Article

How Does Graduate Training Promote Sustainable Development of Higher Education: Evidence from China's "Double First-Class" Universities' Programs

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Abstract: Higher education is crucial to sustainable development. The construction of a "double first-class" university (the 42 top universities in China) is an important initiative to improve the quality of higher education and promote its sustainable development. The aim of the study discussed here was to explore how graduate training promotes the sustainable development of higher education and the main characteristics of graduate training in China's "double first-class" universities. The research in this paper involved 42 "double first-class" universities' graduate training programs (including training objectives, training process, and training methods) for which coding analysis using NVivo12 plus was carried out. It was found that the main characteristics of China's "double first-class" university graduate training are as follows: (1) clear decomposition of quality and ability structure; (2) taking quality as the core of the connotative development of higher education; and (3) innovation in talent training methods. This study focused on talent training itself, which is of significant importance in the competition for talent around the world. China's double first-class universities can not only provide experience for the graduate education of domestic universities, but also for those in other countries.

Keywords: sustainable development; quality of talent training; double first-class universities; graduate training; training program

1. Introduction

Since the concept of "sustainable development" [1,2] was put forward, countries around the world have implemented sustainable development to achieve sustainable development of the economy, society, and environment. In 2015, the 70th General Assembly of the United Nations adopted Transforming our world: the 2030 Agenda for Sustainable Development, which is an agenda for sustainable development. It consisted of 17 sustainable development goals, of which goal four was the only one addressing education. Specifically, goal four commits countries to ensuring inclusive and equitable quality education and promoting lifelong learning opportunities for all. Target 4.3 states that by 2030, countries should ensure equal access for all women and men to afford qualified technical, vocational, and tertiary education including higher education [3]. As far as education is concerned, no one will be left behind in the world, but the importance of higher education seems to be neglected and lower-estimated [4].

Higher education is the strategic heart of education [5], and it's vital for the sustainable development of society. As a country that takes sustainable development and rejuvenating the country through science and education as major development strategies, China has made substantial contributions to the sustainable development goals [6,7]. It is the inevitable choice of China's future development as well as the need and choice of higher education itself [8]. According to the Report on China's Implementation of the 2030 Agenda for Sustainable Development (2021), from 2016 to 2020, the gross enrollment rate in higher

education increased from 42.7% to 54.4%, achieving a leap from mass to universality of higher education. China will adopt the construction of a high-quality education system as its main priority, strive to achieve the development goals of the 14th Five-Year Plan, promote the innovative development of higher education, and thoroughly promote the construction of "double first-class" [9].

In China, the construction of "double first-class" refers to the construction of first-class universities and first-class disciplines [10]. It's another key construction project following the "211 Project" and "985 Project", and an imperative strategy for the reform and development of higher education. In October 2015, the State Council issued the Overall Plan for Promoting the Construction of World-class Universities and First-class Disciplines, which was the first time a systematic plan for the construction of "double first-class" had been introduced into higher education. In 2017, the Ministry of Education, the Ministry of Finance, and the Development and Reform Commission issued the List of World-class Universities and Universities and Disciplines in the Construction of First-class Disciplines ("double first-class" for short), which marked that China's "double first-class" construction had reached the stage of full implementation. A total of 42 first-class construction universities were determined. The construction tasks include building a first-class faculty, the cultivating of top-notch innovative talents, improving the scientific research level, inheritance of excellent culture of innovation, and promoting achievement transformation [11]. Among them, talent training is the key. The quality of talent training is the decisive factor of higher education power, especially at the graduate level. Graduate education should also be highlighted because it symbolizes the development of double-first class universities [12]. To put it another way, graduate education plays an important role in the construction of double-first class and higher education power.

According to the National Education Statistics Bulletin 2021, China has 3012 world-leading, higher education institutions and a total enrollment of 44.3 million students and 3.33 million graduate students [13]. With the expansion of the scale, the quality of graduate training has aroused wide public concern. As the highest level of higher education, the improvement of the quality of graduate education is of positive significance to the sustainable development of China's higher education.

The study of higher education from a perspective of sustainable development can be explored from two aspects: one is the sustainable development of higher education, and the other one is the continuous improvement of the potential of students, both of which are complementary to each other. The quality of talent training is a prerequisite for the sustainable development of higher education. Talent training should also respond to the sustainable development of higher education itself and enhance students' potential. Talent training at universities is directly related to the enhancement of students' potential. Among them, graduate training is the key to cultivating high-level talents. However, current research on the sustainable development of higher education focus on the role of higher education in promoting the sustainable development of society and the economy, and less on its sustainable development from the perspective of higher education itself and talent training. Additionally, research on graduate education in the context of sustainable development is inadequate. Thereby, this study innovatively took the graduate training of "double-first class" universities as an example to explore the main characteristics of graduate training from the perspective of sustainable development of higher education itself. Besides, the study used NVivo 12 software which was rarely used in education research to analyze the training programs of 42 "double first-class" universities.

Five sections follow this introduction. Section 2 reviews the literature on the dilemmas and current situation of graduate training in China's universities. Section 3 describes the data and methodology. Section 4 presents the coding results for training objectives, training process, and training methods. Section 5 provides a discussion and implications about the characteristics of China's "double-first class" university graduate training from three aspects: training objectives, training process, and training methods. Section 6 concludes the paper.

2. Literature Review

The literature review of the study focuses on (1) higher education and sustainable development, (2) the quality of graduate training in different countries, and (3) graduate training at "double first-class" universities.

Higher education must pursue sustainable development as it forms the core of China's healthy development. Four elements of scale, quality, structure, and effectiveness form an interdependent and coordinated system of sustainable development of higher education. Among them, quality is the first element that is directly reflected in the quality of talent training. Nevertheless, as graduate enrollment continues to increase, quality challenges also arise.

2.1. Higher Education and Sustainable Development

Higher education can make a substantial contribution to sustainable development. Benjamin Nölting, and Heike Molitor et al. suggest a concept of transfer for sustainable development which makes it possible to analyze the diversity of HEIs' sustainability transfer activities [14]. Matthias Barth, Jasmin Godemann, Marco Rieckmann, and Ute Stoltenberg argued that through combing formal and informal learning settings within higher education, a variety of contexts can be given, and the competence development can be enhanced [15]. Nawaz N, Durst S., A. Hariharasudan, and Shamugia Z studied Knowledge Management (KM) practices in higher education institutions from Europe, Asia, and the Gulf Cooperation Council countries. They suggested that universities need to incorporate information technology-based practices to enhance knowledge management practices [16]. Based on the current situation of the implementation of sustainability curricula in higher education, Marie Weiss and Matthias Barth et al. did a meta-study on 133 case studies from universities around the world and found that the implementation of sustainability curricula in higher education was associated with strong leadership by universities; incentives and support through professional development; concurrent implementation of sustainability in research, campus operations and outreach; and formal involvement of internal and external stakeholders, and so on.

With the development of society, public awareness of sustainability is growing, and students' awareness of sustainable development is also growing. Xueliang Yuan and Jian Zuo took 1134 students of Shandong University as respondents to investigate students' perceptions of campus sustainability in China. They found that students were aware of sustainability issues, among which environmentally oriented issues were the top priorities [17]. In other words, students' awareness of sustainability is traditional and needs to be changed. Through a comparative study of students' perception in public and private universities, Jiawen Wang, Minghui Yang, and Petra Maresova suggested that higher education should decentralize sustainable plans and decision making for students, staff, and faculty [18]. In terms of curriculum, Tongji University has made an attempt. Through the case study of Tongji University, Qian Jia, Ying Wang, and Li Fengting thought that minor education can help tackle the barriers to undertaking sustainable development initiatives in curricula by nurturing the culture and providing organizational support [19].

In summary, sustainable development cannot be achieved without the development of higher education and requires a transformation of the educational system. To be sustainable, higher education needs to change in many aspects, such as teaching, learning, curriculum, discipline, and innovation, which are all centered on talent training.

2.2. The Quality of Graduate Training in Different Countries

Cultivating talented students who can create novel knowledge and apply such knowledge is an invaluable way to achieve sustainable development goals and support sustainable development [20,21]. Graduate education is crucial for cultivating high-level innovative talents and supporting sustainable development.

Graduate education in China started late, and Chinese universities and disciplines still lag behind those of developed countries, though some key universities are making

rapid progress [22]. Regarding female students, from 2000 to 2020, the proportion rose from 34.4 to 52.5%, among whom master's graduates rose from 36.3 to 53.5% and those with a doctorate from 26.6 to 42.7% [23]. In general, China is gradually developing toward the trend of a massive expansion of graduate education [24].

However, there are some problems in graduate education, and the quality of graduate education needs to be improved [25]. Guifang Shao and Tundong Liu see five problems: (1) the lack of interest and ability to do innovative research is the result of the batch training mode; (2) graduate tutors do not give full guidance, so they cannot guarantee the effectiveness of innovative activities; (3) academic pressure is too heavy and students cannot relieve it; (4) appraisal and incentive policies lack diversity; and (5) theory is detached from practice [26].

Based on an analysis of the history of China's graduate education, Qiang Bai recommends raising quality by the establishment of strategic thinking: "self-knowledge and self-confidence, self-sufficiency and self-improvement, self-reflection and self-initiative" [27]. To achieve this, we should take extraordinary measures on training, faculty development, selection of students, mechanism construction, reality-oriented reform, and international cooperation. Ting Xiao and Yu Dong argued that the second classroom was beneficial in strengthening graduates' conviction and enhancing their innovation [28]. After analyzing the policies of China's graduate education, Jian Li and Eryong Xue suggested that we should improve the quality of talent cultivation, the quality of degree management, classroom synergy, and teaching [29]. By introducing the connotation of industry-education integration and analyzing the difficulties encountered in the process of promoting industry-education integration of graduate education in China, Yuping Xu, Fangyi Su, and Zhenwen Hong suggested that the organization and policy system, comprehensive evaluation system, as well as the role of the enterprise should be strengthened [30]. Wanjiang Han and Yifan Tian propose three stages of a practical teaching system for professional masters. These were practice basis management, practice mode management, and practice process management [31].

Other countries have also made useful research in improving graduate education. In the UK, Zhizhuo Su, Yiduo Wang, and Di Wang who work as teaching assistants at Warwick Manufacturing Group reflect on the Moodle design experience. They found three challenges in the Moodle design. They were digital literacy, information density, and feedback [32]. Making improvements in these areas can help improve postgraduate taught students' learning experience in higher education. In America, Susan T. Charles, Melissa M. Karanze, and Frances M. Leslie conducted a study on the mental health of graduate students. Over 3600 graduate students from 10 campuses of the University of California responded to their questionnaires, and they found that both negative factors and positive factors are related to depressive symptoms, although the positive factors have stronger effects [33]. In New Zealand, Ben K. Daniel explored the critical factors which can enhance postgraduate students' research experience and found that courses on research methodology played an important role in improving the postgraduate experience [34].

It can be seen that the issue of graduate training quality has been identified. Previous research found that the quality of graduate training was influenced by many factors such as tutor factors, curriculum factors, policy factors, and psychological factors. They all focused on one of the influencing factors but did not investigate graduate education itself.

2.3. Graduate Training at "Double First-Class" Universities

The quality of double first-class universities represents the highest level of China's graduate education, and research on their graduate training can provide a useful reference for the connotative and sustainable development of higher education.

Currently, case studies on the training of graduate students at double first-class universities are fruitful. Using Wuhan University's humanities and social science research institution as an example, Fan Liu and Chenglong Ma argue that the development of innovative thinking is urgently needed to solve social, economic, and industrial problems [35]. Jin Liu carried out a case study at Xidian University to explore interdisciplinary graduate

training in literature, history, and philosophy. He found that, against the double first-class background, introducing interdisciplinary studies into graduate training reform was in line with the development of contemporary scientific research and education [36]. Wen Gu and Yufan Sun reviewed and summarized graduate education at Beijing University of Technology concerning talent training, teaching reform, and scientific research [37]. Xinzhong Chen and Baozhong Li took the "C9 Union" universities in our country as their research object and carried out a qualitative analysis of training objectives, action strategies, and mechanism safeguards to compare with the 13th Five-Year Plan texts. In their research, NVivo11 was used to analyze the graduate training patterns of research universities [38]. Huijun Luo and Yunlong Zha investigated the development of graduate tutors at Central South University. They proposed establishing long-term development of teacher ethics, improved evaluation of graduate tutors, and enhancement of their professional ability [39].

In general, higher education plays a vital role in sustainable development. However, many factors can influence the quality of higher education, especially graduate education. A great deal of research has been carried out on this issue and most of it focused on a particular factor or a few factors regarding the talent training process. As China's top universities, "double first-class" universities are exemplary in talent training. China's universities have conducted beneficial investigations into graduate training according to national conditions and times and have achieved fruitful results. Among them, research on their graduate training mainly focuses on case studies and the practice of talent training in a particular school in China. Therefore, there is a lack of group work and textual analysis against the background of sustainable development. Besides, although Chinese scholars have conducted many studies on "double first-class" universities, international scholars have conducted few studies in this field. Thus, this study took graduate training programs as its research object and used NVivo12 for analysis. Associated with the concept of talent training mode, talent training includes training objectives, training process, and training methods. Different approaches to these three aspects can reflect the characteristics of talent training in different universities. Then we propose the following hypothesis:

Hypothesis 1. *The graduate training of China's "double first-class" universities has outstanding characteristics in training objectives, training process, and training methods.*

3. Data and Methods

The data and methods of the study comprise (1) data collection and methods, and (2) conceptual analytical framework.

3.1. Data Collection and Methods

The NVivo12 software used to manage and analyze the data is the most used software package for qualitative management and business studies. It is used in forensics, tourism, hospitality, criminology, and marketing [40]. For this research, it provided a workspace to store, manage, and query functions for researchers. It also helped analyze unstructured data including texts, pictures, audio files, and videos. Its functions of "word frequency" analysis and "text query" increased the validity of the research [41].

This study was divided into two stages. First, the texts of graduate training programs of 42 "double first-class" universities were collected over the internet. Of these, 76 relevant texts were selected for the years up to 2022. These texts refer to the talent training programs of each university which are formulated according to the relevant regulations of the state. Additionally, they are programmatic and serve as the overall plan for organizing and managing education. Every aspect of talent training is covered by these training programs, including the universities' talent training objectives, schooling length, curriculum, credits requirements, examinations, academic exchanges, practical links, and tutorial system. Since each university's training program was made at a different time with different timeliness, the time span of the collected texts is from 2013 to 2022. Among them, the graduate training

program of China Agricultural University has been in effect since 2013, and it's still in use without any modification. In addition, Zhengzhou University and Central South University were the same. Therefore, although some training programs looked old, they were still chosen for this study. Depending on their expression, these texts can be divided into three categories: master's training programs, doctoral students' training programs, and graduate training programs including the former ones (Figure 1).
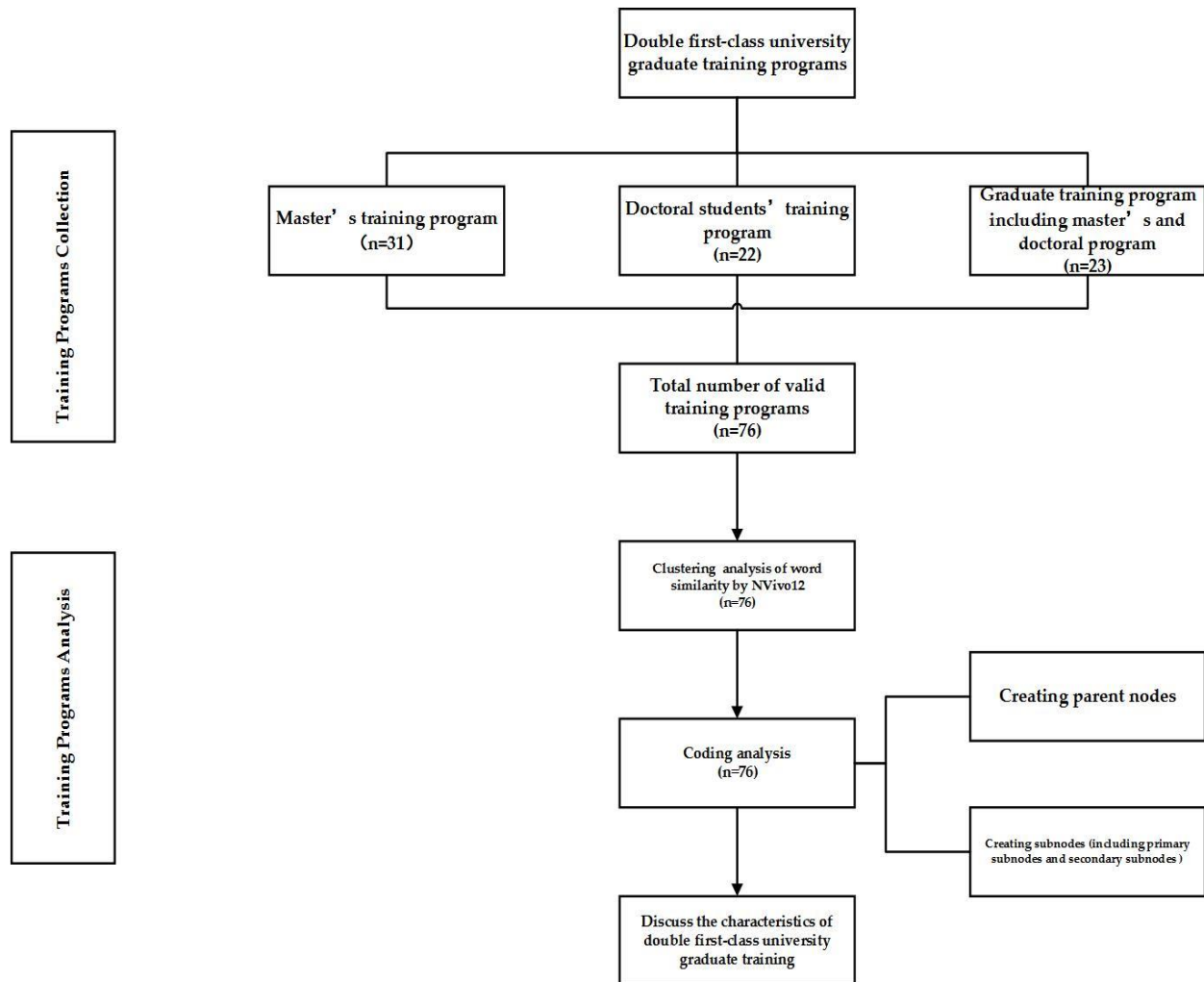

Figure 1. Data collection and research methodology.

Second, these texts were imported into NVivo12 and organized into folders. Then a project and structure were created out of the data to be analyzed using NVivo12. Since the data type of this study was text, the researchers ensured that they had the names of core themes as well as their definitions nearby for reference during keyword coding [42]: "training objectives", "training process", and "training methods" were settled as the three parent nodes, each of which was further encoded to form a subnode. After initial coding, the study reviewed the results and revised the nodes into a structured hierarchy by merging, reorganizing, and renaming [43,44]. For this, the query and exploration functions of NVivo12 were used to conduct high-frequency word and cluster analysis based on keywords and nodes. Then the results told us the main characteristics of graduate training in 42 "double first-class" universities.

3.2. Conceptual Analytical Framework

The term "talent training mode" was introduced by the former National Education Commission in 1994. According to the document Higher education reform plan for

21st century on teaching content and curriculum system, the talent training mode was a major component of higher education research, but its connotation was not fully explained. In 1998, the National Education Ministry wrote Opinions on deepening education reform and cultivating high-quality talents to meet the needs of the 21st century, which gave a specific definition: the structure of knowledge, ability, and quality that the school builds for students, and how to realize this structure. This definition defined the characteristics of talent training and reflected educational thought and concept centrally [45]. In other words, the talent training mode comprised talent training objectives, process, and methods (Figure 2). This provides the analytical framework of this study and the basis for coding analysis. A talent training program is a form of practice in the talent training mode. That is to say, a talent training program is the blueprint for the implementation of talent training objectives in practice. Additionally, it is also the plan form for the concretization of talent training activities. Based on this, this study analyzes the text of 42 "double first-class" universities' graduates' training programs from three dimensions: training objectives, training process, and training methods.
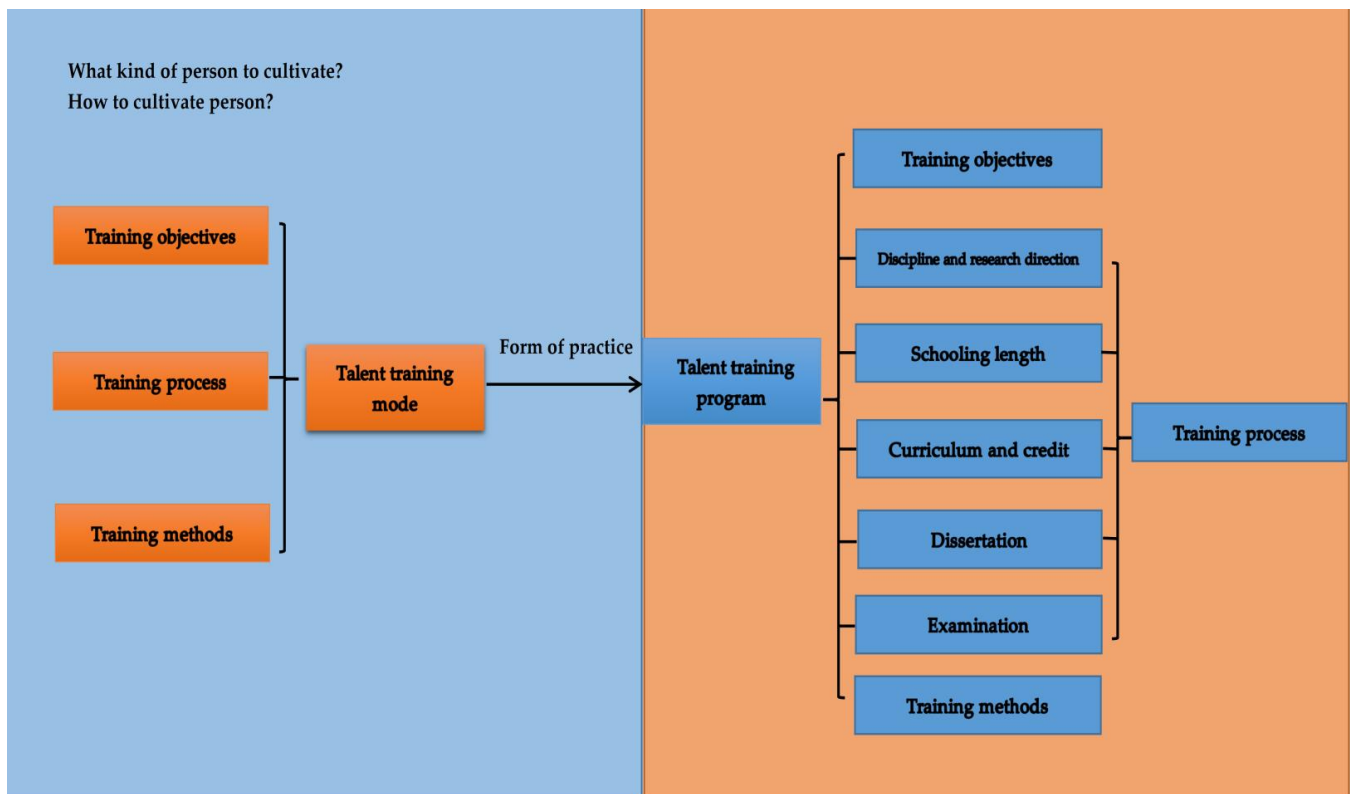

Figure 2. Talent training mode and talent training program.

4. Results

The results of the study mainly include (1) coding analysis of training objectives, (2) coding analysis of training process, and (3) coding analysis of training methods.

The coding analysis of the 76 graduate training programs was carried out on the basis of the above analytical framework. Before the coding analysis began, a cluster analysis of these programs was necessary.

Cluster analysis assumes that all objects have various degrees of similarity and objects can be classified into different categories depending on similarity. If objects are in the same category, it indicates a high degree of similarity between them, otherwise, they are different to some extent. Through a cluster analysis of word similarity, the Pearson correlation coefficient was between 0.9626 and 0.063067. In other words, there was a positive correlation between the texts of their training programs and certain similarities. Specifically, the more

similar the objects are, the closer they appear in the cluster analysis. As shown in Figure 3, the texts of two training programs provided by the same school were highly similar and they were grouped into the same frame and positioned close to each other. For example, the coefficient between the texts of the master's and the doctoral program at Fudan University was 0.9626 and they were closed in the same frame. In addition, the master's and doctoral texts of East China Normal University, Yunnan University, Tongji University, Harbin Institute of Technology, Southeast University, University of Electronic Science and Technology of China, and Tsinghua University were highly correlated, which was possibly related to the writing standards and discourse expression of official documents. The texts of other universities also correlated positively to different degrees. That means the texts of 42 "double first-class" universities were not only consistent but also had some degree of difference. On this basis, the texts of their training programs were coded and then analyzed. The analyses of the coded training programs are given below.

4.1. Coding Analysis of Training Objectives

According to the connotation and orientation of training objectives, the same kinds of subnodes were classified into the same coding category, and three categories of "knowledge", "quality," and "ability" were created under "training objectives". "Knowledge" represented the demands for specialized theory and basic knowledge. "Quality" contained demands for social ability and psychological quality. "Ability" contained the ability of students to acquire and use knowledge and innovate. "Ability", therefore, consisted of training in scientific research, innovation, comprehensive literacy, and competence.

In the process of coding, all the subnodes were divided into corresponding target categories: theory and special knowledge, quality of ideological and political theory, physical and mental health, the ability of scientific research, innovative ability, and comprehensive literacy and competence. After coding, 309 reference points were formed (one datum of codified information formed one reference point). Then word frequency, high-frequency words were found for each subnode. The results are shown in Table 1.

According to the coding results, the "ability" category was coded the most (134 times) and there was not much difference in the coding frequency of the other two (80 times and 95 times, respectively). For the coding results of the subnodes in each category, "knowledge" had the largest number of material sources, reaching almost 65 and accounting for 85.52% of the total number of documents. The "quality of ideological and political" subnode was coded 64 times, the most in the category of "quality". The second one was the "physical and mental health" subnode, which was coded 31 times. According to the "ability" category, the coding frequency of "ability of scientific research" and "ability of innovation" was almost the same, while the "comprehensive literacy and competence" was lower. More attention was paid to scientific research and innovation than comprehensive literacy and competence.

For each subnode, the high-frequency words reflected the main characteristics. In the subnode of "theory and special knowledge", "discipline", "major", and "knowledge" were the most common, which can be concluded from the requirements of "knowledge". This result is consistent with the Ministry of Education's requirements: graduate students should master the solid and broad basic theory and systematic knowledge of their majors. In the subnode of "quality of ideological and political" and "physical and mental health", "socialism" reflected the political orientation of graduate training in China, while "physical health" and "mental health" represented a shift in the universities' focus on students, and more attention was paid to their all-round development rather than learning. In the subnode of "ability of scientific research" and "ability to innovate", "science", "academic", and "innovation" were the most prominent, highlighting the requirements and characteristics of scientific research.
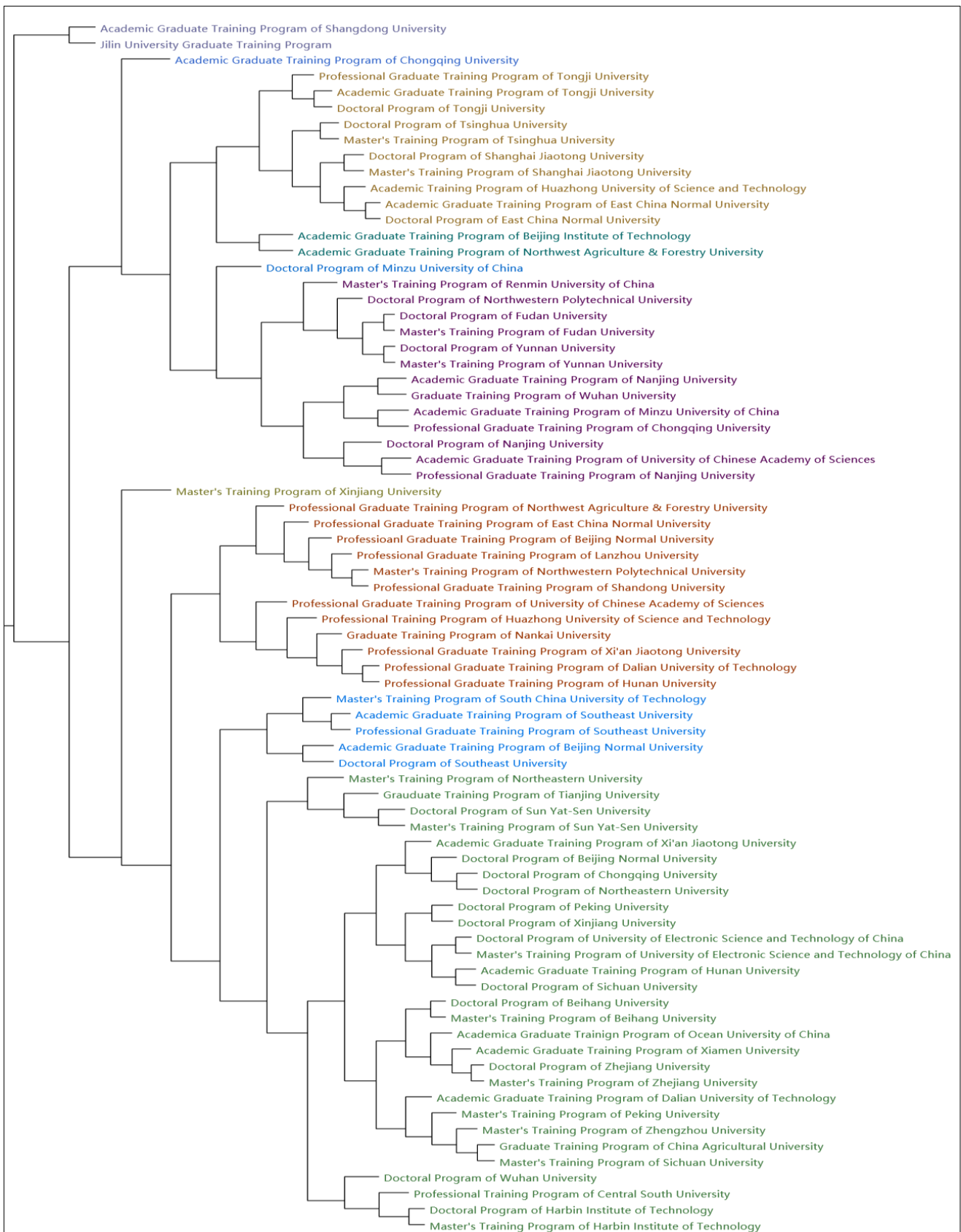
Figure 3. Results of cluster analysis.

Table 1. Coding results of training objectives from 42 "double first-class" universities.

Coding Categories	Subnodes	Number of Source of Materials	High Frequency Words	Number of Reference Points	Examples of Reference Items
Knowledge	Theory and special knowledge	65	Discipline, major, knowledge	80	Shanghai Jiao Tong University: Graduate students should have a solid and broad basic theory and a systematic knowledge of their respective majors.
Quality	Quality of ideological and political	57	Socialism, compliance with the law, country	64	Tongji University: Graduate students should demonstrate the correct direction of politics, love of the socialist motherland, and support for the leadership of the Communist Party of China.
	Physical and mental health	29	Physical health, mental health	31	University of Chinese Academy of Sciences: Graduate students should be sound of mind and body.
Ability	Ability of scientific research	37	Research, science, scientific research, academic	50	Harbin Institute of Technology: Graduate students should have the ability to conduct scientific research independently and creatively; the ability to make creative achievements in scientific research or specialized knowledge; and they should cultivate a rigorous scientific research style, cooperative spirit, and strong communicative ability.
	Ability to innovate	38	Innovation, creativity	51	Xi'an Jiaotong University: Graduate students are expected to be top innovators with an international vision. The school aims to improving self-study and innovative practice.
	Comprehensive literacy and competence	30	Practice, cooperation, organization	33	China Agricultural University: Graduate students should possess high literacy, including the ability to do interdisciplinary research, teamwork spirit, cooperative and organizational management.

4.2. Coding Analysis of Training Process

Through word frequency analysis, a high-frequency word cloud was formed (the larger the font size, the more frequently the words appeared). As shown in Figure 4, the words "research", "examination", "curriculum", "major" and "academy" were the most common. Around them were "science", "theory", "practice", "innovation", "courses" and other words that were highly related to the core words. In addition, "teacher", "society", "enterprise", "cooperation", "tutor", "nation", "writing", and "report" were evenly distributed in the outer ring. It shows that talent training involves several interactive factors.

Among these high-frequency words, which reflect the main characteristics of the training process, "research" appeared the most frequently and the weighted percentage was 2.54. "Examination", "curriculum", "major", and "academy" were also important, and the weighted percentage was 2.13, 1.84, 1.71, and 1.25 respectively. Combined with the main elements of the graduate training process in colleges and universities, the "training process" was taken as a parent node. "Curriculum setting", "academic communication", "dissertation", "practical exercise", and "examination" were generated as 5 subnodes, forming 281 reference points as shown in Table 2.
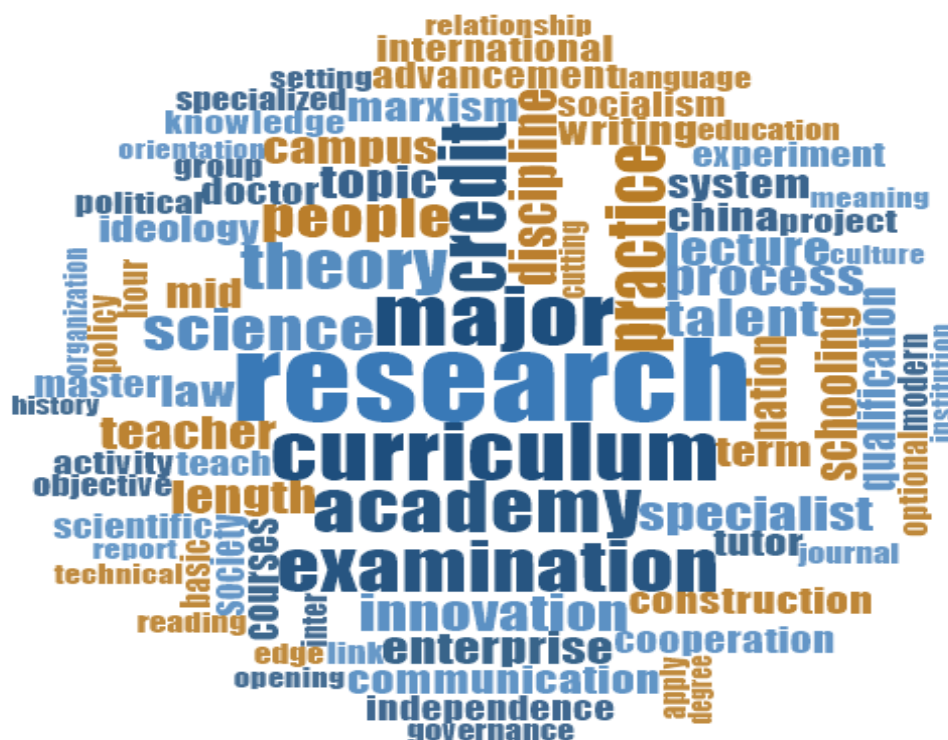
Figure 4. Word cloud of high-frequency words.

Table 2. Reference points in the training process of 42 "double first-class" universities.

Parent Nodes	Subnodes	Number of Reference Points	Secondary Subnodes	Number of Reference Points
Training process	Curriculum setting	77	Compulsory course, optional course	77
			Supplementary course	76
			Interdisciplinary course	21
			Academic and professional course	17
	Academic communication	37	Academic report and lecture	43
			Academic conference	24
			International communication	15
	Dissertation	82	Theory, applicability	29
			Innovation, advancement	41
			Independence	40
	Practical exercise	37	Teaching practice	45
			Social investigation	23
			Professional practice	65
			Social investigation	59
	Examination	48	Curriculum	3
			Mid-term examination	21
			Comprehensive subject Examination (Doctoral qualification)	31

According to the coding results, the 42 "double first-class" universities were mainly concerned with "dissertation", "curriculum setting", and "examination", among which the number of reference points of "dissertation" was up to 82. The emphasis on dissertations has extended beyond the curriculum. The coding times of "academic communication" and "practical exercise" were the same (37). Since the subnodes of the first level were abstract to a certain extent, this study carried out a coding analysis on second-level subnodes to dig out specific problems in each link.

"Curriculum setting" concerned both compulsory and optional courses. In addition, many universities set up supplementary courses to bridge gaps in students' expertise (coding 76 times). According to the "number of sources of materials", the curriculum can be clearly illustrated in Figure 5. The compulsory course was mentioned in 65 documents, followed by the optional course, which was the most important part of the curriculum. The third one was supplementary course and indicated that some universities attach great importance to interdisciplinary courses, especially in graduate courses. Few universities offer academic and professional courses to provide guidance and help for students in their future employment. Nonetheless, the types of courses seem to be diversified and enriched.
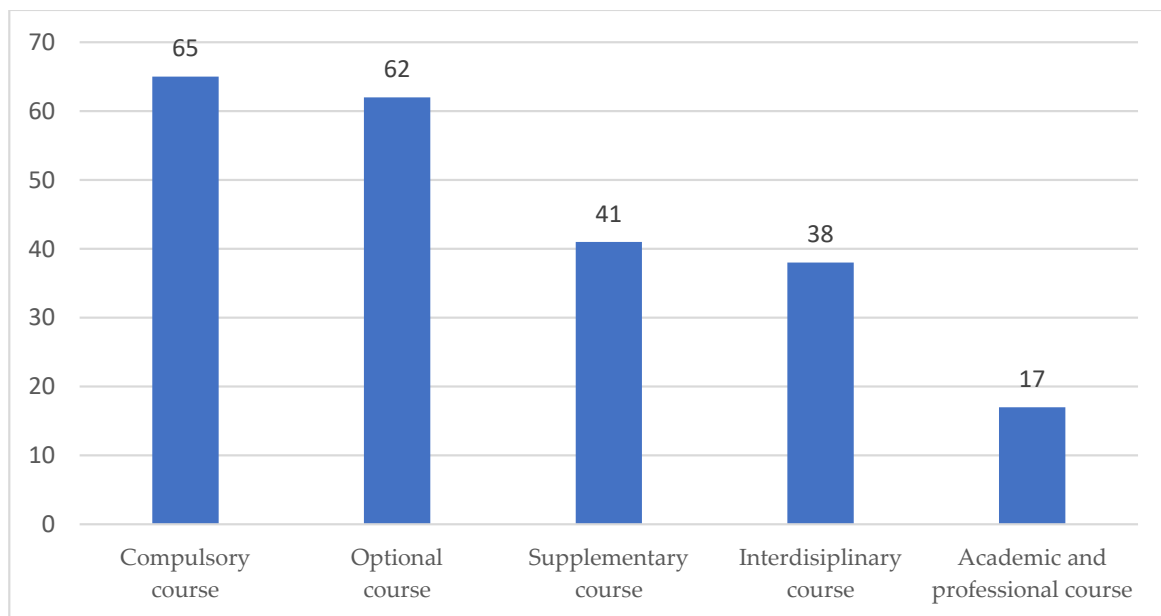

Figure 5. Curriculum setting.

In the "academic communication" link, academic reports and lectures were seen as the primary way to cultivate students' academic research ability, followed by academic conferences and international exchanges. In the "dissertation" link, almost all universities emphasized creativity, innovation, theory, and practice, and all dissertations had to be finished independently by the students themselves. The requirements for advancement and independence are prominent (coding 41 times and 40 times, respectively). In the "practical exercise" link, professional exercise, social activities, and teaching practice were the main options for students and were supplemented by social investigation.

In the "examination" link, the mid-term and comprehensive subject examinations are regarded as screening criteria for the streaming and termination of training, while the screening effect of "course" was relatively weak (coding three times). As shown in Figure 6, each link of the training process had the function of screening. If a student was unqualified at any link, he or she must study for a second time to meet the standard before proceeding to the next link.
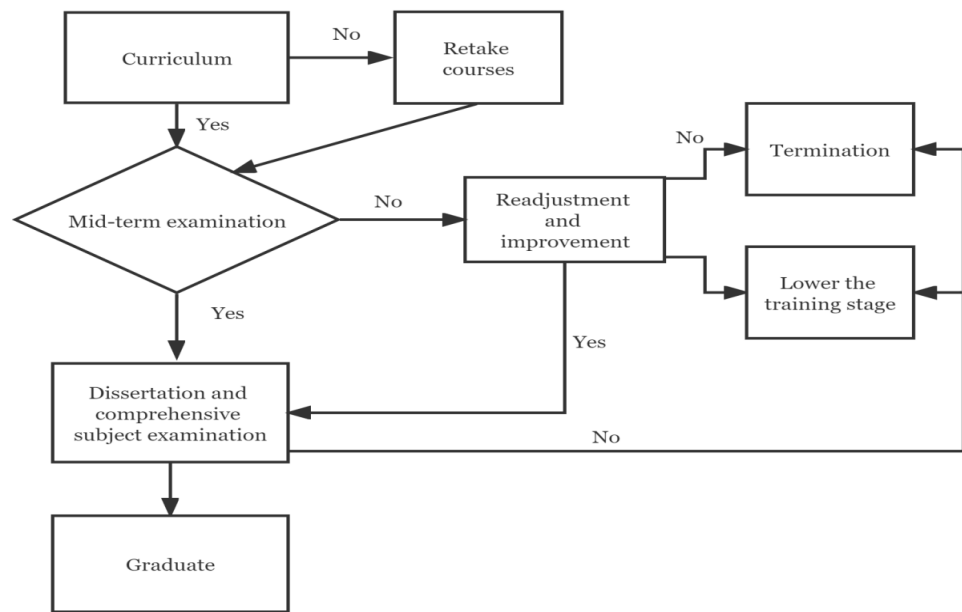
Figure 6. Streaming and termination of talent training.

4.3. Coding Analysis of Training Methods

According to the current training methods, the tutorial system and the combination of curriculum with scientific research are the main ways for graduate training. Specifically, the tutorial system contains an individual tutorial system, a double tutorial system, and a tutor group, while "curriculum and scientific research" refers to the different kinds of combinations of curriculum and scientific research, exercise, and dissertation. Thus, two primary subnodes were created and six secondary subnodes were generated (Table 3).

Table 3. Composition and distribution of reference points of 42 "double first-class" universities' training methods.

Parent Nodes	Primary Subnodes	Number of Material Sources	Number of Reference Points	Secondary Subnodes	Number of Reference Points	Examples
Training methods	Tutorial system	37	122	Individual tutorial system	132	Zhejiang University: We implement individual or tutor group guidance, encourage cooperative training at home and abroad, and implement the joint guidance mode of tutor group.
				Double tutorial system	142	
				Tutor group	424	
	Curriculum and scientific research	61	86	Combination of curriculum and scientific research	9	Xiamen University: The training of doctoral students focuses mainly on scientific research, while the training of master's students adopts a combination of curriculum study and dissertation research.
				Combination of curriculum and exercise	1	
				Combination of curriculum and dissertation	39	

From the distribution of primary subnodes, the training methods focused on the tutorial system and a combination of curriculum and scientific research, the results of which are shown in Table 3. From the coding results of training methods, under the primary subnode of "tutorial system", three secondary subnodes were generated: "individual tutorial system", "double tutorial system", and "tutor group". Among these, "tutor group" was coded the most at 424 times. This indicated that the training methods were "tutor group" followed by "double tutorial system" with a coding frequency of 142. In China, the

double tutorial system referred to two tutors for professional degree graduate students: one on campus; the other, off-campus.

In the coding results of the primary subnode "curriculum and scientific research", three types of combination were deemed as the main methods for talent training. Among these, "the combination of curriculum and dissertation" was seen as the most critical and the coding frequency reached 39 times. Since most universities take "academic communication" to be a single part of the training process (shown in Table 2) and do not include it in the training method for text expression, the number of reference points for "combination of curriculum and scientific research" was only nine. Practical exercise was emphasized in the training process of professional graduate education, and the number of reference points was one, though it was also a method of graduate training.

5. Discussion and Implications

The discussion and implications of the study mainly include (1) training objectives: clear decomposition of quality and ability structure, pointing to students' potential for sustainable development, and (2) training process: focus on "training quality", promoting the connotative development of higher education, and (3) training methods: developing a mixed tutorial system and promoting the students' ability for sustainable development.

According to the coding analysis of the parent nodes "training objectives", "training process", and "training methods", the main characteristics of the "double first-class" universities' training mode include the following aspects:

5.1. Training Objectives: Clear Decomposition of Quality and Ability Structure, Pointing to the Students' Potential for Sustainable Development

The coding results of the texts indicated a high degree of consistency in training objectives covering the demands of knowledge, quality, and ability. In these categories, the number of material sources was higher than 65; that is, more than 85.53% of the program texts for graduate training objectives were decomposed into knowledge, quality, and ability.

In the category of "knowledge", emphasis was placed on strengthening the graduate students' theoretical and special knowledge to promote students' sustainable development of the academy. In China, graduate education shoulders the important task of training high-level talents. Professor Tianxiang Xue says that graduate education has the main characteristics of scientific research [46], meaning that graduate studies represent a higher level of education based on undergraduate education, requiring both depth and breadth of knowledge. Only by mastering solid theoretical knowledge can academic development gain sustainable momentum.

In the category of "quality", the focus was on moral education and the cultivation of ideological and political theoretical literacy. The fundamental task of talent training is to train socialist builders and successors, so China's graduate education must take Marxist theory as its guide. We should take the establishment of moral education as a systematic project: educating people first, moral education first. Our graduate education should reflect Chinese characteristics not only because it is the requirement of General Secretary Xi Jinping, but also because it is the direction it must follow for the sustainable development of higher education. Without morality, education will be dangerous and detrimental to the development of society. In addition, graduates' physical and mental health was also valued by some universities, accounting for 38.16% of all. This shows that with the development of education, the concern for students is no longer limited to knowledge. Instead, the concern for students themselves, especially with their physical and mental health, is gradually increasing.

In the category of "ability", the cultivation of graduate students' ability in scientific research and innovation was emphasized because it was also the first time Chinese students came into contact with academic research in a real sense [47]. Therefore, graduate education is very helpful for cultivating students' abilities in scientific research and we should consider the cultivation of innovative awareness, spirit, and ability as the internal requirements.

Innovation is the inexhaustible power of the sustainable development of society, and it is an effective way for higher education to support sustainable development [48]. In order to build an innovative country and a world powered by science and technology, China needs high-quality innovative talents.

5.2. Training Process: Focus on "Training Quality", Promoting the Connotative Development of Higher Education

According to the distribution of reference points of subnodes in each link of the training process, "double first-class" universities placed great emphasis on graduate training, closely combined with the training objectives.

As for "curriculum setting", we recognized that interdisciplinary studies are essential for the advancement of scientific research in the future. Interdisciplinary graduate training has become the new trend in the development of graduate education and it's the main way to cultivate innovative talents. In terms of curriculum, there are public compulsory courses, professional compulsory courses, public optional courses, and professional optional courses which made up the main part of the whole curriculum. Besides, there are some special courses for students who need them, such as supplementary courses and academic courses. A total of 13 universities offer supplementary courses for students who want to apply for a cross-major examination or lack the requisite undergraduate or master-level standing in their respective disciplines. Harbin Institute of Technology stipulates that such undergraduates select main undergraduate level courses as supplementary courses under the guidance of their tutors [49]. Shandong University requires that students who major in interdisciplinary subjects or the equivalent must take between one–two compulsory courses without credit [50]. Two universities (East China Normal University and Xiamen University) encourage graduate students to select interdisciplinary courses under the guidance of their tutors to develop an interdisciplinary mindset and broaden their knowledge. This indicates that they have begun to promote the training of interdisciplinary graduate students at the curriculum level.

Two of the most important ways to improve students' academic ability are: "academic communication" and "dissertation". First-class universities provide opportunities for students to conduct academic research through domestic and international academic exchanges research projects and writing independent academic papers. Among these activities, international exchanges and academic activities can help universities absorb the most up-to-date knowledge from universities in other countries. It can also help to cultivate graduate students' international ability and improve the level of scientific research. Doctoral students must attain certain achievements in scientific research to be qualified to apply for their doctoral degree. The number of material sources was 32, and the number of reference points was 207. Relatively speaking, the achievement requirement for master's degree students is lower. The core word "academic"—-referring to activities, reports, exchanges, and conferences—-was used 142 times, with a weighted percentage of 8.29%. According to the regulations on the training of academic degree graduate students at East China Normal University, academic activities include lectures, conferences, and competitions [51]. In other words, reports, lectures, and conferences are the main ways that colleges and universities cultivate the ability of graduate students along with international scientific cooperation [52]. China's "double first-class" construction takes Chinese characteristics and world-class as its core, so it must integrate with the world. Consequently, many colleges and universities have established different platforms for international academic communication. They also emphasize the importance of dissertation topic selection and the distinction between training types. For professional degree graduate students, dissertation topics must originate from an applied project or social practice and serve the needs of social development. For academic degree graduate students, the topics should be more theoretical. Through a word frequency analysis of "dissertation", "innovation" occurs up to 30 times. Since a dissertation is one of the criteria to test a student's academic ability, it must be completed independently.

For "practical exercise", teaching practice, professional activities, and social investigation are included in the training at many universities, and the number of material sources is 37. Different kinds of practice cultivate different types of abilities. Students can be familiar with basic teaching, master basic teaching skills and methods, and improve their teaching ability. Xiamen University provides mandatory teaching assistant positions for students and doctoral students for at least one course during their academic year. Professional skills and abilities are cultivated through "professional practice". For example, in the fourth or fifth semester, Wuhan University offers professional degree graduate students to corporations. Universities try to cultivate attention to social development through "social practice" and "social investigation". For example, at Renmin University of China, graduate tutors guide social investigations and encourage students to conduct local investigations and participate in field visits during winter and summer vacations. This shows that in the process of graduate training, "double first-class" universities pay attention to the needs of social and national development and strive to improve the fit between talent training and the needs of society. In addition, we should speed up the integration of science and education in graduate education, strive to improve the graduate education system, and promote their innovative and practical ability.

The quality of graduate training at "double first-class" universities begins with the assessment and screening of students suited for further education and helping other students to choose the right program which is essential for modernizing graduate education [53]. They take the curriculum as the basic assessment measure and strengthen the screening role of academic papers, mid-term assessments, and other links. It can be seen from Table 2 that mid-term and comprehensive subject examinations (including doctoral qualification examinations) have become the main basis for streaming graduate students. Just as the 13th Five-Year Plan of Degree and Graduate Education indicated, we should strengthen the management and examination of the curriculum, mid-term and qualification examinations, and thesis proposals. Channels should be created for the streaming or termination of doctoral and master's students and increase the intensity [54]. In addition to the above measures, the regulations of Beihang University concerning the streaming and termination of training clearly state that under the following conditions students will stop their studies or go down to a lower level of learning. The regulations are as follows: 1, the student cannot continue if he or she is ideologically, morally, or academically unsuitable; 2, a degree is disqualified and canceled due to failure in the dissertation examination; 3, failure to apply for a doctoral degree because of an extension, or if an application for the extension was not approved; 4, the student requests to terminate doctoral study after three years with the permission of his tutor and college approval; 5, the responsible supervisor proposes to stream or terminate the training of the doctoral student with school approval; 6, a doctoral student cannot continue for other reasons [55].

In 2020, the Ministry of Education, the National Development and Reform Commission, and the Ministry of Finance jointly issued Suggestions on Accelerating the Reform and Development of Graduate Education in the New Era and clearly proposed that universities and research institutes strengthen control over the quality of training and improve the graduate qualification examination and the mid-term and annual assessments. They should also increase the intensity of streaming for students not suited for continual learning [56]. For example, Nankai University ended its zero-elimination policy for doctoral students. Huazhong University terminated graduate students whose study time was longer than the length of the degree. Jinan University has begun to remove the status of students.

5.3. Training Methods: Developing a Mixed Tutorial System to Promote the Students' Ability for Sustainable Development

According to the coding analysis of the training methods, the combination of curriculum and scientific research was chosen as the main training method with 61 material sources, accounting for 80.26% of the 76 documents. As a specific method of training, the tutor group and double tutorial system ranked most prominently with 424 and 142 reference points, respectively.

Tutors play a very pivotal role in the training process for students' professional growth and scientific research, and they are the primary instructors in the "curriculum and scientific research". With the development of science and technology, academic research, and the reform of knowledge production, students with the professional knowledge and scientific research of a certain discipline could not adapt to the needs of society. However, the tutor's single-disciplinary quality also affects talent training; therefore, it is necessary to construct a mixed tutorial team with multi-disciplinary knowledge and literacy for students' development and improved training. According to the current types of graduate student training, academic graduate students focus mainly on cultivating academic ability, while professional degree graduate students pay more attention to practical abilities. For academic graduate students, the multidisciplinary background tutor group or tutor group is the appropriate means to develop academic communication, conduct scientific projects, and write papers. For professional degree graduate students, the double tutorial system is more suitable. The academic and professional ability will be enhanced with guidance from intramural and extramural tutors. The intramural tutor gives advice on papers and learning, while the extramural tutor gives advice on practical activities and projects. The "double tutorial system" helps students combine theory with practice and promotes the integration of industry–university research which is beneficial for gaining sustainable momentum and meeting the needs of society better. In addition, for the training of interdisciplinary graduate students, a group of interdisciplinary supervisors is set up to guide them in scientific research. Some universities have set up interdisciplinary institutes, such as the Institute for Interdisciplinary Information Sciences at Tsinghua University and the Institute of Frontier Interdisciplinary Sciences at Peking University. In these institutes, teachers and researchers with different kinds of discipline backgrounds are integrated to cultivate the students' ability in interdisciplinary research.

This study focuses on talent training itself, rather than on a particular part of talent training as previous studies have conducted. The above coding analysis presents the specific practices and characteristics of "double first-class" universities' graduate training. The distinctive Chinese characteristics of graduate training at "double first-class" universities show that the talent training at Chinese universities is in line with the needs of Chinese society. China is, to some extent, following a path of the sustainable development of higher education that places quality at its center. Talent training involves many factors and is affected by many factors. This provides implications for other universities: (1) determine the goal and guiding ideology of talent training according to the needs of the development of national higher education, (2) focus on the quality of talent training and consider it as the core of talent training, and (3) innovate the method of talent training.

6. Conclusions

The purpose of this study is to explore how Chinese graduate training promotes the sustainable development of higher education. This study constructed a three-category analytical framework of training objectives, process, and methods using NVivo12 software to analyze the main characteristics of 42 "double first-class" universities in China. The results show that Chinese "double first-class" universities emphasize training objectives, process, and methods differently, which have distinctive Chinese characteristics. To promote the sustainable development of higher education, the study concludes that the most suitable strategy is one that is appropriate to the needs of the country. Talent training is of primary importance in higher education. Choosing a path of talent training that is suitable for national characteristics is conducive to supporting the sustainable development of higher education. Universities should consider the training objectives, training process, and training methods in an integrated manner to achieve the goal of promoting the sustainable development of higher education.

As with any research, this study had some limitations. The scope of this study was limited to covering only 42 "double first-class" universities; other universities were not included. Their graduate training programs were formulated according to national policy

and combined with school characteristics, making graduate training a guiding role for the whole university. However, due to the professionalism of graduate education, each university refines its training programs according to professional characteristics. This study only analyzed the program texts without considering the specific implementation of these programs. In addition, graduate training at China's "double first-class" universities is important for comparing them to universities in different countries. Therefore, there is room for research both vertically and horizontally, and it is beneficial to continue the research in this direction. Further studies may be conducted at the program implementation level as well as seek to produce international comparisons.

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