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PAPER

A Bibliometric Analysis of Online Learning Emotions from 2006 to 2023

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ABSTRACT

Despite a growing body of research on online learning emotions, few studies have been committed to systematic reviews of the scientific publications in this area using bibliometric methods. Assisted by CiteSpace software, the present study aims to dissect the scientific production of this subject from 2006 to 2023 based on the database of WOS, revealing development trends and hotspots. The following findings are obtained from the bibliometric analysis. Firstly, the number of articles published has increased exponentially from only one in 2006 to 209 in 2022, demonstrating upside potential. Secondly, the United States, China and England are the most contributing countries, while Kruk, Pawlak, Kim and Artino are the most prolific authors and Cao (2020), Loderer (2020), Pekrun (2017), Li (2018), Jiang (2019), Dewaele (2018) are recognized as the most-cited articles. Lastly, studies concerning the COVID-19 pandemic and foreign language enjoyment have taken the academic high ground in the area of online learning emotions in recent years, and the research focus has shifted from negative emotions to positive ones. The findings may have implications for educators and practitioners in online learning and teaching in the future.

KEYWORDS

online learning emotions, bibliometric analysis, CiteSpace

1 INTRODUCTION

Emotions cannot be regarded as separate from the learning environment experience [1, 2], as they exist within a broader and more comprehensive human experience [3]. Furthermore, emotion and emotion regulation are increasingly viewed as critical issues in online learning environments [4, 5, 6], as anxiety and frustration often result from technical issues and social isolation of attending online classes [7]. Garrison, Anderson, and Archer (2000) identified emotional expression as part of being socially present online and proposed a model called the community of inquiry framework, explicating teaching practice and student learning online [8].

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Given the unprecedented COVID-19, teachers and students have swiftly migrated their courses online [9]. Compared to traditional face-to-face learning, online learning has brought learners new opportunities and challenges to the educational system, such as flexibility, isolation, and technical problems [10, 11]. Facing these unique opportunities and challenges, learners may experience emotions more frequently than those in traditional face-to-face learning settings [12, 13, 14]. Consequently, studies on online learning emotions have garnered increasing scholarly attention in recent years. Although previous studies were conducted on the related issues of online learning emotions, few studies have been committed to a systematic review of the scientific publications in this area using bibliometric methods. As a popular and rigorous method for exploring and analyzing large volumes of scientific data, bibliometric analysis enables us to unpack the evolutionary nuances of a specific field, while shedding light on the emerging areas within that field [15]. Accordingly, this study attempts to review the development of online learning emotions in terms of countries/regions, authors, journals, keywords and citations through CiteSpace software. The specific questions to be addressed in the present study are as follows:

1. What is the general publication trend in the area of online learning emotions?
2. What are the most contributing countries/regions, authors and articles to the studies of online learning emotions?
3. What are the hotspots of online learning emotions in different periods and the emerging trends?

To these ends, the present study visually and systematically analyzes prior studies of online learning emotions from 2006 to 2023 based on the WOS database using CiteSpace, a knowledge mapping software. The results may uncover the panorama of online learning emotions, help more scholars track the development trends and provide theoretical support for online learning research in the future.

2 MATERIALS AND METHODS

This section illustrates how the data is collected and what research tools are used for data analysis and visualization.

2.1 Data collection

In this study, data analysis was performed on Social Sciences Citation Index (SSCI) journals collected from the Web of Science (WOS) database, a renowned multidisciplinary database platform [16]. The topic of "online learning emotions" was searched with a retrieval span from 2006 to February 3, 2023. A total of 825 records were retrieved and refined based on language (English) and document type (excluding review articles), resulting in 776 records with all bibliometric information available in the WOS database. The search queries and refinement procedure, including the application of inclusion and exclusion criteria, are displayed in Table 1.

Table 1. Topic search queries and refinement procedure

Set	Results	Refinement
1	825	Topic=online learning emotions
		Index=Social Sciences Citation Index (SSCI)
		Timespan=2006 to present (February 3, 2023)
2	820	Refined by languages: English
3	776	Refined by document types: review article being excluded

2.2 Research tools

With regard to research tools, CiteSpace (version 6.1.R6) and Microsoft Excel were used for quantitative analysis and data visualization. Based on JAVA, CiteSpace is a widely used software for bibliometric analysis and visualization [17], which was developed by Professor Chaomei Chen from the School of Computing and Information at Drexel University. It analyzes keywords in literature based on the principles of bibliometrics and explores and mines the dynamic process of scientific research, showing the trend of scientific development [18]. In this study, all records extracted from the WOS database were imported into CiteSpace to discard duplicates, followed by various visualization analyses such as keyword (cluster) analysis and co-citation analysis. And Microsoft Excel assisted in data organization and diagram drawing.

3 RESULTS

In this section, the findings of the bibliometric analysis of the data collected from WOS database are presented, which consist of the following five parts: the publication output, countries/regions, authors, keywords and citations.

3.1 Publication output

As shown in Table 2, of the 776 publications, there were 355 journals, 2631 authors, 1911 institutions and 269 countries or regions that made contributions to the studies of online learning emotions from 2006 to 2023. Figure 1 displays the time distribution of publication numbers from 2006 to 2023. Notably, the number of articles published from 2006 to 2011 is very small, which is below ten, while there is a significant increase in the number of articles during the period of 2018 to 2022, with a peak of 209 in 2022. The period of 2011 to 2018 witnessed a small rise and fall in the number of publications. Since only papers published before the date of the study were included, it is estimated that 2023 will still reach a relatively high number of publications.

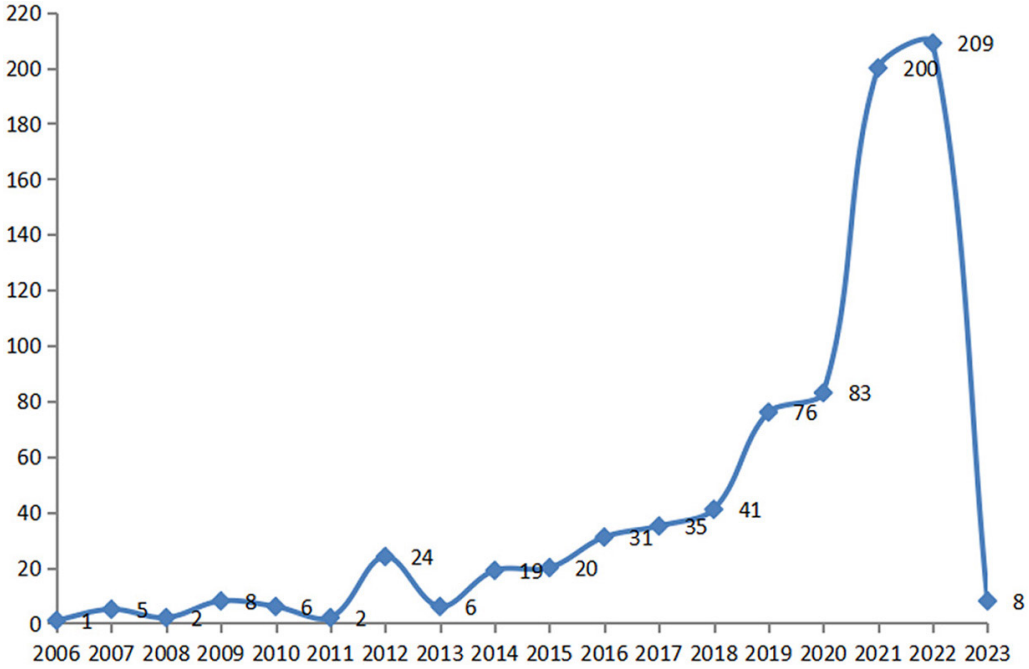

Fig. 1. Distribution of publications by years

Table 2. Bibliographic statistics of 776 publications extracted from WOS (2006–2023)

Total Publications	Journals	Authors	Institutions	Countries/Regions
776	355	2631	1911	269

3.2 Countries/regions

The results show that 269 countries/regions contributed to online learning emotion studies. The top 10 countries/regions concerning the number of documents from 2006 to 2023 are the United States (210 publications, 27.06% of total output), China (189 publications, 24.36%), England (69 publications, 8.89%), Australia (65 publications, 8.38%), Germany (46 publications, 5.93%), Spain (43 publications, 5.54%), Canada (40 publications, 5.15%), Taiwan (37 publications, 4.77%), Italy (22 publications, 2.83%), and India (22 publications, 2.83%).

Table 3 illustrates the top 5 productive countries/regions in online learning emotions studies across four periods. The United States occupied a dominant position in the first three periods, but this advantage dissolved in the latest period during which China witnessed substantial growth, climbing from only one publication from 2006 to 2010 to 139 publications from 2021 to 2023, displaying an explosive development trend. Additionally, Australia could be deemed as a rising star, for it stood out with a strong growth over the past decade, ranking third with a total of 36 publications in the latest period.

Table 3. Top 5 productive countries/regions (2006–2023)

R	2006–2010		2011–2015		2016–2020		2021–2023	
	Countries/Regions	P	Countries/Regions	P	Countries/Regions	P	Countries/Regions	P
1	USA	9	USA	37	USA	81	China	139
2	England	5	England	9	China	46	USA	83
3	Cyprus	2	Taiwan	7	England	32	Australia	36
4	Greece	2	Australia	6	Australia	22	England	23
5	China	1	Spain	5	Germany	20	Germany	23

Notes: R: Rank, P: Publication.

3.3 Authors

Totally 2,631 authors took part in the research of online learning emotions. The minimum number of documents of per author was set to three, and a total of 15 authors met the threshold. The network made of co-authorship relations produced by CiteSpace is presented in Figure 2, with each node representing an independent author and its size weighted by citation. The link between different nodes indicates a co-authorship relationship, and its thickness is weighted by the number of co-authored documents [19]. Among them, Kruk, Pawlak, Kim, and Artino topped the ranking list with five articles each.

Kruk and Pawlak focused mostly on boredom in online classes, and their co-authored article titled "Boredom in online classes in the Iranian EFL context: Sources and solutions," discussing in terms of lessons designed for educators and instructors to enhance the experience of online English learning during and beyond the COVID-19 pandemic [20], has received 85 citations. Kim's work mainly concentrated on the study of computer-supported collaborative learning. His article on learner participation profiles in an asynchronous online collaboration context arouse 26 citations, showing that learner engagement level can be categorized as three levels: cognition, behavior, and emotion [21]. Additionally, Artino is the author who received the largest number of citations (164 citations), focusing on the study of relations between achievement emotions and self-regulated learning behaviors in online learning. As shown in Figure 2, most of the productive authors worked in close cooperation with other authors, indicating that close cooperation can contribute significantly to the increase in the number of publications.

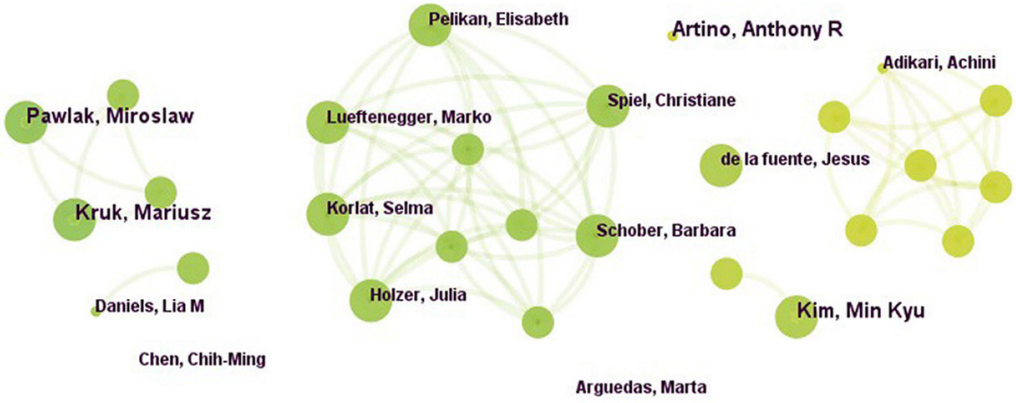

Fig. 2. The co-authorship network map of authors

3.4 Keywords

As a significant indicator, keywords can clearly reflect the core ideas of research articles, which proved to be vital for decoding the themes of a specific discipline to some extent [22]. To flesh out the evolution of online learning emotions from 2006 to 2023, the cluster year by year function [23] of CiteSpace was applied to draw the timeline map (Figure 3).

From Figure 3, the evolution of keywords in the field of online learning emotions becomes clear. The three largest clusters are Cluster #0: COVID-19 pediatric palliative care, Cluster #1: machine learning, and Cluster #2: event detection. The duration of both clusters #0 and #1 is 10 years, from 2012 to 2022 and 2009 to 2019 respectively, which, however, indicates that scholars' attention on cluster #1 has abated these years comparing to cluster #0. Regarding the main keywords included in Cluster #1, efficacy, impact, strategy, and engagement receive less attention from scholars today, but they used to be research hotspots. The study of Cluster #2 event detection began in 2006 and is still active in 2023, lasting for 17 years, which demonstrates that this cluster has always been the focus of scholars since 2006. Among the keywords in Cluster #2, self-regulated learning was the first to be brought up in WOS. Nicol, David J (et al.) (2006) identified seven principles of good feedback practice that enhance self-regulated learning in classrooms, being recognized as the most cited article [24].

The nodes in Figure 3 represent the amount of publication related to corresponding keywords, and the larger the node, the higher the number of publications, indicating the more attention the keyword receives. As shown in Figure 3, the keywords that arouse the most attention are as follows: individual difference (#0), impact (#1), strategy (#1), engagement (#1), stress (#2), intervention (#2), education (#3), online learning (#4), depression (#4), emotion (#6), motivation (#7), sentiment analysis (#8), machine learning (#8), achievement emotion (#9), school (#10), anxiety (#11), mental health (#11), enjoyment (#11), COVID-19 pandemic (#12), teacher (#13), positive psychology (#13), foreign language enjoyment (#13), community (#14), social network (#14), self-efficacy (#15), deep learning (#16), burnout (#17).

Regarding each keyword's corresponding beginning year on the timeline map, there is no denying that studies of online learning emotions concerning the COVID-19 pandemic, foreign language enjoyment, and content analysis have become research hotspots in recent years, while netnography has gradually fallen into oblivion.

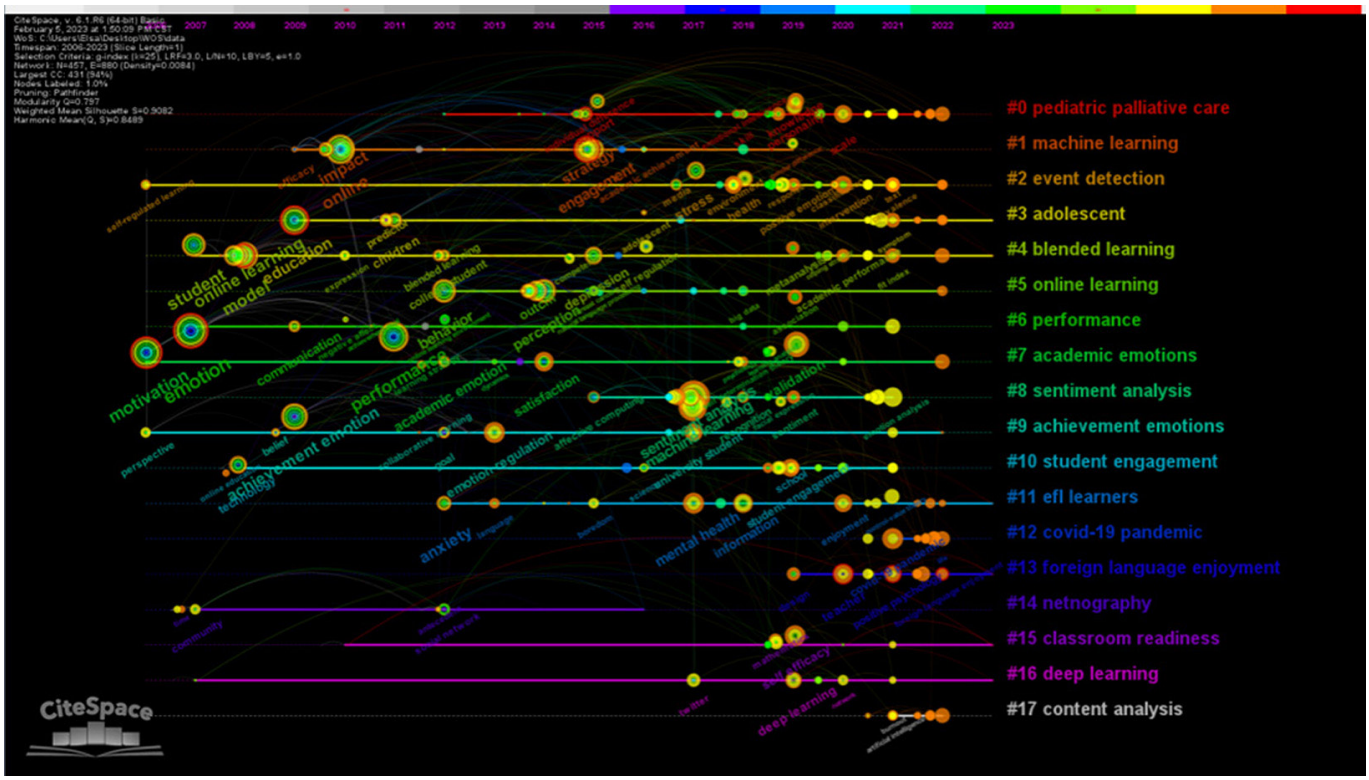

Fig. 3. The timeline map of keywords year by year (2006–2023)

A burst can be ascertained when articles experience a sharp increase in citations [25]. Therefore, the analysis of citation burst can be used to detect research fronts and emerging trends [26]. Based on the data from WOS database from 2006 to 2023, the top 30 keywords with the strongest citation bursts were extracted. As shown in Figure 4, the time interval is displayed as blue while citation burst is depicted as red. Model and achievement emotion are the keywords that received early attention. Social network is the very keyword that has the longest burst time, with achievement emotion coming second, showing that these topics had long been of concern. With the greatest burst strength (4.49), social media is the keyword that had been extremely popular during 2017 to 2020. In addition, among the top 30 keywords, COVID-19 pandemic, foreign language enjoyment, meta-analysis, intervention and life are the keywords that have the strongest citation bursts, lasting until 2023, which indicates that in recent years, the study of online learning emotions under the background of COVID-19 pandemic has had a measurable impact, and positive emotions, especially enjoyment, have drawn a great deal of scholarly attention. Scholars also attempted to use the meta-analysis method to investigate the intervention of emotions in students' online learning life.

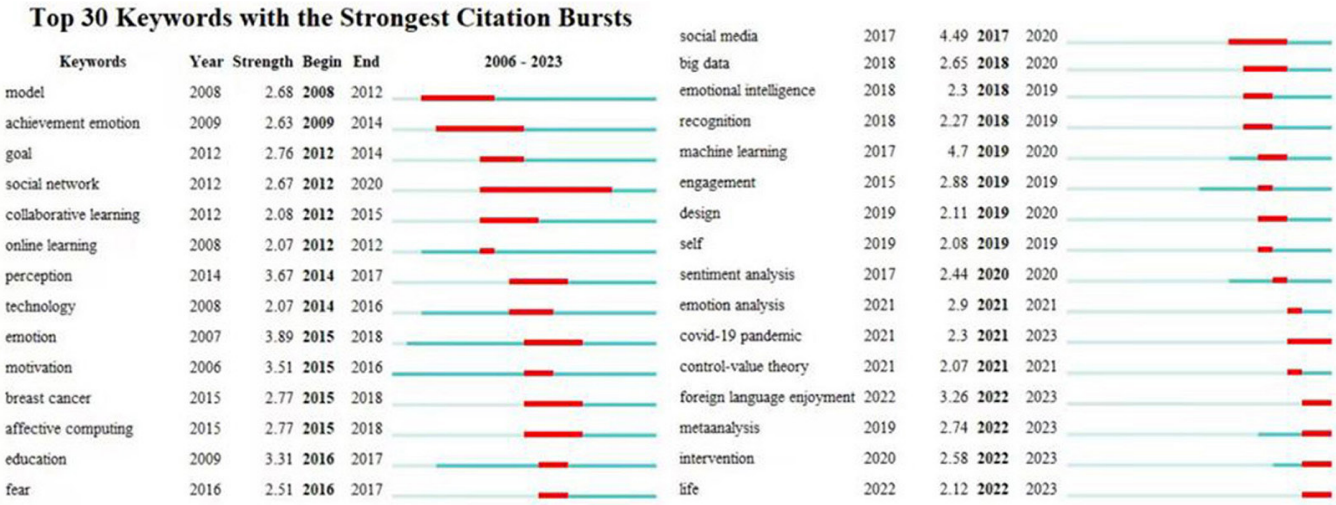

Fig. 4. Top 30 keywords with the strongest citation bursts

3.5 Citation

Citation analysis is a fundamental technique for science mapping that operates on the assumption that citations reflect intellectual linkages between publications that are formed when one publication cites the other [27]. With the impact of a publication determined by the number of citations it receives, citation analysis enables researchers to ascertain the most influential publications in a specific research field [15]. Moreover, co-citation analysis is another technique for science mapping that can reveal the intellectual structure of a research field by identifying thematically similar publications that are cited together frequently [28]. The advantage of using co-citation analysis is that, in addition to finding the most influential publications, scholars can also discover thematic clusters [15].

The following 10 main clusters can be obtained by keyword clustering of highly cited references, and the most representative and influential articles of each cluster are shown in Figure 5. And sorted by the number of citations (count), Table 4 lists the top five references, along with their titles and corresponding clusters.

By using cluster sampling, Cao (2020) drew a conclusion that the mental health of college students is significantly affected when faced with public health emergencies, and they require attention, help, and support from society, families, and colleges [29]. Based on control value theory [30], Loderer (2020) reviewed 186 studies examining emotions in technology-based learning environments (TBLEs) that were published between 1965 and 2018. This review revealed that possible nonlinear relations between certain emotions and correlates are still rarely considered but he held that emotions are vital drivers of learning in technology-based environments, and that learners' emotional experiences can be shaped by the characteristics of those settings [31]. In Pekrun's article (2017), a reciprocal effects model linking emotion and achievement over time is proposed. The model was tested using five

annual waves of the PALMA longitudinal study and showed that positive emotions (enjoyment, pride) positively predicted subsequent achievement, while negative emotions (anger, anxiety, shame, boredom, hopelessness) negatively predicted achievement [32].

It is worth noting that among the seven highly cited references, four belong to Cluster #1 (language enjoyment), accounting for 57.14%, which indicates that studies concerning language enjoyment have garnered extensive attention from scholars. Adopting a mixed-method approach, Li's study (2018) evaluated the psychometric properties of the Chinese Version of the Foreign Language Enjoyment Scale, and investigated FLE in a specific Chinese EFL context [33]. Using a similar mixed-method, Jiang's study (2019) investigated to what extent foreign language enjoyment (FLE) and foreign language classroom anxiety (FLCA) of 564 Chinese undergraduate EFL learners differ from learners outside China [34]. Dewaele (2018) examined whether and to what extent FLE and FLCA are linked to a range of learner-internal variables and teacher/classroom-specific variables within one specific educational context [35]. In another study he conducted in 2018, correlation analysis showed that the positive effect of FLE on performance was stronger than the negative effect of FLCA [36].

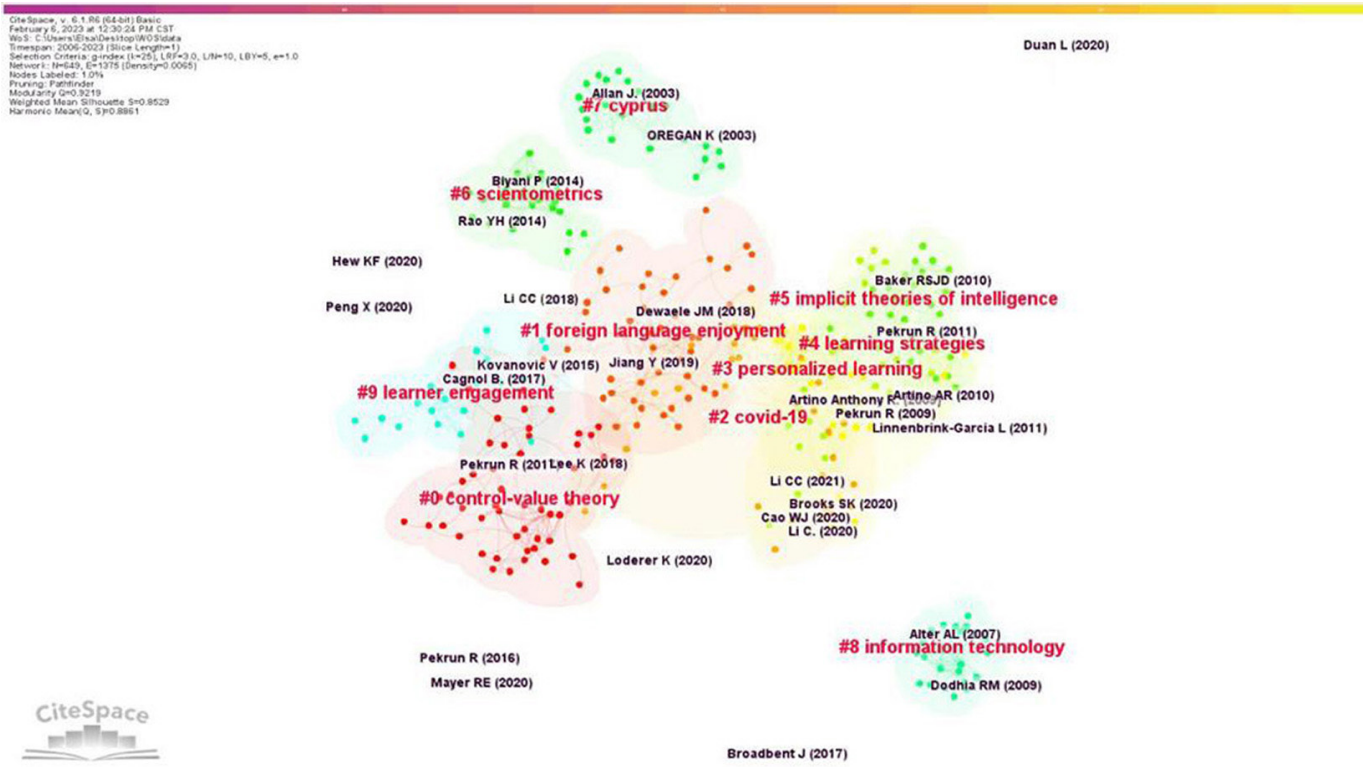

Fig. 5. Cluster map of highly cited references

Table 4. Top 5 highly cited reference

R	C	References	Title	Cluster
1	20	Cao WJ, 2020, PSYCHIAT RES, V287, P0, DOI 10.1016/j.psychres.2020.112934	The psychological impact of the COVID-19 epidemic on college students in China	#2 covid-19
2	18	Loderer K, 2020, LEARN INSTR, V70, P0, DOI 10.1016/j.learninstruc.2018.08.002	Beyond cold technology: A systematic review and meta-analysis on emotions in technology-based learning environments	#0 control-value theory
3	18	Pekrun R, 2017, CHILD DEV, V88, P1653, DOI 10.1111/cdev.12704	Achievement emotions and academic performance: Longitudinal models of reciprocal effects	#0 control-value theory
4	13	Li CC, 2018, SYSTEM, V76, P183, DOI 10.1016/j.system.2018.06.004	Understanding Chinese high school students' foreign language enjoyment: Validation of the Chinese version of the foreign language enjoyment scale	#1 language enjoyment
4	13	Jiang Y, 2019, SYSTEM, V82, P13, DOI 10.1016/j.system.2019.02.017	How unique is the foreign language classroom enjoyment and anxiety of Chinese EFL learners?	#1 language enjoyment
4	13	Dewaele JM, 2018, LANG TEACH RES, V22, P676, DOI 10.1177/1362168817692161	Foreign language enjoyment and anxiety: The effect of teacher and learner variables	#1 language enjoyment
5	12	Dewaele JM, 2018, STUD SECOND LANG LE, V8, P21, DOI 10.14746/ssllt.2018.8.1.2	Does the effect of enjoyment outweigh that of anxiety in foreign language performance?	#1 language enjoyment

Notes: R: Rank, C: Count.

4 DISCUSSION

The present study analyzes a total of 776 publications concerning online learning emotions extracted from the WOS database, providing a comprehensive bibliometric analysis of research evolution and emerging trends in this field. Now, attempts can be made to discuss about the answers raised in the introduction:

General publication trend in the area of online learning emotions: The number of articles published has increased considerably from one in the year of 2006 to 209 in the year of 2022, and is expected to reach a new high in 2023 as the overall trend is rising. Especially since the outbreak of COVID-19 pandemic, the number of publications began to show an exponential growth. On the whole, the study of online learning emotions demonstrated upside potential.

The countries/regions, authors and articles contributing most to the studies of online learning emotions: In terms of the total number of publications, the United States, China and England rank the top three, which are 210, 189 and 69 respectively. In particular, China has made remarkable progress in this field, topping the list in the latest period (from 2021 to 2023). Other notable contributors include Australia, Germany, Spain, Canada, Taiwan, Italy, and India, with Australia as a rising star. Among the 2,631 authors who participated in the research, Kruk, Pawlak, Kim, and Artino topped the ranking list as the most contributing authors. Meanwhile, the co-authorship network map reveals that close cooperation is positively correlated with the increase in the number of publications. Through citation analysis, Cao (2020), Loderer (2020), Pekrun (2017), Li (2018), Jiang (2019), Dewaele (2018) are identified as the articles most cited by scholars. The specific details of these articles are displayed in Table 4.

The hotspots of online learning emotions in different periods and the emerging trend: Studies of online learning emotions related to the COVID-19 pandemic (2019–2022) and foreign language enjoyment (2019–2023) have taken the

academic high ground in recent years, according to the timeline map, keywords with the strongest citation bursts, and the top 5 highly cited references with their corresponding clusters. Under the background of COVID-19 pandemic, the learning modes of students were to be altered as they were forced to study online. And changes have taken place, for example, students have less time and depth of interaction with classmates and teachers, less peer comparison pressure and supervision of teachers, and less extrinsic motivation [37]. It is estimated that studies these years have been focusing more on how to provide efficiency assurance for online learning education, and foreign language enjoyment has been of great concerns in studies of emotions. In earlier periods, there were hot topics such as achievement emotion, efficacy, social network, motivation, anxiety, depression and so on. Previous studies have pointed out that language learning researchers' curiosity about emotions has largely focused on a single negative emotion, namely anxiety [38]. However, this study shows that there has been a notable shift from studying negative emotions to positive ones in online learning education. Therefore, it could become an emerging trend to study how positive emotions related to the online learning education, how these emotions affect learning results and how to elevate these emotions so as to allow learning to become more effective. It is essential to do research and pay more attention to positive emotions since they not only advance foreign language learning by bringing some cognitive and motivational benefits [39], but also enhance well-being [40] .

Limitations do exist in the present study. By addressing them, the study can be further refined in future endeavors. First, although bibliometric studies, such as this one, are often thought to be scientific and systematic for getting an overall view of a specific theme, this study is also limited by the data source used, for only articles indexed in the database of WOS from 2006 to 2023 were included. Future research can extract more scientific publications from other data sources such as Scopus, EI Compendex, CNKI, etc., and the time span can be set to be wider. Furthermore, it is also a good choice for future studies to probe into online learning emotions by focusing on specific online classes through the lens of individual students and educators through a micro-perspective approach and to explore the different manifestations of different emotions and corresponding relationships between these emotions and students' academic performance.

5 CONCLUSION

The present study collects data of publications regarding online learning emotions from the WOS database and CiteSpace is used for visual analysis with Excel as an assistant tool. From the results, the research of online learning emotions presents an exponentially upward trend, demonstrating upside potential and indicating the number of publications may hit a new high in the future. The United States, China, and England rank as the top three countries contributing to this field, with Kruk, Pawlak, Kim, and Artino as the most contributing authors. In addition, Cao (2020), Loderer (2020), Pekrun (2017), Li (2018), Jiang (2019), Dewaele (2018) are recognized as the articles most cited by scholars.

Since the outbreak of COVID-19 pandemic, it seems that studies have focused more on how to provide efficiency assurance for online learning education with foreign language enjoyment being of great concerns in studies of emotions. To look more closely, a shift of the study of online learning emotions from negative emotions to positive ones in online learning is under way, displaying an emerging trend.

Overall, this study, being one to systematically and objectively analyze the studies of online learning emotions, can offer valuable insights to educators and scholars in this field. The findings may help researchers gain a comprehensive understanding of online learning emotions so as to better address students' emotional struggles in online classes. Furthermore, it can uncover the most frequently addressed themes in the field and point out directions for future research.

6 ACKNOWLEDGEMENT

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