

# Research on Discipline Construction from the Perspective of Big Data Management

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**Abstract.** This paper explores how big data promotes discipline construction in colleges. We takes the 42 “First-Class Universities” in China as the research object. Based on the perspective of bibliometrics, contents related to “Discipline Construction” in the construction scheme of universities were analyzed with the help of ROST software. Through word frequency statistics, the high-frequency hot words of first-class discipline construction were obtained. On this basis, the keyword correlation analysis and keyword coding were carried out respectively to form the high-frequency word network association diagram and discipline construction concept model of “First-Class Universities”. Finally, with the characteristics of big data, this paper puts forward the thinking of discipline construction in the information age.

**Keywords.** Information Technology, Big Data, first-class discipline, discipline construction concept

## 1. Introduction

Talent has increasingly become the key driving force of national and regional development in the era of knowledge economy [1]. Therefore, it is of great significance to improve the quality of higher education. The strategic measures to comprehensively promote the construction of world-class universities and first-class disciplines (referred to as the “double first-class” construction) aim to promote a number of high-level universities and disciplines with characteristics to enter the world-class ranks, and realize the transformation from a major country in higher education to a powerful country in higher education [2]. The promulgation of the Overall Plan for Promoting the Construction of World-Class Universities and First-Class Disciplines [3] and the Implementation Measures for Promoting the Construction of World-Class Universities

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and First-Class Disciplines (Interim) signifies that the construction of “Double First-Class” [4] has become a national strategy. On September 2017, the Ministry of Education, the Ministry of Finance, and the National Development and Reform Commission jointly issued the List of Universities and Disciplines in the Construction of World-Class Universities and First-Class Disciplines, in which 42 universities were selected as “First-Class Universities” and 95 were identified as “First-Class Disciplines” constructing universities. The construction of “Double First-Class” initiative officially kicked off.

Discipline is the basic element of university structure and the key to the gene reconstruction of university organization and system construction and governance [5]. Different from the previous “985 Project” and “211 Project”, the construction of “Double First-Class” initiative emphasizes the core position of disciplines and regards the construction of world-class disciplines as the key breakthrough to join the ranks of world-class universities, which serves as the common experience of world-class universities [6].

In discipline construction, the concept of discipline construction plays an important role. It is the guiding ideology of discipline construction, people’s basic understanding of the mission, nature, function, structure, and culture of the university discipline, and the grasp of the relationship between university discipline and various elements of the external world as well as various internal elements [7]. Therefore, the establishment of a scientific concept of discipline construction is of great significance to the construction of first-class disciplines. In this paper, the 42 “First-Class Universities” were taken as the research object. The Chinese logic of the concept of first-class discipline construction were summarized and refined from the perspective of policy text analysis and its theoretical basis was analyzed deeply. At the same time, the misunderstandings to be avoided in the process of practicing the concept were put forward in view of the actual situation. It is anticipated that our study will provide reference for the construction of the first-class discipline in China’s universities.

## 2. Research Data and Methods

The 42 “First-Class Universities” cover the top universities in China and serve as the main power in the construction of first-class disciplines in China’s universities. Therefore, taking the “First-Class Universities” as the research object of this paper is scientific and representative. On the other hand, as a concentrated manifestation of policy makers’ intentions, policy texts can reflect the value orientation and thinking characteristics of policy makers in a certain period of time [8]. Based on this, this study collected the “Double First-Class” construction schemes of 42 “First-Class Universities”, extracted the contents related to “Discipline Construction”, and summarized them into a text database with a total of 97,484 words, which was used as the research data of this study.

Word frequency analysis is one of the analysis methods in bibliometrics, and the keywords of a literature usually reflect its core contents [9]. If a keyword appears frequently in the field, it can be inferred that the keyword is a hot spot in the field, and the change of word frequency can also reflect the development trend of the field. In this paper, the word frequency analysis method was used to analyze the sorted text library with the help of ROST software, so as to refine the discipline construction concept of “First-Class Universities” in the first cycle of “Double First-Class” construction.



As can be seen from Figure 1, “discipline” is located at the center, while the keys words closely related to “discipline” include “engineering” “advantage”, “characteristic “key” “intersection” “discipline group” “basic discipline” “ESI”, and “first-class”.

3.3. Keyword Coding

By further coding the above high-frequency keywords, the concept of constructing first-class discipline in the 42 “First-Class Universities” in China can be summarized into five aspects: “demand guidance” “key construction”, “characteristic development” “cross and integration” and “stratification and classification”, as shown in Table 2:

**Table 2** Coding Table of High-frequency Words of “First-Class Discipline Construction Concept”

Primary Coding	Frequency (times)	Secondary Coding	Frequency (times)
Demand and guidance	861	Country	307
		Society	242
		Strategy	166
		Demand	146
Key construction	765	Key	342
		Advantage	370
		Focus	27
		First	20
Characteristic development	341	Characteristics	276
		Differentiation	42
		Dislocation	23
Cross and integration	925	Cross	333
		Discipline group	405
		Integration	187
Stratification and classification	52	Stratification	30
		Classification	22

4. Summary and Analysis

4.1. Demand and Guidance

The words “country”, “society”, “strategy” and “demand” appears 307 times, 242 times, 166 times, and 146 times respectively, indicating that focusing on social demands and serving national strategy is an important discipline construction concept for the construction of “First-Class Universities”. For example, Nankai University proposed to “Establish the Beijing-Tianjin-Hebei Collaborative Development Research Institute, China New Generation Artificial Intelligence Strategic Development Research Institute, and the Ecological Civilization Research Institute, deploy research and development platforms such as new energy materials, cultivate docking disciplines to serve the industrial development demands of Beijing, Tianjin and Hebei”. From the perspective of political logic, Brubeck pointed out in the Philosophy of Higher Education that the development of universities must have correct “political objectives” and “serve the

country.” The construction of “Double First Class” is a national strategy and a code of conduct formulated by the central government based on the national macro-strategic interests, which is the explicit form and visual existence of the government’s will. Discipline is an important support for universities to realize their basic functions. Therefore, the action logic of discipline construction, which is the action basis of discipline construction, must also include political logic. In other words, the construction of disciplines must meet the national political demands and contribute to the realization of national interests. From the perspective of academic logic, with the in-depth promotion of knowledge-based society, higher education has gradually moved from the edge of society to the social center. As the source of knowledge production and the key town of knowledge innovation, universities have been entrusted with the important task of promoting economic and social development and shoulder the historical mission of talent pool, knowledge bases and incubators [10]. Therefore, the construction of disciplines in universities must take the country’s economic construction and the overall development of the society as the starting point and destination, and must adapt to the development of science, technology, and culture.

#### 4.2. Key Construction

The words “advantage”, “key”, “first” and “focus” appear many times in the text, 370 times, 342 times, 27 times and 20 times respectively, which reflects the thought of “do something more important by leaving the others undone”. For example, Beijing Normal University proposed to “focus on the construction of some disciplines, including pedagogy, psychology, Chinese language and literature, linguistics, Chinese history, mathematics, geography, system science, ecology, environmental science and engineering, drama and film and television, Marxist theory “. The limited resources for running schools and the infinite development of disciplines determine that no university can cover all disciplines, nor can it reach a high level in all directions of a discipline. The construction of disciplines must concentrate on some fields and make a breakthrough, which is the key for the success of all world-class universities. “It can be noticed that universities that have risen rapidly in the rank of the world university all make breakthroughs in one or two fields at first. It is impossible for a university to achieve world- class levels in many fields at the same time. Therefore, research-oriented universities should spare no effort to improve the construction of their most outstanding disciplines to the top level all over the world”, said Tian Changlin, the former President of the University of California, in his invited speech at Tsinghua University. Take Stanford University as an example. It tried to break the traditional practice of balanced development of all disciplines and strategically put forward the concept of “Top Academic Program”, with the focus on the development of applied disciplines such as chemistry, physics, and electronic engineering. By this means, its electronic engineering and “Silicon Valley” has become the model of discipline construction among prestigious universities. Therefore, colleges and universities can never seek unity and completeness in their ambition to build top disciplines. They should give overall consideration on future development based on their current situation, concentrate superior forces and resources to achieve specific goals in a certain period so as to realize overall development in the long term.

### 4.3. Characteristic Development

In the text, “characteristic” has also become a high-frequency word, appearing as many as 276 times. The concept of “characteristics” is divided into two types. The first is “to have what others haven’t”, that is, the strategy of differentiation, which means that a university should identify and focus on development of disciplines that other universities have not yet set foot in to form its own characteristics; the second is “to be better than others”, that is, the strategy of advantage, which means that a university should form its own characteristics based on its own advantages. For example, Renmin University of China proposed to “promote the construction of discipline groups with the characteristics of the National People’s Congress, comprehensively revitalize the humanities, strengthen the construction of supporting disciplines, make advantageous disciplines and supporting disciplines complement and promote each other, and finally create a discipline system with Chinese characteristics and universal significance”. In today’s world, characteristics have become a development concept and strategic thinking accepted by universities. California Institute of Technology and Princeton University are known for being “small but excellent”, the discipline development of University of California at Berkeley is comprehensive and synergistic, California Institute of Technology is famous for its aerospace engineering; Princeton University has the reputation of “Capital of Mathematics”; Stanford University is better known for creating “Silicon Valley”; Massachusetts Institute of Technology has a leading position in the military industry. In terms of discipline development strategy, world-class research-oriented universities all emphasize their outstanding advantages and characteristic positioning, and promote the full development of advantageous disciplines through the cultivation of characteristic disciplines, so as to enhance the overall competitive strength of disciplines [11]. Therefore, under the condition of relatively limited resources, the construction of first-class disciplines should size up the situation, adopt the strategy of “emerging unexpectedly and winning by surprise”, choose unique research directions or those that can have significant impact at home and abroad, create brands with distinctive characteristics, strive for the first-class with advantages, and constantly improve the core competitiveness of the discipline.

### 4.4. Cross and Integration

In the concept of disciplinary construction among “First-Class Universities”, “intersection” appears 333 times, “discipline group” appears 405 times, and “integration” appears 187 times. As is shown by existing data, there are 352 discipline groups mentioned in the construction plan of “First-Class Universities” by 41 universities (excluding National University of Defense Technology), fully reflecting the significance of the multidisciplinary fusion. For instance, based on the disciplines of Weapon Science and Technology, Materials Science and Engineering, and Control Science and Engineering, Beijing Institute of Technology zooms on the construction of five discipline groups by combining its traditional advantages and long-term development demands. As technology and science develops by leaps and bounds, the production of knowledge has no longer been confined in the single discipline as usual, but come out at the intersection of disciplines. Carrying out interdisciplinary penetration, forming complementary strengths among disciplines, and optimizing the allocation of discipline resources has become a clear direction for the development of contemporary universities. MIT, for example, places great emphasis on the

interdisciplinary research and the teaching integration of humanities, social sciences, and management sciences with engineering technology, and has established more than 50 interdisciplinary research institutions and laboratories, represented by vibration and acoustics laboratories. These various forms of inter-departmental scientific research and teaching institutions contribute to its academic development and success, yielding substantial results in academic. So implementing the disciplinary construction project in the form of discipline group is a crucial way to integrate advantageous resources, refine school-running characteristics and brands, and enhance core competitiveness for a college. It is an inevitable choice for building a world-class discipline.

#### *4.5. Classification and Stratification*

In the text library, the frequency of “classification” is 30 times, and “stratification” appears 22 times, indicating the wisdom of “classification and stratification” in the establishment of “First-Class Universities”. Stratification is generally based on the level of objectives, such as “Front Ranks of the World First-Class”, “World First-Class” and “Front Ranks of the Domestic First-Class”. Meanwhile, given the feature of a particular discipline, multiple discipline can be divided into “characteristic disciplines”, “interdisciplinary disciplines”, “emerging disciplines”, “basic disciplines” and so on. For example, Harbin University of technology carries out its disciplinary construction in three different approach, including “disciplines that are highly likely to be world-class”, “discipline plateau which need to be further consolidated and developed” and “emerging interdisciplinary and new disciplines”. Due to the differentiation between disciplines, the diversification of social demands, and the increasing degree of international competition, it is urgent for universities to explore the path of discipline construction according to different levels and categories. For one thing, stratified construction is conducive to concentrating forces to cultivate advantageous disciplines, and drive different levels to leap up at the same time. For another, classified development is helpful to avoid the phenomenon of “one size fits all” and formulate development strategies in a more targeted manner. Therefore, only by dividing disciplines into multiple levels and categories and implementing different construction approach, management skills and assessment methods according to their characteristics and situations, can colleges and universities achieve the innovation in the improvement of disciplines and realize maximum development in all subjects.

### **5. Discussion and reflection**

Based on bibliometrics, through the text analysis of the construction scheme of 42 “double first-class” universities, it can be concluded that the ideas of China's first-class discipline construction include “demand and guidance” “key construction” “characteristic development” “cross and integration” “classification and stratification”. Meanwhile, In the process of discipline construction, we should avoid the following misunderstandings, which includes the lack of “supporting needs”, the distortion of key construction, the lack of “Chinese characteristics”, the tendency of “shell” in the construction of discipline group, and the confusion of the concept of classified construction and layered construction.

Under the background of increasingly in-depth application of big data, we should actively explore and achieve the goal of deep integration of discipline connotation

construction and big data governance, so as to rely on modern information technology to improve the specialization of discipline construction and the refinement of discipline management. This is the proper path for universities to promote discipline construction in the new era. Combined with the above concept of discipline construction and based on the characteristics of informatization, we propose the following four specific methods of discipline construction under the background of big data.

Firstly, we should strengthen the theoretical research of discipline construction based on big data.

In order to strengthen the practical application of big data in discipline construction, we must promote the theoretical research of discipline construction based on big data, so as to lay a solid foundation for specific discipline construction practice. Universities should not only comprehensively collect and sort out all kinds of subject data, but also accurately and deeply analyze the meaning of data. Only in this way can we ensure the close connection between theory and practice of discipline construction, which is helpful to develop the resources of discipline construction effectively with the advantage of big data. On the other hand, universities should effectively explore the contents of network system, big data, Internet technology and other aspects with the characteristics of big data itself, and ensure the directivity and accuracy of its positioning. By this way, we could better open up multi-dimensional channels of discipline construction practice, so as to greatly improve the effect of discipline construction.

Secondly, we should build a management platform of big data of the discipline information.

Universities should pay high attention to the construction of big data of discipline information management platform. Through the management platform, we could collect discipline information by various channels, and effectively aggregate the frontier development of various disciplines, national policies and other aspects of information resources, so as to integrate the information into specific discipline construction practice. At the same time, we should be good at extracting effective information from big data, ensuring the accurate connection between big data content resources and discipline construction. In addition, universities should make use of data mining, analysis and modeling technology to conduct dynamic monitoring and real-time analysis of the resource efficiency of discipline construction, which could improve the system of discipline construction itself. Finally, universities need to deepen big data information by Internet channels, extending information value efficiency through real-time information update to better improve the effectiveness of discipline construction.

Thirdly, we should cultivate the literacy of information and data of teachers.

The literacy of information and data is the essential quality of citizens in the present age. The informatization level of teachers is an important factor for the efficiency of big data of discipline management and construction. Therefore, universities should strengthen the cultivation of information and data literacy of teachers. First of all, we should take concrete measures to enhance the digitalization and information consciousness of college teachers. For example, we could invite experts to give lectures on information-based and digital education, hold seminars on information-based teaching, carry out digitalized ideological education for college teachers, so as to help college teachers change their teaching concepts, which make them meet the requirements of digitization. Secondly, universities should organize and guide teachers to actively participate in information training, so that they could learn to use digital technology in daily teaching management, and be very clever with various



digital software tools. In addition, universities should establish a digital learning community with the characteristics of the digital age, so that teachers could share and learn new knowledge and experience through digital and information channels innovatively, which contributes to share digital information resources, and effectively improve the informatization ability of each teacher.

Fourthly, we should make full use of big data to promote interdisciplinary integration.

Data is the “connector” of institutional setup, institutional and governance system construction, which could not only enhance the trust and interaction between organizations and individuals, but also eliminate conflicts and exclusion of discipline construction. By this way, it would be more easier to achieve the goal of symbiosis between discipline construction and informatization. It is no doubt that the symbiotic pattern is conducive to forming a stable relationship. Then, most members of the discipline group gradually give up the old behavior standards under the influence of subject informatization. So, what happens with all this is that the new sharing thinking, procedural thinking and data thinking would gradually evolve into new cultural elements, forming a new ecology of discipline development with information technology.

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