Based on the Perspective of Transfer Learning and Future Fusion: The Combination of Teaching and Research

Taking China as an Example

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ABSTRACT

It has always been a difficult problem to emphasize research and neglect teaching. The evolution of grassroots academic organizations and two international authoritative academic career surveys illustrate the severity of this phenomenon further. Combining the essential differences between teaching and research and the excellent policies of the United States and Germany, this article regards balancing teaching and research as a model, and proposes suggestions from a new perspective of transfer learning and future fusion, to realize the interactive embedding of teaching and research and to give play to dual function with scientific research.

Keywords: Teaching and research, Essential difference, Transfer learning, Future fusion.

1. INTRODUCTION

China's "Higher Education Law" clearly stipulates that modern universities have three major tasks: teaching, research and social services. Whether the public opinion caused by the appointment of "teaching professors" in universities, or the former dean of Harvard University Harvard University, Harry Lewis once mentioned that "Universities attach importance to graduate education, market fame and wealth, but despise undergraduates, teaching and the cultivation of students' moral character. They forget that the latter is the soul of the university." [1], both reflect that balancing the relationship between teaching and research has always been a difficult problem.

The increase in frivolous courses and the decline of classroom quality and cramming education have become the synonyms of some schools. However, these schools have repeatedly won the crown of research. The phenomenon of emphasizing research and neglecting teaching has become an indisputable fact. What causes this phenomenon? There is a general explanation: Research is playing a more important role than teaching when teachers are promoted. At the same time, research can bring a higher reputation and more financial support to the school. Then why are the countermeasures proposed for those reasons generally not helpful? Professor Xiao Liu from Nanjing University believes that "what really affects the choices of college teachers is based on the quality of the teaching and research trainings, which they received at the graduate level. This is a choice based on ability perception." Professor Zhentian Liu of Renmin University of China believes that unknown, curiosity, and clear purpose are the inherent attributes of research. Therefore, universities must return to the teaching-oriented model and need to re-understand teaching to obtain essential characteristics consistent with research.

2. THE DEVELOPMENT PATH OF CHINA'S GRASSROOTS ACADEMIC ORGANIZATIONS: THE TRANSFORMATION OF EDUCATIONAL INSTITUTE TO RESEARCH INSTITUTE

2.1 The Development of Teaching Institute

The teaching institute of a university is a grassroots organization that undertakes teaching and scientific research. It is a product of the Soviet Union's higher education model and extracted from the national conditions of education in my country. Generally, it is based on the courses or majors taught by teachers, and its activities mainly focus on organizing teaching and conducting research on teaching content and teaching methods. To give full play to the scientific research role of universities, To give full play to the scientific research role of universities, the first step is to build a grassroots teaching organizations.

The development of teaching institute has roughly gone through four stages. The first stage is the Start-up Period (1949-1954), a period of rapid establishment and development of the teaching institute system in China. The second stage is the Stereotype Period (1955-1965). During this period, the teaching group as a form of teaching organization and teaching research system basically took shape in Chinese universities. At the same time, the administrative functions of the teaching group of universities have become increasingly apparent. The calculation of the workload of teachers, the evaluation of scientific research achievements, and the issuance of salary and food coupons are also carried out through teaching institute. The third stage is the Recovery and Transition Period (1978-2000). During the Cultural Revolution, teaching institute was destroyed, and the restoration of teaching institute became the primary task of reorganizing the school order. After the restoration of teaching institute, the teaching quality of universities was guaranteed, and teaching institute began to transform into a research institute and research center. The fourth stage is the Blurring Period (2001-present). During this period, the position of teaching institute in the school's teaching management was gradually marginalized, and its positive function was ignored by related policies.

2.2 The Development of Research Institute

The research institute takes scientific research as the core, projects and research fields as the starting point, and strives to complete higher education knowledge production. In 2004, the Office of the Ministry of Education defined the concept of higher education research institutions, "higher education research institutions are under the leadership of education administration departments and institutions of higher education. Educational scientific research units are responsible for the research on the theoretical and practical issues of higher education reform and development, provide decision-making consulting services for education administration departments and higher education institutions, and promote the organization of cadres and teachers to carry out mass higher education scientific research and other tasks. Among them, "higher-level and stronger higher education research institutions are also responsible for cultivating specialized talents for higher education research and management, and building and developing higher education disciplines."

The research institute started as the "Higher Education Research Office" established by Xiamen University in 1978. With the "recovery and reconstruction" of higher education, it has experienced rapid and unconventional development with its core functions of teaching research and policy consultation. During this period, the service level and research capabilities of higher education research institutions were limited, and there were too many part-time researchers, and the level of professionalism of researchers needed to be improved. With the Reform and Opening up of higher education in the 1990s, the development of higher education research institutions has gradually become rational. In terms of organizational functions and positioning, higher education research institutions have initially formed a division of academicization, administration, and maintenance. In terms of quantity, higher education research institutions attached to the Academic Affairs Office and barely maintaining the status quo account for a large proportion. Compared with the 1980s, the professional level of higher education researchers has been significantly improved, and the research level of institutions has also improved. Since the 1920s, as the cause of higher education has become "diversified", the development of higher education research institutions in China has stabilized, the overall number has declined, and the trend of differentiation of organizational functions

and organizational positioning has become more obvious. With the continuous development of the marketization of higher education and the deepening of the reform of the internal management system of universities, different types of higher education research institutions are facing the pressure of competition and the challenge of sustainable development.

3. REALITY: SUPPRESSING EDUCATION AND PROMOTING RESEARCH

At the end of the 20th century, the educational institute gradually transformed into a research institute. After the transformation, there are two international authoritative academic career surveys in the world, respectively Changing Academic Profession in 2007 and Academic Profession in Knowledge Society in 2018. The main content of the two surveys contains relevant background information such as teachers' work units, teaching and research participation. The questionnaire structure and questions are basically the same, which can support longitudinal comparison.

3.1 Teachers' Work Orientation Is Seriously Shifted to Research

Teachers' work orientation is the subjective orientation of teachers' work conditions. Combining "Table 1" and "Figure 1", in 2007, the proportion of teachers who tend to teach was about 40%, and teaching and research during that time period can be received as an equal. According to data in 2018, the work orientation of teachers has been heavily tilted towards research, accounting for up to 80%. Further analysis of the influence of teachers' professional titles in both 2007 and 2018 shows that the higher the professional title is, the greater the proportion of research will be. In 2007, the work interests of associate professors and below were not obviously biased towards one of them. In 2018, the proportion of their research orientations has risen significantly, and they have gradually been in line with professors.

Table 1. Comparison of teachers' work orientation and working hours

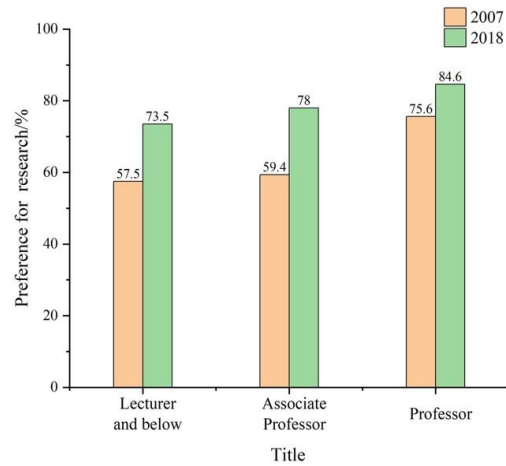| Year	2007	2018
Teaching-oriented teachers/ Research-oriented teachers	38.4:61.6	19.8:80.2
Average hours of teaching / Average hours of research	1:1.3	1:2.4

Figure 1 The influence of professional titles on teachers' orientations in 2007 & 2018.

3.2 Teachers' Working Hours Are Increasing, But Teaching Hours Are Decreasing

Working time is the most direct statistic for evaluating teachers' work, and it also reflects the influence of teachers' work orientations on actual work. Combining "Table 1" and "Figure 2", it can be seen that from 2007 to 2018, the gap between the average hours of teachers' research work and the average hours of teaching work became larger and larger, and in 2018 it was more than twice the average hours of teaching and research work. Analyzing the working hours further, in 2007, teachers' average weekly research hours were 21.7 hours and teaching hours were 16.8 hours. In 2018, the average weekly research work hours of teachers increased to 31.3 hours, and the teaching work hours decreased to 12.8 hours. In general, the total working hours of teachers increased by 14.5%, and the length of research work increased by 44.2%, but their teaching hours dropped by 23.8%.
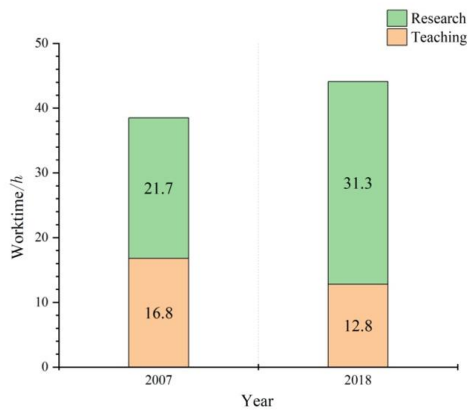
Figure 2 Teachers' weekly time spent on teaching and research in 2007 & 2018.

3.3 Policy Leads to "Emphasizing Research and Neglecting Teaching"

The work orientation of teachers is seriously shifted to research. Teachers not only add more working time, increase the workload for research, but also sacrifice part of teaching working time to fill research working time. At the same time, teachers who emphasize research did not use research results more in teaching. The phenomenon of "emphasizing research and neglecting teaching" has become an indisputable fact. Teaching, as a kind of lack of in-depth communication, is a mere formality. The quality of the classroom is degraded, and teachers cannot conduct joint research on teaching issues. The reform of teaching art, teacher means, and teaching methods is struggling.
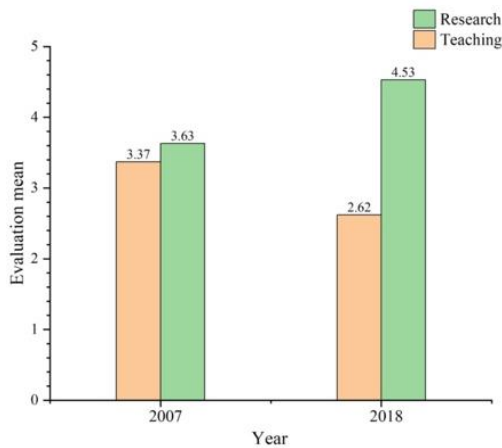

Figure 3 Teachers' perception of college policies in 2007 & 2018.

What is the cause of this phenomenon? There is a general explanation: There is a difference in the degree of importance that universities attach to the two when teachers are promoted. [3] In both surveys, teachers were asked to evaluate the above-mentioned importance. It can be seen from "Figure 3" that in 2007, the average evaluation value of teachers' emphasis on teaching was 3.37, and the average evaluation on research was 3.63. In 2018, the average evaluation value of teachers' emphasis on research rose to 4.6, close to the upper limit of 5.0, while the average evaluation value of teachers' emphasis on teaching dropped to 2.62, in sharp contrast with the average value of research. These changes are consistent with the changing trends of work orientation and working hours in the previous article. From the level of teacher perception, it shows that the teacher employment system of colleges and universities has played a negative effect of suppressing education and promoting research to a certain extent. In addition to "utilitarian" reasons, Professor Xiao Liu from Nanjing University believes that ability-based cognition is the key reason. The quality of teaching and research training that university teachers receive in their postgraduate and doctoral stages has a subtle influence on the choice of teachers. Professor Zhentian Liu from Renmin University of China pointed out that the intrinsic attributes of the two are different as the essential reason. Something unknown, curiosity, and clear purpose are the inherent attributes of research superior to teaching and research. Therefore, universities must return to the teaching-oriented model and need to re-understand teaching to obtain essential characteristics consistent with research. At the same time, with the development of scientific measurement, it is easier to measure what is a good research result, but it is difficult to clearly define excellent teaching. Therefore, college teachers will prefer tasks that can be objectively measured and verified.

Research-based teaching has limitations. For most majors and courses, basic knowledge transfer is still the focus. There are contradictions between the fragmentation of knowledge, the deepening of research and the knowledge base of students, and the research learning goals of research-based teaching are difficult to achieve. Without the support of grassroots academic, teaching and research organizations, first-class undergraduates are bound to be marginalized and hollowed out.

4. EXCELLENT COUNTERMEASURES IN THE UNITED STATES AND GERMANY

The United States and Germany, as the first countries to strive for a balance between research and teaching, both gave their own countermeasures.

Harlan Tony believes that the research teaching of higher education is about the connection between teaching and research, rather than the more common concepts. In this kind of teaching, teaching is improved through research, and it becomes the leading research in research [14]. In 1989, the Education and Human Resources Council (EHR) established a university teacher improvement project. "This project enables teachers of various departments to adapt and bring new content into new courses and new experiments, to learn new experimental skills, to evaluate the applicability of their teaching applications, and to explore innovative teaching methods, to merge knowledge scattered in different disciplines, and be able to fully communicate with experts, active scientists, teachers and colleagues in this field. It is required to closely integrate research and teaching, and teachers are required to bring the latest achievements in research into classroom teaching, integrate and exchange scattered knowledge, and then evaluate. In 2001, the American Association of Teacher Education Institutions (AACTE) decided at its annual meeting to use new standards in teacher training programs. Provost Barbara Birch of Western Kentucky University said: "Teachers need to teach more art and science in training, which can force them to pay more attention to their own teaching."[16] By strengthening teacher training, changing training standards, they closely linked teaching and research, corrected the direction of research, made rigid evaluations of training results, and eased the imbalance.

In Germany, the concept of the integration of teaching and research advocated by the educator Humboldt is widely circulated. In comprehensive universities, professors generally believe that both teaching and research will have a "cross-benefit" effect on teaching and research quality. Considering disciplines, discipline methods and cultural factors, not all research institutions and higher education institutions apply this concept to practical work. Different teaching and research modes are adopted to ensure that each mode can play a good role in accordance with the characteristics of various higher education institutions. The balance of teaching and research should be centered on the characteristics of higher education institutions. Each institution has a clear positioning and presents as "the pattern of difference sequence" [1] on the whole. In Germany, research has not been overestimated as a sign of the ability of a professor. "Universities are not ivory towers. This is the spiritual legacy left by Humboldt to German universities." [20]

5. A NEW PERSPECTIVE BASED ON TRANSFER LEARNING AND FUTURE FUSION

Based on the countermeasures taken by the two countries and the reasons, this article puts forward suggestions based on the ideas of transfer learning and future fusion.

As one of the most important research directions in the field of Machine Learning, Transfer learning has received more and more attention in recent years. It is a Machine Learning method that transfers knowledge from one domain (source domain) to another domain (target domain), so that the target domain can achieve better learning results. The following are two commonly used methods of transfer learning:

- Develop model: independently train the source model and apply the model migration to other similar target tasks.

- Pre-training model: migrate to your own target task based on the model released by others (authoritative research institutions).

Future fusion is a model fusion based on merging different features in different data. The multi-scale future fusion aims to efficiently fuse the low-level with large amount of information and noise and the high-level with strong semantics and low resolution to improve the model. According to the order of fusion and prediction, it is classified into early fusion and late fusion. The flowchart is shown in "Figure 4".

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1.   "The pattern of difference sequence" was put forward by Xiaotong Fei when he was studying the structure of Chinese rural areas, that is, "Every family uses its own status as the center, and a circle is drawn around it. The size of this circle depends on the thickness of the central force. "[19]

Figure 4 Flow chart of the idea of Transfer learning and Future fusion in machine learning.
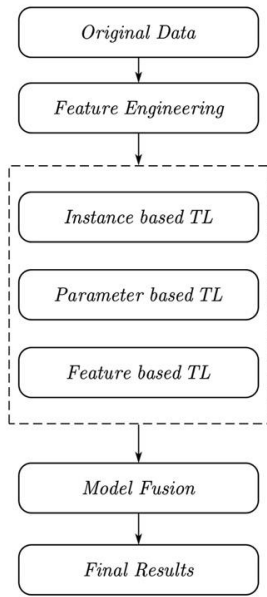
Balancing teaching and research is also a model. The income, system, and educational experience are input as raw data, and teachers make their own choices based on their own understanding and ability. When society and even the teachers themselves find that this "model" is not effective and violates the original intention and the meaning of education, it is necessary to adjust this "model". The model structure is shown in "Figure 5".
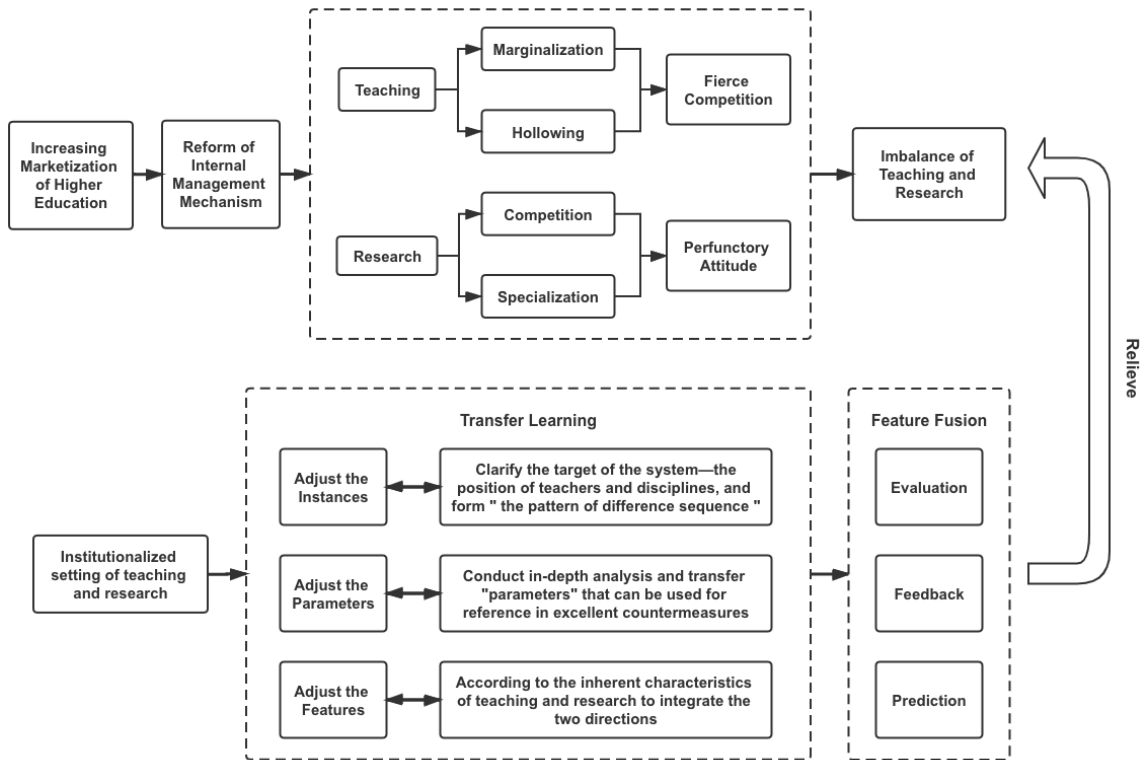

Figure 5 Flow chart of the idea of Transfer learning and Future fusion in balancing teaching and research.

The first step is to adjust the "instance", or clarify the target of the system. Clarify the positions of teachers and universities, treat different discipline methods and cultural factors, carry out corresponding system reforms, reject stereotypes

and form a benign "the pattern of difference sequence." Adjust the proportion of research and teaching in the promotion system, set Teaching Awards, and standardize the basic system and safeguards of university teaching. When cultivating

research talents, it is not only necessary to emphasize the importance of scientific research literacy, but also the cultivation of teaching literacy, to establish the dominant position of teaching.

The second step is to adjust "parameters", or analyze excellent countermeasures, and choose the essence. Parameter-based transfer learning realizes the effect of transfer learning by sharing parameters among different fields. For the excellent countermeasures taken by other countries and provinces, it is necessary to analyze what kind of positioning the countermeasures are suitable for, what macro measures have been adopted, and what problems have been solved in essence, so as to obtain inspiration for their own positioning.

The third step is to adjust the orientation of the two according to the inherent characteristics of teaching and research. Professor Zhentian Liu summed up the essential differences between teaching and research and scientific research from the following three comparative characteristics: known and unknown, curiosity and responsibility, exactness and vagueness. Based on the comparison between the first two groups, how to use subject knowledge for some creativity? For example, teachers in the Department of Mathematics use math questions to extract homework from students, and teachers in the Department of Computer Science use Online Judge (online program evaluation system) to check the number of people who have checked in. What about teachers of other subjects? If teaching is regarded as a scientific research with timely feedback, how to find innovative points in this special research? How to solve the students' extracurricular "thinking questions"? The more flexible unknown may be more challenging. For the third group, clear evaluation indicators and the scope of influence of peers must be more attractive. The U.S. countermeasures have played a good role in demonstrating, increasing practical evaluation and peer exchanges, emphasizing the clever use of scientific research in teaching, making innovative teaching content and teaching methods the guide of scientific research, and integrating the evaluation indicators of research and teaching. Now that the Internet is so developed, the influence of excellent teaching experience, teaching process and teaching methods may not be lower than that of peers in scientific research. Use policies to encourage teachers to share their own teaching, and measure the pros and cons through indicators such as student broadcasts, evaluations, and likes. Based on the increasing maturity of natural language processing

technology and physiological feedback technology, through data analysis, process evaluation and formative evaluation must be diversified and precise. Once the problem of unclear teaching evaluation indicators is solved, other problems will be solved soon.

Based on the idea of "late fusion", it is necessary to carry out process evaluation, feedback and prediction for each step of adjustment, and finally to promote the application.

6. CONCLUSION

Only by clearly understanding the essential relationship between teaching and research, the effective methods and feasible ways to solve the problem of "Emphasizing Research and Neglecting Teaching" will emerge. Combining Transfer Learning and Feature Fusion in Computer Thinking, this article proposes suggestions from three aspects: teaching objects, excellent experiences, and inherent characteristics. University education must establish the dominant position of the teaching, give full play to the boosting role of research, and build a benign development model of "teaching guide research, research boost teaching". Computer models are changing step by step, and our "model" will always be dynamically adjusted as well.

AUTHORS' CONTRIBUTIONS

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