Current Situation and Hotspot Analysis of Blended Teaching based on Bibliometrics

Yuqian Xue *

Department of Economics and Management, University Nanjing University of Science and Technology, Nanjing, China

* Corresponding Author Email: xyq720@qq.com

Abstract. With the rapid development of information technology and data science, blended teaching has received widespread attention. It has both the dual advantages of offline traditional teaching and online learning, and its flexible organization, diversified resource forms and interactive ways are favored by many educational researchers at home and abroad. In order to understand the development status and hot spots of blended learning more intuitively and clearly, this paper takes the research papers of blended learning in the recent ten years from the Web of Science database as samples to quantitatively analyze the literature quantity distribution and development situation of blended learning. The bibliometric tool CiteSpace was used for visual analysis, and the evolution trend of blended teaching research content was sorted out by keyword co-occurrence analysis and cluster analysis. This paper further summarizes the development hotspots of blended learning.

Keywords: Blended learning, Online learning, Bibliometrics.

1. Introduction

In 2012, with the popularity of the Internet, a web-based massive open online courses (MOOC) for the general population mushroomed. The development of education Informa ionization to drive the rapid growth of online learning users and the explosion of learning resources. In 2019, massive open online courses represented by MOOC developed rapidly again under the influence of the COVID-19, however, some problems were also highlighted during its rapid development [1]. Due to the wide audience of online education, learners have great differences in learning motivation, knowledge background and learning ability, so the methods of traditional education are not applicable in online platforms with massive learners. In order to break the imbued education form of traditional MOOCs and get rid of the predicament of broadcast education [2], many universities have begun to explore the practical methods of blended teaching. The innovative concept of "Internet plus" education provides methods and paths for theoretical research and practical teaching of blended learning. Blended teaching has the advantages of both traditional and online teaching, which has a significant impact on the existing teaching model and learning background [3]. As scholars pay more and more attention to blended learning, a large number of studies on blended learning have emerged. Based on this, this paper takes the research papers of blended learning from 2012 to 2022 included in the core database of Web of Science as the research object, combined with bibliometrics and content analysis method, to sort out and analyze the current research status, research hotspots, existing problems and development trends of blended learning.

2. Data Sources and Research Methods

2.1. Data Sources

The data collected in this study came from articles published in the Web of Science Core Collection Database from 2012 to the present ten years. The retrieval time was September 15, 2022. The topic was "Blended Teaching" or "Blending Learning", and a total of 5713 articles were retrieved. To ensure the accuracy of the study, only 5539 papers, review papers and conference accepted papers were selected as data samples.

2.2. Research Methods

This study adopts the research method of bibliometric analysis and uses CiteSpace software to visualize the data samples. Through the graph principle of citation analysis and the technical basis of information visualization, the software uses key words co-occurrence, keyword cluster analysis and other functions to detect the research hotspots and research trends in the subject field.

3. Research Results and Analysis

3.1. Quantity Analysis of Publications

The annual publication volume of statistical literature can be formed into a line chart as shown in Figure 1. According to the figure, the research process of blended teaching is on the rise as a whole, which can be roughly divided into three stages: the first stage is from 2012 to 2015, and the research on blended teaching is in the emerging exploration stage; The second stage is from 2016 to 2019. Compared with the previous stage, the number of publications has increased significantly, and the research hotspot has also changed from basic theory to practical integration of discipline application. The third stage is from 2020 to now. Due to the large-scale popularization of offline teaching affected by the epidemic, the development of blended teaching will be greatly promoted, and the growth trend of blended teaching will continue to be maintained in the future.

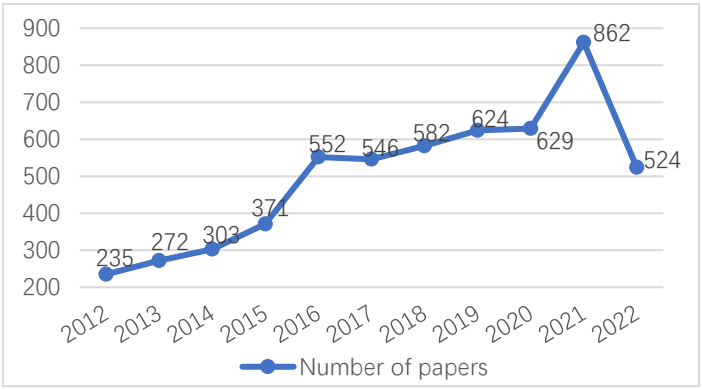


Figure 1. Distribution of literature number

3.2. Keywords Co-occurrence and Cluster Analysis

The keywords of the paper are a high generalization of the content of the article. The higher the frequency of keywords, the more relevant research has been carried out. Select the node type as keyword in CiteSpace, set the node screening threshold as top 50, and cut the network. After running, obtain the keyword co-occurrence graph with frequency distribution, as shown in Figure 2.

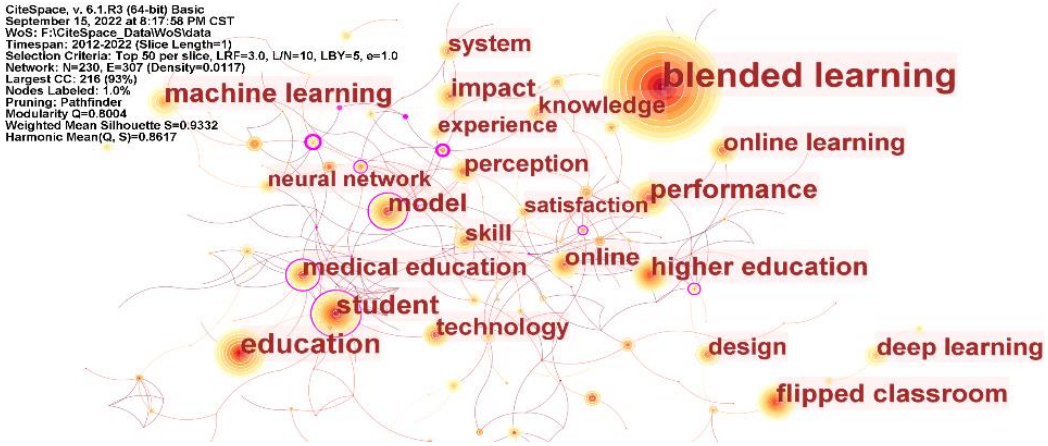


Figure 2. Keywords Co-occurrence Graph

The figure contains a total of 230 nodes and 733 connections. Each node represents a keyword. The larger the shape of the node, the higher the frequency of the keyword. Further, cluster analysis was carried out based on keyword co-occurrence network, and a total of 13 clusters were obtained. The top 10 clusters with more labels and clusters were selected for visual display, as shown in Figure 3. The Modularity Q value is 0.8004 and the mean Silhouette value is 0.9332, indicating that the cluster structure is significant and the result is convincing.

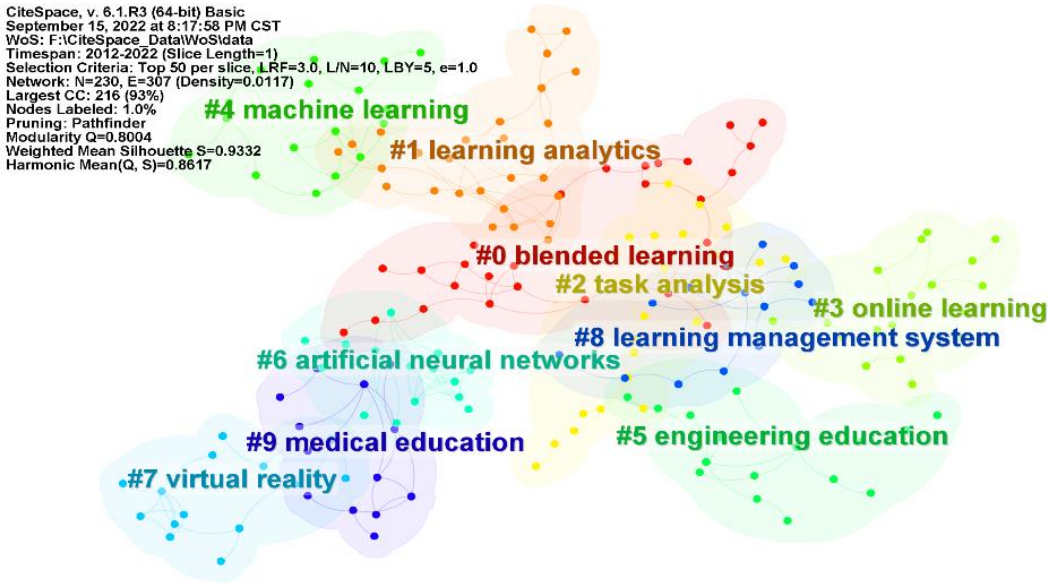


Figure 3. Keywords Cluster Graph

The frequency, centrality and their relationship of keywords can directly reflect the focus of researchers in a certain period. The higher the frequency, the more likely it is to become a research hotspot in the keyword co-occurrence network. The higher the value of Centrality, the stronger the Centrality of the keyword in the whole co-word network. If the frequency of a node is high but the centrality is 0, it means that although the keyword appears frequently, it is an isolated node and cannot be regarded as a key node [4]. The top 10 keywords with the highest frequency and highest mediation centrality in the keyword network were selected, as shown in Table 1.

Table 1. High-frequency and High-centrality keywords

Number	High-frequency keywords		High-centrality keywords	
	Keywords	Count	Keywords	Centrality
1	blended learning	1396	instruction	0.58
2	education	331	validity	0.46
3	student	271	classification	0.44
4	machine learning	222	reliability	0.44
5	performance	220	user acceptance	0.4
6	flipped classroom	203	motivation	0.32
7	model	197	medical education	0.28
8	higher education	191	model	0.26
9	impact	164	teaching/learning strategy	0.23
10	medical education	159	virtual patient	0.22

From Table 1, hot keywords include machine learning, flipped classroom, User acceptance, classification, Reliability, teaching/ Learning strategy, etc. Thus, it can be concluded that the hot content of blended teaching can be summarized into the following categories: 1. Theoretical research on blended teaching based on students, teaching and learning models [5]; 2. Teaching practice research on autonomy, reliability and learning motivation related to students' autonomous learning [6]; 3. Research on blended teaching model related to teaching strategies, user feedback, classroom performance and other factors [7].

3.3. Burst Word Analysis

Burst detection is to analyze the situation that a word becomes a hot spot after its citation times surge in a short period of time. Through the detection of burst words, the evolution trend of the research field can be reviewed or predicted which keywords become hot spots when. In this paper, burst-word detection is performed on the basis of the keyword co-occurrence network, and the top 20 words with the highest emergence intensity since 2012 can be obtained, as shown in Figure 4. It can be seen that the development and evolution trend of blended teaching in the past ten years is from the research on teaching model and teaching strategy [8] to the practical research on blended teaching and mobile teaching [9]. In recent years, studies on learning models [10], teaching data, image processing [11] and other technical means that can help improve the effect of blended teaching continue to grow, and will remain one of the research hotspots in the future.

Keywords	Year	Strength	Begin	End	2012 - 2022
teaching/learning strategy	2012	4.16	**2012**	2013	
learning style	2012	6.24	**2013**	2016	
collaborative learning	2012	6.15	**2013**	2017	
engineering education	2012	6.14	**2013**	2014	
clinical education	2012	4.74	**2013**	2016	
mobile learning	2012	9.97	**2014**	2018	
blended learning	2012	22.94	**2015**	2016	
case study	2012	5.44	**2015**	2018	
serious game	2012	5.08	**2015**	2019	
flipped classroom	2012	5.83	**2016**	2017	
online course	2012	5.82	**2016**	2018	
higher education	2012	5.5	**2016**	2017	
educational data mining	2012	4.99	**2016**	2018	
flipped learning	2012	4.84	**2016**	2018	
metaanalysis	2012	4.29	**2016**	2018	
educational technology	2012	4.13	**2016**	2018	
nurse	2012	4.22	**2017**	2020	
convolutional neural network	2012	5.93	**2020**	2022	
prediction	2012	5.81	**2020**	2022	
image segmentation	2012	4.52	**2020**	2022	

Figure 4. Top 20 keywords with the Strongest Citation Bursts

4. Conclusion and Prospect

This study uses bibliometrics method and CiteSpace for visual analysis to explore the research status, hot spots and trends of blended teaching in the past ten years. Its development can be divided into the following three stages: A. Theoretical research stage (2012-2013). The research in this stage mainly focuses on the strategy research and theoretical model research of blended learning. Among them, teaching existence theory, behaviorism, connectionism and other theories [12] have formed important theoretical support for blended teaching. At the same time, with the large-scale emergence of online teaching forms such as MOOC and flipped classroom, it has laid a good foundation for the concrete practice and effect feedback of blended teaching. B. Practice and exploration stage (2014-2016). At this stage, a large number of online and offline combined teaching models went into practice, and relevant studies focused on the teaching effect and teaching feedback under this model [13]. Researchers pay attention to students' autonomous learning, learning motivation and other internal

factors [14]. The relevant research in this stage will play a great role in improving the effect of blended teaching and promoting the practical application of blended teaching. C. Multiple development stages (2017 to present). With the more perfect construction of various online teaching platforms, various online evaluation, offline guidance feedback, teaching evaluation and other modules are integrated, which greatly reduces the difficulty of blended teaching. In addition, more research focuses on the integration of information technology and online teaching [15], mainly discussing how to integrate big data, prediction model [16], deep learning and other technological means into blended teaching mode to achieve teaching objectives.

This study analyzed and summarized the overall development of blended teaching in the past ten years, but did not compare and analyze the blended teaching research in different disciplines. It is found that the effect of blended teaching in subjects such as medicine and physical education is slightly better than that in other fields, so it will be further studied in combination with relevant data in the future.

References

[1] Ismail, A. O. A, Mahmood, A. K., & Abdelmaboud, A. Factors Influencing Academic Performance of Students in Blended and Traditional Domains. International Journal of Emerging Technologies in Learning. 2018 (02), 170 – 187.

[2] Stephen Downes. In the Digital Era, how to break through the siege of education and teaching. China Education Network. 2017 (12): 5 - 6.

[3] Stephen Downes, Junhong Xiao. Not just free: Open learning in the online world. Distance Education in China. 2015 (4): 5 - 16.

[4] Guohua W, Shuyu Y, Huifang H, Yan Hu. Visual Analysis of distance Education Research in China--Core Literature, Hot spot, Frontier and Trend. Journal of distance Education. 2015 (1): 57 - 65.

[5] Lin, WS. Perceived fit and satisfaction on web learning performance: IS continuance intention and task-technology fit perspectives. International Journal of Human-Computer Stidues. 2012, 70 (7): 498 - 507.

[6] Barak M, Watted A, Haick H. Motivation to learn in massive open online courses: Examining aspects of language and social engagement. 2016 (94): 49 - 60.

[7] Porter WW, Graham CR, Spring KA, Welch KR. Blended learning in higher education: Institutional adoption and implementation. Computers & Education. 2014,75: 185 - 195.

[8] Rasheed RA, Kamsin A, Abdullah NA. Challenges in the online component of blended learning: A systematic review. Computers & Education.2019, 114.

[9] Chung CJ, Hwang GJ, Lai CL. A review of experimental mobile learning research in 2010-2016 based on the activity theory framework. Computers & Education. 2019,129: 1 - 13.

[10] Xian Peng, Qinmei Xu. Investigating learners' behaviors and discourse content in MOOC course reviews. Computers & Education, 2020, 143.

[11] Ng YY, Przybylek A. Instructor Presence in Video Lectures: Preliminary Findings from an Online Experiment. IEEE Access. 2021, 9: 36485 - 36499.

[12] Murray M C, Pérez J, Geist D, Hedrick A. Student Interaction with Online Course Content: Build It and They Might Come. Journal of Information Technology Education: Innovations in Practice, 2012 (11): 125 - 140.

[13] Eppich W, Cheng A. Promoting Excellence and Reflective Learning in Simulation (PEARLS) Development and Rationale for a Blended Approach to Health Care Simulation Debriefing. Simulation in Healthcare-journal of the Society for Simulation in Healthcare. 2015, 10 (2): 106 - 115.

[14] Hoic-Bozic N, Mornar V, Boticki I. A Blended Learning Approach to Course Design and Implementation. IEEE Transactions on Education. 2009, 52 (1): 19 - 30.

[15] Shang, WL. Application of Machine Learning and Internet of Things Techniques in Evaluation of English Teaching Effect in Colleges. Computational Intelligence and Neuroscience.2022, 2022.

[16] Yimin Wen, Ye Tian, Boxi Wen, Qing Zhou, Guoyong Cai, Shaozhong Liu. Consideration of the Local Correlation of Learning Behaviors to Predict Dropouts from MOOCs. Tsinghua Science and Technology, 2020, 25 (03): 336 - 347.