



The Causes and the Hindrances of the Development of Interdisciplinary Education

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Abstract. The concept of interdisciplinary education was proposed as early as 1926, and now the interdisciplinary setting of programs has been widely used in universities from all over the world. In recent years, many scholars have conducted in-depth research on the cultivation method of interdisciplinarity in combination with relevant factual cases. On the basis of systematically summarizing the results of existing literature of interdisciplinary researches, this paper focuses on two points: First, the rationality in the development of interdisciplinary education, and second, the obstacles faced in the development of interdisciplinary education in China. The research finds that the rationality is as follows: one is the drawbacks of the traditional division of disciplines, and the other is the increase in the society's demand for compound graduate talents. The obstacles faced in the development of this kind of disciplines can also be summarized into two points. The first one is the scope of interdisciplinary programs is more ambiguous than the general disciplines, which creates cognitive problems within such disciplines, and the second one is the institutional problem in constructing interdisciplinary programs, causing a shortage of educational resources for such disciplines.

Keywords: Interdisciplinary education · educational model · university education · diversity in education · education in China

1 Introduction

The concept of interdisciplinarity has a quite long history. The initially recorded public use of the concept was in 1929, when Professor Robert Sessions Woodworth, the distinguished Columbia University psychologist suggested at a conference of Social Science Research Council (SSRC) that scholars from different field should work together on the problems they face in common, thus they may find a new way to solve such problems by using knowledge from other fields. As a founding member of SSRC, Woodworth said that no other bodies could take on the responsibility of considering an “interdisciplinary working” approach other than the SSRC as a collection of several disciplines [1].

After nearly one hundred years of academic research and practice by scholars around the world, the construction of interdisciplinary education has been gradually improved,

and many successful attempts have been made by various countries and regions in the construction of interdisciplinarity. For example, in 2021, the National University of Singapore integrated its Faculty of Arts and Social Science and the Faculty of Science to the College of Humanities and Sciences. This means that new students entering this college in the fall of 2021 will be able to mix and match their course selection. In this regard, Sun Yeneng, former dean of the Faculty of Science, said the purpose of the faculty integration is to let students of the college to graduate with “interdisciplinary thinking and ability”, which is needed by the “complex, vague, uncertain and volatile world” [2].

In today’s competitive university market, “interdisciplinary research” is a big selling point for universities [3]. It has certain rationality and practical significance to analyze the reasons for the rise of interdisciplinary education and the difficulties faced by the development of this model in this environment, and can provide a theoretical basis for subsequent research and practice.

2 Causes of the Development of Interdisciplinary Education

There have been many scholars around the world that argued a basic question of interdisciplinary activities: What’s the purpose of it? This question was answered by the Organization for Economic Cooperation and Development (OECD) in 1970s. After conducting the first international survey of interdisciplinary activities, the OECD found that interdisciplinary activities have five origins, namely the needs of scientific (knowledge) development, the needs of students, the needs of professional training, the needs of society, and the needs of university operations and management. Interdisciplinary education is an important part of interdisciplinary activities, among the origins of the above five types of interdisciplinary activities, it can be concluded that two points have contributed to the continuous development of interdisciplinary education.

2.1 The Needs of Social Cognitive Development

Since the concept of interdisciplinarity firstly proposed in 1929, it has been mentioned in the research of scholars all over the world, but there has no generally accepted definition of it. Obviously, the word “interdiscipline” is combined with two parts: “inter-” and “discipline”. The former part of the word stands for “intersection”, which means the emergence of this kind of new disciplines comes from the interaction of existing disciplines. According to the OECD in 1972, the main body of interdisciplinary activities should consist of people trained in different fields of knowledge, who will bring together concepts, methods, data and terminology from different disciplines, which are constantly interacting with each other and working together to solve their common problems. In addition, Professor Julie Thompson Klein points out from the perspective of the unique function of interdisciplinarity that this is a method of solving and answering problems that cannot be satisfactorily solved by a single method or approach [4]. There is a common key point of both explanation from the OECD and Klein: problem solving.

The concept of disciplines has a very long history. In order to make knowledge more systematic, early humans set up the concept of disciplines to divide knowledge into areas for research. Since then, the discipline has been divided into different areas,

such as history, mathematics, and chemistry. To distinguish between disciplines, it was necessary to cut off the connection with each other and form a unique system, so there are unique systems, discourses, logic and principles of each discipline. However, nature and society exist as a whole, and the problems in reality are complex and diverse so that dividing the world artificially into various disciplines cannot reflect the real world after all. With the deepening of human exploration of natural and social problems, more and more problems can no longer be explained by the knowledge and logic from a single discipline. In the process of researching problems, there is a need to proceed from the reality and the problems themselves instead of only proceed from the concept of discipline division set artificially. Based on this, interdisciplinarity is bound to appear [5]. The concept of interdisciplinarity and other related concepts is essentially a deep introspection by the academic community on the earlier artificial division of disciplines. Therefore, the reason why many people put forward the concept of interdisciplinarity is to break through the narrow boundaries of single disciplines in the past, and try to return to the true form of human beings' understanding of the world.

2.2 The Demand of New-Age Graduate Students' Education

The trend of discipline intersection is not just a passive way to deal with the natural and social environment, but also a subjective need of college graduates in the new era. Nowadays, more and more graduates have a strong interest in interdisciplinary training, and what they seek for is the interdisciplinary experiences ranging from seminars and short courses to full-fledged interdisciplinary degree-granting projects. According to the observation of Dr. Meredith Welch-Devine's team, the six interdisciplinary doctoral programs of the University of Georgia have a large number of students that enter the programs with fellowships or university honorific awards [6]. Under this circumstance, faculty members often argue that interdisciplinary programs attract the "best and brightest" students [7].

Compared with graduates before, the qualities required of new-age graduates have shifted. According to the 5Cs framework for 21 century key competences proposed by China Education Innovation Institute of Beijing Normal University and Partnership for 21st Century Learning, there are five key competences (Culture Competence, Critical Thinking, Creativity, Communication and Collaboration) that a must for a citizen in the 21st Century, in which the competence of collaboration is an important dimension in the framework of the 5C model. This competence refers not only to the cooperation between people in the narrow sense, but also the cooperation between different industries and academic fields. Cooperation competence is of great significance for promoting individual development, achieving organizational goals, maintaining social functioning, and promoting social progress, especially with the advent of the era of knowledge society, artificial intelligence and globalization. On the one hand, human beings can only overcome the challenges brought about by technological development through cooperation. On the other hand, talents from different fields also need more interdisciplinary collaboration to achieve iterative development of knowledge and technology [8].

As mentioned above, the social environment will facilitate the cultivation of interdisciplinary talents. In turn, nurturing interdisciplinary talents will benefit society. Many occupations, if pursued by people trained across disciplines, will have different effects

than if they were pursued by people trained in a single discipline. For example, in the basic profession of teaching, it is very common in many countries for a teacher to teach multiple subjects. This kind of design has a certain rationality, especially in primary schools. According to a field sample survey conducted by Professor Roland G. Fryer from Harvard University in Houston, Texas from 2013 to 2014, the specialization of teachers that each teacher only teach one subject has obvious negative effects on student performance and attendance compared with the way that one teacher teaches multiple subjects. To be more specific, teacher specialization reduced student math and reading scores by 0.11 standard deviations per school year, while students in educational specialized schools were 1.13 times more likely to be suspended for bad behavior per year than students in schools with multiple education, and students in such schools had 0.36 fewer school days per year [9]. Teaching multiple subjects from a single teacher has been shown to improve student performance, which requires teachers to be qualified to teach in multiple subjects. This means that teachers should have an interdisciplinary awareness when they receive teaching training, and be able to organically link the subjects they teach.

3 Hindrances in the Development of Interdisciplinary Education in China

As the model of interdisciplinary education has become a trend in the world, China has also been carrying out related research and attempts. In 2021, the “interdisciplinary category” became the 14th discipline category in China, by the side of traditional disciplines of Philosophy, Economics, etc., with “Integrated circuit science and engineering” and “National security” as the next level of disciplines [10]. This can be seen as an initial attempt to develop interdisciplinary education in China. In February of 2021, Professor Hong Chengwen from Beijing Normal University was interviewed by Guangming Daily, about how to conduct interdisciplinary construction and the challenges that may be encountered in the process. Hong said that there are three challenges faced in interdisciplinary programs: The first is how to give a precise definition of “interdisciplinary”. If the definition is not clear, the construction of interdisciplinary programs is very likely to be just a fad and unable to develop continuously. The second is to how to prevent the category of interdisciplinary programs from being simply defined as a category other than the thirteen categories like philosophy and economics, which hurts the connotation of the category because of its infinite extension. These two challenges can be integrated into one question, the question in defining what is a interdisciplinary program. The third is how to determine which of the root disciplines that make up the interdisciplinary programs are eligible for admission to it. If the division of qualifications is not clear, the interdisciplinary program may be divided among the disciplines that make it up, and whoever relies on a strong parent discipline can gain the power to award degrees [11].

3.1 The Ambiguity of the Concept of Interdisciplinarity

From the perspective of interdisciplinarity itself, the biggest conceptual obstacle in its development is the cognitive dilemma of discipline identity, that is, what is the meaning

and value of an interdisciplinary program set beyond other disciplines independently. This question can only be answered by the introspection of interdisciplinary programs themselves. After the most basic identity cognition problem is solved, what also needs to be thought about is how to solve the external conceptual problems in the process of interdisciplinary construction. On the one hand, it is necessary to determine what is the core of the interdisciplinary category, in other words, what are the issues that interdisciplinary programs focus on. On the other hand, it is necessary to think about what the boundaries of the interdisciplinary programs are, that is, what areas should not be involved in the interdisciplinary programs in the early stage of establishment [12].

The problems mentioned above are very prominent in the process of interdisciplinary construction in China. The discipline setting of colleges and universities is organized from top to bottom according to discipline categories, first-level disciplines, and second-level disciplines in China [13]. In this context, the setting of interdisciplinary programs is mostly a simple combination of the disciplines from the same category or the same level of disciplines, or a temporary mutual borrowing and cooperation of individual disciplines, which lacks full consideration of the internal connection between related subjects and cannot reflect the logic and the interaction between different disciplines. If the integration of disciplines is promoted in such a rigid academic system, the breadth, integration and depth of the intersection of disciplines are tend to be insufficient, so it is difficult to generate a new knowledge system. What is more, due to the limitations of subjective understanding of disciplines, the actual construction of disciplinary structures in China is likely to be uneven, which forms a gap between the construction levels of every single disciplines, and it is difficult for a well-established discipline to cooperate with an undeveloped discipline. In short, due to the uneven and difficult composition within the interdisciplinary programs, it is difficult for these disciplines to form their own research and educational development models, and therefore it is difficult for them to stand as emerging disciplines and gain an equal disciplinary status among the general disciplines.

The conceptual issues mentioned above are encountered in the process of interdisciplinary construction all over the world. There have been some very good answers on how to deal with these problems. In the process of constructing interdisciplinary programs in the United States, project-based research on complex issues has been undertaken to achieve interdisciplinarity and self-reflection [14]. Such researches not only exposes faculty and students to ideas, terminology, theories, and methods from multiple disciplines, allowing them to move beyond their own “disciplinary silos” and explore solutions to complex social problems, but also helps to deepen their understanding of interdisciplinarity and develop research skills and interdisciplinary thinking [15].

3.2 Institutional Problems Faced in the Development

In addition to the conceptual problems of the discipline itself described above, institutional and organizational problems at the implementation stage also hinder the development of interdisciplinary programs. In many universities, interdisciplinary activities in research and training do not receive sufficient attention in the formulation of policies and procedures by administrative agencies. This is reflected in the fact that interdisciplinary

scholars may be disadvantaged in the promotion process [16]. Those who assess faculty positions within universities often have difficulty assessing publications that span a wide range of disciplines, thus contributing to the low recognition of interdisciplinary scholars' research.

The root of the institutional problem can be attributed to the lack of recognition of interdisciplinary programs at their inception, but is reflected in the lack of educational resources. Like general disciplines, interdisciplinary programs require ongoing funding, with the difference being that interdisciplinary programs face special challenges in terms of both financial and human resources. Financially, many interdisciplinary programs do not receive the same level of stable funding from the university's administration as the general disciplines. This forces these programs to struggle to get funding beyond basic research and teaching activities [6]. Human resource issues may be more difficult for interdisciplinary programs to address. In some universities, interdisciplinary programs do not have their own faculty, so interdisciplinary education may be constrained by differences in disciplinary backgrounds and the pre-existing affiliations of disciplinary faculty. In other words, because of the large differences in the discipline backgrounds of the teachers in the team, it is difficult to form a team cohesion [15].

In China, a discipline is both a classification of knowledge and a form of organization. The traditional paradigm of disciplinary organization is basically solidified and relatively exclusive according to the categories of disciplines, which has its own boundaries and code of conduct, with a mechanism for what knowledge is produced, how it is applied, and what research results are considered effective [13]. At present, interdisciplinary programs are already co-located in other disciplines, and should also have a fixed organizational structure of institutions, personnel, funds, research sites, etc. so as to strengthen the integration and depth of interdisciplinary integration. In addition, in terms of faculty evaluation, the universities should adopt a positive encouraging policy like the preference in financial investment, project application, title evaluation and resource guarantee to appropriately contribute to teachers involved in interdisciplinary training. In terms of student evaluation, in addition to examining students' general academic ability, the awareness and ability of interdisciplinary vision, interdisciplinary cooperation, and multifaceted creative problem solving should be incorporated into the evaluation system, and attention should be paid to the personalization and dynamism of the evaluation [15].

4 Conclusion

It is believed in some philosophy systems that the inevitability of intersection is determined by the intersecting and infinite nature of development, so that the birth and thriving of interdisciplinarity is bound to appear. As a trend in the creation of majors in universities, interdisciplinary programs should address the conceptual and institutional issues mentioned above if they are to grow significantly. Besides, it is also needed for conscious collaboration and communication among disciplines, just like Kleinberg said, interdisciplinary majors are now poised to lead the university in new directions, but to do so, disciplines in universities should work together rather than isolate themselves.

At present, there are various research perspectives on interdisciplinarity, and the scope of this paper is mainly derived from theoretical studies on the causes and impediments of interdisciplinary development, which is limited by the fact that the references

do not cover all aspects. In addition to analyzing the reasons and obstacles for the development of interdisciplines, some literature also analyze the development status of interdisciplinary education from the perspective of quantification. For example, scholars such as C. E. Shannon and A. L. Porter have proposed algorithms to quantitatively analyze the composition of interdisciplinary programs. If the results of such quantitative and qualitative analyses are combined in subsequent studies, the analysis of interdisciplinary education will be more thorough.

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