



Analysis of the Current Situation of Instructional Design in the Field of Education: A Bibliometric Analysis from 2012 to 2023

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Abstract. In order to gain a comprehensive understanding of the development in the field of instructional design, a bibliometric and visual analysis was conducted on relevant literature in the Web of Science (WoS) core database from 2012 to 2023, utilizing VOSviewer and CiteSpace software. Quantitative and visual analyses were performed to examine the distribution of authors, journals, and countries in the field of instructional design research. By mapping and visualizing graphs, network patterns, the research paths, hotspots, and development trends in instructional design over the past decade were systematically reviewed and summarized. This analysis aims to provide subsequent researchers in the field of instructional design with a comprehensive and organized overview, facilitating a deeper understanding of the landscape within this domain.

Keywords: component; design instructional design; pedagogy.

1 Introduction

With the continuous reform and development of educational studies in the new era, instructional design, as a crucial research field in education, has experienced rapid growth. It has evolved from initial reforms in curriculum and instructional design to concepts emphasizing students as the foundation of educational design. In recent years, there has been a surge in the application of advanced technologies, such as artificial intelligence and the internet, in the field of instructional design. These technological advancements have injected new vitality and creativity into the domain.

Researchers in instructional design have achieved significant results, particularly in the areas of professional skills instruction, higher education teaching design, and instructional design frameworks. However, educational design faces pressing challenges, such as the integration of computer use with curriculum [1].

This paper, based on these considerations, provides a detailed overview of the current state of instructional design from 2012 to 2023. It is hoped that this analysis will serve as a valuable reference and inspiration for subsequent researchers in the field.

2 Methodology

2.1 Research Methods

Bibliometrics is a quantitative method used to describe and analyze the research history and progress of a specific academic discipline. With the assistance of modern data software, this approach employs concise and clear visual patterns to present the outcomes of literature in that field [2]. On the other hand, researchers have also found that the visual co-citation analysis of bibliometrics can conveniently illustrate the associations between data, facilitating the clarification of intrinsic connections within information [3].

In this paper, CiteSpace and VOSviewer, two software tools, were employed for bibliometric research in the field of instructional design. Each software tool has its advantages and can complement each other in terms of graphic representation. CiteSpace is used to obtain timezone views and timeline views within time slices, thereby presenting the process and clustering timespan of the field's evolution from a temporal perspective [4]. This aids in understanding the developmental processes and trends within the field. On the other hand, VOSviewer employs probability-based data analysis methods and provides various visualization views in areas such as keywords, co-institutions, and co-authors, including Network Visualization, Overlay Visualization, and Density Visualization, which feature simplicity and aesthetics [5].

However, relying on data visualization software for research analysis also has certain limitations. While it allows for a comprehensive overview of the past and present research in the field, it may not delve deeply into the thoughts and concepts of a few classical works within the discipline. Therefore, by combining the in-depth reading and exploratory methods from traditional literature review models with the bibliometric methods of visualization analysis tools, this paper conducts a quantitative analysis of the development of instructional design in recent years. It presents the current status and framework of the field in a graphical format for the reference of subsequent instructional design researchers.

2.2 Research Materials

To ensure the comprehensiveness and authority of the data analysis in this study, Web of Science was chosen as the source for data analysis, specifically from Science Citation Index Expanded (SCI-EXPANDED) and Social Sciences Citation Index (SSCI). The selected index keywords and strategy were TS = ("education" and ("pedagogical design" or "instructional design")). The time frame for the search ranged from January 1, 2012, to November 1, 2023. The document types included were Articles and Review Articles, and the language chosen was English. After the initial search, a total of 1,302 results were obtained. To ensure the quality of this study, further screening and data cleaning were conducted to eliminate duplicates and results not relevant to the research topic. In the end, the researchers selected a total of 273 valid articles from the initial 1,302 articles.

The instructional design papers used in this study come from 49 countries, 390 organizations, and involve 825 authors. These papers were published in 130 different sources and cited a total of 12,748 references.

3 SCIENTOMETRICS and VISUAL ANALYSIS

3.1 Basic Quantitative Analysis

The 273 selected papers, after screening, involve 825 authors from 49 countries and 390 organizations. These papers were published across 130 different sources, citing a total of 12,748 references from 5,759 journal sources.

Table 1. Time of trend of the publications on instructional design

<i>Year of publication</i>	<i>Number of Documents</i>
2012	17
2013	14
2014	17
2015	18
2016	19
2017	21
2018	22
2019	21
2020	22
2021	36
2022	40
2023	33

Table I presents the publication timeline of papers in the field of instructional design. Overall, there is an increasing trend in the number of publications. The average number of papers published annually from 2012 to 2022 is 21.9 (excluding data from 2023 as it has not concluded as of the manuscript submission date). Particularly noteworthy is the rapid increase in relevant articles after 2019, indicating a growing interest from educators and establishing itself as a significant focal point in the field of education.

3.2 Bibliometric Analysis of Authors

Table 2. Highly Productive Authors on Instructional Design

<i>Autuor Name</i>	<i>Documents</i>	<i>Citations</i>
admiraal,wilfried	3	57
pellas,nikolaos	3	41
van merrienboer,jeroen j.g.	3	81
yanchar,stephen c.	3	21

As shown in Table II, using VOSviewer software to compare the number of published articles in this field, authors with a relatively high number of publications were selected, with a minimum requirement of three publications. A total of four prolific authors were identified, each having published three articles. This indicates a relatively even distribution among top authors in the field. Among them, Van Merriënboer, Jeroen J.G. has the highest average citation count, with 27 citations per article.

3.3 Bibliometric Analysis of Countries

To understand which countries have made the most significant contributions to the field of instructional design, this paper analyzed papers from 49 countries. Visualization was conducted using the VOSviewer software, excluding countries with fewer than 14 published articles. The analysis, as depicted in Figure 1, reveals that the size of the circles corresponds to the number of publications by each country. The connecting lines between nodes indicate the strength of collaboration, with thicker lines suggesting deeper cooperation between two countries. Node colors represent different clusters. It is evident that the distribution of research countries in the field of instructional design is uneven, with a prominent concentration of authors from a few countries such as the United States, the Netherlands and China.

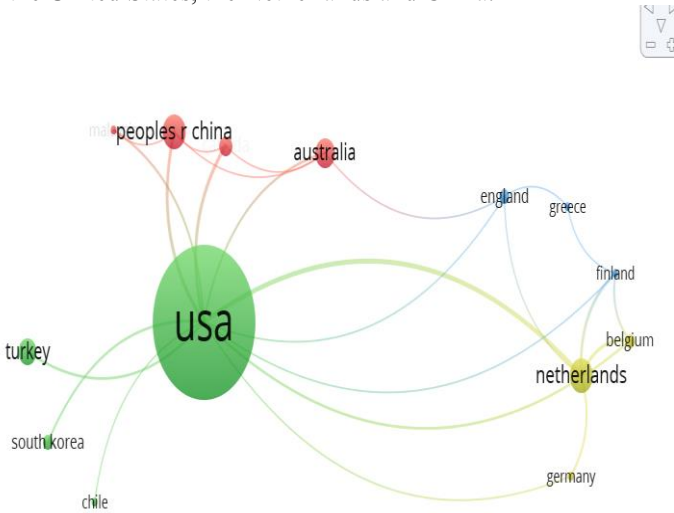


Fig. 1. Distribution of Authors in the Field of Instructional Design

Through further analysis of countries with high publication numbers in the field, Table III displays the top 5 countries in terms of published articles in instructional design. The United States is the leading contributor in this field, with a total of 110 papers, accounting for 40.29% of the articles in this domain. The average citation frequency for these articles is 22.01. Following closely is the Netherlands, contributing 23

papers with an average citation frequency of 13.63 per article. The United States holds the top position in both the number of publications and average citation frequency, underscoring the significant and leading role of American scholars in the field of instructional design research.

Table 3. top 5 countries in the Instructional Design

<i>Rank</i>	<i>Country</i>	<i>Documents</i>	<i>Citations</i>	<i>Average Citation/publication</i>
1	The United states	110	2421	22.01
2	Netherlands	23	314	13.63
3	China	23	169	7.35
4	Australia	20	342	17.1
5	turkey	18	135	7.5

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3.4 Network visualization

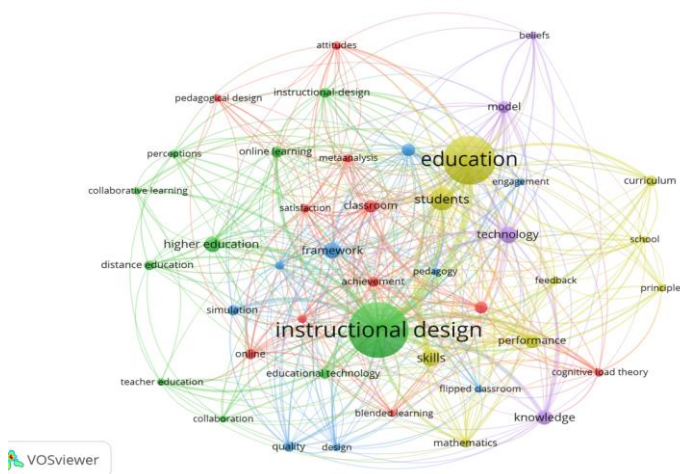


Fig. 2. High-Frequency Keyword in the Field of Instructional Design

Through the use of VOSviewer software for literature analysis, analyzing the keywords of the papers provides insights into the core essence of the articles. Co-occurrence analysis of keywords reveals the research hotspots in the field. In this study, VOSviewer was employed to conduct a co-occurrence network analysis of keywords in 273 articles, with a minimum occurrence criterion set at 7. A total of 46 keywords were filtered based on this criterion. In Figure 2, larger nodes represent key-

words that appear more frequently, indicating areas of focus in the field. Node colors represent different clusters, and upon observation, there are a total of six clusters, corresponding to research topics. The thickness of the lines between nodes indicates the frequency of appearance together in the same literature; thicker lines represent higher co-occurrence frequencies.

The entire network is centered around core terms such as "instructional design" and "education," while secondary core keywords include "students," "science," "performance," and "technology."

Table 4. Keywords in the Field of Instructional Design

<i>Keyword</i>	<i>frequency of occurrence</i>	<i>connection strength</i>	<i>Keyword</i>	<i>frequency of occurrence</i>	<i>connection strength</i>
instructional design	106	256	teachers	15	58
education	90	194	classroom	15	56
students	33	100	model	14	52
science	25	81	knowledge	19	49
performance	18	80	higher-education	13	47
technology	22	76	online	12	46
skills	24	72	achievement	12	45
framework	21	60	mathematics	10	43

Table IV further analyzes the selected paper keywords for strength and frequency. The high-frequency occurrence of words constitutes representative keywords in this field. Some scholars argue that to assess the effectiveness of instructional design improvements, student performance enhancement should be used as the criterion [6]. A closer examination of the keyword table reveals that "performance" and "technology," although appearing infrequently, have high linkages, indicating their significance in the research field of instructional design. Some scholars believe that integrating practical activities and interactive sessions between teachers and students in instructional design has a positive impact, contributing to improved student classroom performance [7].

With the continuous progress of technology, new technologies are being applied to instructional design, presenting challenges for educators. Some scholars assert that in pharmacy education, acquiring clinical reasoning skills through experiential learning is crucial, with virtual reality technology being one of the most effective tools. It allows learners to experience more realistic clinical scenarios [8].

There is a growing interest in the use of augmented reality technology in instructional design, as it is widely believed to have advantages such as accessibility, improved learning outcomes, and enhanced motivation. We found that augmented reality

technology is primarily used in training or practical scenarios and aids in understanding complex, abstract, or hard-to-find information [9].

3.5 Analysis of Total Citations for Articles

The purpose of conducting a co-citation analysis on articles in the field of instructional design is to understand the highly cited papers and journals in this domain. Through the use of VOSviewer software for co-citation mapping of journals, it is possible to analyze the co-citation relationships and provide reference for submission and topic selection to scholars in the same field. For this analysis, the threshold for journal selection was set at 50, resulting in 31 journals meeting the criteria. The final co-citation relationships are presented in Figure 3.

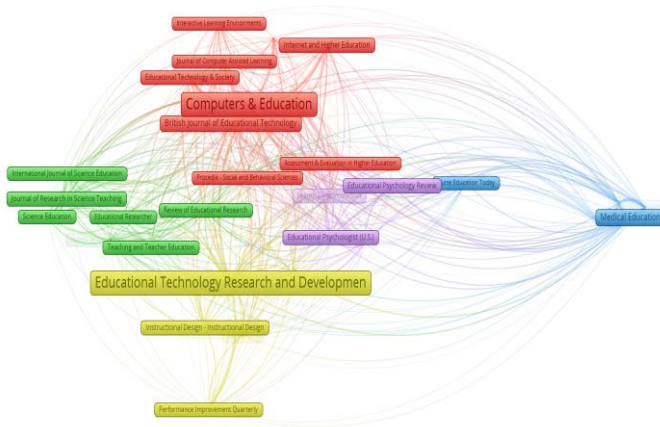


Fig. 3. Articles Co-Cited in the Field of Instructional Design

By observing Figure 3, it can be summarized that there are a total of 5 colors in the patterns. Therefore, the co-citation network of the journal consists of 5 clusters, with each different color representing a different research field journal. Currently, research in the field of instructional design is mainly focused on fields such as computer technology, educational science, psychology research, clinical medicine, etc. Particularly, there is a significant focus on the application of high-tech technologies such as computer artificial intelligence. The main purpose of collecting the names of these journals is to provide reference support for researchers.

4 CONCLUSION AND PROSPECT

4.1 Conclusion

Research in instructional design, as an important field within education, plays a significant role in educational reforms. This study, utilizing the VOSviewer and CiteSpace software, comprehensively reviews numerous studies in the field of in-

structional design worldwide over the past decade. It systematically analyzes the recent development status and historical context of this field, with the overall findings summarized as follows:

The article selected a total of 273 valid papers from 1302 articles. The instructional design papers used in this study come from 825 authors affiliated with 390 organizations in 49 countries. These papers were published across 130 different sources and cited a total of 12,748 references.

The field of instructional design has gradually gained attention since 2019.

The United States is the leading country in terms of the number of publications in this research domain. Furthermore, American scholars receive relatively high recognition for their contributions, as evidenced by the average citation per article.

Keywords such as "students," "science," "performance," and "technology" have become hot topics in the field of instructional design in recent years.

4.2 Contribution and outlook

With the rapid development of the economy, societal demands for education are also increasing. In order to meet these demands, educational reforms have become particularly crucial. In the context of educational reform, instructional design plays a key role and undoubtedly holds great potential for future development. Therefore, from the perspectives of bibliometrics and scientometrics, a comprehensive review of the existing research landscape is of high value. This type of review can guide scholars in this field towards research directions and provide them with research insights.

This study is beneficial for those who aspire to conduct research in the field of instructional design in the future. It provides a clear cognitive framework for researchers interested in quickly understanding the research landscape in instructional design and gaining insights into its development process and trends. Keywords such as "students," "science," "performance," and "technology" have become hot topics in the field of instructional design in recent years.

Through the analysis of high-frequency words and keywords, this study helps scholars grasp the hotspots and focal points in the field of instructional design. It facilitates researchers in quickly selecting research topics and defining their future research directions.

The analysis of core authors and journals in the field of instructional design in this study can assist scholars in swiftly finding the necessary references, providing them with a research foundation, and offering suggestions for submission choices.

We have reason to believe that instructional design, as a discipline aiming to enhance teaching efficiency and quality, holds significant development potential in the future. Therefore, this study has meaningful and valuable implications for deepening research in this field. In future research, it is essential to integrate literature resources from multiple databases to ensure comprehensive and authoritative data. Additionally, close communication with scholars in this field is crucial to stay informed about the latest dynamics, deepen objective understanding of the instructional design domain, and develop a more comprehensive and rational cognitive framework.

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