

# Research on the Academic Influence of Physical Education Teachers in Higher Vocational Colleges of Shandong Province from the Perspective of Bibliometrics

Shiwei Zhang<sup>1\*</sup>, Aining Li<sup>2</sup>, Zhanbin Feng<sup>3</sup>

<sup>1</sup>Dept of Continuing Education, Laiwu Vocational and Technical College, Laiwu, Shandong, China, 271100

<sup>2</sup> Dept of Library and Information Center, Laiwu Vocational and Technical College, Laiwu, Shandong, China, 271100

<sup>3</sup> Dept of Physical Education, Shandong Polytechnic College, Jining, Shandong, China, 272067

\* Corresponding author. Tel.: + 86-015563419160; email: lwzyzsw @ 163.com

**Abstract**— By means of literature reviews, bibliometric analysis, mathematical statistics, rank sum ratio, etc., this paper analyzes the academic influence of P.E teachers in higher Vocational Colleges of Shandong Province from the aspects of the quantitative score of papers published, cited frequency, H index, P index, etc.. The results show that the number of papers published by P.E teachers in higher Vocational Colleges of Shandong Province is relatively small, journals hierarchy, the total cited frequency, the H index and the quoted value are all low, the ability to serve high-level sports science research is not strong, the overall academic influence is relatively weak. The rising stars with relatively strong scientific research strength and academic level are obviously insufficient, and the scientific research backbone with relatively outstanding academic achievements are lacking.

**Keywords**— Bibliometrics, Shandong Province, higher vocational colleges, P.E teachers, academic influence.

## I. INTRODUCTION

In January 2019, State Council of the People's Republic of China issued the National Plan for the reform and implementation of vocational education, which makes it clear that vocational education and general education are two different types of education with equal importance. Promoting the high quality development of higher vocational education is an important content of perfecting the vocational education system. So it's clear that the higher vocational education has become a new type and an important part of the higher education in our country. In the process of the rapid development of higher vocational education, the majority of teachers in higher vocational colleges are actively engaged in scientific research on hot issues, such as talent training objectives, curriculum system, teaching model, cooperation between schools and enterprises, integration of production and teaching, etc., it has produced a large number of influential achievements, promoted the improvement of teaching quality and personnel training quality, and expanded the social influence of higher vocational colleges. As the implementer of school physical education work, the Physical Education teachers in higher vocational colleges of Shandong Province, following the good trend of higher vocational education reform, closely following the theme of serving the overall

development of physical and mental health of higher vocational students, vigorously carry out sports scientific research, seriously write research papers, and have made certain research results. This research will proceed from the angle of Bibliometrics, carry on the bibliometrics analysis to the papers published by Physical Education teachers in higher vocational colleges of Shandong Province, and evaluate their academic influence truly and objectively, in order to accurately understand and grasp its research status and development trends, for the overall improvement of their academic level and scientific research strength to provide reference.

## II. THE OBJECT AND METHODS OF RESEARCH

### 2.1. The Object of Research

In June 2019, the Shandong Provincial Department of Education published a list of general schools with higher education qualifications, including 56 state-run higher vocational colleges, this research takes the of Physical Education teachers' academic influence of these 56 schools as the research object.

### 2.2. The Methods of Research

#### 1) The method of literature reviews

Through the China National Knowledge Infrastructure (CNKI), we had searched the literature on academic influence, literature measurement and the construction of P.E teachers, and downloaded the academic papers published between 2001 and 2018 as the first author by the P.E teachers in higher Vocational Colleges of Shandong Province, the search deadline is December 20,2019.

#### 2) The method of bibliometric analysis

With the help of the various quantitative characteristics of the constituent elements of the literature, we used mathematical and statistical methods, described, analyzed and synthetically evaluated the academic influence of P.E teachers by using the indexes of quantitative score of papers published, cited frequency, H index, P index and so on. We can discover the inherent regularity from the change of the quantity.

3) *The method of mathematical statistics*

The fields of “title”, “first author”, “first author unit”, “paper source”, “publication time”, “cited frequency” and so

on in the downloaded papers of P.E teacher are imported or filled in the EXCEL form, We use the statistical function of Excel to process the data and obtain the relevant statistics.

Table 1. Statistical Table of Higher Vocational Colleges in Shandong Province

Order	School name (abbreviations of some school names)	Order	School name (abbreviations of some school names)
1	Shandong Institute of Commerce Technology(Shandong Commerce)	29	Yantai Engineering & Technology College
2	Rizhao Polytechnic (Rizhao)	30	Dezhou Vocational and Technical College(Dezhou)
3	Qingdao Technical College(Qingdao)	31	ZaoZhuang Vocational College of Science and Technology
4	Weihai Vocational College (Weihai)	32	Jinan Engineering Polytechnic(Jinan Engineering)
5	Shandong Polytechnic	33	Shandong College Of Electronic Technology
6	Shandong Labor Vocational and Technical College	34	Shandong College of Tourism and Hospitality
7	Laiwu Vocational and Technical College (Laiwu)	35	Shandong Aluminum Vocational College
8	Jining Polytechnic	36	Taishan Polytechnic
9	Weifang Vocational College	37	shandong drug and food vocational college
10	Yantai Vocational College(Yantai)	38	Shandong Business Institute
11	Dongying Vocational Institute (Dongying)	39	Shandong Vocational College of Light Industry
12	Liaocheng Vocational and Technical ollege(Liaocheng)	40	Shandong Urban Construction Vocational College
13	Binzhou Polytechnic (Binzhou)	41	Yantai Automobile Engineering Professional College
14	Shandong Vocational College of Science and Technology	42	Shandong Judicial Police Vocational College(Shandong Judicial)
15	Shandong Vocational Institute of Clothing Technology	43	Heze Domestic Professional College
16	Shandong Water Polytechnic	44	Shandong Communication & Media College
17	Shandong Vocational Animal Science and Veterinary College	45	Linyi Vocational College
18	Shandong Transport Vocational College	46	Zaozhuang vocational college
19	Zibo Vocational Institute(Zibo)	47	Shandong Polytechnic College (Shandong Polytechnic)
20	Shandong Foreign Trade Vocational College	48	Qingdao Ocean Shipping Mariners College
21	Qingdao Vocational and Technical College of Hotel Management (Qingdao Hotel)	49	Jinan Vocational College of nursing
22	Shandong College Of Information Technology	50	Taishan vocational college of nursing
23	Qingdao Harbour Vocational & Technical College	51	Weifang Nursing Vocational College
24	Shandong Shengli Vocational College	52	Weifang Engineering Vocational College
25	Shandong College of Economics and Business	53	Heze Vocational College
26	Shandong Vocational College of Industry	54	Weihai Ocean Vocational College
27	Shandong Chemical Engineering & Vocational College	55	Shandong Vocational College of Special Education
28	Jinan Vocational College	56	Qingdao Engineering Vocational College

4) *The Method of Non-integral Rank Sum Ratio*

A total of 55 out of the top 30 teachers selected for their quantitative score of papers published, total cited frequency, H index, P index, etc., we used the non-integral rank sum ratio method to transform the various evaluation indexes, and obtain the dimensionless statistic RSR, which is used to rank the evaluation objects in order of magnitude.

III. RESEARCH RESULTS AND ANALYSIS

The academic influence of the researcher and his contribution to the discipline mainly come from his academic achievements. The academic influence of the researcher is analyzed and evaluated by means of bibliometrics, first, it depends on his publishing situation, including the number of published papers and the journals hierarchy, and second to see his papers cited, including the total cited frequency, the maximum cited frequency, the average cited frequency, H index, P index.

3.1. *Quantitative Analysis of Physical Education Teachers' Paper Published*

1) *Overall Analysis of the Number of Papers Published and Journals Hierarchy*

Journal papers are the main presentation of scientific research achievements and the crystallization of scientific

research work. Statistical analysis of journal papers can reflect the status of scientific research and academic influence of institutions or researcher individuals from a side.[1] For the convenience of statistics and research, we divide the journals into three levels: Chinese core journal (core journal for short) , undergraduate college journal (undergraduate journal for Short) and ordinary journal, the core journals are based on Peking University's overview of the main contents of the Chinese core journals, supplemented by papers published in the statistical journal Nanjing University (CSSCI), the undergraduate journals refer to the non-chinese core journals in the undergraduate journals, and the ordinary journals refer to other journals besides the core journals and the undergraduate journals. Because the selection of core journals and CSSCI journals is dynamic, we define the retrieved papers according to the release time of each edition and the catalogue of each edition.

According to the characteristics of the distribution of the journals hierarchy of the published papers by P.E teachers in higher Vocational Colleges of Shandong Province, 1433 papers were published in ordinary journals, accounting for 86.07% of the total papers, 80 papers were published in undergraduate journals, accounting for 4.80% .152 core journals, accounting for 9.13% , among them, there are 26 sports core journals (1.56%) , 126 other core journals (7.57%) ,

and 20 CSSCI journals (1.20%). Generally speaking, the number of papers published in various journals is highly concentrated and unbalanced. Ordinary journals are the main carriers for teachers to publish research results, and fewer papers are published in authoritative journals of higher academic level, the journals hierarchy that published the paper is low, the overall academic influence is small, CSSCI papers included in a small number can also explain this point.

Hong Liu and other scholars have made statistics on the data of the papers published by the teachers of higher

vocational colleges during the period from October 30, 2018 to October 30, 2019. There were 120828 papers published in the whole year, 11017 core journals, accounting for 9.12%, of which 1294 were CSSCI papers, 1.07%. [2] As a public course teacher, the proportion of papers published in core journals and CSSCI journals of P.E teachers in Higher vocational colleges in Shandong Province can roughly equal the national average, and even surpass some other professional teachers in high-level scientific research, it should be said that it is commendable, is achieved a good result.

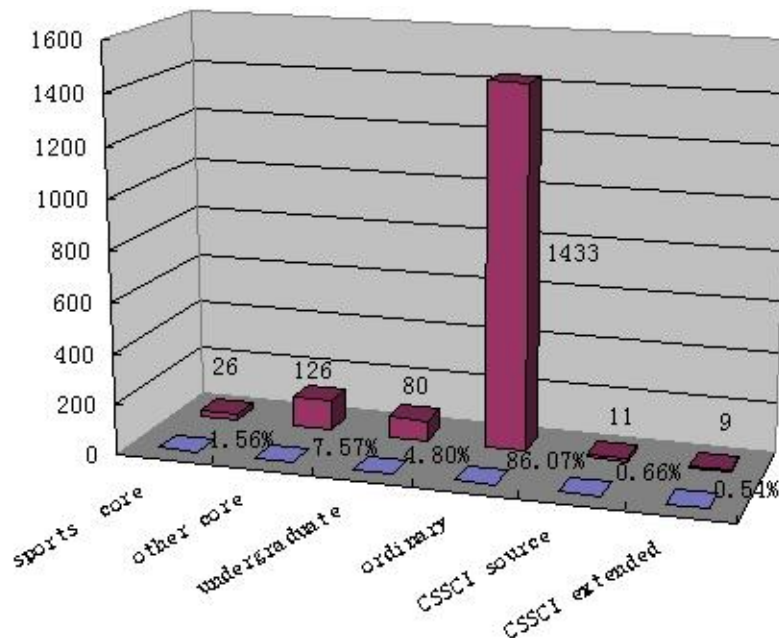


Fig. 1. Journals hierarchy statistics of papers published by Physical Education Teachers

### 2) Analysis of Papers Published in Core Journals

Scholars are the main body of scientific research, their academic influence mainly comes from their published papers, so the quantity and quality of published papers become a measure of their scientific achievements and academic contributions. The number of papers published represents the level of scientific research activity and academic output of the scholars, while the journal hierarchy of published papers can, to a certain extent, represent the quality of the papers, the papers published by scholars in core journals can better reflect their scientific research level and academic influence. In particular, the papers published in CSSCI journals is itself an affirmation of the academic community, papers published in CSSCI journals is a necessary condition for the acceptance of many high-level social science fund projects, which is highly valued by social science researchers. According to the index, from 2001 to 2018, P. E teachers in higher vocational colleges of Shandong Province published a total of 1,665 scientific research papers in 363 academic journals. According to the statistics of the first author, there were 558 persons, 2.98 chapter capita, with the increase of the number of papers published, the number of authors shows a very obvious decreasing trend. 1 person has 28 papers at most, 3 person

have 11 papers, and only 10 person have more than 10 papers. According to the statistics of the papers published by the author in the core journals, there are 88 teachers published 152 papers in the core journals, including 26 sports core journals and 126 other core journals. Lili Zhang of Binzhou Polytechnical College and Lanxia Pang of Dongying Vocational Institute are at most five, Haifeng Yue, Lizhen Xu, Xianmin Xi, Aiyong Qiu and Fei Xia are at most four, and only 13 authors have published more than three papers. Only 13 authors published papers in CSSCI journals, Lizhen Xu up to 3, the other 12 authors were 1 to 2.

Wenjuan Liu and other scholars have counted the number of papers published by researchers in the field of physical education and training in China, pointed out that Zhenming Mao is the person who publishes most papers as the first author, there are 124(core 74). The top 20 authors have published more than 30 papers (the core 10 or more)[3]. Shunping Wei and other scholars made statistics on the number of papers published by the teachers of the National Radio and Television University system in 1999 – 2008, the maximum number of published papers was 98, no less than 20 with 136 authors, no less than 40 with 17 authors. The core journals have a maximum of 38 papers and no less than 10

papers with 46 authors. Although P. E teachers in higher vocational colleges are also college teachers, there is a very big gap in scientific research between them and P. E teachers in ordinary undergraduate schools, especially experts in the subject of physical education. Even the relatively close level of radio and television universities, there are still some distance between their outstanding scholars and P. E teachers in higher vocational colleges of Shandong Province.

Generally speaking, the proportion of papers published in core journals of P. E teachers is not high in Higher vocational colleges in Shandong Province, the quantity of core journals, especially CSSCI journals is less, there are few high-quality papers with great academic influence, lack of scientific research backbone with outstanding academic achievements, and have not formed the true leader in the field of physical education with great influence and academic attainments.

Table 2. Number of papers published in core journals by authors

Number of papers	Number of core journals						Author total	Core total	Number of CSSCI				Papers total	Papers proportion	Proportion total
	5	4	3	2	1	0			3	2	1	total			
28							1	4					28	1.68%	1.68%
11	1					2	3	5			1	1	33	1.98%	3.66%
10	1		1	1	1	2	6	11		1		2	60	3.61%	7.27%
9				2		4	6	4					54	3.24%	10.51%
8				1	2	4	7	4					56	3.36%	13.87%
7		2	2		2	7	13	16	1			3	91	5.47%	19.34%
6			2	4	4	14	24	18		1	1	3	144	8.65%	27.99%
5		1	1	3	3	32	40	16		1		2	200	12.01%	40.00%
4		1		4	10	55	70	22			2	2	280	16.82%	56.82%
3				6	7	87	100	19		1	3	5	300	18.02%	74.83%
2				8	5	118	131	21		1		2	262	15.74%	90.57%

3) Analysis of Quantitative Score of Papers Published

At present, the number of papers is still one of the main factors to measure the academic influence of institutions or individuals, but the evaluation of academic influence is a comprehensive system, we should pay more attention to the quality of papers as well as the number of papers. In order to better reflect the academic influence of the papers and make the statistics of the papers published more reasonable, we reasonably distribute the weight of the papers of different journals hierarchy, while counting the number of papers published by authors, according to the journals hierarchy, the paper is assigned a score, the specific criteria are: 2 points per core Journal, 1 point per undergraduate journal, 0.5 points per ordinary journal, 1 point added by CSSCI source journal, 0.5 points added by CSSCI extended journal, the quantity and quality of the papers were evaluated comprehensively, and the quantitative scores of the published papers were calculated.

From the statistics of the quantitative scores of the papers published by the P.E teachers in higher vocational college in Shandong Province, Haifeng Yue from Dongying Institute, was the first one, with 28 papers and 20 marks, and opened a big gap with Lili Zhang from Binzhou Polytechnic. Haifeng Yue, Lili Zhang, Lanxia Pang, Lizhen Xu, Shiwei Zhang Shurui Yue, Cuihua Zhang, Jianming Wei, Xianmin Xi and Aiyong Qiu were among the top 10 teachers who not only published a large number of papers, and the journals hierarchy is also relatively high, at least in the core journal published more than 2 papers, is high-level sports research representatives in higher vocational colleges of our province. It can be said that in order to have a greater academic influence, the number of papers is not enough, but also high-quality papers. Four of the top 10 teachers in the number of papers published failed to make the top 20 in the quantitative score of papers published, the reason is that the papers of these four authors are published in ordinary journals, without core journals, the journals hierarchy is relatively low, and the score

of comprehensive quantification is not high. The top 20 teachers all had papers published in the core journals, and 13 authors who published more than 3 papers in the core journals all made the top 20 in quantitative scores, it shows that these 20 teachers have higher academic level and stronger scientific research ability, are the teachers with great academic influence in higher vocational colleges of our province, and are also the main force of high-level sports scientific research in higher vocational colleges of our province.

3.2. Aanalysis on the Cited Papers of P.E Teachers

Citations by other authors are an important indicator of the value of an academic paper, and the cited frequency is an absolute quantitative indicator, which refers to the total number of citations from the publication of a journal, institution or scholar to a specific statistical time, it is both a specific and objective quantitative index, indicating the degree to which a paper is used and valued by the readers of the study. As far as a paper is concerned, the more frequently it is cited, the higher the degree to which the paper is paid attention by other researcher, the more influence it has on the subject and its related fields, the more academic influence it has, to some extent, it reflects the academic quality and academic value of the paper [4].

1) Overall Analysis of Papers Cited

The total cited frequency of 1665 papers of P.E teachers in higher vocational colleges of Shandong Province was 3235 times, and the maximum cited frequency of a single paper was 121 times, averaging 1.94 times per paper. Among the 1665 papers, 843 were cited 0 times, accounting for 50.63% of all papers, indicating that the cited rate of P.E teachers' papers in higher vocational colleges of Shandong Province was 49.27%. There were 1339 papers whose cited frequency was close to or less than the average (not more than 2 times), accounting for 80.42% of the total number of papers. These 1339 papers only



accounted for 20.71% of the total cited frequency, which conformed to the Pareto's principle.

Table 3. Top 20 P.E teachers of quantitative score of papers published in higher Vocational Colleges of Shandong Province

Order	Name	School	Sports core	Other core	Core total	undergr -aduate	Papers total	CSSCI source	CSSCI total	Papers score	Score RSR
1	Haifeng Yue	Dongying		4	4		28		0	20	1.00
2	Lili Zhang	Binzhou	1	4	5		11	1	1	14	0.70
3	Lanxia Pang	Dongying		5	5		10		0	12.5	0.62
4	Lizhen Xu	Binzhou	3	1	4		7	3	3	12.5	0.62
5	Shiwei Zhang	Laiwu	2		2	4	10	2	2	12	0.60
6	Shurui Yue	Shandong Judicial		3	3	2	10		0	10.5	0.52
7	Cuihua Zhang	Yantai		2	2	6	8		0	10	0.5
8	Jianming Wei	Rizhao	1	2	3	2	6		2	9.5	0.47
9	Xianmin Xi	Dongying		4	4		7		0	9.5	0.47
10	Aiyong Qiu	Binzhou	1	3	4		4	1	1	9	0.45
11	Fang liu	Yantai		1	1	6	8		0	8.5	0.42
12	Fei xia	Qingdao Hotel		4	4		5		0	8.5	0.42
13	Xiuyun liu	Shandong polytechnic	1	2	3		5		2	8	0.40
14	Yanan Liu	Shandong Judicial		3	3		7		0	8	0.40
15	Xingfu Sui	Dongying		3	3		7		0	8	0.40
16	Qiang Jing	Dongying		2	2		9		0	7.5	0.37
17	Kai Liu	Dongying		2	2		9		0	7.5	0.37
18	Peng Wang	Shandong Commerce		3	3		6		0	7.5	0.37
19	Gang Xu	Shandong Commerce	1	1	2	1	6		1	7	0.35
20	Xiaofeng Ren	Dezhou		1	1		10		0	6.5	0.32
20	Zhijian Zhang	Qingdao Hotel		2	2	1	6		0	6.5	0.32

Table 4. The totalizing distribution of papers with different cited frequency intervals

Cited frequency	Number of papers	Papers totalizing	Papers proportion	Papers proportion totalizing	Cited frequency totalizing	Cited frequency proportion totalizing
121	1	1	0.06%	0.06%	121	3.74%
70	1	2	0.06%	0.12%	191	5.90%
53	1	3	0.06%	0.18%	244	7.54%
38	1	4	0.06%	0.24%	282	8.72%
35	3	7	0.18%	0.42%	387	11.96%
30	1	8	0.06%	0.48%	417	12.89%
29	4	12	0.24%	0.72%	533	16.48%
28	1	13	0.06%	0.78%	561	17.34%
24	2	15	0.12%	0.90%	609	18.83%
21	1	16	0.06%	0.96%	630	19.47%
20	3	19	0.18%	1.14%	690	21.33%
19	2	21	0.12%	1.26%	728	22.50%
18	4	25	0.24%	1.50%	800	24.73%
17	3	28	0.18%	1.68%	851	26.31%
16	3	31	0.18%	1.86%	899	27.79%
15	3	34	0.18%	2.04%	944	29.18%
14	7	41	0.42%	2.46%	1042	32.21%
13	6	47	0.36%	2.82%	1120	34.62%
12	7	54	0.42%	3.24%	1204	37.22%
11	8	62	0.48%	3.72%	1292	39.94%
10	9	71	0.54%	4.26%	1392	43.03%
9	16	87	0.96%	5.23%	1527	47.20%
8	9	96	0.54%	5.77%	1599	49.43%
7	18	114	1.08%	6.85%	1725	53.32%
6	26	140	1.56%	8.41%	1881	58.15%
5	37	177	2.22%	10.63%	2066	63.86%
4	52	229	3.12%	13.75%	2274	70.29%
3	97	326	5.83%	19.58%	2565	79.29%
2	174	500	10.45%	30.03%	2913	90.05%
1	322	822	19.34%	49.37%	3235	100.00%
0	843	1665	50.63%	100.00%	3235	100.00%

Among the 1665 papers, 19 of the first 1.14% were highly cited frequency papers (no less than 20 times), their total cited frequency was 690 times, the average cited frequency was 36.32 times, these 19 papers reached 21.33% of the total cited frequency. Ping Yu made a statistical analysis of the high cited papers in the Journal of Science and Technology Management Research from 2007 to 2016, and pointed out that the top 1% of 146 high cited papers contributed 8.5% of the cited frequency. Compared with this, the highly cited frequency papers have greater contribution to total cited frequency in higher vocational colleges of Shandong Province. Generally speaking, the average cited frequency of P.E teachers' papers in higher vocational colleges of Shandong Province is relatively low, and most papers are distributed in the range of low cited frequency, the academic influence is weak as a whole, but the cited contribution rate of high cited frequency papers is relatively large.

2) Cited Frequency Analysis

① Analysis of Total Cited Frequency

The number of citations a researcher has in his or her field of study is a better indicator of his or her influence on the discipline than the number of publications, it indicates the degree to which the scholar's research results have received attention and have influenced and contributed to the development of the discipline. The so-called total cited

frequency, which is the sum of the cited frequency of all the papers published by the researcher, is one of the main indicators to reflect their overall academic level and influence. The total cited frequency depends on the number of published papers and the cited frequency of each paper. If the number of published papers is large and his cited frequency of each paper is high, the total cited frequency is high, whereas if the number of published papers is large but his cited frequency of each paper is low, the total cited frequency is low. [6] According to the statistic data of the total cited frequency by P.E teachers in higher vocational colleges of Shandong Province, Lili Zhang from Binzhou Polytechnic is the maximum with only 149 times (among which the maximum one is cited 121 times and the other eight are cited 28 times), the other teachers are all under 100 times. Liu Ji from East China Normal University is scholars in the field of physical education and training in China with the maximum total cite frequency, 2883 times, and the top 20 scholars are between 881 -- 2883. It can be seen that the total cited frequency of P.E teachers in higher vocational colleges of Shandong Province is on the low side, which indicates that the overall quality of P.E teachers' research papers is not high, and they are paid less attention by their counterparts in the field of physical education, and can not provide more useful help for the research of their peers, the overall academic influence is weak.

Table 5. Top 20 P.E teachers of papers Citation score in higher Vocational Colleges of Shandong Province

Order	Name	School	Papers total (papers sited total)	Maximum cited frequency	Total cited frequency (RSR)	H index (RSR)	P index (RSR)	RSR mean
1	Lili Zhang	Binzhou	11(9)	121	149(1.00)	4(0.58)	12.64(1.00)	0.86
2	Haifeng Yue	Dongying	28(16)	29	91(0.62)	7(1.00)	6.66(0.54)	0.72
3	Jianming Wei	Rizhao	6(5)	24	72(0.49)	4(0.58)	9.52(0.76)	0.61
4	Yulian Gao	Binzhou	4(2)	70	76(0.52)	2(0.30)	11.30(0.90)	0.57
5	Lizhen Xu	Binzhou	7(6)	30	65(0.45)	4(0.58)	8.45(0.67)	0.57
6	JinPei Wei	Laiwu	2(2)	53	57(0.39)	2(0.30)	11.76(0.93)	0.54
7	Lanxia Pang	Dongying	10(8)	16	61(0.42)	4(0.58)	7.19(0.58)	0.53
8	Shiwei Zhang	Laiwu	10(9)	24	60(0.41)	4(0.58)	7.11(0.57)	0.52
9	Cuihua Zhang	Yantai	8(8)	29	53(0.37)	4(0.58)	7.05(0.57)	0.50
10	Yongshun Qi	Laiwu	6(6)	20	41(0.29)	3(0.44)	6.54(0.53)	0.42
11	Shurui Yue	Shandong Juldicia	10(6)	20	44(0.31)	3(0.44)	5.78(0.47)	0.40
12	Hongyan LI	Binzhou	3(2)	35	37(0.26)	2(0.30)	7.70(0.62)	0.39
13	Xiaoyan Song	Shandong Tourism	5(2)	38	42(0.29)	2(0.30)	7.07(0.57)	0.39
14	Fengjun Zhou	Laiwu	2(2)	15	30(0.22)	2(0.30)	7.66(0.61)	0.38
15	Meili Wu	Binzhou	2(2)	18	28(0.20)	2(0.30)	7.32(0.59)	0.36
16	Jian Cao	Dongying	2(1)	35	35(0.25)	1(0.16)	8.49(0.68)	0.36
17	Kai Liu	Dongying	9(5)	17	30(0.22)	3(0.44)	4.64(0.38)	0.34
18	Yumei Sun	Jinan Engineering	5(2)	17	33(0.24)	2(0.30)	6.02(0.49)	0.34
19	Xiqiang Xing	Liaocheng	5(4)	13	24(0.18)	3(0.44)	4.87(0.40)	0.34
20	Yubo Han	Rizhao	5(4)	14	23(0.17)	3(0.44)	4.73(0.39)	0.33

② Academic Contribution to Sports Scientific Research

Researchers conduct scientific research and write academic papers, which are systematic summaries of their own research process and content. The purpose of publishing academic papers is to introduce and promote their research results and conduct academic exchanges. An important indicator of the

academic value and contribution of a research paper is its ability to be widely read, referenced, and cited by others, especially by outstanding peers, to provide them with research ideas, methods and ideas for reference, if their research results are published in influential academic journals, then it will be more able to show that the paper has higher quality and

academic value, it shows the author's great contribution to the development of the subject. From the sources of the cited papers of 55 P.E teachers in higher vocational colleges of Shandong Province, the proportion of papers cited in core journals is 8.16% , of which the proportion of CSSCI (including expansion board) is 2.91% , the proportion cited

documents for doctoral theses is only 1.11, which shows that the research achievements of P.E teachers in higher vocational colleges of Shandong Province are not too high, and their ability to serve high-level sports science research is somewhat deficient, the academic contribution to sports science research needs to be further improved.

Table 6. Top 20 P.E teachers of papers Citation score in higher Vocational Colleges of Shandong Province sources of the cited papers of 55 P.E teachers in higher Vocational Colleges of Shandong Province

Paper type	Sports core	Other core	Core total	CSSCI	Undergraduate	Ordinary journal	Journal total	Doctoral theses	Master's thesis	Conference paper	Total
Number	54	78	132	47	123	806	1061	18	522	17	1618
Proportion%	3.34	4.82	8.16	2.90	7.60	49.81	65.57	1.11	32.26	1.05	100

3) *H index Analysis*

In 2005, American physicist JorgeHirsh proposed to use the H index to evaluate the level of scientific research papers and academic influence, it means that no more than H papers published by a scholar are cited at least H times. The H index can be used to evaluate the quantity and quality of the papers published by researchers at the same time. It is a robust index, it is the embodiment of researchers' long-term academic achievement accumulation. The results show that it takes 4 ~ 6 papers and 1 ~ 2 classical papers for scholars to improve one H index. Therefore, the H index can reflect a researcher's academic achievements more accurately. The higher a researcher's H index is, the greater the academic influence of his thesis is. According to the distribution of H index of P.E teachers in higher vocational colleges of Shandong Province, the whole is on the low side. There are only 23 authors whose H index is not less than 3. Some scholars define the authors whose H index is not less than 5(the first author) as the high influence authors, according to this standard, only one person, Haifeng Yue entered the high-influence author category, and six others, including Lili Zhang, Jianming Wei, Lizhen Xu, Lanxia Pang, Shiwei Zhang and Cuihua Zhang, had an H index of 4, close to the high-influence authors, these seven authors not only publish a large number of papers and quotes, but also the maximum and total cited frequency is relatively high. Wenjuan Liu and other scholars have studied the academic influence of the scholars in the field of physical education and training in China, and pointed out that the maximum H index is 20, from Liu Ji of East China Normal University, and the H index of the top 20 scholars is generally between 12--20, the high level H index (CSSCI index) is from 3 to 8, which shows that there is still a big gap between the academic influence of P.E teachers in higher vocational colleges of Shandong Province and the experts in the field of physical education and training in China.

4) *P index Analysis*

The H index is simple in content and widely used in academic fields, but it also exposes many problems, such as insensitivity to highly cited papers, although it corrects the bias that individual highly cited papers may cause their influence to be exaggerated, however, the specific number of papers cited the most frequently can not be represented by the H index, ignoring the contribution of highly cited papers to the

academic influence, and failing to reflect the academic value of the most influential representative research achievements of scientific researchers, etc. , scholars such as Jiazhi Zheng also suggest increasing the maximum cited frequency in a single paper to reflect the academic achievements of such researchers. In 2010, on the basis of summarizing the research of other scholars, PRATHAPG put forward the concept of P index( prestige index or outstanding index), which has higher fitting ability with H index and richer connotation than H index, the formula of P index:  $P = (C^2 / N)^{1/3}$ , among them, the C is the total cited frequency and N is the number of papers[8]. From the formula of the P index, it is related to the total cited frequency and the average cited frequency, and the maximum cited frequency has a greater contribution to the total cited frequency and the average cited frequency. Therefore, P index can reflect the academic value and contribution of the papers with the maximum cited frequency. We analyzed the correlation between the P index and the number of published papers, papers cited, total cited frequency, average cited frequency, and the maximum cited frequency of the 55 P.E teachers, the results show that the P index is highly correlated with the total cited frequency, the average cited frequency and the maximum cited frequency, and the correlation coefficients are 0.91,0.91 and 0.93, respectively, the average cited frequency and the maximum cited frequency can be comprehensively reflected by the P index. For example, Lili Zhang of Binzhou Polytechnic has an H index of 4, the same as Lili Zhang has five authors, however, Lili Zhang 's paper "on the study of the factors affecting the benefit of the development of stadium resources in Chinese universities", published in the core Journal of Physical Education and science (CSSCI) , has been cited 121 times, the P index is 12.64, which is higher than the other 5 authors, and is the first one. It can be seen that the P index is a useful supplement to the H index and can be used to distinguish and evaluate the academic influence of the same authors with the H index.

3.3. *RSR Comprehensive Ranking Analysis of P.E Teachers Academic Influence*

For the comprehensive ranking of individuals, we used weighted average to calculate the RSR mean, in which quantitative score of papers published is 30%, the total cited frequency is 20%, the H index is 30%, the P index is 20%. The

top seven overall teachers, including Haifeng Yue, Lili Zhang, Lizhen Xu, Jianming Wei, Lanxia Pang, Shiwei Zhang and Cuihua Zhang, all ranked in the top 20 in the four influence components, it shows that the seven teachers have high

academic level and strong scientific research strength; the Eighth to Twelfth teachers Yulian Gao, Shurui Yue,, Yongshun Qi, Jinpei Wei, Kai Liu also have three indicators in the top 20.

Table 7. Top 20 P.E teachers of papers Citation score in higher Vocational Colleges of Shandong Province  
Top 20 in RSR of Academic Influence of P.E Teachers in Vocational Colleges of Shandong Province

Order	Name and school	Age	Papers number (core)	Papers score RSR (rank)	Cited number	Total cited RSR (rank)	H index RSR (rank)	P index RSR (rank)	RSR mean
1	Haifeng Yue(Dongying)	49	28(4)	1.00 ( 1 )	16	0.62(2)	1.00 ( 1 )	0.54 ( 17 )	0.83
2	Lili Zhang(Binzhou)	51	11(5)	0.7 ( 2 )	9	1.00(1)	0.58 ( 2 )	1.00 ( 1 )	0.78
3	Lizhen Xu(Binzhou)	51	7(4)	0.62 ( 3 )	6	0.45(6)	0.58 ( 2 )	0.67 ( 6 )	0.58
4	Jianming Wei(Rizhao)	55	6(3)	0.47 ( 8 )	5	0.49(4)	0.58 ( 2 )	0.76 ( 4 )	0.57
5	Lanxia Pang(Dongying)	48	10(5)	0.62 ( 3 )	8	0.42(6)	0.58 ( 2 )	0.58 ( 12 )	0.56
6	Shiwei Zhang(Laiwu)	50	10(2)	0.60 ( 5 )	9	0.41(7)	0.58 ( 2 )	0.57 ( 13 )	0.55
7	Cuihua Zhang(Yantai)	58	8(2)	0.50 ( 7 )	8	0.37(9)	0.58 ( 2 )	0.57 ( 15 )	0.51
8	Yulian Gao(Binzhou)	50	4(2)	0.24	2	0.52(3)	0.30 ( 19 )	0.90 ( 3 )	0.45
9	Shulei Yue (Shandong Judicial)	56	10(3)	0.52 ( 6 )	6	0.31(10)	0.44 ( 8 )	0.47	0.44
10	Yongshun Qi(Laiwu)	47	6(1)	0.3	6	0.29(12)	0.44 ( 8 )	0.53 ( 18 )	0.38
11	Jingpei Wei(Laiwu)	56	2(0)	0.07	2	0.39(8)	0.30 ( 19 )	0.93 ( 2 )	0.38
12	Kai Liu(Dongying)	51	9(2)	0.37 ( 16 )	5	0.22(18)	0.44 ( 8 )	0.38	0.36
13	Fang liu(Yantai)	45	8(1)	0.42 ( 11 )	5	0.17	0.44 ( 8 )	0.33	0.36
14	Hongyan Li(Binzhou)	57	3(2)	0.27	2	0.26(13)	0.30 ( 19 )	0.62 ( 7 )	0.35
15	Qiang Jin(Dongying)	49	9(2)	0.37 ( 16 )	6	0.18	0.44 ( 8 )	0.33	0.34
16	Meili Wu(Binzhou)	51	2(2)	0.3	2	0.20	0.30 ( 19 )	0.59 ( 11 )	0.34
17	Xiaofeng Ren(Dezhou)	39	10(1)	0.32	8	0.20	0.44 ( 8 )	0.34	0.34
18	Xiuyun Liu (Shandong Polytechnic)	65	5(3)	0.40 ( 13 )	3	0.12	0.44 ( 8 )	0.29	0.33
19	Yanan Liu (Shandong Judicial)	35	7(3)	0.40 ( 13 )	6	0.21(20)	0.30 ( 19 )	0.4	0.33
20	Xiqiang Xing (Liaocheng)	50	5(2)	0.27	4	0.18	0.44	0.4	0.33

The relevant data of these teachers show that, in order to become a researcher with high academic influence, not only many papers are published and high journals hierarchy, but also a larger cited frequency, and the results can be noticed, referenced and cited by the majority of peers. According to the age structure of the former 20 teachers, as of February 2020, one of them is over 60 years old, has retired, and 51 to 60 years old as 9,46 to 50 years old as 7. At present, the middle-aged teachers are the high level representative group of the sports scientific research in Higher vocational colleges of Shandong Province, there are only three P.E teacher under the age of 45, of whom only Xiaofeng Ren of Dezhou Vocational and Technical College and Yanan Liu of Shandong Judicial Police Vocational College are under the age of 40, ranking 17th and 19th respectively, the influential core authors are on the older side, the age structure is not reasonable, and the rising stars with strong scientific research strength and academic level are obviously insufficient.

IV. CONCLUSIONS AND RECOMMENDATIONS

4.1. This study comprehensively evaluates the academic influence of P.E teachers in higher vocational colleges of Shandong Province by using a number of bibliometric indexes, which can overcome the limitation of single index evaluation, to achieve an objective and accurate evaluation of the academic influence of teachers, and in the follow-up research will explore the application of alternative metrics, expand the content and scope of evaluation, and improve the index

evaluation system, improving the comprehensiveness and authoritative of academic influence assessment.

4.2. The number of papers published by P.E teachers in higher vocational colleges of Shandong Province is not balanced in different journals hierarchy, mainly focusing on the ordinary journals of lower levels, and the number of papers published by teachers is relatively small, there are fewer papers published in core journals, especially in CSSCI journals, and there is a shortage of high-quality papers with great influence. Therefore, the higher vocational colleges of Shandong Province should take effective measures to optimize the incentive mechanism of scientific research, increase the incentive for high-level papers, guide teachers to improve the quality of scientific research and enhance the influence of sports academic.

4.3. Ten teachers, including Haifeng Yue, Lili Zhang, Lizhen Xu, Jianming Wei, Lanxia Pang, Shiwei Zhang, Cuihua Zhang, Yulian Gao, Shurui Yue, Yongshun Qi, etc., are teachers with high academic influence in higher vocational colleges of our province. The influential core authors are on the older side of the age, the rising stars with strong scientific research strength and academic level are obviously deficient, and the scientific backbone with relatively outstanding academic achievements is lacking, there has not been a true leader in the field of sports with great influence and academic attainments. Therefore, higher vocational colleges of Shandong Province should carry out the training and introduction of high-level sports talents in a planned way,



strengthen the selection of the existing scientific research backbone and subject leaders, and pay attention to the training of young outstanding reserve talents, to give priority to scientific research funds, welfare benefits, etc.; to introduce high-level talents of sports specialty through full-time, external and part-time employment so as to give full play to their academic leading role, to promote the further improvement of scientific research strength and academic level of P.E teachers in higher vocational colleges.

4.4. The total cited frequency of P.E teachers in higher vocational colleges of Shandong Province are relatively small, and the cited rate is low. Most of the papers are distributed in the interval of low cited frequency. The value of the research results cited is not high, and the ability to serve high-level sports scientific research is not strong, the paper's academic quality is not high, the overall academic influence is weak. P.E teachers should improve the quality of papers and journals hierarchy on the basis of increasing the number of published papers, so that more achievements can be widely noted and cited by peers, and the academic contribution to the subject of physical education can be enhanced.

#### ACKNOWLEDGMENT

This work is supported by the Teaching Reform Research Project of Laiwu Vocational and Technical College, the project number is 2019014. I would like to express my appreciation to Aining Li, zhanbin Feng, they have provided exciting insights to our creative process. I would also thank

the authors of the references for their research has helped us a lot.

#### REFERENCES

- [1] Wei.S.P, Sun.H.F, "Research performance and research groups at China's open universities: An evaluation based on China National Knowledge Infrastructure (CNKI) journal and citation index database," *Distance Education in China*, no.13, pp. 19–24, 2012.
- [2] Liu.H, Kuang.H.H, "An analysis of the scientific research achievements of higher vocational colleges in China in 2019—— Data based on China knowledge network," *Chinese Vocational and Technical Education*, no. 36, pp.17–26. 2019.
- [3] Liu.W.J, Chen.Yong and Cui.J.Q, "Academic influence of scholars in the field of physical education and training," *Journal of Shenyang Sport University*, vol.31, no.4, pp. 9–14, 2012.
- [4] Zhang.J, "Citation, citation analysis and evaluation of academic papers," *Management and Review of Social Sciences*, no. 1, pp. 33–38, 2008.
- [5] Yu.P,Wang. L.I, "Characteristics and Academic Influence Analyses of Highly Cited Papers in the Journal Science and Technology Management Research," *Science and Technology Management Research*, no. 6, pp. 246–250, 2018.
- [6] Kong.C.M, "The influence of Chinese archival scholars based on CNKI: 2004 ~ 2008," *Journal of Archives and Construction*, no.2, pp. 16–18.24,2010.
- [7] Zhu.D.M, "Discussion on the evaluation method of scientific researchers academic influence based on citation," *Science and Technology Management Research*, no.11,pp.86–87,2008
- [8] Zhang.L.L, Lin.M.F, "P-index: evaluating researchers under the context of time——citation distribution," *Journal of Modern Information*, vol. 39, no.1, pp. 169–177, 2019.
- [9] Zheng.J.Z, Zhang.Jie, "An evaluation method of individual academic influence, *Chinese Journal of Science and Technology Research*," vol.18, no. 6, pp. 957–960, 2007.
- [10] Dai.P.Y, LI.X.L and Wang.D.J, "A Comparative Study on Academic Influence of Higher Vocational Colleges in Shandong Province," *Journal of research in vocational education*, no.8, pp. 25–30, 2019.