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The Development of Educational Technology in Financial Management: A Bibliometrics Study

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ABSTRACT

Purpose: This study was conducted to find out the direction of using educational technology in financial management.

Method: Bibliometrics and scientific mapping techniques have been used in this applied research. Research data were collected from the Scopus database from 1973 to 2022. Bibliometrix R was used to analyze and visualize data and scientific maps.

Findings: The research findings show that educational technology in financial management among 60 documents in 6 clusters of financial management, medical education, short survey, priority journal, public relations, and university. In the research, educational technology and financial management are the most widely used words in a single cluster and have the most centrality and betweenness. Likewise, the field of dentistry is one of the fields that are most active in using educational technology in financial management.

Conclusion: Educational technology as an interdisciplinary field has a direct and effective impact on most service businesses affecting the country's economy. Knowledge development and integration of key issues in financial management are essential. According to the findings of this study, for the promotion in the industries especially the service sector, it is suggested to provide a strategic view in applying educational technology in financial management. ©**authors**

Introduction

Scientometrics methods are increasingly used to measure the impact of a research field (Sahoo & Pandey, 2020). Bibliometrics methods are commonly used to analyze and compare scientific performance (Ho & Ranasinghe, 2022). Bibliometrics, coined by Alan Pritchard (1996), have been widely utilized for evaluating research articles or other publications of scholars. In any discipline, bibliometrics can be applied, which helps to discover hot trends and literature growth (Brahma & Verma, 2019; de Oliveira et al., 2019; Shao et al., 2022). The results can help young researchers and students to choose their research direction and ensure to choose a new, developing, and required research topic.

Financial management is critical in the sustainability process and of the most significant concepts in finance (Alkaabi, H., & Nobanee, 2019). Financial management, if well incorporated into business operations, can be a tool for promoting sustainable business practices and sustainable financial growth for firms (Al Ahbabi & Nobanee, 2019). As a type of management activity, it is an effective system on the financial manager's decisions (Adashev, 2020).

Financial Management, as a core course of accounting majors (Cui, 2021), is based on enterprise financial statements. Moreover, it is committed to meet the necessities of enterprise managers and interest stakeholders (Peng, 2022). In the era of modern technology and applying big data, financial management needs to be taught regarding the applicability of new technology to be able to respond to opportunities and challenges.

Financial management curriculum needs to be improved with the outstanding characteristics of teaching and integrated with modern educational technology (Hu & Huang, 2021; Cai & Ma, 2020).

This article aims to analyze the educational technology importance and application in financial management based on the analysis of data from the associated scientific publications that allow the development of a future research agenda for researchers and education system authorities to decide about curricula. It addresses the research question:

what is the current state of educational technology in financial management and where should future research on the subject be directed? This research objective and question goes

beyond the bibliometric analysis of the term and its variants, which show the development and evolution of a general or substantive theory.

The following sections encourage discussion on educational technology in financial management and present a series of information and the vision of this subject from the perspective of dynamic publications and researchers' interests.

A bibliometric analysis is undertaken to describe the evolution of this study in terms of the number of publications, keywords analysis by different maps, collaboration, reference spectroscopy, and countries in which the research has been carried out.

Finally, the importance of educational technology in financial management is discussed, and further research in this field of management sciences for future lines of research are proposed.

Literature Review

There have been considerable bibliometrics studies and research on educational technology.

Educational technology as an interdisciplinary field showed the Technology Acceptance Model of most studied theories and some main clusters developing including Technology in Learning Environments, Theoretical Foundations, and Online Learning (Gümüş et al., 2023). Promising areas like Artificial Intelligence in Education, Learning Analytics and Knowledge, Educational Data Mining, Intelligent Tutoring Systems, and Learning at Scale created diversity and advance of information, communication, and analytical technologies and their increasing adoption to assist instruction and learning (Chen et al., 2023). Yılmaz Özden et al. (2023) have stated that revealing the hot trends in educational technology is of great importance. In this

study, the UK is known as one of the main countries leading the research trends in the educational technology field.

In other bibliometrics research, educational technology has been studied in the SITE scholarship network to identify emerging leaders and research trends in the discipline (Rand, Shepard & Wilson, 2023). The USA was known as the country with the most publications in mapping the status of open access to scientific publications globally in the field of "educational technology"(Anam et al., 2021). Data mining and big data are tools to discover new trends in this field. The journals in the field of educational technology have been developing, and open-access journals have played a role in promoting the development of the field (Wang et al., 2022). mapping of research data on digital technology in the field of health education showed that dentistry is among of top fields of the health sector (Maulana et al., 2022).

To our best knowledge in the financial management field, a bibliometric study has not been carried out. There are some research which study education and business in developing and uplifting the economy (Koibichuk et al., 2022).

The work of Muchiri et al. (2022) contains an overview of green finance after the Paris Agreement by applying a bibliometric analysis. In Islamic Economics, Banking, and Finance (IEBF) field, a bibliometric study suggested that future research must elaborate their findings with the current facts and academic reasons to enrich the discussion (Supriani & Mubarrok, 2023). A bibliometric study on green finance research, found the potential research gaps and focus on future research trends (Hu & Wei, 2019).

A knowledge economy bibliometric study tried to build a link between the literature field of knowledge economy and sharing to advance each environmental, social and governance (ESG) limitation (Pu et al., 2022).

Regarding the gap knowledge in financial management in the case of using education technology and the importance of educational technology, in this paper we seek to find out to what extent scholars consider education technology in financial management. Moreover, we study the research documents to find the hot trends and topics interesting for scholars.

Method

In this research, the data obtained from the Scopus database was used. Scopus has one of the most detailed coverages of academic journals and pays more attention to the comprehensiveness of academic content (Caputo and Kargina, 2021). Also, Scopus is designed for bibliometric research and citation analysis and is a suitable alternative to Web of Science (Vieira and Gomes, 2022; Farooq, 2019) and provides more articles for citation analysis (Falagas et al., 2008).

To retrieve articles, two keywords financial management and educational technology were used in the search. Due to limited resources, no restrictions were imposed.

In this research, the basic statistical characteristics of the publications are examined in the first part of the findings. To analyze and draw scientific maps, the R package Bibliometrix is used to check the conceptual structure. R (an open-source statistical language) is designed to help researchers perform automated scientific mapping (Aria and Cucorolo, 2017). Also, to ensure the accuracy and validity of the results, we used Bibliometrix and Excel tools to integrate data and remove duplicate data (Caputo and Kargina, 2021). Then, 60 documents were kept for bibliometric analysis. These documents were obtained from 295 sources between 1973-2021 and include 60 documents (26 articles, 6 conference papers, 2 editor's speeches, 1 letter, 9 notes, 13 review articles, and 3 short studies), from 43 sources. In total, 173 authors have contributed, of which 23 are single-authored documents. The participation rate of international co-authors is 13.33%.

Findings
Co_occurrence Network

Figure 1. Co-occurrence network of key words in the field of research
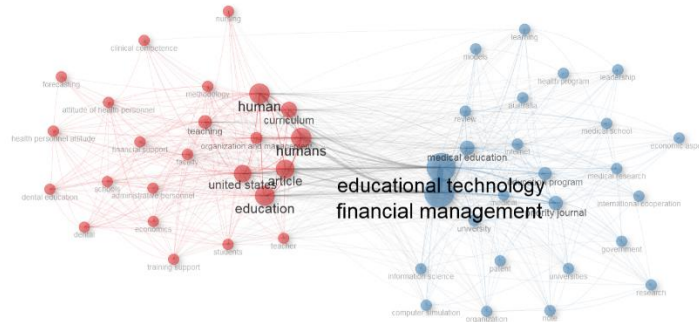
To identify the content, main topics, and methods used in particular research, keywords are practical tools (de Araújo Lima, Crema & Verbano, 2020). The keyword co-occurrence network is a popular method for capturing knowledge structure. After constructing the network, centrality measures such as betweenness centrality and closeness centrality are usually used to identify the importance of the keyword or also used to classify the relationship between keywords. In this way, the topological structure of science can be systematically extracted (You et al., 2021). a co-occurrence network is an engaging approach that allows a comprehensive analysis and understanding of the assembly and functioning of communities (Liu et al., 2022). The co-occurrence network is important for predicting the processes that control the scientific structure and direction of a community.

Table 1. Ranking of top keywords based on centrality criteria

| Node	Cluster	Closeness	Betweenness	PageRank
Financial management	2	0.020408163	147.5175166	0.077213041
Educational technology	2	0.020408163	127.1989779	0.073698739
Education	1	0.02	60.33839169	0.049951518
Humans	1	0.02	54.94419102	0.050699772

This study uses betweenness centrality and closeness centrality as the criteria for the occurrence of keywords. The large closeness centrality of a node indicates its great influence in the keywords network (Sun et al., 2018). Betweenness centrality is a measure of the frequency at which a node appears on the shortest path to other nodes (Dennis & Grady, 2022; Carchiolo et al., 2022; Yao et al., 2022).

As shown in Table 1, the field of research on the role of educational technology in financial management includes two clusters. Keywords such as educational technology and financial management, which belong to cluster 2, have the highest centrality. In other words, these keywords are in the shortest distance among other keywords. Education and human beings have the highest visibility in cluster 1, which indicates the importance of these two in the field of research.

Examining the relationships between the keywords of the two clusters shows that financial management, economics, financial and educational support, and curriculum related to this area are mostly seen in healthcare education (such as nursing, and dentistry). Financial management and educational technology as researchers' interests can be seen in the field of education and medical research and educational program.
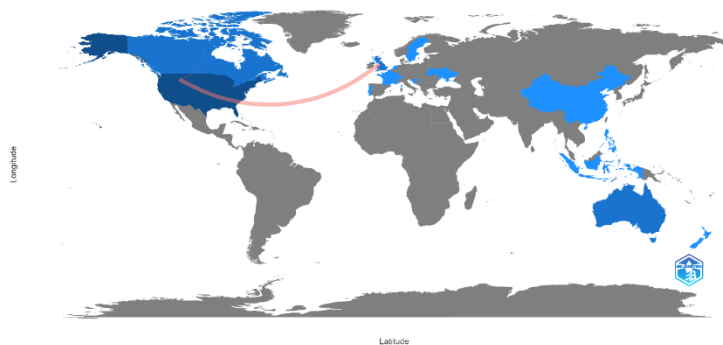
Collaboration_Network

Figure2. Collaboration network in the field of study
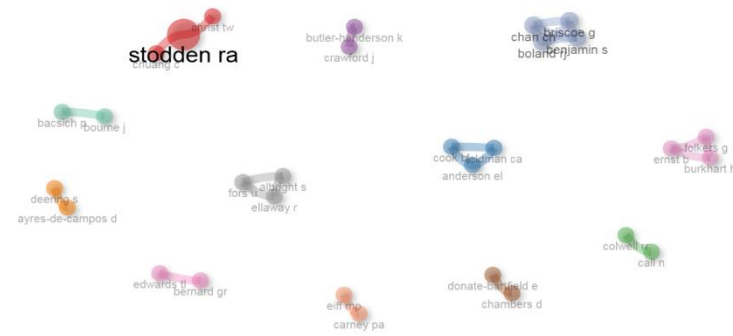
As shown in fig.2, there are 12 clusters of authors. Stodden with 3 articles in cluster 1 is the most productive author in the field of study.

CountryCollaborationMap

**Figure 3.** country collaboration map

As shown in fig.3, USA with frequency of 72 is the most productive in studies related to education technology in financial management. Canada and Australia with frequency of 8 and 6, respectively, are next by a wide margin. After Switzerland and UK (4), China, Croatia, France, Indonesia, Netherlands, New Zealands, Philippines, Portugal, Sweden and Ukraine (1) are in the list of productive country.

USA is also among the most cited countries, with 488 citations is at the top of the list. Canada (140) and Australia (20) are at the second and third ranks.

Dendrogram

Figure 4. dendrogram results
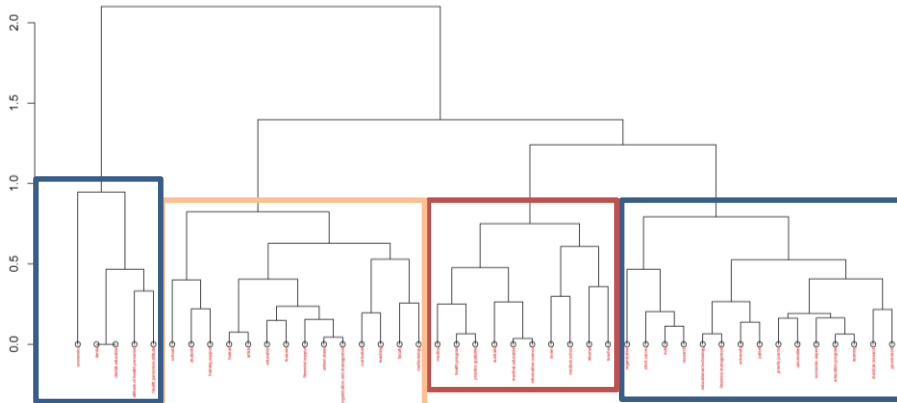
A dendrogram is a schematic diagram that seeks to visualize clusters within a group of objects and demonstrate the relationship between the various sets hierarchically (Altarturi et al., 2021). A dendrogram is a tool that is primarily utilized to dislocate certain items (keywords) into respective clusters by measuring the height of different objects that are joined together into research branches (Kalia, et al., 2022).

As can be seen in fig.4, economics is a separate branch not connected to other branches which shows less topic connectivity. This clade is called simplicifolious, a term from botany that means "single-leafed". It shows that the distribution of words in that chunk is substantially different from the distribution in the remaining chunks.

To identify which individual parts are most similar to each other, the dendrogram is read from the bottom up. Two-leaved clades are bifolious. There is no limit to the number of leaves in a clade. The height of the branch points indicates how similar or different they are from each other: the greater the height, the greater the difference (Drout & Smith, 2012).

In cluster 3, the connection between financial management and education technology is the closest link to the bottom of the diagram. Therefore, they are most similar and join together first in the branching diagram. The upper joining connects the clades. This geometry indicates that every chunk within that cluster is more similar to each other than to any chunks that join at a higher level

In addition to the similarities that bifolious have, they are connected to a common clade in a higher connection. Therefore, in cluster 3, it can be concluded that universities, educational programs, learning, and the government are effective factors related to financial management and related educational technology.

Factorial Map

Figure 5. Multiple Correspondence analysis (MCA) in the field of research
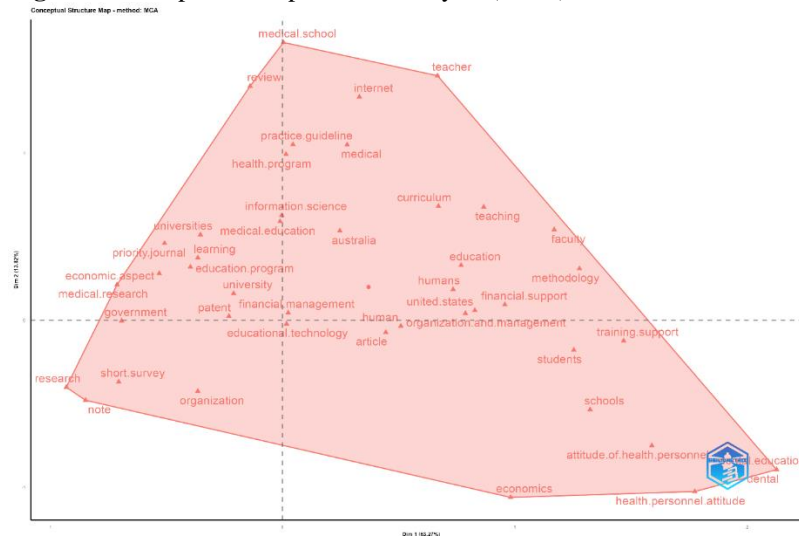
The bibliometrix R-package allows using the conceptualStructure function to perform multiple correspondence analysis (MCA) to draw a conceptual structure of the field and K-means clustering to identify clusters of documents that express common concepts (Aria & Cuccurullo, 2017). The factorial network showed four clusters when multiple correspondence analysis was performed for the Keywords Plus field. As can be seen in the figure, the variables that are at the smallest distance from each other are shown in the cluster together. In Figure 5, the conceptual structure map, we wanted to see how closely related the keywords and research areas are, and to see how close or distant these areas are if they are related (Radanliev et al., 2022).

Reference Spectroscopy

Figure 6. Reference Spectroscopy results
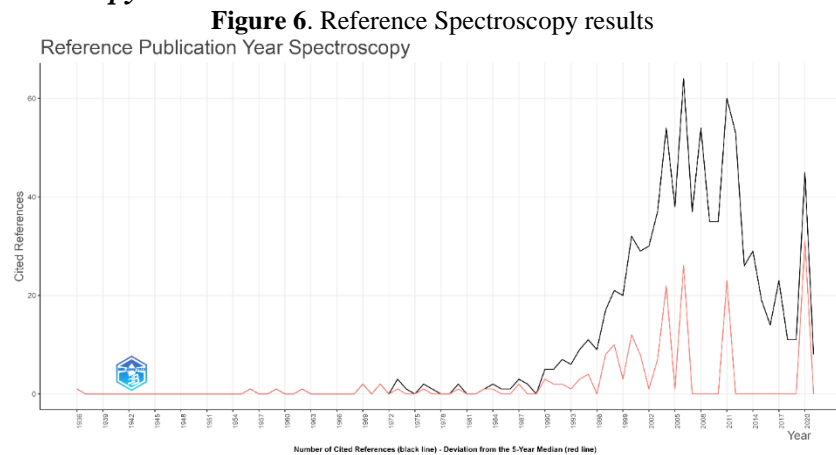
RPYS (Reference publication year Spectroscopy) is a bibliometric method first introduced by Marx et al. (2014) to reveal the significance of historical publications and to reveal the historical roots of a given research field (Mostafa, 2022; Haunschild & Marx, 2021). This method analyzes the cited references (CR) and especially the referenced publication years of a publication set (Leydesdorff et al., 2016). In this method, the most highly cited papers are not identified. but instead, it demonstrates the most frequently referenced publications within a specific reference publication year (Bornmann Haunschild & Marx, 2022).

Basically, there are a total of 881 references cited in 60 papers in the dataset. Based on this data, fig. is demonstrated. The oldest citation belongs to 1936, i.e. Health Insurance Portability and Accountability Act of 1996, by Spallek et al., 2015. The orange line shows the five-year median deviation.

The spectroscopy shows 5 peaks. The first peak shows that year 2006 with 64 citations is at the top of list of publication year citations. The second peak belongs to year 2011 with 60 citations. Years 2004 and 2008 are equally placed at the third ranks. Year 2012 with 53 citations is the fifth peak.

Thematic Map

Figure 7. Thematic map mapping using Walktrap Algorithm method.
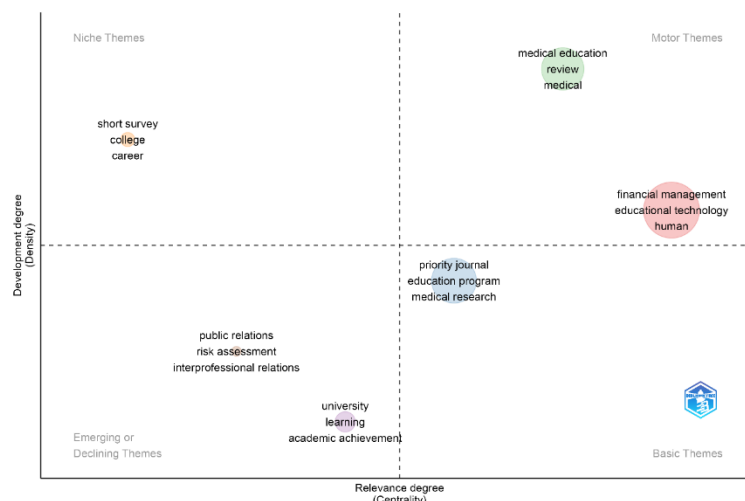
As can be seen in Figure 7, the co-words analysis shows the formed clusters and the stage of their evolution. This map has four quadrants with 6 clusters:

1. On the upper right side, we have themes with high density and centrality, which show motor themes as the driving force of the research field (Macaskill et al., 2021). These topics are vital and well-developed. As can be seen, education technology and financial management have been given attention in the medical field. Different researchers investigate financial

management and education technology in the field of medicine (Cui, 2021; Zhong et al., 2021; Nwankwo et al., 2023; Pogrebnaya et al., 2023)

2. On the upper left side, we have themes with high density and low centrality, which are called niche themes. Niche topics are highly specialized and developed topics of a research field, but they are not vital for the life of the field (Cai & Guo, 2021; Xiao et al., 2022) and have marginal importance. This section refers to short studies, and colleges that have dealt with this field.

3. In the lower right, we have themes with low density and high centrality, which represent core themes that are fundamental to a research field but are not yet well developed (Yildirim et al., 2022). Priority journals, education programs, and medical research are among the subjects of this section.

4. In the lower left side, we have themes with low density and centrality, which show emerging or declining themes. These topics are weakly developed and marginal (Yildirim et al., 2022). The university, risk assessment, learning, and academic achievement are in this group as peripheral and undeveloped topics that have had the lowest impact on the research field.

Trend Topics

Figure 8. Top trend topics in the field of research.
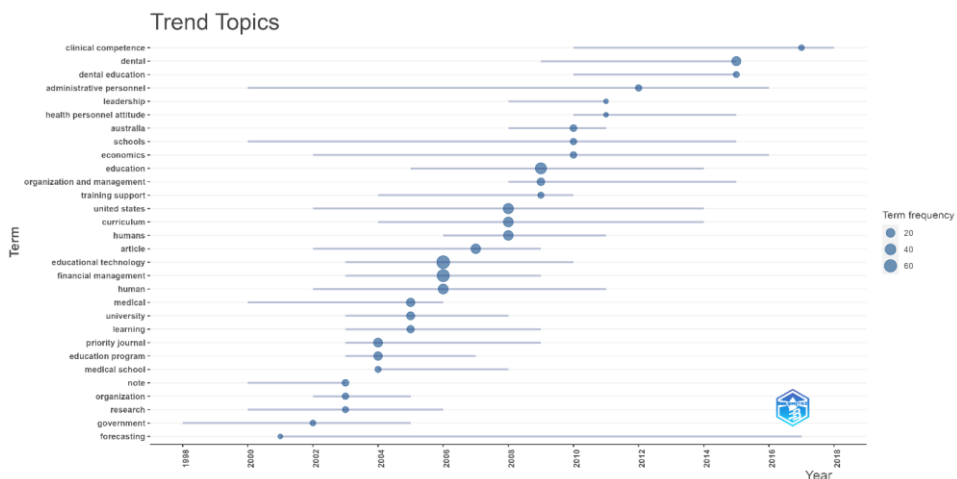
Educational technology (68) and financial management (58) were repeated 2003-2010. The fig show that the field of research is considered in clinical competence, dental education which has been scholars' interest too (Dalaya et al., 2015; Sabato et al., 2023; Van der Berg-Cloete et al., 2020).

Words' Frequency over Time

Figure 9. Word dynamics representing the repeated indexed keywords.
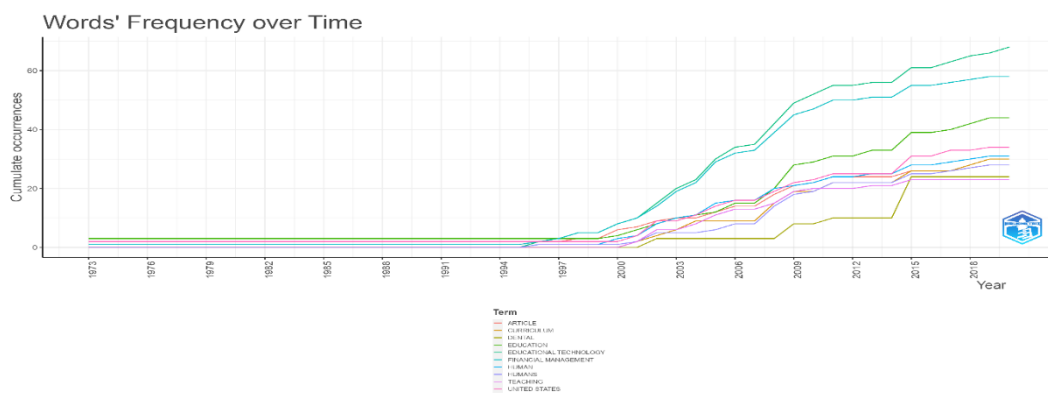
In the dataset of this study, educational technology was appeared in 1996 with 2 documents and educational technology has been considered from 1973 (1 document), which both have been increasing up to now. After year 2005, there is a noticeable increase in the field of educational technology and financial management in the USA and dental education. The importance of financial management in dental education has been considers by different researchers (Haden et al., 2016; Moreira et al., 2022; D'Assunção et al., 2022).

Discussion

This study was conducted to find out the direction of using educational technology in financial management.

Co_occurrence Network analysis showed that there is research on studying educational technology in financial management. Educational technology has been considered highly in research. This is one of the hot trends researchers tend to study to discover new directions in different fields, such as social sciences, computer science, engineering, and medicine (Murnaka, 2021). As mentioned in some research, educational technology such as AI, learning systems, and other similar technologies are essential factors in the education of different fields (Gümüş et al., 2023; Chen et al., 2023; Yılmaz Özden et al., 2023). Moreover, the USA is the most productive in the field of this research. The USA has been also recognized as a pioneer country in most studies too (Anam et al., 2021). Dentistry is a considerable field in this study which has been found in other studies related to educational technology. Educational technology and financial management are researchers' interests in this field.

Education and human are among the close keywords in a cluster. Education and human resource development are considered in relation to economic development (Chen, 2019). University graduates can bring their newly acquired knowledge and skills, their novel methods, and new ideas into practice (Tijssen et al., 2021). With technology development, there are new methods and processes for doing some tasks in every field.

Conclusion

Despite underlining the implicit significance of educational technology in financial management, the bibliometric analysis showed the existence of few articles on educational technology in financial management in the Scopus database, suggesting the contribution of this topic in specific sectors and territories.

Recently, important changes in teaching have been occurring in various areas of knowledge (Da Silva et al., 2023). Therefore,

it requires to raise the need to link educational technology in financial management with different areas of knowledge, such as medicine, engineering, psychology, and every other service sector business. There is a need to change the curricula of financial management to apply educational technology for better effect. Developing financial managers' key competencies and qualifications and personnel competencies by defining and applying educational technology is felt. it is suggested to provide a strategic view in applying educational technology in financial management.

Training systems for financial managers need to be included in financial management curricula. Conducting seminars on introducing educational technology in financial management for faculties and authorities.

Finally, it is necessary to mention that, as in all research, our study is subject to a series of limitations. The first is that the set of documents considered for the bibliometric the analysis covered only the articles contained in the Scopus repository, so we can affirm the existence of a greater number of articles in repositories such as the Web of Science (WOS) or in journals not covered by the quality criteria that form part of the WOS Core Collection.

Declaration of Competing Interest
The author declares that he has no competing financial interests or known personal relationships that would influence the report presented in this article.

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