



# A Review and Prospect of Evidence-Based Research on Teaching and Learning Based on CNKI and WOS Bibliometric Analysis

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**Abstract.** The paper combined CiteSpace software to conduct visual knowledge mapping analysis of authors, institutions and keywords for 909 documents included in CSSCI in CNKI database during 1999-2024 and 6785 documents in WOS core data collection during 1992-2024, aiming to reveal the laws of education, thus providing innovative research perspectives for the reform and high-quality development of education in China.

**Keywords:** Evidence-based teaching; Information visualization; Comparative research; Science frontiers mapping; Knowledge communication.

## 1 Introduction

In educational research, the purpose of evidence-based is to serve the development of education, emphasizing the problems in educational practice, integrating multiple data and evidence, and exploring the laws of education, in order to promote the scientific and professionalization of educational research, practice reform, and educational decision-making.

The purpose of this paper is to analyze the current status of evidence-based education research in China, to clarify its position in the field of evidence-based research, and to explore the core authors and clusters of institutions, research hot spot, and their development trends in domestic research. In addition, this paper will introduce an international comparative perspective, focusing on the front-line practice of teaching research, comparing the current status of evidence-based teaching research in foreign countries, and combining the international research hot spot and evolutionary paths, with the aim of providing the domestic evidence-based education research and its sub-theme--evidence-based teaching research, aiming to provide innovative research paths and new entry points for domestic evidence-based education research and its sub-theme - evidence-based teaching research.

## 2 Research Preparation

### 2.1 Data Source

This study intends to search CSSCI source journals in cnki.com with the theme of "evidence-based", and obtain a total of 921 pieces of data, eliminating the literature that obviously did not fit the theme, such as information, book reviews, etc, finally obtain 909 pieces of data, and export the selected literature in Refwork format to save.

In the WOS core collection, with "evidence-based teaching" as the theme, we screened three types of articles, namely, "article", "review article" and "proceeding paper", and obtained 6785 articles of related data. The selected documents are exported in plain text format to "Full Record and Cited References" and saved.

### 2.2 Research Methods

This paper intends to adopt a bibliometric approach, using the CiteSpace software as an analysis tool.

The author chose CiteSpace 6.2.R6 (64-bit) Advanced version for visual mapping and analysis, and tried to summarize the current status of research on evidence-based topics in terms of the volume of literature, research institutions, core authors, etc.; analyze the focus of research using the keyword co-occurrence network mapping; use the clustering relationship analysis to obtain the hot spot in the research; and track the research frontiers using the emergent word analysis method.

## 3 Research Process

### 3.1 Comparative Analysis of Core Authors and Highly Producing Institutions

#### Analysis of Core Authors.

Import 909 data into the citespace project, set the time from 1999.1 to 2024.12, each year as a time slice, adjust the (c,cc,ccv) of the thresholds in the adjustment panel of the selection criteria to (2,2,4) (2,2,5) (2,2,5), and other parameters Select the default settings, and then set the node types of author for the co-occurrence analysis of core authors, a total of 899 data visualizations were showed in Figure 1.

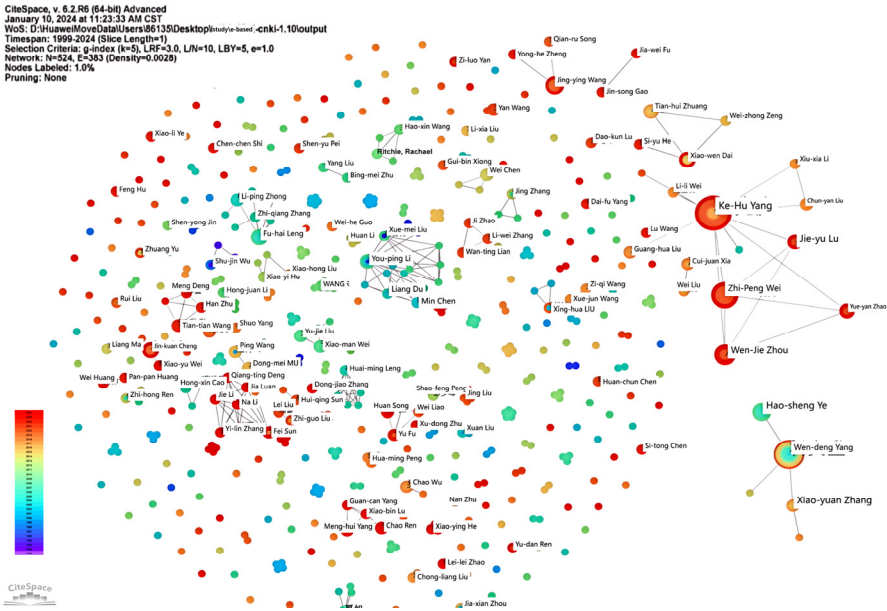


Fig. 1. Diagram of the co-operation network of domestic core authors

Reading the figure, it can be seen that the connecting lines in the network diagram are significantly smaller than the nodes, while the width and density are smaller, indicating that there are more scholars under the field, but not yet formed a close cooperation relationship, in which the author with the highest number of publications is Yang Kehu, with 24 publications.

According to Price's law formula  $M=0.749 \times \sqrt{N_{\max}}$ , where M refers to the minimum number of publications of the core authors in the field, and  $N_{\max}$  refers to the number of publications of the authors with the most publications in the field,[1] i.e., 24, which is substituted into the formula and solved as  $M \approx 3.7$ , so the authors with 4 or more publications can be regarded as the core authors of the field, and there are 13 core authors in total.

Comparing with the research status of "evidence-based teaching" in foreign countries, 6785 pieces of data were imported into the citespace project, and the time was set as 1992.1 to 2024.12, with each year as a time slice, and the other parameters were selected as the default settings, and then the node types were set as author for core author co-occurrence analysis. A total of 6784 data were visualized, adjusted as shown in Figure 2.





and a total of 8,696 publications, accounting for 78.5% of the total number of publications, indicating that a cluster of core research institutions in this field has been formed.

Particularly, the research results of the research institutions of the University of California System are the most numerous, and a research radiation network centered on this institution has been formed. Combined with the analysis of the distribution of research countries' cooperation network in Fig. 5, it can be concluded that most of the foreign research on the theme of "evidence-based teaching" is concentrated in the United States, followed by the United Kingdom, Australia, Canada and Germany.

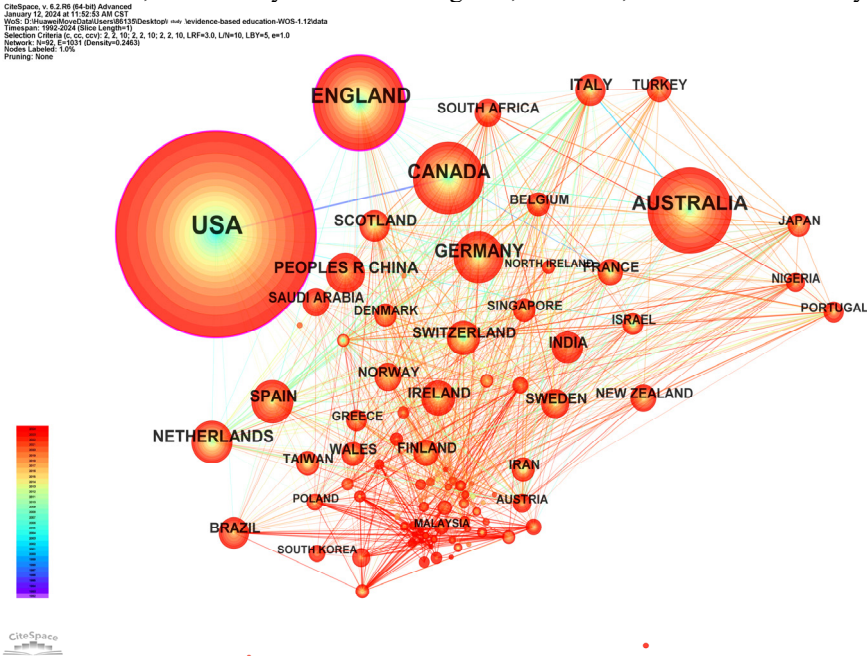


Fig. 5. Diagram of the network of foreign core research country co-operation

### 3.2 Analysis of Research Hot Spot

#### Visual Description of the Distribution of Research Hot Spot.

Using CiteSpace software for study of keywords, the higher the mediacy centrality of the keyword, indicating that the keyword and other keywords in the research field appear at the same time with a higher frequency,[2] in the specific analysis, the key node is the node with mediacy centrality > 0.1,[3] we can combine with the frequency of keyword appearance to carry out a comprehensive analysis.

The keyword is set as the node type for visual analysis, to get the keyword co-occurrence network mapping, adjusted as shown in Figure 6 and Figure 7, combined with the reading of the map and the frequency of keyword occurrence statistical ranking, a total of the frequency ranking of the top 6 keywords are obtained as shown in Table 1, which the domestic evidence-based research in the "evidence-based practice"



**Table 1.** List of high-frequency of co-occurring keywords on domestic evidence-based research and foreign evidence-based teaching research

No.	<i>Domestic</i>				<i>Foreign</i>			
	Keywords	Freq	Centrality	Year	Keywords	Freq	Centrality	Year
1	Evidence-based practice	88	0.36	2007	education	744	0.02	2003
2	evidence-based medicine	63	0.39	1999	students	538	0.04	2000
3	Evidence-based policy making	50	0.2	2006	Evidence-based practice	459	0.02	2000
4	Evidence	44	0.1	2007	knowledge	416	0.03	1999
5	Evidence-based	36	0.12	2011	care	401	0.06	2005
6	Medical journals	22	0.11	2000	impact	390	0.04	1996

Considering that clustering analysis can organize similar keywords into the same theme and present hot spot and changing trends in the research field more clearly, we further take "Keyword" as the center of clustering, and use the LLR(Logarithmic Likelihood Ratio algorithm) algorithm to extract the clusters, finally obtained Fig. 8 and Fig. 9 (of which Fig. 9 is based on the word frequency sorting and adjusted after the threshold is adjusted to 100). The modularity values of the clustering spectra of the two diagrams are all greater than 0.3, and the average profile values of the two diagrams are all greater than 0.7, which indicates that the structure of the clustering diagrams is significant, and the result is highly trustworthy.

The results of the clustering diagrams are shown in the following table. At the same time the author try to compare the statistics of the clustering results after exporting them in the form of table as Table 2, which will be analyzed specifically on the research hot spot in the following.





**Table 2.** Statistical table of comparative analysis of clustering results of domestic evidence-based research and foreign evidence-based teaching

Domestic				Foreign					
ClusterID	Size	Silhouette	mean(Year)	Label (LLR)	ClusterID	Size	Silhouette	mean(Year)	Label (LLR)
#0 Evidence-based practice	23	0.833	2018	Evidence-based practice (51.81, 1.0E-4); Evidence (19.79, 1.0E-4); Evidence-based education (14.11, 0.001); educational reform (8.49, 0.005); Evidence-based decision making (7.76, 0.01)	#0 evidence-based medicine	211	0.801	2003	evidence-based medicine (174.96, 1.0E-4); medical education (104.96, 1.0E-4); evidence based medicine (96.88, 1.0E-4); critical appraisal (75.06, 1.0E-4); journal club (53.68, 1.0E-4)
#1 Evidence-based	17	0.652	2018	Evidence-based (20.39, 1.0E-4); Evidence-based decision making (18.29, 1.0E-4); Evidence-based practice (14.91, 0.001); systematical evaluation (11.93, 0.001); basic education (11.93, 0.001)	#1 mental health	170	0.658	2009	fertility control (0.92); obstetrics and gynaecology (0.92); consent (0.92); caesarean section (0.92); clickers (0.92)
#2 United States of America	9	0.872	2020	United States of America (21.46, 1.0E-4); Australia (15.88, 1.0E-4); after-school service (15.88, 1.0E-4); safeguard mechanism (10.54, 0.005); evaluation model (10.54, 0.005)	#2 autism	170	0.705	2013	fertility control (1.28); obstetrics and gynaecology (1.28); consent (1.28); caesarean section (1.28); clickers (1.28)
#3 Evidence-based research	8	0.956	2020	evidence-based research (17.38, 1.0E-4); Literature Evidence Search (15.13, 1.0E-4); theoretical foundation (10.04, 0.005); saturation (10.04, 0.005); Educational research (10.04, 0.005)	#3 active learning	163	0.649	2015	fertility control (1.07); obstetrics and gynaecology (1.07); consent (1.07); caesarean section (1.07); clickers (1.07)
#4 Medical journals	7	0.929	2016	medical journal (21.39, 1.0E-4); factor (11.62, 0.001); clinical research (11.62, 0.001); Academic quality (11.62, 0.001); quality control (11.62, 0.001)	#4 evidence-based practice	131	0.654	2011	fertility control (1.27); obstetrics and gynaecology (1.27); consent (1.27); caesarean section (1.27); clickers (1.27)
#5 Evidence-based medicine	7	0.954	2015	evidence-based medicine (33.86, 1.0E-4); Rule of law decision-making (8.21, 0.005); knowledge organisation (8.21, 0.005); Electronic medical records (8.21, 0.005); evidence-based law (8.21, 0.005)	#5 Practitioner	7	0.985	2001	evidence-based practice (0.03); education (0.02); evidence-based medicine (0.01); medical education (0.01); curriculum (0.01)
#6 Educational Practice	6	0.91	2021	educational practice (15.5, 1.0E-4); cultivation of talent (15.5, 1.0E-4); innovator (7.66, 0.01); Talent Selection (7.66, 0.01); integration of body and medicine (7.66, 0.01)	#6 health promotion	6	0.993	1996	evidence-based practice (0.02); education (0.02); clickers (0.01); interactive teaching (0.01); physician speciality (0.01)

### 3.3 Hot Spot Analysis of Domestic Evidence-based Research

Due to a certain degree of similarity between some of the themes, after further consolidation, combined with the content analysis of the literature, it was finally concluded that the domestic evidence-based research is centered on three key research directions, i.e. "evidence-based medicine", evidence-based education" and "evidence-based decision-making".

(1) Direction 1-Development and Application of Evidence-Based Medicine: Includes #0 Evidence-Based Practice, #4 Medical Journals, and #5 Evidence-Based Medicine.

Early studies focused on editorial strategies, journal concepts, topic planning, editorial literacy, etc. In recent years, they have focused on the application of big data technology in the fields of psychotherapy, treatment of children with autism, and evidence-based practice of special sports, which has also implicated information literacy enhancement.

In addition, with the promotion of the "Healthy China Initiative", the research on evidence-based medicine has been further expanded into the fields of evidence-based exercise, the integration of physical education and medicine, and the alleviation of poverty in rural public sports, etc.

(2) Direction 2-Practice and Innovation of Evidence-Based Education: contains #0 Evidence-Based Practice, #3 Evidence-Based Research, #6 Educational Practice, #2 U.S.

Research in this area focuses on evidence-based teacher education practice, educational reform, teaching practice, and comparative studies between China and the rest of the world, with a special focus on educational practice and teacher training in the era of big data.

Under the theme of evidence-based teacher education practice, we mainly cover teacher listening and evaluation practice, teaching and research, and professional development model, etc. Specifically, we mainly include primary and secondary school teachers' listening and evaluation practice, evidence-based teaching and research pointing to the generation of teachers' practical knowledge, PD&R practice model of evidence-based teacher professional development, secondary school mathematics "excellent teacher" training, evidence-based teacher development, and evidence-based teacher development model. The research aims to provide the best evidence for the construction of a high-quality teaching force, such as optimizing the governance of teaching reflection in lesson study, and exploring the connotation of evidence-based teacher education practice.

(3) Direction 3-Multidisciplinary Applications of Evidence-Based Policymaking: including #0 Evidence-Based Practice, #1 Evidence-Based, #2 U.S.

In the late 1990s, with the development of evidence-based medicine gradually emerged as an emerging cross-disciplinary - evidence-based social science, which is known as the third wave of "scientization" of the social sciences, the development of evidence-based social science has experienced evidence-based policymaking, evidence-based pedagogy, evidence-based law, evidence-based social work, and other fields. [4]

After reading and summarizing the relevant literature, it is found that there is a wide range of research under this thematic direction, including evidence-based rural governance, medical social work, and library and intelligence work. Especially in the practice of poverty alleviation and grassroots governance, the application of evidence-based methodology provides a practical framework for poverty alleviation in rural public sports and poverty alleviation governance in western regions.

### **Hot Spot Analysis of Foreign Evidence-based Teaching Research.**

What is "evidence-based teaching", it is evidence as the core, based on the teacher's experiential literacy, to the development of students as the goal of the design and organization of teaching activities, [5] combined with the previous analysis of Figure 9 and Table 2, and the relevant nodes corresponding to the title of the list of literature and abstract reading, you can roughly determine the research content of the cluster. Especially in the field of #0 evidence-based medicine research mostly focuses on multiple aspects of medical education, such as e-learning in health sciences education, evidence-based medicine curriculum, medical education: quality of evidence and pedagogical strategy, social media in knowledge translation and education; digital education in health professions, blended learning education intervention, a randomised controlled trial, etc.

Further analyzed by combining the keywords in the clustering results export table in Table 2, the research content of #1, #2, #4 and #5 still revolves around medicine, nursing, medical education and other aspects.

In the past five years, evidence-based teaching research still follows the closed-loop model of problem/need-evidence exploration-evidence evaluation-practice-assessment of evidence-based concepts, from the perspectives of developing 21st century skills, narrowing achievement gaps, and engaging students in classrooms. The research methodology includes innovations in teaching tools, and the use of a variety of teaching methods. Research methods include innovations in teaching tools, comparative tests (e.g., traditional lecture versus active learning), improvements in teaching approaches and course designs, innovations in instructional strategies, the role of the teacher as a researcher, teacher education, and the role of the teacher in the classroom. The role of the researcher, teacher education, critical reflection, social emotional learning, and systematic scoping review are some of the research themes that provide a wealth of keyword references for evidence-based teaching and learning research in China.

### **3.4 Analysis of Research Trends-keyword emergence**

Using the burst detection function of CiteSpace, the number of burst words parameter  $\gamma$  is set to 0.3, and 18 burst words appearing in 1999-2024 are drawn.

### Top 18 Keywords with the Strongest Citation Bursts

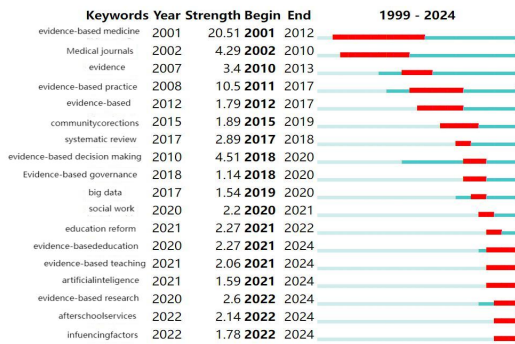


Fig. 10. Mapping of keyword emergence in domestic evidence-based research, 1999-2024

Combined with the analysis in Figure 10, the top five keywords in terms of the intensity of keyword emergence are "evidence-based medicine," "evidence-based practice," "evidence-based decision-making," "medical journals" and "evidence". In terms of the starting year of keyword emergence, "evidence-based medicine" and "medical journals" are the earliest; from 2020 onwards, the research emergence terms include "social work" "education reform" "evidence-based education" "evidence-based teaching" "artificial intelligence" "evidence-based research," "after-school services," and "influencing factors," suggesting that the research themes represented by these keywords have been hot spot of interest in recent years.

Comparing with the screening data analysis of WOS core database, setting the parameter  $\gamma$  of the number of emergent words to 1, a total of 118 emergent words appeared from 1992 to 2024, and sorting according to the intensity of emergence of keywords, we get Fig. 11, and the top five words are, in order, "evidence-based medicine", "controlled trial", "users guides" and "critical appraisal", and "curriculum", etc. The research around these key words started earlier, in 1992-1998, and most of the related researches focus on evidence-based medicine, clinical practice, and evidence-based disease management.

### Top 118 Keywords with the Strongest Citation Bursts



Fig. 11. Keyword emergence mapping of foreign research on evidence-based teaching, 1992-2024 (top eight intercepted)

Sorting according to the year of keyword emergence, we intercepted the information of keywords with emergence start time after 2020, as shown in Figure 12, and the top five according to the emergence intensity are "autism" "retention" "artificial

intelligence" "scoping review" "educational technology", indicating that the research themes represented by these keywords are hot spot of interest in recent years.

Top 118 Keywords with the Strongest Citation Bursts

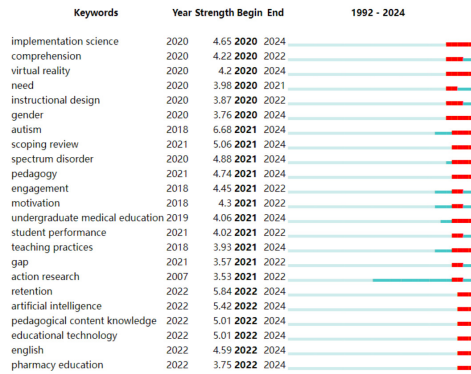


Fig. 12. Keyword emergence mapping of foreign research on evidence-based teaching, 1992-2024

## 4 Research Conclusion

### 4.1 Research Conclusions

Through comparative analysis, this study found that in terms of core authors, the number of domestic core authors is relatively small, teams with high impact have not yet been formed. Overseas has formed a core group of authors centered on Khan, Khalid S, etc., whose research was concentrated in 2008-2010, focusing on early evidence-based medical practice. On the other hand, Krishna, Lalit Kumar Radha and other core authors' research team is active in 2021-2023, and their research field is expanded from medical practice to social-emotional education, communication teaching and assessment, systematic scoping review and other topics, which shows the shift trend of foreign research on evidence-based teaching and learning. turning trend in teaching research.

In terms of research institution cooperation, a core cluster of research institutions has been formed abroad, centered on the University of California System, with research mostly concentrated in the United States. Although three clusters of institutions with close cooperation have been formed in China, most of the institutions still focus on independent research, and cross-institutional cooperation is still insufficient.

Domestic evidence-based research is centered on "evidence-based practice", and the main research directions include evidence-based medicine, evidence-based education and evidence-based decision-making. Overseas research on evidence-based teaching and learning is mainly centered on the fields of medicine, nursing and medical education, and the research theme is developed along the closed-loop path of evidence-based concepts, while new research turns have appeared, such as 21st century skills mastery, classroom participation improvement, teaching tool innovation, teaching methods and curriculum design changes, teacher role as a researcher, teacher edu-

cation, critical reflection, social-emotional learning extension, and the scope of the systematic approach, etc., which provide keyword references for selecting topics for evidence-based teaching research in China.

## 4.2 Future Outlook

The instrumental rationality of evidence-based research may lead to the lack of humanistic care in curriculum research, too much emphasis on evidence assessment may trigger the conflict between scientific and empirical evidence, systematic operational procedures may increase the difficulty of promotion, and insufficient foresight may limit its role in the future construction of curriculum. [6]

At the same time, rapidly updating knowledge and changing working lives require learners to be prepared for continuous learning. Schools need to seek new forms of teaching and learning for the future. In international discussions, teachers are seen as a key force in driving learning towards these goals (Darling-Hammond, 2010; Darling-Hammond and Lieberman, 2012; Ministry of Education, 2012; Sherrill, 2011). [7] Therefore, teacher education (TE), the training of exceptional teachers, and the exploration of teacher development models continue to be the focus of research.

The research ideas of active learning in foreign countries, including 21st century skill mastery, teaching tool innovation, teacher's role as a researcher, critical reflection, etc., providing new perspectives for in-depth research in China, promote education from discipline-based and knowledge-based to student literacy-based transformation, and promote the improvement of evidence-based teaching competence in social-emotional learning, excellent teacher professional development and Talent cultivation practice, in-depth synergy and value co-creation across disciplines and school segments, etc. The above research themes are still worthy of further in-depth exploration by domestic research.

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## References

1. Wang X J,Zhao W P.(2023) Hot spot and Evolutionary Trends of Research on Vocational Education Teaching Materials in China since the 21st Century: A CiteSpace-based Knowledge Mapping Visualization Analysis. *China Vocational and Technical Education*, 17:71-81.doi:10.3969/j.issn.1004-9290.2023.17.010.
2. Chen C M.(2009) CiteSpace II : Detecting and Visualizing Emerging Trends and Transient Patterns in Scientific Literature. *Journal of the China Society for Scientific and Technical Information*,3:401-421.doi:10.3772/j.issn.1000—0135.2009.03.012.

3. Ren H.(2021) Progress and Trends of Research on Domestic Social Think Tanks in the Past 25 Years--An Analysis of Information Visualization Based on CiteSpace. *Journal of Southwest Minzu University(Humanities and Social Sciences Edition)*,42:232-240. [https://lib-cqvip-com.vpn.sict.edu.cn:8118/Qikan/Article/Detail?id=7104218604&from=Qikan\\_Search\\_Index](https://lib-cqvip-com.vpn.sict.edu.cn:8118/Qikan/Article/Detail?id=7104218604&from=Qikan_Search_Index).
4. Yang K H.(2018)Evidence-based Social Science: The Origin, Development and Prospects. *Library and Information*,3:1-10. [https://qikan.cqvip.com/Qikan/Article/Detail?id=7000833009&from=Qikan\\_Search\\_Index](https://qikan.cqvip.com/Qikan/Article/Detail?id=7000833009&from=Qikan_Search_Index).
5. Cui Y X.(2021)On the Process Logic and Operational Mechanism of Evidence-based Teaching. *Curriculum, Teaching Material and Method*,41:64-71. doi: 10.19877/j.cnki.kcjcf.2021.01.010.
6. Zhang J J,Huang X B.(2022)The Enlightenment and Introspection of Evidence-Based Research on Curriculum Research. *Education Sciences in China*,5:123-130. doi: 10.13527/j.cnki.educ.sci.china.2022.03.013.
7. Hannele Niemi, Anne Nevgi.(2014) Research studies and active learning promoting professional competences in Finnish teacher education. *Teaching and Teacher Education*, 10: 131-142.<https://doi.org/10.1016/j.tate.2014.07.006>.

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