized talents and so on. Universities must not only meet the need of the great majority of people attending colleges, but also take the responsibility of transferring talents to various walks of life. However, while cultivating a large number of high-quality talents, the quality of talents tended to be converging gradually.[3] First, the training objectives and training programs are converging, and similar courses and materials are used. Secondly, professional education is deeply rooted and the intersection and integration of disciplines is deficient. Third, talent training focuses on theoretical teaching, ignoring the cultivation of practical ability. Relying on a small class such as the experimental class to carry out the reform of talent training, it can reduce the risk of reform by taking advantages of the school, thus selecting and cultivating the talents that the society really needs.

The Inevitable Trend of Student Source Competition in Universities

“Research Universities” and “Innovation Classes” have become a trump card for admissions promotion in some universities. Many “985” and “211” universities have positioned themselves as research universities. Some local colleges with weak academic powers have also transformed to research universities in order to strive for excellent students and improve their reputation and competitiveness, while colleges with strong professional characteristics are also busy upgrading themselves through the “college degree upgrades to bachelor degree”. Only the research university can cultivate talents seems to be a consensus. The innovation class in research universities is the best of the brightest. The “innovation class”, the “international class” and the “excellent class” have become the cradle of talents. Therefore, the experimental class has become an important means for universities to attract high-quality students, which has prompted other universities to follow suit.

The Development of the Experimental Class

Junior Class

In the early days of the new establishment of China, in order to cultivate a large number of professionals to restore the domestic economy quickly, higher education system in China imitates the professional education model of the former Soviet Union—planning enrollment, professional education, and job assignment. Although this kind of training mode, to a certain extent, has relieved the urgency for talents in social development. However, with the development of economy and society, the talent training mode under this specialized education is not compatible with the development of economy and society. China's demand for talent has become diverse. Therefore, in March 1978, a junior class was established in the University of Science and Technology of China (USTC). The purpose of the class is to cultivate outstanding figures in the fields of science and technology and promoting the development of education and economy. In 1985, on the basis of absorbing the successful experience of the junior class, a “experimental class of teaching reform” (so called the experimental class) was established in USTC. Due to the successful case of junior class, the Ministry of Education immediately asked 10 universities including Peking University and Tsinghua University to discuss matters related to the juvenile class. In January 1985, the Ministry of Education officially issued a document in which junior class was set up among 12 universities.[4]

International Mathematical Experimental Class

With the in-depth development of reform and opening up, international talents have increasingly become an urgent need for the development of economy and society, especially for compound talents with cross-disciplinary background and international perspective. In order to cultivate a compound talent with an international vision and cross-disciplinary background to reserve high-quality talents for country, the experimental classes started an international integration attempt. In 1996, Professor Zou Hengfu, founder of the Center for Advanced Studies in Economic Science at Wuhan University, Ph.D. in Economics at Harvard University, and Senior Economist at the World Bank, proposed a program for recruiting undergraduates majoring in mathematical

finance and mathematical economics, and international mathematical economics and finance experimental class were established.[5] The International Mathematical Economics and Finance Experimental Class in Wuhan University is the first experimental class in China to cultivate economics and finance talents in an international way. The experimental class uses a new version of foreign English textbook and hires the world's top experts and professors in economics, management and other fields to give lectures. The students in this class accept the knowledge of finance, mathematics and English at the same time, and become a real high-quality professional talent with international vision. The mode of new internationalization and cross-disciplinary talent training established by the Mathematical Economics and Finance Experimental Class has become an important innovation in higher education, and provides valuable lessons for other universities in China on the exploration of experimental class.

Top-notch Plan and Excellent Plan

“Why does our school always fail to cultivate outstanding students?” This is a question raised by Qian Xuesen and later became the famous “Qian Xuesen’s question”.[6] This is a serious question about the development of education in China. In order to train high-quality students, and also in response to Qian Xuesen's question,

National Initiative on Top-notch Student Cultivation in Math and Science (so called Top-notch initiative project) is launched in 2009 by the Ministry of Education with the Organization Department, CCCPC and the Ministry of Finance.[7] The purpose of this project is to cultivate country’s academic masters. The Ministry of Education at first has selected five disciplines in 20 universities including mathematics, physics, chemistry, information science and biology, and aims to make breakthroughs in the cultivation of students. Since the implementation of the plan, these 20 universities such as Tsinghua University and Peking University have made efforts to innovate, having formed an effective mechanism in selecting top students, teaching students according to their natural ability, attracting academic masters, and strengthening international training.

Since the founding of China, especially since the reform and opening up, higher engineering education has made great achievements. In 2010, the “Excellent Engineer Education and Training Program” (so called the “Excellent Plan”) is launched, aiming at cultivating a large number of high-quality engineering and technical talents with strong innovation ability who can adapt to the needs of the development of economy and society.[8] In 2018 the “Excellent Plan 2.0 is started, which puts forward higher requirements for the university to continue to deepen the reform of engineering education

Research Design

Research Questions

What are the obstacles in the development process of experimental class? This research attempts to explore the problems of experimental class in talent training by retrospectively the experiences of learning and working of students and teachers. The interviews were designed to motivate respondents to naturally express their feelings about the curriculum, teacher structure, teaching methods, assessment and evaluation, etc., and it is not systematically designed for the problems of the experimental class. The research questions are as follow:

(1) How does the experimental class affects your' life? How do you enter the experimental class? Is there a uniform test for before entering the class? How do you adapt to the experimental class at the very beginning? What have you learned in the class? What role does it play in your development.

(2) What kind of teaching staff is equipped in the experimental class? How does teacher's research ability and teaching ability? What’s the number of foreign teachers in the teaching staff? Which countries are they from? In addition to the courses, are there any professors to be hired to give lectures regularly? Does the class provide you with the opportunity to study abroad? How often do you participate in research competitions? What’s the teaching method in the class? What is

the number of non-professional courses in the class? What is the type of the courses (art, history, social sciences, etc.)? How does the class assess the ability of students? What is the proportion of various assessment methods? Are students satisfied with the resources provided by the class and the training model? Are there any suggestions about the class?

Research Objects

A total of 8 students and 2 teachers from the School of Mechanical and Automotive Engineering and the School of Civil Engineering and Transportation in South China University of Technology were interviewed. South China University of Technology (SCUT) is one of the first universities to be selected in the “Excellent Engineer Education Program”. Since the beginning of the “Excellent Plan”, SCUT has carried out engineer education, cultivating outstanding talents, and has rich experience in training high-level engineering students, especially the School of Civil Engineering and Transportation. The school began the training of international engineers as early as 2009, which has been around for ten years. The students surveyed include undergraduate students, who come from all-English class and bilingual class, and graduate students. The teacher interviewed was the teacher of the class.

Problems in the Experimental Class

Abnormal Curriculum

First of all, the current curriculum of the experimental class failed to balance the difficulty of courses and the level of understanding of students. The excellent bilingual class uses the new foreign version of textbook. However, due to the various English listening and speaking ability of the students, in order to take care of the understanding ability of all students and the level of English listening and speaking, the teaching will be generally simplified, and the simple English phrases and sentences are used instead of the complicated ones. For students with solid foundations, the level of the curriculum is simple, and the content that students really want to learn is not covered in the classroom, which still takes a lot of spare time to study. For students with relatively weak basic skills, the low level of knowledge of the course is more harmful for their follow learning. Students with poor foundation may spend double efforts learning further. Secondly, an outstanding student needs not only professional basic knowledge, but also the knowledge of culture and art, the knowledge of psychology and the knowledge of logical thinking. According to the survey, in the optional courses of the experimental class, the courses in the humanities and social sciences accounted for a relatively small proportion. The optional courses in the humanities and social sciences such as linguistic courses, the courses of Chinese and foreign culture, the courses of art, etc, are exactly what the students need. The accumulation of basic knowledge is a process like building a house, which is grounded in solid foundation. However, the current curriculum of the experimental class only provides courses in the areas related to the major, seldom involving the courses of other fields, which is particularly unfavorable for the accumulation of students' basic knowledge.

Unreasonable Teaching Team

The foreign teachers of the experimental class account a small proportion, and the structure of the teaching staff is very unreasonable. There are only 1-2 full-time foreign teachers in the excellent bilingual classes, and some classes even have only one full-time foreign teacher. The vast majority of bilingual courses are taught by domestic teachers. Bilingual courses, as the name implies, are special courses taught by two languages (usually Chinese, the domestic one, and English, the foreign one), which are reasonably taught by teachers who are proficient both in Chinese and English. However, the English level of the domestic teachers who gives a bilingual course is generally not very high. Therefore, when teaching in bilingual, Chinese is used more often than English. What's more, according to the training objectives of the excellent bilingual class, it is not enough to train students' international vision only by 1-2 foreign teachers. The frequency of inviting

famous international scholars to give lectures, about 1 or two times a semester, is relatively low. In the case of such a teaching staff, how to promote the exchange of knowledge between East and West has become a severe problem. Moreover, those full-time foreign teachers usually come from Asia and Africa, and there are almost no full-time foreign teachers from Europe and America. Therefore, it is a serious problem how to cultivate students' international vision.

Insufficient Funding

At present, the funds for all kinds of experimental classes in universities are the highest among all students, because of the highest standards of the teaching hardware and teaching staff. For example, for a bilingual class, it requires a lot of money to invest in sophisticated laboratory equipment and experimental equipment. Secondly, the universities regularly hire well-known scholars from home and abroad to give lectures, or arrange for young teachers to study abroad, which also adds to the financial burden. Thirdly, in order to cultivate outstanding professionals with international vision, it is necessary to send outstanding students for academic exchanges. All of this adds to the financial burden of the universities, and the main source of funding for higher education is government financial appropriation. However, due to the large population of students and the long-term shortage of education funding, especially higher education funding in China, the great difference of the expenditure per student with developed countries affects the quality of higher education and seriously restricts the development of the experimental class. According to the students in the excellent bilingual class, the students in the experimental class all have the opportunity to participate in some Sino-foreign cooperative programs or exchange programs with foreign famous school, but some of them should pay by students themselves. Some students give up the opportunity to exchange abroad precisely because of the high expenses. This also reflects the insufficient education funding, which affects the student developments in experimental class.

Deficient Awareness of Innovation

At present, students' awareness of innovation in experimental classes is deficient. As mentioned above, when asked what assessment methods are acceptable, students still considered that examination and papers are better assessment ones. The traditional assessment method is deeply rooted in the students' mind, and the innovative thinking is seriously deficient. What's more, students are in a state of passive innovation with a weak awareness of active innovation. According to the results of survey, students are not very concerned about the research projects and topics, and most students are confused about their research interests and directions. For the research competitions on and off campus, a considerable number of students participate in the competitions under the arrangement of teachers. Few students really take the initiative to participate in the research competition. The current experimental class hopes that students' innovation ability can be improved by arranging students to participate in research competitions and research projects. This is not an effective way to improve students' innovation ability. It will be a fruitless attempt to improve students' innovation ability not by promoting their awareness of innovation.

Suggestions of Student Cultivation in Experimental Class

Adjustment of Teaching Team and Improvement of Teachers' English Ability

Universities should adjust the structure of the teaching staff and increase the proportion of foreign teachers. The selection of foreign teachers should not be confined to the Asian and African regions. The source of foreign teachers should be expanded and a certain number of full-time foreign teachers from Europe and the United States should be hired. Importantly, international high-level teachers and world-wide famous scholars should be hired as part-time teachers, giving professional courses. However, increasing the proportion of foreign teachers still cannot solve the problem of low level of foreign language among domestic teachers. To solve the problem fundamentally, we should promote the development of teachers themselves. The experimental class should cooperate with the teacher development center to regularly organize the training of foreign

language ability. At the same time, the universities should support the overseas study of young teachers, which can not only improve the overall foreign language level of the teaching staff, but also promote the knowledge renewal of the teachers themselves, and can significantly promote the exchange and integration of professional knowledge between the East and the West.

Coordination with Difficulty of Courses and Understanding Abilities of Students

How to coordinate the difficulty of the course and the level of student understanding has always been a problem in education. The selection of the students in bilingual class is based on the level of the college entrance examination and the level of English test organized after enrollment. The English test is only a written test, without covering the part of listening and speaking. Therefore, the students' listening and speaking ability and English communication ability are not reflected. When the teachers are teaching in English, even if the knowledge can be understood by the students visually, the content presented by the hearing is not easily accepted and understood by the students. Therefore, when the teacher teaches in whole English, the course is often simplified in order to take care of all students' English level. The uneven listening and speaking ability of students' English makes it difficult for the curriculum provision. Therefore, the experimental class needs to redraft the selection plan of students. To entering the excellent bilingual class, students should not only finished the professional examinations, but more importantly, their English proficiency should be strictly assessed, especially the assessment of students' English listening and speaking ability. Therefore, the experimental classes must carefully select the appropriate selection plans.

Increase of Education Funding

The investment in higher education mainly comes from government expenditures. Only when sufficient funds are invested can bring more high-quality and rich teaching resources to the experimental class. First of all, we should increase the intensity of government funding for the experimental class. Government should not only invest in talent training and scientific results to encourage teachers and students to conduct scientific research, but also should increase the personal subsidies and rewards for papers and other scientific results. Second, it is significant to prepare for the establishment of the experimental class foundation. Like the Harvard University Foundation at Harvard, the Foundation effectively compensates for the lack of government funding. However, the establishment of an education foundation requires a dedicated operations team and technical support. Meanwhile, how to establish a monitoring system to monitor the operation and use of foundation funds is also a major problem. Thirdly, we should attract the efforts of all sectors of society to broaden the channels for social donation. The government should emphasize the role of social donations in the financing of education in the whole society. It should appeal to enterprises and individuals to join the team of social donation for education funding, thus improving the social donation system.

Emphasis on the Unfairness of Experimental Class

In reality, the fairness of the experimental class is questioned. However, "fairness in higher education is not the equitable distribution of educational resources or the equalization of opportunities, but whether it provides appropriate education for each youth to realize value of oneself." The "experimental class" model refers to the special training for a small number of students. The so-called special training requires more educational resources. If the experimental class and the ordinary class are to be measured by uniform standards, then there is no necessity for the experimental class. And when the experimental class is equipped more abundant educational resources, better teachers, more policy inclinations, etc., more excellent talents and more abundant scientific output should also be seen. The public should clarify that the purpose of the experimental class is not to select students, but to increase students' opportunity, an exploration of talent training.

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