A Systematic Literature Review of Online Learning Spanning 26 Years (1993–2018)

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This article aims to provide the reader with a comprehensive background for understanding current knowledge on online learning through a systematic literature review of the published literature in peer-reviewed English language journals. We reviewed 5,803 articles published over 26 years (1993–2018). We focused on the number of articles published, journals' names, and overall research trends about online learning. We reviewed the growth and evolution of keywords, titles, and abstracts to develop an understanding of the growth and fall of trends in research on online learning. We discovered that the dominant trends in the published articles on online learning are learning, students, environment, courses, education, and teaching. The growing areas are online delivery, learning in online setting, teacher (teaching), and students (learners), and we discuss the gaps in the discipline that indicate a potential growth area for the future of the discipline including technology research.

Keywords: Online learning, systematic literature review, longitudinal analysis

Introduction

Online learning has emerged as a mode of delivery for learners across the globe at *all levels of education* in the COVID-19 pandemic of 2020 (Morgan, 2020). Online learning has seen rapid growth in the last 10–15 years due to a combination of factors such as the focus of higher education institutions on increasing their productivity by teaching more students for the same cost or less and expectations of students to access high-quality educational content in easily accessible digital format and growth of technology (Bates, 2019). Between 2012 and 2015 the number of students studying on campus in the United States has dropped by almost one million (Digital Learning Compass, 2017). Reports show that higher education institutional leaders consider online learning very or extremely important for the future of their institution (Bates, 2018). Based on recent news reports from higher education institutions, we can predict that the COVID-19 pandemic will only fast-track the imminent rapid adoption of online teaching and learning across educational levels. As many academic disciplines are rushed into quick

KEY POINTS:

- Results show that in the last 26 years online learning research was published in over 1,300 journals resulting in 5,803 articles, and *Online Learning* journal was the journal with most number of articles at 3.75% of total articles.
- Qualitative analysis of all the abstracts in the data set revealed that the top themes of research are: "learning," "online," "course," "students," "teaching," "environment," and "education."
- Keywords and words in the title are also analyzed in the given timeline to depict growth overtime.

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adoption of online learning mode, it is pertinent to review what we already know about online learning and identify the gaps in our understanding of this important education delivery mechanism. This review will also benefit educators in fields that have been teaching online for many years, including library and information science (LIS) educators, among others. Veteran online educators will find this research on online pedagogy, the trends in online learning, and the gaps in the research streams useful in focusing their research efforts and in learning from the past trends. Some of the student-related themes that we discover in this research will be very helpful for online educators in planning and delivering their future courses. Reviews like this are essential for grounding instruction practice in rigorous and systematic research for educators delivering content via online tools. At this critical stage, we look back at the history of research on online learning since its inception as a delivery mode for learning to extract the research's prominent themes to deepen our understanding of online learning's growth. This review will help us in charting our way forward. Understanding where the focus of the research has been and where it can be in the future will help develop future research agenda that does not replicate but instead build upon what has already been done. For this review, the term *online learning* describes education, instruction, or courses delivered over the internet and includes various levels of education or online educational environments. It includes educational content being delivered online either partially or completely.

Therefore, in this article, we present the results of a systematic literature review of "online learning" in the last 26 years. Taking this window, larger than the scope of most of the other studies, gives us a comprehensive view of the growth of research on online learning from when it started (the early nineties), what terminology became popular but faded over time, which words have become synonymous in this evolution, and what concepts have developed over time.

Related literature

Systematic literature reviews about education and related concepts are a well-established stream of research. The value of systematic literature review is evident in the published work of many scholars in and around the field of distance education, massive online open courses (MOOCs), e-learning, asynchronous learning, and synchronous learning. These reviews effectively describe the trends in the selected field of inquiry and are informative in providing a big picture of the rise and fall of paradigms and theories, while describing the status of the discipline. They synthesize, analyze, and present actionable data for future research. Some of these studies select a narrow focus and present an in-depth analysis of research on that topic. When we reviewed the literature related to systematic literature review for online learning, we found that the scopes of these literature reviews were mostly narrow and focused on a niche aspect of online learning instead of a comprehensive approach to developing general trends. The lack of any such comprehensive systematic literature review became the impetus for the current project.

An example of a recent systematic literature review with a specific narrow focus is a review focused on gamification in online learning; Antonaci, Klemke, and Specht (2019) through a systematic literature review show that gamification, and its applications, research

is still relatively new and lacks empirical experiments to accurately predict the effects on learning. Their work also outlines future research for the topic and draws considerations for the gamification design of MOOCs. Similarly, Hwang and Tsai (2011) focused solely on variations of types of learning, such as mobile and ubiquitous learning through a systematic literature review. In medical education, a systematic literature review by McCutcheon (2015) on blended learning approaches highlighted the lack of available evidence on the implementation of a blended learning approach to teaching clinical skills in undergraduate nurse education. Shahini, Davis, and Bothwick (2019) used a systematic literature review to understand cultural issues in MOOCs. They report on how cultural differences are influential factors in learning and teaching and collected several pedagogical, contextual, and behavioral strategies that have been implemented to overcome cultural differences in learning. These three studies are examples of a systematic literature review conducted with a narrow focus on online learning.

Systematic literature reviews are also useful in defining concepts and developing an understanding of the evolution of terminology related to a field, an approach similar to the one we take in this study for the broad concept of online learning. Cook, Garside, Levinson, Dupras, and Montori (2010) conducted a systematic literature review, spanning a decade (2001–2010) to demonstrate the heterogeneity of the term *web-based learning*. They reviewed the literature published in one decade to describe the variation in configurations, instructional methods, and formats in web-based learning. Similarly, Boelens, Wever, and Voet (2017) conducted a systematic literature review to understand challenges in the design of blended learning. With this narrow objective, they reviewed 20 studies from 640 sources and discovered four key challenges to the design of blended learning. They realized that the efforts to resolve these challenges are scattered; therefore, in their review, they selected 20 studies about the design of blended learning and found that few studies offer learners control over the implementation of the blend. Social interaction is generally stimulated through introductory face-to-face meetings, while personalization and monitoring of students' learning progress are commonly organized through online instructional activities. They also found little attention is paid to instructional activities that foster an effective learning climate. These two examples show the different approaches that can be taken in a systematic literature review, the first example takes a time-based approach covering research from 10 years while the second approach selected specific articles related to blended learning, based on their exclusion/inclusion criteria.

A literature review on learning analytics methods, benefits, and challenges was conducted by Nunn, Avella, Kanai, and Kebritchi (2016) to summarize and present a status report on learning analytics research. Rodriguez Triana et al. (2017) took a slightly different focus on the learning analytics and educational data mining research and reviewed literature about the complexity of blended learning in terms of monitoring, awareness, and reflection as learning happens across different spaces and modalities to present a state of the art of research in learning analytics and educational data mining research Rodriguez Triana et al. (2017).

In one of the more comprehensive systematic literature reviews, Martin, Ahlgrim-Delzell, and Budhrani (2017) conducted a systematic literature review of research on

synchronous online learning over two decades. They provide insight about critical factors for synchronous learning, such as the most studied variables in the research on synchronous online learning, content areas, research design, and the role of technology, and identified gaps in the research in terms of missing demographics or countries involved in this research. Our research extends the scope and timespan of this study by a focus on all types of online learning and covering all research published in peer-reviewed journals in the Web of Science (WoS) and Education Resources Information Center (ERIC). This focus allows us to include all concepts related to online learning, such as blended, synchronous, asynchronous, web-based, and so forth, and is a useful approach to capturing general trends.

In this systematic review, we collected 5,803 articles on online learning from over 100 different countries, published over 26 years from January 1, 1993 to December 31, 2018. Articles were collected in June and July 2019 from the ERIC and WoS. We chose this period because online learning as a term was first used in 1995 when the web-based system WebCT was developed (Bates, 2014), and our time span ended in 2018 because that was the last complete year at the time of data collection. We collected data from 1993 onwards to be comprehensive and confirm that the term was not used before 1995. This collection of articles allows us to present a comprehensive view of the landscape of peer-reviewed published research on online learning since its beginning. In our extensive literature review, we did not come across any other study with this scope and comprehensive approach. Most other studies focused on much smaller timeframes, and on a specific aspect of online learning, not on the overall concept. The level of analysis and the number of articles included in this study make it uniquely informative about the trends, evolution, and growth of the online learning research.

Methods

The model of the U.S. Department of Education's What Works Clearinghouse Procedures and Standards Handbook, Version 3.0 by Oliver (2014), informs this systemic literature review of Online Learning research and the examples set by Martin et al. (2017). We conducted the review process through the following phases:

1. Development of review protocols, including the definition of key terms,
2. Identification of relevant literature,
3. Retrieval and screening of studies and basic inclusion/exclusion criteria,
4. Extraction of data, and
5. Analysis and reporting on findings.

Development of review protocols

Definition of Online Learning

While various terms for the online delivery of learning material are widely used throughout the literature, few such terms have consistent definitions for online delivery of learning material. Even the term "online learning" significantly changes in meaning based on the context and field of study. For example, "online learning" implies different concepts in computer science, education, and psychology. For this review, the term *online learning*

describes education, instruction, or courses delivered over the internet and includes various levels of education or online educational environments. It includes educational content being delivered online either partially or completely. To be included in the data set, the article must mention the use of the internet to deliver educational materials or instruction in the title or abstract and must use the words "online learning."

Formulation of research questions

Based on this definition of online learning developed, we formulated the following research questions for this systematic literature review on ERIC and WoS:

1. How many total articles about online learning were published in the last 26 years?
2. Where are the research articles related to online learning published?
3. What are the most common author-created keywords used in the literature about online learning? How has the use of these keywords changed over time?
4. What are the most commonly used words in the titles of the articles about online learning? How has the use of these words changed over time?
5. What are the most commonly used words in the abstracts of the articles about online learning? How has the use of these words changed over time?
6. Who are the most prolific authors in online learning in the last 26 years?
7. What are the key online learning themes discussed in the last 26 years?

Identification of relevant literature

Data collection for this systematic literature review was conducted by searching for references for articles in ERIC and WoS. ERIC was accessed through EBSCOhost and chosen as a source for its large collection related to education and online learning, while WoS was chosen for its wide breadth of fields and interrelated topics.

Search terms were determined based on previous research and reviews of similar studies. The search term "online learning" was used applying the "all text" function on EBSCOhost and the "topic search" (TS) function on the WoS. The search parameters for both searches were confined to articles published between January 1, 1993 to December 31, 2018, published in academic journals, and available in English. The search was conducted in June–July 2019.

The search results were further narrowed by excluding fields of study and journals with less than 11 articles in the search results. WoS organizes search results into categories, and any categories with less than 11 articles in the search results were excluded (e.g. Law, Family Studies, Food Science Technology). Articles from ERIC that came from journals with less than 11 articles in the search results were also removed. See Table 1 for the exclusion and inclusion criteria for this systematic literature review on online learning.

Retrieval and screening of studies

References were downloaded from the databases into a Research Information Systems (.RIS) file format that could be imported into EndNote. Once the references were in EndNote, the references were updated, and the relevant data and metadata were downloaded.

Table 1: Inclusion and exclusion criteria

Criteria	Inclusion	Exclusion
Related to online learning	Describes education, instruction, or courses delivered over the internet	
Technology	Use of technology for education	
Search relevance to online learning	ERIC: The journal has more than 10 articles in the search results	ERIC: Journal has less than 11 articles in the search results
	WoS: Category includes more than 10 articles in the search results	WoS: Category includes less than 11 articles in the search results
Publication date	January 1st, 1993 to December 31st, 2018	Before 1993 or after 2018
Publication type	Articles from peer-reviewed journals	
Language	Articles are available in English	Not included

Additionally, duplicates were removed. From there, the EndNote library was imported into Spreadsheets for further cleaning and removal of irrelevant and duplicate articles.

Once the collection was in Excel, the data was cleaned to retain the columns that were relevant for this systematic review. Relevant columns included Record Number, Author, Year, Title, Publisher, Keywords, and Abstract. The Record Number was a unique identifier created by EndNote and was used for identifying the references. The Keywords are the author-assigned keywords for the article and were retrieved from the databases (see Table 1)

Considerations during screening

Due to the overlap in the use of the term "online learning" among various fields, many of the articles retrieved from the database search were not relevant to the study and had to be removed. For example, "online learning" is used in Computer Science for describing a subset of machine learning. An example of an irrelevant article removed from the data set would be an article that discusses using big data mining algorithms for understanding online learning for system-based learning.

All the retrieved articles were reviewed for relevance by reading the title, abstract, and keywords. Additionally, searching specific terms and phrases within Excel helped to identify the relevance of batches of articles. For example, searching "higher education" would identify articles as relevant while searching "machine learning" might identify them as irrelevant. After the 2,141 irrelevant articles and 1,130 duplicates were removed, the final collection of 5,803 articles was used for analysis.

Data extraction

Once the collection was finalized, the references and metadata were saved as a CSV file for analysis in Rstudio. The CSV file included the columns Author, Year, Title, Journal, Keywords, and Abstract. The primary goal of using Rstudio was to create useful tables and figures for data analysis and representation and visualizations. In Rstudio, the keywords

were divided into their rows with the relevant year (1993–2018) and counted. For this analysis, we focused on the top 10 most common keywords across the 26 years. Because the total number of articles published each year increases, we see a general increase in the use of all of the keywords. To get a better idea of the portion of the articles using each of these keywords, we normalized the data in the graphs presented.

To avoid any labeling conflicts, the columns in each dataset were renamed. For the abstracts and titles, irrelevant words and punctuation were removed. The stop words employed came from the TidyText package. Additionally, two words, "based" and "study," were removed because they appeared in the top ten-word frequencies, but were determined to be unimportant, as these terms told us little about the data set. TidyText tokenizer was used to further clean the data and prepare it for analysis.

Authors, keywords, words in the title, and words in the abstract were tokenized and saved as one data source. Each of the data sources was then counted for the top words. Once each dataset was counted, the top ten results from each data frame were selected and plotted. The top results for each category were put into tables for analysis. The top journals and authors told us who was writing and publishing about the topic. The top words employed in abstracts and titles were used to identify common themes in the articles, as were the top author-assigned keywords.

Creation of visualizations

The top ten author-assigned keywords were plotted by keyword frequency for each year to analyze how the keywords were used over time. These plots are useful for comparing the use of keywords to each other.

Because the number of articles published each year generally increases over time, the increasing use of each keyword every year is to be expected, so the keyword count present in the collected articles had to be normalized for the number of articles published that year, which was useful for analyzing how the use of the keywords changed over time.

These plots showed the use of distance education, online learning, and electronic learning on the same graph. Comparing these terms alongside one another shows how the use of these terms has changed over time and identifies which terms were popular during a given period. For example, we searched the abstracts and titles for the frequency of the phrases "online learning," "distance education," and "electronic learning" to better understand how these terms were used over time.

Results

This section is organized by the research questions posed in the previous section. For each research question, the results are described, and visualizations are included.

1. Total articles published about online learning in 26 years

The search resulted in 5,538 articles from ERIC and 3,536 articles from WoS after restriction criteria were applied. Between these two searches, 1,130 duplicates were found, and 2,141 articles were found to be irrelevant (i.e., not related to online learning). This resulted in

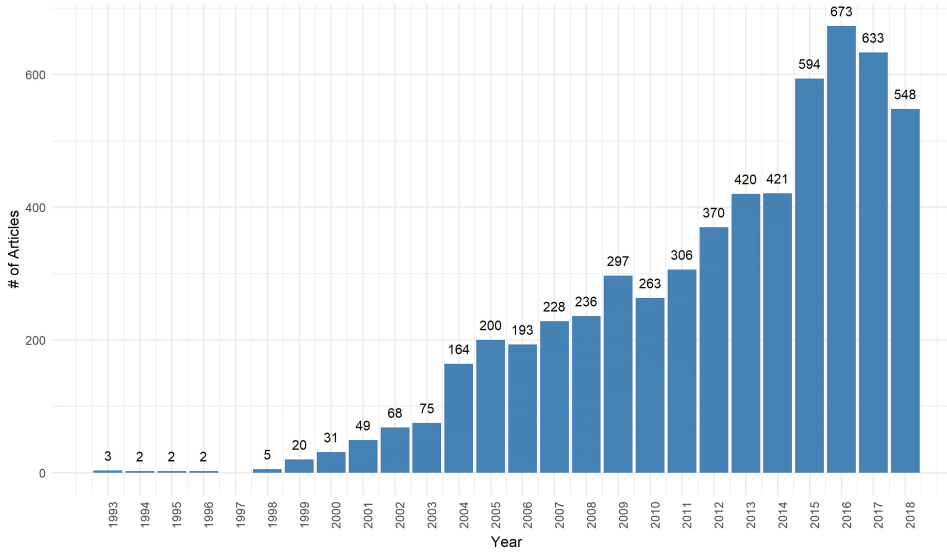

Figure 1: Number of articles published each year

a collection of 5,803 articles. The dataset for these articles can be provided upon request. Figure 1 presents the graph for the articles published from 1993 to 2018.

2. Publication venues for research on online learning

1,376 different journals published articles included in the collection. Table 2 presents the 20 journals with the most publications about online learning within the data set.

Of the top 20 journals from our dataset, in terms of number of publications related to online learning, the majority of the journals are focused on education, higher education, and also technology/computers used for learning. *Computer in Human Behavior* (*CHB*) is the only journal on the list that is not about education or technology related to learning; but it publishes articles related to online learning in a high number. It is interesting to note that, at the time of writing this article (2021), out of the top three most cited articles in *CHB*, two are about online learning. This journal publishes articles related to the use of computers from a psychological perspective, and the online learning articles fall under the "human interactions with computers" area of interest. Some of the topics are gamification of online learning, learning styles and computers, social presence, instructor presence and its impact on learning, and so forth. All the other journals are related to education or technology use for learning.

3. Top author-assigned keywords in the last 26 years and the evolution of keywords

There were 9,293 different author-defined keywords used to describe the articles in the dataset. In total, the 5,803 articles used 71,865 author-defined keywords. Table 3 displays

Table 2: Top 20 journals by highest number of publications

Journals	Count	% Of total articles
Online Learning	198	3.41%
1 Journal of Interactive Online Learning	165	2.84%
2 Computers and Education	160	2.76%
3 Distance Education	113	1.95%
4 International Review of Research in Open and Distance Learning	108	1.86%
5 Educational Technology and Society	87	1.50%
6 International Review of Research in Open and Distributed Learning	86	1.48%
7 Internet and Higher Education	72	1.24%
8 Online Journal of Distance Learning Administration	69	1.19%
9 Computer in Human Behavior	68	1.17%
10 Quarterly Review of Distance Education	67	1.15%
11 Australasian Journal of Educational Technology	66	1.14%
12 The Internet and Higher Education	60	1.03%
13 British Journal of Educational Technology	59	1.02%
14 Interactive Learning Environments	59	1.02%
15 Journal of Educational Computing Research	55	0.95%
16 International Journal on E-learning	54	0.93%
17 Journal of Computer Assisted Learning	51	0.88%
18 Turkish Online Journal of Distance Education	51	0.88%
19 Journal of Online Learning Research	47	0.81%

the top 10 keywords used to describe the articles in descending order with the number of articles that used the keyword and the percentage of articles that used the keyword.

Throughout academia, scientific publication steadily grows at roughly 4% per year and doubles every 12 years, which means failing to account for inflation results in skewed results of the scientific impact of an article or field (Petersen et al., 2019). Therefore, normalizing the data shows how online learning has increased in popularity relative to other fields of study. Figure 2 presents the usage of each keyword over time from 1993 to 2018. It is easy to see the growth and the addition of new concepts in this graph. Figure 3 presents the normalized graph for the same keywords but adjusted for the overall number of publications.

From these graphs, we can see how the use of these keywords has changed over the 26 years. From 1993 to 1998, only 14 articles were published, so that period on the graphs is skewed. Notable trends observed online include:

- The use of "distance education" decreases significantly after 2012;

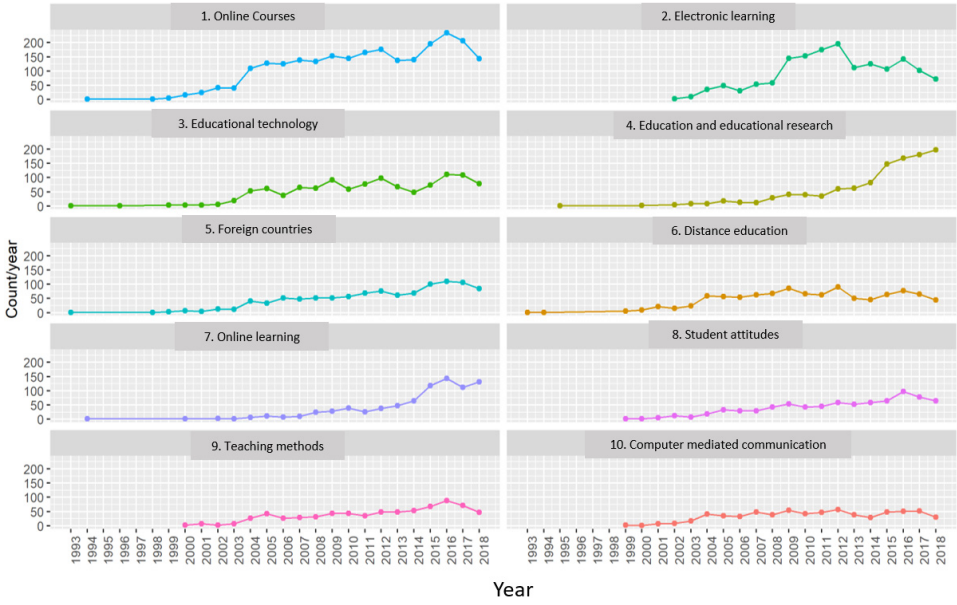

Figure 2: Top 10 keywords by year

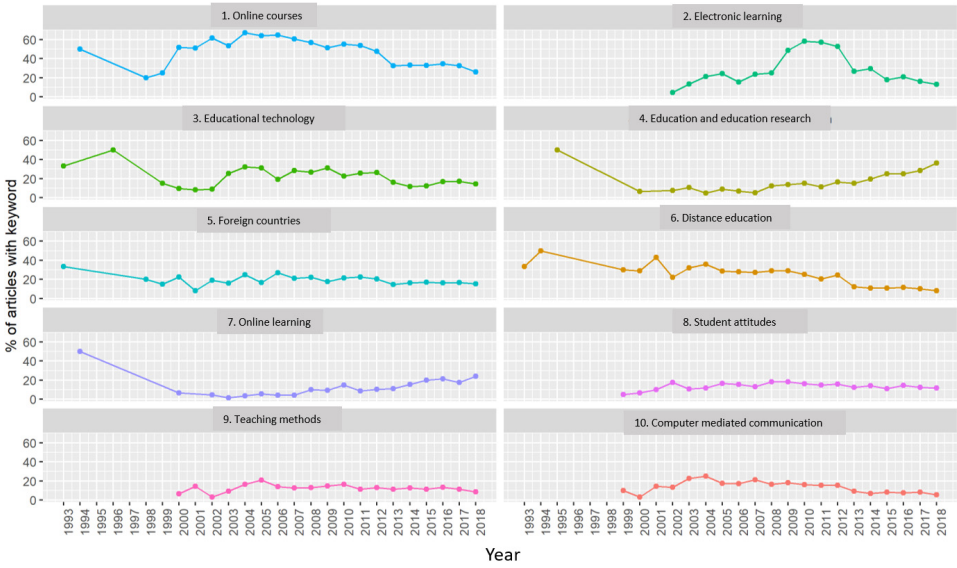

Figure 3: Top 10 keywords normalized by year

Table 3: Top 10 author-assigned keywords

Keywords	Count	% Of total articles
1 Online courses	2460	42.4%
2 Electronic learning	1568	27.0%
3 Educational technology	1135	19.6%
4 Education and educational research	1106	19.1%
5 Foreign countries	1050	18.1%
6 Distance education	1027	17.7%
7 Online learning	812	14.0%
8 Student attitudes	799	13.8%
9 Teaching methods	718	12.4%
10 Computer-Mediated communication	678	11.7%

- The use of "educational technology" fluctuates but generally decreases;
- The use of "electronic learning" peaked in 2012;
- "Online courses" was very popular in the early 2000s but dropped off in 2012;
- The use of "online learning" generally increases, albeit slowly (Figure 4), even for the normalized comparison by year (Figure 5).

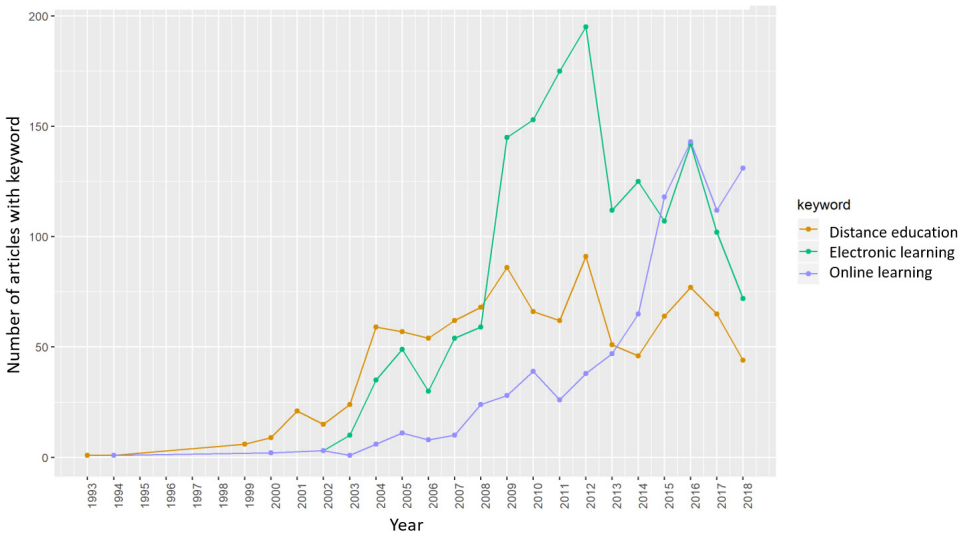

Figure 4: Comparison of electronic learning, distance education, and online learning by year

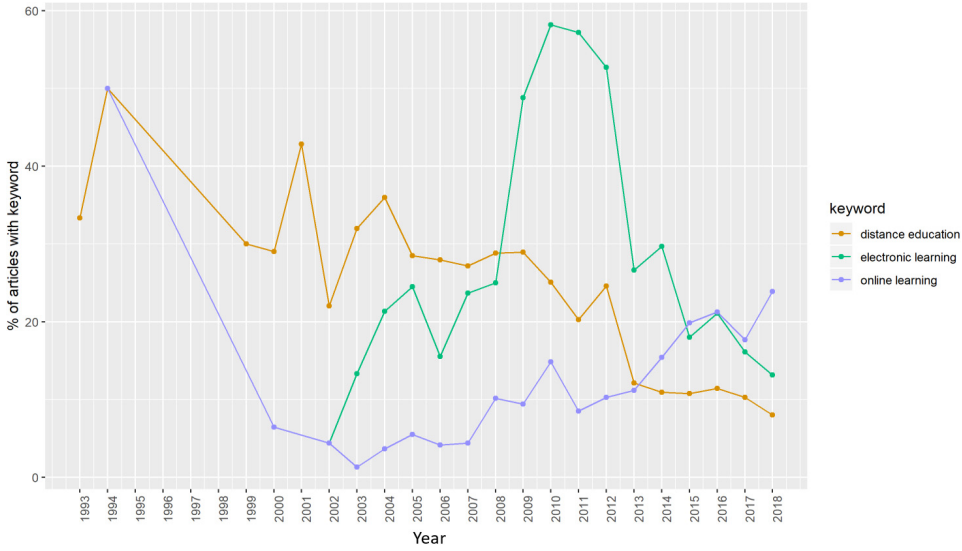

Figure 5: Normalized comparison of electronic learning, distance education, and online learning by year

4. Most frequently used words in all titles

Table 4 shows the top 20 words used in the articles' titles, with their counts and percentage after removing stop words.

Figure 6 provides an enhanced visualization of these frequencies by plotting them on a time scale, showing the usage of the top 10 words used in articles and their growth over time.

5. Most frequently used words in abstracts

Table 5 shows the top 20 words used in the articles' abstracts with their counts and percentage after removing stop words. Figure 7 plots the graph for the usage of these keywords and demonstrates the usage over time.

6. Most prolific authors in online learning in the last 26 years

12,363 different authors published articles within the dataset, which is an average of 2.1 authors per article. Of the authors, 10,724 were only cited as authors once, and 1,121 were cited twice. Table 6 lists the 20 most prolific authors in the dataset in descending order with the number of articles included in the dataset.

7. Key themes in the research on Online Learning in the last 26 years

For this analysis, we conducted an automated qualitative analysis using Nvivo and focused on the abstracts for each article in the dataset. From this analysis, we derived seven major themes, based on the occurrence of key terms and phrases within the abstracts:

Table 4: Top Words in Titles

Words in titles	Count	Weight (%)
online	3541	7.65%
learning	3499	7.56%
student	1317	2.84%
education	771	1.66%
environment	623	1.35%
teacher	363	0.78%
teaching	340	0.73%
social	309	0.67%
learner	306	0.66%
development	297	0.64%
course	293	0.63%
design	287	0.62%
community	286	0.62%
blended	271	0.59%
practice	261	0.56%
experience	260	0.56%
perception	260	0.56%
distance	258	0.56%
technology	232	0.50%
system	227	0.49%

"learning," "online," "students," "courses," "environment," "education," and "teaching." These themes represent overlapping yet distinctive areas of consideration within the research on online learning. For example, even in examinations of "online learning," researchers may focus on the "online" or "learning" aspect to different degrees, analyze them in different ways, or use different sets of vocabulary in referring to each. In addition to the major themes, we further identified subthemes within each theme, representing notable clusters in these different degrees of analysis and choices of terms.

As expected, based on the keywords used to search the articles—online and learning are the dominant themes in these articles. What is interesting about the themes from these keywords is the usage of these keywords. The words that were used with "learning" and "online" help us understand the context of usage of these terms.

Learning and online

"Learning" is the most common theme among the publications reviewed, and "online" is the second most common theme, occurring about 15% less frequently than "learning." As

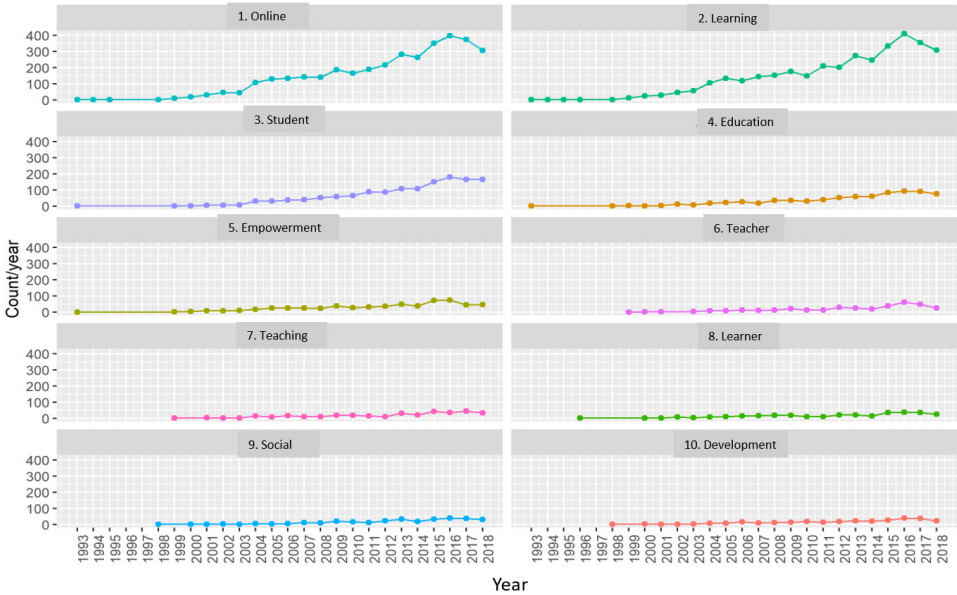

Figure 6: Top 10 words in titles by year

online learning is the broad subject of the studies considered in this review, the "online" theme often appears in close conjunction with the "learning" theme, and the subthemes for "online" closely match with those for "learning." Main subthemes for "online" and "learning" separately and together as one keyword "online learning" are discussed below.

The most common related subtheme is the "learning environment," which is primarily used to discuss various deployment methods for learning materials (e.g., learning management systems) and how students interact with one another. A variety of terms describe different learning environments such as "online learning environments," "learning communities," "blended learning," "learning management systems," "learning platforms," "learning materials," and "learning contexts."

Among the other subthemes, "learning outcomes and experiences" are concerned with how students learn and the effects of online learning. Terms describing this subtheme include "online learning experiences" and "learning performance."

The "online course development and evaluation" subtheme is concerned with how the course materials are presented to students and how students perform in online learning environments. It covers topics such as learning processes, activities, management systems, resources, strategies, styles, modules, courses, materials, and performance.

The "students and learning process" was studied with a focus on learning communities, activities, strategies, styles, and performance.

Table 5: Top Words in Abstracts

Words in abstracts	Count	Weight (%)
learning	20724	3.98%
online	17620	3.38%
student	15003	2.88%
education	4548	0.87%
environment	3595	0.69%
research	3351	0.64%
learner	3318	0.64%
course	2824	0.54%
teacher	2811	0.54%
teaching	2712	0.52%
result	2698	0.52%
design	2550	0.49%
experience	2416	0.46%
paper	2092	0.40%
technology	2042	0.39%
program	2026	0.39%
data	2023	0.39%
social	2008	0.39%
development	1952	0.37%
model	1908	0.37%

The next five themes provide us deeper insight into the topics that are dominant in the research on online learning, and the analysis provides subthemes highlighting the most published research topics in each theme.

Students

Students appear as the third most common theme, occurring about half as frequently as Online, and is the most common theme that includes a term not used during the search. Research discussing students is concerned with how *students interact* with one another and with the *learning materials*.

As an extension of the "learning outcomes and experiences" subtheme, abstracts also discuss student outcomes, engagement, and experiences. Key descriptors used are "student interaction," "student engagement," "student performance," "student participation," "student success," "student support," "student achievement," "student perceptions," "student satisfaction," and "student motivation."

Table 6: Top 20 prolific authors in the dataset

Author name	Affiliation	Department	# Of articles
Shea, Peter	SUNY Albany	School of Education	19
Borup, Jered	University at Albany, State University of New York	School of Education and the College of Computing and Information	16
Barbour, Michael K.	Touro University California	Instructional Design for the College of Education and Health Sciences	14
Arbaugh, J. B.	University of Wisconsin-Oshkosh	Professor of Management	13
Cho, Moon-Heum	Syracuse University	School of Education	13
Bonk, Curtis J.	at Indiana University	Instructional Systems Technology (IST) in the School of Education	12
Graham, Charles R.	Brigham Young University	Instructional Psychology and Technology	12
Bidjerano, Temi	Furman University	Department of Education	11
Dringus, Laurie P.	at Nova Southeastern University	College of Computing and Engineering	11
Hachey, Alyse C.	The University of Texas at El Paso	Education	11
Meyer, Katrina A.	University of Memphis	Division of Leadership	11
Richardson, Jennifer C.	Perdue	Learning Design and Technology	11
Smith, Sean J.	University of Virginia	School of Education and Human Sciences - Special Education	11
Swan, Karen	University of Illinois at Springfield	Dept. Educational Leadership	11
Tsai, Chia-wen	Ming Chuan University	Department of Information Management	11
Wang, S.	The University of Southern Mississippi	Department of Curriculum, Instruction, and Special Education at	11
Heafner, T. L.	University of North Carolina at Charlotte	Department of Middle, Secondary, and K-12 Education	10
Palmer, Stuart	Deakin University	Integrated Learning in the Faculty of Science, Engineering and Built Environment	10
Tsai, Chin-Shung	National Taiwan Normal University	Program of Learning Sciences	10
Wladis, Claire	Borough of Manhattan Community College at the City University of New York	Mathematics and Education research	10

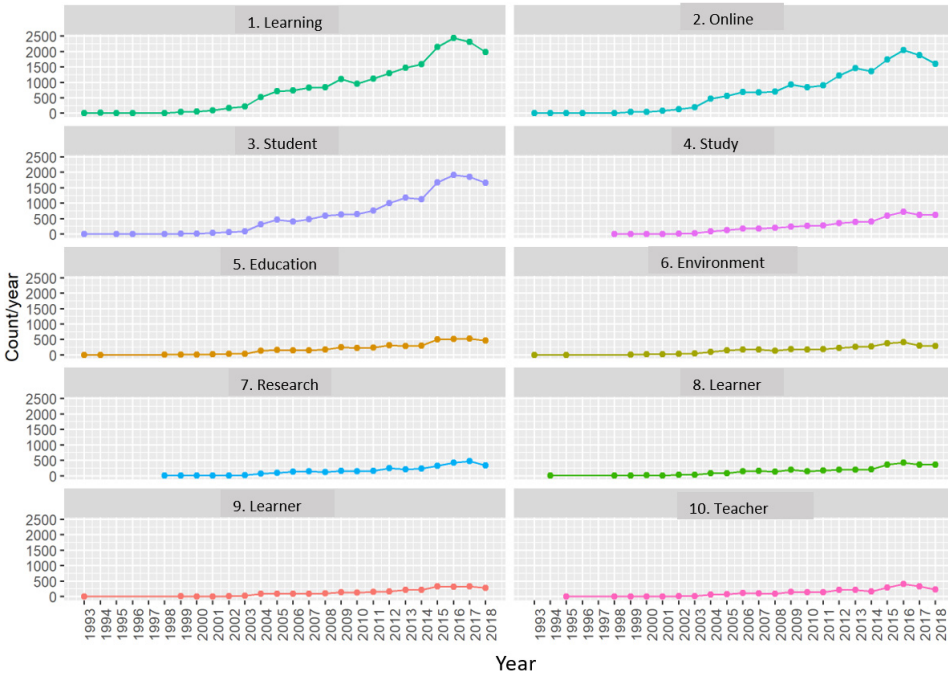

Figure 7: Top 10 words in abstracts by year

Abstracts that discuss students also discuss the types of students (education level) and student demographics, using terms such as "graduate students," "undergraduate students," "medical students," "university students," "school students," "college students," "female students," "international students."

Courses

As a theme, Courses are associated with terms related to "content and delivery mode," such as "online courses," "blended courses," "hybrid courses," or "web-based courses." Some abstracts also mention traditional classroom settings (e.g., face-to-face course), which was likely discussed in comparison to online learning.

Courses also appeared alongside the "learning environments" subtheme, in discussions of methods for delivering online learning materials (e.g., course management systems and course delivery). For "online course development," the focus of the research was on terms like "course content," "online course design," "course materials," "course development," "course structure," "course activities," and "course evaluations." The level of education is specified when graduate and undergraduate courses are mentioned.

Environment

Environment as a theme appears mostly through the subtheme of the "digital learning environment." This subtheme was the focus of all research that discussed the environment in this corpus, even where the traditional learning environment is discussed briefly to provide a comparative aspect to the study. Terms used to describe the digital learning environment include the "online environment," "online learning environment," "virtual environment," "e-learning environment," "online teaching environments," "digital environments," "online discussion environment," and "web-based learning environments."

A related subtheme was the "intersection of online and traditional learning environments, which covers discussion of different approaches to delivering courses, different course management systems, and different interactive activities within the learning environment. Terms connected to this subtheme were "educational environments," "blended learning environments," "blended environments," "instructional environments," "teaching environments," "education environments," "interactive learning environments," "face-to-face environments," "traditional classroom environments," "classroom environments," and "working environments."

Education

The theme of education includes several subthemes and multiple terms related to variance in the use of the term "education." The "types of education" subtheme involves terms related to the means of education that are impacted by online learning, such as "online education," "online distance education," and "distance education." "Education levels" relate to research that distinguished between categories such as higher education, tertiary education, adult education, continuing education, traditional education, and professional education. "Education domain" relates to research in which online learning in different subject areas/domains is being studied, such as medical education, teacher education, teacher education programs, and nursing education. Research related to the education theme was also divided by "components of education," such as the education system, education sector, and education contexts. Lastly, there were some instances of research on the "education discipline" itself, which included education students and education courses.

Teaching

The teaching theme appears through several important subthemes. "Online teaching" subtheme includes research that focuses on online teaching environment, teaching presence, online instruction development, and online evaluation. The closely related "teaching practice" subtheme includes a discussion of teaching strategies, teaching methods, and ways of effective teaching in an online environment. The "professional development/support for instructors" subtheme included discussion of support for teacher education, teaching strategies, teaching methods, and teacher education programs. "Types of instruction" were discussed concerning the categories of preservice teachers, in-service teachers, and also concerning teacher education and teacher education programs. Also, some comparative references to traditional education, specifically face-to-face classroom teaching, were observed.

Discussion

In this section, we highlight and discuss the most significant results about the growth of online learning as a mode of delivery. This research is unique because of the broad coverage spanning 26 years and the number of articles that were analyzed to conduct a systematic literature review about scholarly published research on "online learning" in the peer-reviewed journals in WoS and ERIC. Based on our extensive literature review, we did not find any other article of this scope and that is a unique analytical contribution to the discipline.

Number of articles

We found that over the 26 years, the number of articles published each year significantly increased over time, with 14 articles published in the first five years (between 1993–1998) and 2,869 articles published in the last five years (2013–2018). The articles published in the last five years comprise nearly half of the entire dataset of 5,803 articles. As the graph in Figure 1 shows, this field is consistently growing, and increasingly more studies are being published about online learning. It is important, however, to consider that the growth in the number of publications is not a measure in isolation but is also correlated to overall growth in the number of publications in all academic fields (Petersen et al., 2019). Nevertheless, the takeaway from this research is that online learning is a rapidly growing field even before the expected growth after the COVID-19 pandemic in 2020. The research and the field are continuing to grow, and we observed a particularly significant increase in the number of publications in 2016. In future research, we are interested in focusing on what internal/external factors could have caused this clear jump in the number of publications. Is it being driven by technology developments, by a change in the perceptions about the quality of online learning, or some combination of other such factors?

Publication venues and authors

We found that there are over 1,376 different journals that publish research about online learning, which is a surprisingly high number. These publications are scattered across academic disciplines, and no one discipline contains the majority of research published on online learning. The interdisciplinary nature of this topic is very clearly demonstrated by reviewing the list of journals where this research is being published (Table 2). Online learning publications are not limited to education. The highest number of articles were published in *Online Learning,* with 198 articles from the dataset of 5,803 (3.45% of the total). *Computers in Human Behavior,* a psychology-focused journal, also stands for its high number of publications about online learning (68, 1.17% of the total). The large number and wide disciplinary range of journals publishing research on online learning is one reason for the prior lack of a comprehensive literature review of the field.

We observed a similar trend in our author analysis, where we saw that, out of 12,363 authors writing 5,803 articles over the past 26 years, the top 20 most prolific authors only account for 251 articles. This amount is less than 5% of the total articles, after considering the overlap in articles and authors; the most prolific author of the field, Peter Shea,

contributed to just 19 articles in the dataset. Just like the venues, this finding demonstrates the wide appeal of online learning as a field of research interest and notes the engagement and participation in the field by a large number of scholars. This finding also helps us in understanding the often discussed confusion in the use of terminology related to online learning (Moore, Dickson-Deane, & Galyen, 2011).

Trends in author-defined keywords

When we delved deeper into the articles published in online learning in the last 26 years, we found a large number (9,293) of unique author-defined keywords used to characterize the articles. Table 3 presents the top 10 keywords used in these articles and shows that more than 40% of articles are about online courses. Electronic learning and educational technology are the next two most popular author-defined keywords. The presence of these two keywords indicates a relationship between the growth of technology and the growth of online learning. The use of "online learning" as a keyword was found in only 14% of the articles and only about 13% of the articles were about student attitudes. This finding shows us that the top areas of interest in the field of online learning in the last 26 years are courses, e-learning, and educational technology. This result indicates that the growth of technology has an important role in the evolution of online learning as an education delivery platform and the terminology used to distinguish between emerging forms of online learning, as posited by Miller, Topper, and Richardson (2017).

Many articles included multiple terms to mean online learning, such as "online courses," "e-learning," and "distance education." Similar to prior research (Singh & Thurman, 2019), we found that the definitions for these concepts are varied, overlapping, and confused. Figures 2 and 3 show the usage of keywords over time, and we can see steady growth in the use of each keyword after 2012 (Figure 2). This growth coincides with the overall increased number of publications about online learning and, therefore, is not necessarily indicative of a given keyword becoming more popular. Since generally more articles were published each year as time went on, it makes sense that all the keywords appeared more frequently. To better understand the growth in the use of each keyword over the period, we plotted the usage of keywords normalized for the number of articles published each year. The percentage of articles associated with each keyword per year was plotted in Figure 3 to give us a better view of the popularity of specific keywords in each year.

Interestingly, we find that, when normalized for the number of articles published, usage of the keyword "online learning," has been steadily increasing since 2011, while usage of "electronic learning" has consistently decreased over the same period. Similarly, we see a consistent decline in the percentage of articles using the "distance education" keyword. Figure 3 clearly shows that "educational technology," "online learning," and "educational research" are increasing, and student attitudes are also showing a clear stable trend. On the other hand, the use of "online courses," "teaching methods," "electronic learning," "distance education," and "computer-mediated communication" as author-defined keywords are decreasing. The earlier years show the confusion of the field and a lack of a standardized vocabulary as evidenced by the usage of multiple similar terms to denote the concept of online learning. As the field has grown and matured, we see that the term "online learning"

has risen to the top of the usage statistics, and the usage of some keywords, like "e-learning" and "distance education," is declining. Figure 5 shows the line plots depicting the usage of these three keywords normalized for the number of articles published each year. The usage of "electronic learning" peaked in 2010 and has seen a sharp decline since then. The usage of "distance education" has been consistently decreasing too. "Online learning" as a keyword has been increasing consistently, albeit slowly, and seems to be reaching the point of standard terminology for online delivery of educational content.

Trends in Titles and Abstracts

When we analyzed the titles of all the 5,803 articles, we found that after "online" and "learning," the third most popular word in the titles was "student"; it occurred 1,317 times, showing that students are a focus of a large number of published articles on online learning. Surprising to the authors of the study was the fact that technology only appeared in the title of 232 articles. When we started this investigation, we hypothesized that the focus of online learning research, because of the medium of delivery, would be technology. The evidence demonstrated otherwise; "technology" is in the top 20 words, but almost at the bottom. The presence of the word "student" at the top shows clearly the trend of online learning research being focused on students, their learning, outcomes for them, or impact on the students.

Plotting the top 10 words used in titles and abstracts over time shows that the keywords "online," "learning," and "students" are increasing in use. In the initial years, all of the top 10 keywords were used at the same levels, but we see consistent growth in the top keywords, except "social" and "development," which have stayed at the same level. Teacher and environment-related studies have been used increasingly since 2013, and we expect more research to happen in these areas. The concept of online learning has rightfully focused on the learning of students, but, going forward, we expect to see more research that is focused on teaching in an online environment and support for instructors.

Our investigation into the words used in the abstracts, and comparison of these terms to the words used in titles, shows that the top 5 words are the same—"online," "learning," "student," "education," and "environment." The other high-frequency words are different, though there are still overlaps in the words. "Technology" appears more frequently in abstracts than in the titles.

Themes and patterns in abstracts

The themes and subthemes we derived from the qualitative analysis were very useful in understanding the specific topics that are addressed within the broad themes of (online) learning, students, environment, courses, education, and teaching. Combining the thematic analysis with our examination of word usage over time, we can deduce that the research in this discipline is still increasing and the focus is moving toward students (learners) and teachers. Discussion in the field has evolved from using a variety of keywords as synonyms, to the use of "online learning" as the most common term dominating the discourse. The focus on students and learners is consistently increasing combined with more consideration of teaching in an online context and the support that it requires.

Gaps in the published research

The gaps we observed in the published research on online learning represent potential areas of future research and growth. A majority of the research we found dealt with Western countries; not as much research was found about other countries where online learning is being implemented but is, perhaps, not studied. We did not find significant research on accessibility issues in online learning and teaching even though it is a key selling point for online learning. Since online learning is becoming a major pillar of education delivery, we must not ignore the populations that need the benefits of online learning the most. There was also less research in the peer-reviewed journals dataset that focused on economic issues related to online learning, such as the affordability of the medium, the financial benefits to institutions, or the pedagogical decisions made because of finances. With the usage of online learning as a business proposition outside higher education institutions, there must be investigations that assess and compare the quality of education being delivered across the board. In light of the growth of research on teaching in online learning, we saw little focus on contextual teaching or teaching according to cultural norms despite the journals and articles being from different parts of the world. Nor did we find research on differences in teaching different subjects in an online environment. For example, what would be the differences in best practices for teaching a math course versus a public communication course or a graphic design course? Finally, we did not find much discussion about multilingual learners or teaching in languages other than English. Even though the journals part of this dataset is restricted to the English language, we expected publications regarding multilingual learners, teaching in languages other than English, and how technology does or does not support such teaching and learning. All these issues are critical for further improvement of the teaching practice, and scholars should focus on these in the context of online pedagogy.

Limitations of this research

This research, as comprehensive as it aims to be has its own set of limitations. First and foremost, this research is based on two databases, ERIC and WoS, and completely excludes any online blogs and publications. Also, it excludes any non-peer-reviewed publications and any publications that are in a language other than English. This research was carried out on specific exclusion and inclusion criteria (e.g., keywords for searching) as defined in the Methods section, and any publications that were excluded because of that criteria, limit the scope of this work. We acknowledge that there may be some articles about online learning as defined for this study that uses a different term or terms for the same concept, and, because they do not use the same terms, they are excluded from this study. This limitation is a result of the confusion that about terminologies that we found from this research. Some of the results presented in this paper will be enriched by further research and will contribute to a deeper understanding of certain relationships such as technology and online learning. Likewise, the sudden jump in the number of articles published about online learning in 2012 is an interesting result from this study, and, in future work, we are focusing on digging deeper into the articles collected dataset and asking more refined research questions.

Conclusions and Future Work

Overall, we found that the published research about online learning has shown significant growth in the last decade with a large number of journals (1,376) and authors (12,363) contributing to the development of the discipline. We demonstrated that the growth of the discipline is not from one specific discipline but is across a range of disciplines, some of which are expected, and some, not. This diversity highlights the true nature of interdisciplinary and trans-disciplinary research conducted about online learning. The appeal of online learning as a research topic crosses most disciplinary boundaries. The quantitative word frequency analysis (for keywords, titles, and abstracts) and the qualitative theme analysis (of the abstracts) corroborated the findings from each method. The main trends in the published articles on online learning are learning, students, environment, courses, education, and teaching. The growing areas are online learning, teacher (teaching), and students (learners). Technology has been an important topic, but not the dominant one. In future work, we will continue to dig deeper into the dataset to discover trends that are more specific and combine multi-method research to answer questions about changes in the landscape of publications about online learning. At this critical juncture in 2020, when the majority of educational institutions at all levels are being forced into adopting online learning to fulfill their educational mission, we believe this type of longitudinal analysis helps us understand how to move forward and continue teaching effectively.

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References

Antonaci, A., Klemke, R., & Specht, M. (2019). The effects of gamification in online learning environments: A systematic literature review. *Informatics*, *6*(3), 32; https://doi.org/10.3390/informatics6030032

Bates, T. (2014). A short history of educational technology. https://tonybates.wpengine.com/2014/12/10/a-short-history-of-educational-technology/

Bates, T. et al. (2018). Tracking online and distance education in Canadian universities and colleges 2018. Halifax, NS: Canadian Digital Learning Research Association.

Bates, A.W. (2019). *Teaching in a digital age – Second edition*. Vancouver, B.C.: Tony Bates Associates Ltd. Retrieved from https://pressbooks.bccampus.ca/teachinginadigitalagev2/

Boelens, R., Wever B. D., & Voet, M. (2017). Four key challenges to the design of blended learning: A systematic literature review. *Educational Research Review*, *22*, 1–18. https://doi.org/10.1016/j.edurev.2017.06.001

Cook, D., Garside, S., Levinson, A. J., Dupras, D. M., & Montori, V. M. (2010). What do we mean by web-based learning? A systematic review of the variability of interventions. *Medical Education*, *44*, 765–744. https://doi.org/10.1111/j.1365-2923.2010.03723.x

Digital Learning Compass. (2017). Distance Education Enrolment Report 2017 Wellesley, MA.

Chiappe, A & Rodríguez, P. (2017) Learning Analytics in 21st century education: a review Ensaio: aval. pol. públ. educ. 25 (97) • Oct-Dec 2017. https://doi.org/10.1590/S0104-40362017002501211

Halverson, L. R., Graham, C. R., Spring, K. J., Drysdale, J. S., & Henrie, C. R. (2014). A thematic analysis of the most highly cited scholarship in the first decade of blended learning research. Internet and Higher Education. *20* (1), pp. 20-34. Elsevier Ltd. https://doi.org/10.1016/j.iheduc.2013.09.004

Yu-Chen Hsu, Hsin Ning Jessie Ho, Chin-Chung Tsai, Gwo-Jen Hwang, Hui-Chun Chu, Chin-Yeh Wang, & Nian-Shing Chen. (2012). Research Trends in Technology-based Learning from 2000 to 2009: A content Analysis of Publications in Selected Journals. *Journal of Educational Technology & Society*, *15*(2), 354-370. Retrieved September 7, 2021, from http://www.jstor.org/stable/jeductechsoci.15.2.354

Hwang, G.-J., & Tsai, C.-C. (2011). Research trends in mobile and ubiquitous learning: a review of publications in selected journals from 2001 to 2010. *British Journal of Educational Technology*, *42*(4), E65-E70. https://doi.org/10.1111/j.1467-8535.2011.01183.x

Maria, K., Traynor, M., & Martin, D. (2014). A systematic review evaluating the impact of online or blended learning vs. face-to-face learning of clinical skills in undergraduate nurse education. *Journal of Advanced Nursing*, *71*(2), 255–270. https://doi.org/10.1111/jan.12509

Martin, F., Ahlgrim-Delzell, L. and Budhrani, K. (2017). Systematic review of two decades (1995 to 2014) of research on synchronous online learning. *American Journal of Distance Education*, *31*(1), 3–19, https://doi.org/10.1080/08923647.2017.1264807

McCutcheon, K., Lohan, M., Traynor, M., & Martin, D. (2015) A systematic review evaluating the impact of online or blended learning vs. face-to-face learning of clinical skills in undergraduate nurse education. *Journal of Advanced Nursing 71*(2), 255–270. doi: 10.1111/jan.12509

Miller, A., Topper, A. M., & Richardson, S. (2017). Suggestions for improving IPEDS distance education data collection. (NPEC 2017). U.S. Department of Education. Washington, DC: National Postsecondary Education Cooperative. Retrieved from http://nces.ed.gov/pubsearch

Moore, J., Dickson-Deane, C., & Galyen, K. (2011). E-learning, online learning and distance learning environments: Are they the same? *The Internet and Higher Education*, *14*(2), 129–135. http://doi.org/10.1016/j.iheduc.2010.10.001

Morgan, H. (2020). Best practices for implementing remote learning during a pandemic. *The Clearing House: A journal of Educational Strategies, Issues and Ideas*, *93*(3). 135–141. https://doi.org/10.1080/00098655.2020.1751480

Nunn, S., Avella, J., Kanai, T., & Kebritchi, M. (2016). Learning analytics methods, benefits, and challenges in higher education: A systematic literature review. *Online Learning, 20*(2). http://doi.org/10.24059/olj.v20i2.790

Oliver, M. (2014). Fostering relevant research on educational communications and technology. In *Handbook of research on educational communications and technology*, ed. J. M. Spector, M. D. Merrill, J. Elen, and M. J. Bishop, 909–918. New York: Springer.

Petersen, A., Pan, R., Pammolli, F., & Fortunato, S. (2019). Methods to account for citation inflation in research evaluation. *Research Policy*, *48*(7), 1855–1865. https://doi.org/10.1016/j.respol.2019.04.009

Rodriguez Triana, M. J., Prieto Santos, L. P., Vozniuk, A., Shirvani Boroujeni, M., Schwendimann, B. A., Holzer, A. C., & Gillet, D. (2017). Monitoring, awareness, and reflection in blended technology enhanced learning: A systematic review. *International Journal of Technology Enhanced Learning*, *9*(2/3), 126–150. https://doi.org/10.1504/IJTEL.2017.084489

Singh, V. & Thurman, A. (2019). How many ways can we define online learning? A systematic literature review of definitions of online learning (1988–2018). *American Journal of Distance Educatio*n, *33*(4), 289–306. https://doi.org/10.1080/08923647.2019.1663082

Shahini, R., Davis, H., & Borthwick, K. (2019). Design recommendations to address cultural issues in multicultural MOOCs: a systematic literature review. In Plutino, A., Borthwick, K., & Corradini, E. (Eds.), *New educational landscapes: innovative perspectives in language learning and technology* (pp. 55–66). Research-publishing.net. https://doi.org/10.14705/rpnet.2019.36.956