

VISUAL ANALYSIS OF MY COUNTRY'S PHYSICAL EDUCATION RESEARCH FIELD BASED ON KNOWLEDGE GRAPH

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Abstract: Taking 4,795 core journal papers on physical education research included in the CNKI database from 2000 to 2014 as the research object, using methods such as bibliometrics, co-occurrence analysis, and word frequency analysis, and using CiteSpaceIII software to draw knowledge The visual analysis of the number of published papers, research institutions, core authors, research hotspots and frontiers of physical education research aims to comprehensively grasp the dynamic process of my country's physical education development research and provide valuable reference for theoretical research and practice of physical education in my country . The results show that: in the past 15 years, the number of papers published in my country's physical education research has shown a wave-like growth trend; the high-yielding institutions are mainly composed of Beijing Sport University, the School of Physical Education and Health of East China Normal University, and the School of Sports Science of Fujian Normal University, and the normal colleges are my country The main force in physical education research; the leading figures in my country's physical education research are represented by Ji Liu, Wang Jian, Huang Hansheng, etc. The co-occurrence network density of core authors is low, and the degree of cooperation needs to be improved. Finally, through the analysis of high-frequency keywords in the literature, it is concluded that the hot spots and frontiers of physical education research in my country mainly focus on physical education thoughts, physical education theory, physical education in colleges and universities, teaching reform, physical education curriculum reform, quality education, and professional research on physical education etc.

Keywords: Physical education; Scientific research institution; Core author; Teaching mode; Physical education; Teaching reform; Physical education curriculum; Quality education

1. INTRODUCTION

The scientific knowledge map is an image that takes the knowledge domain as the research object and shows the development process and structural relationship of scientific knowledge. It has the dual nature and characteristics of "graph" and "spectrum" [1]. It is a new field developed in the fields of scientometrics, informetrics, bibliometrics, mathematics, and statistics. Many domestic researchers use knowledge map-based visualization methods to conduct research from many aspects such as physical education teacher education, physical education disciplines, and hotspots of physical education research, which has become a new hot spot in the field of physical education research. For example, Li Fang made a comparative analysis of the frontiers and hotspots of Chinese and foreign physical education teacher education from the perspective of scientific knowledge graph, Niu Honglin analyzed the research hotspots of physical education in my country from the perspective of knowledge graph, and Gao Ming used CiteSpaceIII to analyze foreign sports education from the perspective of metrology. Education conducts scientific research. Since the formation of the modern education system, physical education has always been an important means of school education and an important content of the school curriculum system. In June 1999, the "Decision of the Central Committee of the Communist Party of China and the State Council on Deepening Educational Reform and Comprehensively Promoting Quality Education" pointed out: "To implement quality education, we must organically integrate moral education, intellectual education, physical education, and aesthetic education into all aspects of educational activities." "Decision" shows the importance of physical education as quality education, and also points out the fundamental purpose of school physical education, and stipulates the nature of physical education and curriculum [2] . What is the development of physical education in the 15 years after the implementation of the "Decision"? What hot topics have emerged? There are no detailed reports on such issues in China. In view of this, this paper uses the method of scientific knowledge graph to analyze the 4,795 documents included in the China Academic Journal Network Publishing Database (CNKI) in the field of physical education in my country from 2000 to 2014, from the development trend, scientific research institutions, core authors, research hotspots and frontiers, etc. The purpose of visual analysis is to comprehensively grasp the dynamic process, characteristics, hot spots and frontier fields of my country's physical education development research, and to provide valuable reference for the theoretical research and practice of my country's physical education.

2. RESEARCH METHODS

2.1 Bibliometric Method

Bibliometric method is commonly referred to as bibliographic statistical analysis, which is to use statistical methods to statistically analyze the characteristics of related documents.

Statistical analysis is a method of using data to describe or explain the data characteristics and changing laws of literature, thereby explaining the characteristics and laws of literature [4].

2.2 Co-occurrence Analysis Method

Co-occurrence analysis method was proposed by M. Clon, a researcher at the French National Center for Scientific Research in the middle and late 1970s. It is based on the characteristics of the document content, takes the subject terms of the document as the analysis object, counts the number of times they appear in the same document for a group of words, and performs cluster analysis on this basis. It is generally believed that the more frequently words appear in the same document, the closer the relationship between the two topics is, and then analyze the structural changes of the disciplines and themes represented by these words, and discover the research hotspots of the disciplines. Horizontal and vertical analysis The dynamic development and static structure of subject areas [5].

2.3 Word Frequency Analysis

Word frequency analysis refers to a metrology method that uses keywords that can reflect the core content of documents to reveal the quantitative relationship and internal laws of the development of things according to their frequency of occurrence. The higher the degree of concern of researchers in the research field, the more likely it represents the research hotspots and frontiers in this field [6].

2.4 Visual Analysis Method

Visual analysis method is the method of converting data into graphics or images by using computer graphics and image processing technology [7].

On the basis of the above methods, this research uses CiteSpaceIII (version 3. 8. R6 (64- bit)) scientific literature analysis tool [8]. The downloaded bibliographic data of 4 795 articles was input into CiteSpaceIII software; the time span was selected as 2000 to 2014, the Time Slice (time zone division) was set as one stage per year, and the source of the subject words was Title (title), Abstract (Abstract), Author Keywords(DE) (author keywords), Keywords Plus (ID) (keywords plus), the threshold is set to (2, 2, 20) (2, 2, 20) and (2, 2, 20), the selected path search is the minimum spanning tree (Minimum Spanning Tree) algorithm, and its institution (Institution) and Author (author) co-occur using (pathfinder)

algorithm. According to the different analysis contents, the corresponding network nodes are selected, such as authors, keywords, institutions, etc., and the knowledge map in the field of physical education in my country is drawn.

3. RESEARCH RESULTS AND DISCUSSION

3.1 Time Distribution of Research Literature

Analyzing the relationship between the number of papers published in the field of physical education and time changes can reveal the research history and development speed of this field, and predict its development trend [9]. It can be seen from Figure 1 that the number of published research papers on physical education in my country is increasing in waves, which can be roughly divided into three stages: the first stage is the development stage (2000-2005), and a total of 1511 papers were published in 6 years, accounting for Total

31. 76%. The second stage is the stage of rapid development (2006-2010). my country's sports industry has entered a period of rapid development, and the annual publication of papers shows a rapid growth trend. According to statistics, 290 papers were published in 2006, increasing year by year. By 2010, the number of papers published reached a peak of 429; The third stage is the stage of stable development (2011-2014). In this stage, my country's physical education policy is gradually improved, the concept of physical education is gradually mature, and the development trend is relatively stable. Although the number of annual papers has declined, it still remains high. The average annual publication volume is 330.5.

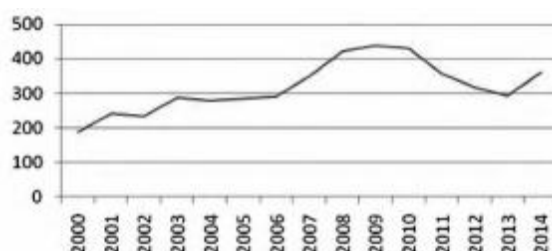


Figure 1 Number of Published Papers About Physical Education in China During 2000-2014

3.2 Co-occurrence Analysis of Scientific Research Institutions based on Knowledge Graph Analysis of Scientific Research Institutions

It can intuitively show the main force and influence distribution of physical education research in my country. Using CiteSpace III software, the network node selection institution (Institution), using the path algorithm (pathfinder) for analysis, to obtain the knowledge map of research institutions in the field of physical education in my country. At the same time, select the Clusters | Cluster Explorer command to further analyze the institutional co-occurrence network, and count the top 10 institutions that publish papers (Table 1).

Table 1 Top 10 Research Institutes Published the Most Papers About Physical Education in China During 2000-2014

Ranking	Number of articles published (articles)	Research institutions
1	83	Beijing Sport University
2	45	School of Physical Education and Health, East China Normal University
3	44	School of Sports Science, Fujian Normal University
4	43	School of Sports Science, Nanjing Normal University
5	37	Hunan Normal University Physical Education College
6	36	School of Physical Education, Central China Normal University
7	33	School of Physical Education and Sports, Beijing Normal University
8	31	School of Physical Education, Anhui Normal University
9	30	School of Sports Science, South China Normal University
10	30	Henan University Sports College

Note: The scientific research institution is subject to the actual department where the author publishes the paper.

The annual ring represents the history of papers published by the institution, the color of the annual ring represents the corresponding publication time, and the thickness of an annual ring is proportional to the number of papers published by the institution in a certain time zone [10].

It can be seen from Table 1 and Figure 2 that Beijing Sport University has the largest node, with 83 research papers published on physical education from 2000 to 2014, ranking first; the second place is the School of Physical Education and Health of East China Normal University, which published 45 papers; Ranked third is the School of Sports Science of Fujian Normal University, which has published 44 papers. Among them, among the top 10, 1 sports college published 83 papers, accounting for 20.15%; 8 teacher training colleges published a total of 299 papers, accounting for 72.57%; 1 comprehensive university, published 30 papers, accounting for 7.28%. It shows that Beijing Sport University is far ahead of other sports colleges and universities in the field of physical education research, and has strong scientific research strength. In addition, normal colleges and universities pay close attention to the research of physical education in our country, and have strong scientific research strength, which is the main force in the research of physical education in our country [11].

From Figure 2 of the co-occurrence network of my country's physical education research institutions, it can be seen that there are 433 institutions ($N = 433$), and the network density is low ($Density = 0.001$), indicating that the institutions in the field of physical education research in my country are widely distributed. Among them, 92 institutions have cooperative relations ($E = 92$). The largest cooperation network is a co-occurrence network constructed with Beijing Sport University as the core and the School of Physical Education and Sports of Beijing Normal University, School of Physical Education of Hebei Normal University, Capital Institute of Physical Education, Hebei Institute of Physical Education, School of Sports Science of Nantong University, etc.; The second largest co-occurrence network constructed by the School of Physical Education and Health of East China Normal University, the School of Physical Education of Fujian Normal University of Physical Education, the Physical Education College of Hunan Normal University, the Physical Education College of Henan Normal University, the Physical Education Department of Zhengzhou University, and the Physical Education College of Yangzhou University; The 3rd place is a co-occurrence network constructed by the School of Physical Education of Central China Normal University, the Sports Department of Wuhan University of Technology, the School of Physical Education of Jiangxi Normal University, the School of Sports Science of South China Normal University, Guangzhou Institute of Physical Education and the Department of Physical Education of Jiaying University; ranked 4th The co-occurrence network constructed by the School of Physical Education of Nanjing Normal University, the Physical Education Department of Nanjing University, the Physical Education Department of Nanjing University of Technology, and the Physical Education Department of Hohai University; , Xi'an Institute of Physical Education, Soochow University Institute of Physical Education, and Wuhan Institute of Physical Education as the core of five relatively prominent co-occurrence networks, conducting research and close cooperation in different fields of physical education.

In Figure 2, burst indicates that the publication of papers fluctuates greatly in a short period of time, and a high burst value indicates that the publication of papers increases rapidly [12]. Among them, the College of Sports Science of Fujian Normal University has the highest emergent value of 8.17; the second is the College of Physical Education and

Health of East China Normal University (6. 51); the third is the College of Physical Education of Ningbo University (5. 82); the fourth is It is the School of Physical Education of Central China Normal University (5. 06), and the fifth place is the School of Physical Education of Zhejiang Normal University (4. 63).

3.3 Core Author Knowledge Map Analysis

Generally speaking, the number of authors' documents reflects their knowledge output ability, which is one of the objective criteria for the author's labor efficiency. The author's achievements are highly related to the number of papers published in important journals, and the number of high-quality papers is directly proportional to scientific and technological achievements [13].

Among the 4795 documents in this study, a total of 6076 scholars are engaged in the research of physical education in my country. Among them, there are 9 people with a frequency of more than 10 times, accounting for 0. 15%; 144 people with a frequency of 4 to 9 times, accounting for 2. 37%; 289 people with a frequency of 2 to 3 times people, accounting for 4. 51%; there were 5 625 people with 1 occurrence frequency, accounting for 92. 72%. It shows that the subject of sports research in our country has been widely

The attention of university scholars and high-yield authors are relatively concentrated. In this study, a statistical analysis of the institutions (or departments) of high-yield authors who have published more than 10 papers (including 10 papers) found that there are 9 persons in total (Table 2). Among them, there are 7 scholars from normal colleges, accounting for 77.78% of the total number of "high-yield" authors; 1 scholar from sports colleges, accounting for 11.11% of the total number of "high-yield" authors; 1 scholar from comprehensive universities, accounting for 11.11% of the total number of "highly productive" authors. This is completely consistent with the analysis of the distribution of high-yield institutions, and the principle of symbolizing the distribution of high-yield authors by high-yield institutions.

Table 2 Top 10 Researchers Published the Most Papers About Physical Education in China During 2000-2014

Serial number	Author	Number of Articles published (articles)	Author unit
1	season view	31	School of Physical Education and Health, East China Normal University
2	Wang Jian	25	School of Physical Education, Central China Normal University
3	Huang Hansheng	15	School of Sports Science, Fujian Normal University
4	Wu Yandan	14	School of Sports Science, Fujian Normal University
5	Zuo Xinrong	12	School of Physical Education, Anhui Normal University
6	Ma Weiping	12	Hunan Normal University Physical Education College
7	Tian Yupu	10	School of Sports Science, Nanjing Normal University
8	Li Jingbo	10	Department of Physical Education, School of Education, Sun Yat-sen University
9	Yao Lei	10	Beijing Sport University
10	Liu Bo	9	Tsinghua University Sports Department

Using CiteSpace III software, the network selects Author (author) and selects the path algorithm (pathfinder) for analysis, and obtains the core author co-occurrence network, which contains a total of 442 authors, which shows that a relatively stable author team has been formed in the field of physical education research in my country .

Through the introduction of the official website of the high-yield authors and their institutions, it is found that among the top 10 core authors in the field of physical education research in my country, 8 are professors, 2 are associate professors; 7 are doctors, 2 are masters, and 1 is a bachelor's degree; The author group of the core team in the field of educational research is strong. Ji Liu is a professor and doctoral supervisor at the School of Physical Education and Health, East China Normal University. His research mainly focuses on sports psychology, physical education curriculum and teaching. Wang Jian is a professor and doctoral supervisor of the School of Physical Education of Central China Normal University. He is mainly engaged in research in the fields of school physical education and sports sociology. Huang Hansheng is a professor and doctoral supervisor of the School of Sports Science of Fujian Normal University. He is mainly engaged in research in the fields of physical education and training, curriculum content and curriculum system reform of physical education majors. Wu Yandan is a professor and master supervisor of the School of Sports Science of Fujian Normal University. His main research directions are the theory and practice of college sports and special physical education. Zuo Xinrong is a professor and master supervisor of the School of Physical Education of Anhui Normal University. His main research fields are sports humanities and sociology and school physical education. Ma Weiping is a professor and doctoral supervisor of the School of Physical Education of Hunan Normal University. His main research fields are sports humanities and sociology, sports theory research and application. Tian Yupu is a professor and doctoral supervisor of the School of Sports Science of Nanjing Normal University, mainly

engaged in the teaching and research of sports sociology and mass sports. Li Jingbo is an associate professor and master supervisor of the Department of Physical Education of Sun Yat-sen University. He is mainly engaged in research in the fields of physical education teaching, training and management. Yao Lei is a professor and doctoral supervisor of Beijing Sport University. Her main research directions are physical education, school physical education, and physical education courses. Liu Bo is an associate professor and doctoral supervisor of the Department of Physical Education of Tsinghua University. His main research directions are German sports, comparison of sports systems, combination of sports and education to train high-level student athletes, and national sports development strategies.

Looking at the research fields and directions of the above-mentioned core authors, it can be seen that pedagogy, psychology, sociology and other disciplines intersect and integrate with physical education research. Through the continuous and stable research and extensive cooperation and exchanges of outstanding leaders in the field of physical education research in our country, it has played a positive role in promoting the sustainable development of physical education in our country.

Some studies believe that scientific output is highly correlated with the frequency of cooperation between scientists, and a high output rate is positively correlated with a high level of cooperation [14]. Figure 3 is the core author's collaborative knowledge graph, where Nodes (nodes) = 442, Links (connections) = 182, and Density (density) = 0.0019. The analysis shows that the co-occurrence network density of core authors in the field of physical education research in my country is low, indicating that the degree of cooperation among authors is low, and only a few large cooperative teams have been formed. Among them, the largest cooperation team, with Ji Liu as the core, includes Li Lin, Dong Cuixiang, Wang Xiaozan, Yin Zhihua, Chen Zuosong, etc. The team mainly focuses on the physical education curriculum model, physical education curriculum reform, physical education teacher education reform, and national standards for teacher education in colleges and universities. research in other fields. The second largest cooperation team is composed of Wang Jian, Huang Aifeng, Shao Weide, Hu Jianhua, and Li Qidi. The main research fields are the dialectical relationship between the "discipline" and "skills" of physical education, the principle of "monism of physical and mental education" in physical education courses, Ba Zeduo, Piaget, Pestalozzi's thoughts on physical education, and the reform of physical education for students with disadvantaged sports. The third largest cooperation team, composed of Huang Hansheng, Wu Yandan, Ji Keyi, Fang Qianhua, etc., the main research areas are the curriculum setting, curriculum system, curriculum reform of undergraduate physical education majors in ordinary colleges and universities in my country, physical education for "special" students in colleges and universities, and American sports education. Educational issues faced during periods of development and reform. In addition, there are several outstanding teams with Ma Weidong, Gao Zhiwei, Wang Kangle and Xu Benli as the core. These teams have conducted in-depth analysis and research in different fields of physical education in my country, and have made great contributions to the research and development of physical education in my country. The contribution and strengthen the cooperation among the teams should play a positive role in the development of physical education in our country.

3.4 High-frequency Keywords and Co-Occurrence Network Analysis of Physical Education Research

Keywords are highly condensed literature content, reflecting the focus of its research field and the academic topics that researchers are interested in. Using CiteSpace III software, select Keyword (keyword) for network nodes, and use Minimum Spanning Tree (Minimum Spanning Tree) algorithm for analysis, a total of 876 nodes and 831 connections are generated to generate a high-frequency keyword knowledge map in the field of physical education research. And by properly adjusting the thresholds of "Threshold", "Font size" and "Note Size" in the "Article Labeling" panel, the backbone structure of the keyword emergence network is obtained, as shown in Figure 4. The nodes in the graph represent keywords, and the size of the nodes is proportional to the co-occurrence frequency of keywords. The different colors of the outer rings of the nodes represent the co-occurrence years of the keywords, and the thickness of the lines indicates the cooperative relationship of the keywords; Words emerge in the network, and the high emergent value indicates that the frequency of co-occurrence increases rapidly, which represents the frontier of physical education research in my country.

Table 3 Top 10 Keywords in Physical Education Research in China During 2000—2014

Ranking	High frequency keywords	Frequency	High Prominence Keywords	Emergent value
1	physical education	1 483	quality education	16. 114 3
2	Physical education	532	sports thinking	9. 712 1
3	school sports	448	sports history	8. 633 2
4	colleges and universities	253	sports culture	6. 943 9
5	Physical Education Major	233	sports management	6. 059
6	College Students	199	guiding ideology	5. 761 9
7	physical education	176	physical education	5. 224 6
8	college sports	150	course	5. 049 8

9	physical education teacher	143	modern sports	5.008 5
10	reform	131	national traditional sports	4.981 7

Table 3 lists the top 10 keywords in terms of frequency and emergent value in the field of physical education in my country. Among them, physical education as the subject of this study has the highest frequency of 1483 occurrences; followed by physical education, which appears 532 times; and the third is school sports, which appears 448 times. The emergent value of quality education is 16.114 3, ranking first; followed by sports thinking, with an emergent value of 9.712 1; and the third is sports history, with an emergent value of 8.633 2. It shows that physical education, physical education, and quality education are the center of the research field of physical education in our country.

Knowledge group 1 "Physical Education" has the largest node in the network, and the keywords directly connected with it "college physical education", "curriculum setting", "physical education", "sports thinking" and "health education" form a sub-group with a strong co-occurrence relationship. network [15]. It shows that the research on physical education in colleges and universities in my country has always been the key research object; the physical education curriculum is an important research content in physical education, and the reform and development of physical education cannot be separated from the optimized physical education curriculum; physical education thinking is the direction of physical education, directly affects the formation of physical education ideology. The purpose of the guiding ideology of modern school physical education in my country is to promote the continuous development of school physical education in my country and to promote the physical and mental health of students. Six main periods of physical education thought: physical fitness enhancement, all-round development, happy sports, lifelong sports and health first [16].

Knowledge group 2 takes "Physical Education" as the core, and forms a closely related sub-network with "Physical Activities" and "Sports Events". Physical education is a purposeful and organized educational process according to certain plans and curriculum standards. It is the basic form of school sports realization and one of the ways to implement sports goals. It shows that the completion of physical education teaching tasks is closely related to the arrangement of physical activities, the setting and selection of sports items.

The high-frequency keywords "teaching reform" and "physical education courses" in knowledge group 3 are closely related to "physical fitness" to form a sub-network. It shows that the reform of physical education curriculum and the improvement of students' physical quality are the hot spots of research in this period in the teaching reform, and are closely related to the background of the times. After entering the 21st century, under the trend of rapid economic development, the continuous deepening of my country's education reform, the continuous expansion of college enrollment, and the overall decline in the physical fitness of students, the "guiding ideology of school education" pointed out in the "Decision of the Central Committee of the Communist Party of China on Strengthening Quality Education" Under the guidance of the idea of "health first", the teaching objectives, teaching content, teaching methods and teaching evaluation of college physical education courses are facing comprehensive reforms.

The high-frequency keywords "school sports", "education" and "students" in knowledge group 4 are closely related to form a sub-network. It shows that the focus of school physical education research is on educational issues, and the research objects are students.

The high-frequency keywords in knowledge group 5, "university", "quality education", "teaching mode" and "physical education major" are closely related to form a sub-network. Quality education is an education aimed at improving the basic physical and mental quality of the people, and it is the core content of the concept of modern physical education. In a broad sense, it is an educational process that comprehensively improves students' physical quality, improves physical and mental health, takes social education as the fundamental purpose, and sports practice as the main means to promote students' all-round development. It is a hot research issue of physical education in our country. In addition, the teaching mode and physical education specialty of colleges and universities are also research hotspots in our country's physical education.

4. CONCLUSIONS AND RECOMMENDATIONS

1) The research on physical education in my country shows a wave-like growth trend, which can be divided into There are three stages: development stage, rapid development and stable development. It should be actively guided by policies, increase investment in physical education, and explore the innovative mechanism and concept of sports from a deep level. 2) Cooperation among scientific research institutions

Very few, only three typical scientific research teams have been formed with Beijing Sport University, School of Physical Education and Health of East China Normal University, and School of Physical Education of Central China Normal University as the core. It is necessary to improve mutual cooperation and enhance the depth and breadth of scientific research cooperation. 3) In terms of comprehensive ability of scientific research, Beijing Sport University has the strongest comprehensive ability, followed by the School of Physical Education and Health of East China Normal University, and the third place is the School of Sports Science of Fujian Normal University; main force of research. 4) Scholars who have had a profound impact on physical education in my country include leading figures such as Ji Liu, Wang Jian, Huang Hansheng, Wu Yandan, Zuo Xinrong, Ma Weiping, Meng Fanqiang, Ji Keyi, etc., who have vigorously promoted the development of physical education in our country. 5) The research hotspots and frontiers of physical education in my country mainly focus on

Physical Education Thought, Physical Education Theory, Physical Education in Colleges and Universities, Teaching Reform, Physical Education Curriculum Reform, Quality Education, Physical Education Major, etc.

COMPETING INTERESTS

The authors have no relevant financial or non-financial interests to disclose.

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