

Research on the Path of Interdisciplinary Training of Talents——Based on the Comparison of MIT and Universities in China

Ting Lyu^{1, a}, Meng Zhang^{2, b,*} and Jianrong Huang^{2, c}

¹Institute of Higher Education, South China University of Technology, Guangzhou, China

²Social Work Research Centre, South China University of Technology, Guangzhou, China

^alvting233@163.com, ^{b,*}mengzh@scut.edu.cn, ^cjrhuang@scut.edu.cn

Keywords: MIT; Interdisciplinary; University

Abstract: Today, the concept of cultivating talents by interdisciplinary has become the consensus of higher education all over the world. As a “leader” in interdisciplinary, MIT has accumulated a lot of experience in training talents. This study summarizes the beneficial experience of MIT in training talents, and compare it with some universities in China to find the best way to develop interdisciplinary talent training on their own.

1. Introduction

Discipline, usually defined as teaching subjects. It is a system of some basic element, such as education purpose, school mission and so on. There are some similar vocabulary about interdisciplinary, such as cross-disciplinary, cross-science, transdisciplinarity. It also refers some keywords: 1) multidisciplinary, juxtapose two or more disciplines but do not integrate with each other. Each of these disciplines generates its own specific results, and integration is left to third-party researchers, multidisciplinary is low-level research that uses knowledge from multiple disciplines^[1]. 2) transdisciplinarity is knowed as the scientific integrated research form. Transdisciplinary research usually involves a series of related scientific knowledge methods which is a high-level and unified study without disciplinary boundaries.

It is not difficult to find that discipline is a kind of knowledge system that is artificially divided. When solving practical problems, it may be difficult for single discipline knowledge to solve complex and changeable practical problems. Therefore, interdisciplinary came into being. Since the last century, many well-known universities abroad such as MIT and Harvard University, have successively put forward the new concept of cultivating talents. In China, Peking University and Tsinghua University have also proposed to train interdisciplinary talents to meet the needs of society for high-quality and diverse talents. MIT has accumulated rich experience in running both undergraduate and graduate students, which is worthy of reference for some universities in China.

2. Overview of MIT Interdisciplinary Talent Training

MIT is committed to creating, disseminating, and preserving knowledge so that students can meet the challenges of 21st century and be better to serve their country and the world^[2]. Under the concept of cultivating outstanding talents, MIT has carried out many interdisciplinary education practices and has formed a complete set of interdisciplinary talent training systems. In present, MIT has a total of 6 interdisciplinary bachelor degrees and 17 elective courses for undergraduates; 15 postgraduate joint training programs for graduate students.

3. Characteristics of MIT Interdisciplinary Talent Training

MIT interdisciplinary has some outstanding characteristics in the training of talents, which is worthy of reference for some universities in China. There are two main points below:

First, interdisciplinary activities flow across faculties, universities and society, not just within or among faculties. It is often expressed in some aspects below:

(1) The inter-faculty flow is reflected in the fact that MIT has a total of 5 universities and 30 majors. Each of them has a certain degree of autonomy to form a school-level unit. For example, the Massachusetts Institute of Technology's Global Operations Leaders course for graduate students, also known as the LGO program (Leaders for Operation Program), is a collaboration between the Massachusetts Institute of Technology School of Engineering and Sloan School of Business. The aim is to cultivate leaders for the world's top manufacturing and operations companies.

(2) MIT is also actively cooperating with other school. Harvard-MIT Health Science and Technology or the Whitaker College of Health Sciences and Technology, for example, is an inter-academic academic department of the Massachusetts Institute of Technology's Medical Engineering and Scientific Research Center. It is co-founded by Harvard Medical School and MIT, and aims to promote biomedical personnel from both universities to solve human health problems in an interdisciplinary manner^[3].

(3) MIT also actively cooperates with other institutions outside the school, in order to strengthen students' practical ability and improve social competitiveness. For example, MIT has launched a joint project with the Woods Hole Oceanographic Institute for graduate students. Students can participate in the daily cruising activities of the Woods Hole Oceanographic Institute, etc. After completing the corresponding courses, they will get a PhD degree diploma. In addition, the project allows students from other universities, such as Harvard and Boston University, to participate in the project, which should be broadened.

Second, interdisciplinary activities flexible credit system gives students full autonomy. MIT offers two types of interdisciplinary programs for undergraduates. One is degree course, and the other is elective course. There are 17 elective courses for undergraduates, and all of them will provide students with in-depth understanding and expertise in areas outside their majors. These Students are able to face complex social issues independently. The credit system is relative to the academic year system. It is not a measure of time but a unit of teaching management. Students can graduate after completing certain credits. This requires universities to provide a large number of elective courses as well as teachers to meet the different choices of different students. It is so flexible that it can broaden diversification of students' knowledge structure.

Besides, MIT has further demonstrated its ability to train graduate students by interdisciplinary in some other aspects: open selection concepts of talents, flexible curriculum settings, guidance services throughout, systems scientific research training, perfect funding system, etc^[4].

4. Limitations of Universities S in Chinese Interdisciplinary Talent Training

Although interdisciplinary talent training in China started late, quite a lot universities have attempted to make some changes, of which Peking University is the backbone. Peking University began to implement interdisciplinary talent training in the early 21st century, and it established 12 interdisciplinary categories for both graduates and undergraduates.

There were some limitations, first of all, in terms of course construction, MIT has supported elective and degree courses for students to choose from. Both courses have clear implementation plans so that students can choose individually according to their actual needs. In contrast, universities in China like South China University of Technology, there were only 13 elective courses distributed in 7 colleges for students in September 2017. The courses mainly involved some professional and practical courses, such as business English, accounting, computer science, and technology. Secondly, in terms of disciplinary boundaries, there are obvious disciplinary boundaries in Chinese universities. Interdisciplinary studies can only be conducted in a limited number of disciplines, which hinders the smooth progress of interdisciplinary education. For example, MIT has only five colleges (School of

Architecture and Planning, School of Engineering, School of Humanities and Social Sciences, MIT Sloan School of Management and School of Science) with more than 30 majors, while South China University of Technology has 27 colleges and more than 120 majors while there are too many departments. As a result, interdisciplinary studies can only be carried out in a limited number of departments and cannot be promoted as a school-wide activity^[5]. Thirdly, in terms of training goals, MIT has great confidence in the interdisciplinary talents it cultivates. The goal is to cultivate leaders for the world. Their slogan is building the culture into the architecture; while the training of talents in China started late. At present, training of comprehensive talents can only be taken as the training goal.

Therefore, compared with MIT, Chinese universities still have many obstacles in the training of interdisciplinary talents. First, knowledge barriers. There is a certain gap between knowledge levels of different disciplines in the same university, which will affect the establishment of interdisciplinary disciplines. The second is organizational obstacles. Chinese universities, especially comprehensive universities, use a "school-faculty-department" structure. Teachers, students, and researchers are restricted to a single discipline and curriculum system. The third is the obstacle to consciousness and ability. What is needed for interdisciplinary research and training of talents is that researchers have a strong sense of knowledge output and knowledge input, so that knowledge can be transferred in different disciplines. However, most researchers in Chinese universities are too independent to cooperate. Fourth, cultural barriers. The occurrence and realization of knowledge transfer in interdisciplinary research is based on mutual trust between two parties or even multiple parties. However, the current research in Chinese universities generally has small, scattered, and closed problems. The specialty is too narrow for skills training^[6].

In addition, there are problems such as institutional barriers consisting of rigid personnel systems and evaluation systems, management systems based on disciplinary differentiation, and resource barriers caused by "standardism" in degree evaluation. And for the training of interdisciplinary talents in engineering universities in China, it is especially urgent to strengthen the construction of interdisciplinary courses and highlight the basic position of humanities in the discipline.

In summary, compared with MIT, Chinese universities still have many deficiencies in the process of building an interdisciplinary talent system. The main manifestations are: (1) have not a long history; (2) have not curriculum structure system completely; (3) have not an ambiguous positioning and focusing only on the integration of the subject curriculum; (4) have not concepts in training talents.

5. Conclusion

(1) Actively promoting concept change and establish the concept of interdisciplinary talent training

The change of concept in interdisciplinary involves multiple subjects. First of all, senior management departments in universities should strengthen communication and cooperation. Breaking the barriers among subjects divided by traditional system of disciplinary, universities, universities and departments. Each department should play their own role, strengthen management, raise awareness, and rationally allocate resources within the universities to maximize the benefits of education, society and economy. At the same time, focus on the development of students. All students should be considered first and the actual needs of students should be taken into account when formulating rules and regulations. For example, Yuanpei of Peking University is known as the "Shenzhen Special Economic Zone" of China's higher education reform. It trains high-quality talents with patriotic feelings, innovative and practical abilities, and leading roles in various industries. The enrollment of Yuanpei is different from other universities. Regardless of majors, students in lower grades can choose Arts or Science and their own courses. In addition, they can arrange thier knowledge structures within the disciplines of the universities under the guidance of their tutors and independently choose majors in each specialty of each department. In 2014, the leader in interdisciplinary education-Professor E Weinan of Princeton University, served as the dean of Yuanpei, also demonstrated Peking University's determination to cultivate interdisciplinary talents.

(2) Reforming student training methods and promoting cooperation and exchanges among disciplines

First, take the selection and appointment of mentors seriously and promote tutorial system

To achieve the goal of cultivating talents by interdisciplinary, it is mainly about the reform of training methods. Chinese universities mostly adopt a tutor system for the cultivation of graduate students. Therefore, strict selection and appointment of tutors is particularly important. The quality of tutors determines the quality of students. A high-quality and experienced tutors training team is the fundamental guarantee for graduate students. Compared with traditional tutors, interdisciplinary trainers need to have stronger diathesis. Yuanpei of Peking University has carried out a full range of tutoring systems, including tutors, professional tutors, full-time tutors and extracurricular tutors. Each type of tutor is responsible for different tasks. The university's tutor team has played a great role in the development of Yuanpei, especially in the selection and adaptation of freshmen. Professional tutors will establish a full system for each professional direction. This team of tutors will be responsible for the development of the teaching plan for the major, and provide further guidance for students in the major. The full-time tutor is usually a retired professor, and its office is located in the Yuanpei student dormitory building. Extra-curricular tutors will provide students with multi-angle tutoring and support for students' scientific research practices and career planning. Pay attention to students' learning and life from all aspects.

Second, create an interdisciplinary cooperation platform and promote communication among disciplines.

According to the actual situation of Chinese universities, multi-disciplinary research centers can be established, such as a research groups, or a small group structures formed around a topic. Universities should try their best to overcome the obstacles among universities, departments, and majors. They should also cooperate in depth with each other, truly share educational resources and cultivate interdisciplinary talents better.

Acknowledgements

This work was supported by Special Fund for Publicity and Cultural Talents in Guangdong Province (N4160210), 2015 Special Funds for Fundamental Scientific Research Business Expenses of Central Universities (2015ZDXM12)), and 2014 South China University of Technology Higher Education Research Fund Project (gj2014011).

References

- [1] C L Palmer. *Work at the Boundaries of Science* (Kluwer Academic Publishers, Netherlands 2001). Reference to a chapter in an edited book:
- [2] Information on <http://catalog.mit.edu/mit/overview/>
- [3] Information on <http://www.pku.edu.cn/academics/index.htm#6>
- [4] Y.D. Zhu, Z.G. Zhang and Y.J.Ye : Characteristics and enlightenment of MIT's cross-disciplinary postgraduate training, *J. Research in Higher Education of Engineering*. Vol. 2 (2015), p.134-138.
- [5] Information on <http://jwc.scuteo.com/jiaowuchu/cms/index.do>
- [6] W.P. Zhao, M. Wu, A.M. Wang: Obstacles and Countermeasures of Interdisciplinary Research in Chinese Universities, *J. China Electronics Education*. Vol. 3 (2007), p.6-10+32.