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Bibliometric Visualization of Literature on Information and Communications Technology (ICT) in Education

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ABSTRACT

Information and communication technology (ICT) in education, also known as education technology, is an important component of SDG 4's goal of improving educational quality. This Bibliometric study examines research patterns over time using the term "education technology." Three research questions are prioritised: (1) What is the current publication trend in EduTech? (2) What are the most popular themes among EduTech scholars? (3) What is the current citation pattern of EduTech publications? The methodology of this study uses bibliometric analysis with quantitative approach (document trend statistics) in the data scopus.com database for the years 1946 to 2022. The study's findings showed the number of publications on this education technology has increased since 2005, and this trend is expected to continue, with a recent notable theme being a focus on methodology studies, particularly in the field of health education. Furthermore, the most cited document was an article about activity design by Koehler et al., (2005), and the most cited author was Jonathan Michael Spector. Apart from Europe, Asian countries such as Malaysia and China are currently conducting more EduTech research. The implications of this study provide a positive outlook on the future of multiple educational technology research projects. Global pressures such as the pandemic and the need for IR4 are having an impact on the explosion of educational technology in society, government, industry, the environment, and academia.

Keywords: *ICT, education technology, EduTech, bibliometric studies, VOSviewer.*

INTRODUCTION

Information and communication technology (ICT) is one of the advances used as a component of educational tools, and it has played an important role in the effective integration of technology and the lecturer for high-quality teaching and learning (Mohamad, Idrus, & Ibrahim, 2018). However, according to Fazil (2018), the government advocates for the use of Information and Communication Technology (ICT) systems in all public sectors, despite the fact that some public sectors, such as public policy, financial reporting, and organisational planning, do not use it. While at the government system, the ICT system was incompatible. In terms of education, some countries have yet to reap the full benefits of ICT. For example, Lubis, Idrus, and Sarji (2018) state that the use of ICT in education has resulted in significant changes in learning and brought many benefits to higher learning institutions. However, when compared to other Southeast Asian countries, the development of ICT in higher education institutions in Indonesia is a negative value (e.g., Singapore and Malaysia). This is due to a number of factors, including a lack of knowledge and motivation, particularly in Medan, North Sumatera. Medan, Indonesia's fourth largest city, has a low penetration of ICT utilisation when compared to other cities of its size.

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For many years, the integration of technology in education has been a major topic of study and debate. Since the deployment of the first computer system in the 1960s, various methods and programmes have been established to promote the integration of Information and Communications Technology (ICT) in all educational fields (Nordin et al., 2010; Salehi & Salehi, 2012). In today's educational environment, the most important demand for the content of classes in the advanced education system is the revision, consolidation, and diffusion of technology. Because of the popularity of these technologies in terms of the benefits or components they provide in Teaching-Learning (T-L) processes, an increasing number of teachers at all levels of education and disciplines are betting on their use in the classrooms.

"Education technology" is the term used to characterise this phenomenon. Educational technology is a method of using current technology to improve educational quality in a systematic and organised manner (efficiency, optimality, correctness, and so on) (Nerru et al., 2021). This is a methodical approach to conceptualising, implementing, and evaluating the educational process, i.e. learning and teaching, as well as assisting in the application of modern educational teaching approaches (Stošić, 2015). In a nutshell, education technology is a set of skills for interacting with a computer in an automated environment to create programming and computing products that can be used for a variety of learning activities.

Technology as a pedagogical tool motivates students and teachers to digitalize their teaching/learning process, even if they are not academically trained or aware of why, when, and how it might be employed (Davies, 2011). Information and communication technologies (ICT) provide students and teachers more freedom in tailoring learning and teaching to individual needs, and society is forcing schools to keep up with this technological innovation. Given the popularity and ubiquity of this element in daily life, this branch of knowledge has experienced growth in the previous two decades (Jiménez et al., 2019). Several studies have explored the impact of a range of factors on the innovative use of ICT at various levels of education and disciplines. The studies conducted were focused on the method, the teacher, or the student.

As technology has become more integrated into education, a significant amount of research has been conducted in this field. As a result, the purpose of this research is to look at the trend of published literature on education technology in the Scopus database, based on publication profile, keywords, and citation pattern. In this study, bibliometric analyses were used to track the trend of publication in education technology. Bibliometrics is a quantitative analytic methodology that uses mathematical and statistical techniques to determine the relationships and effects of publications in a specific field of study (Lee at al., 2020).

Bibliometric mapping is an important research subject in bibliometrics that has quickly gained interest among education technology experts (Börner et al., 2003). The following are the main research questions concerning education technology that have guided the bibliometric analysis of this study:

QR 1: What is the current publication trend on EduTech?
QR2: Which themes are the most popular among scholars on EduTeach?
QR3: What is the current citation pattern of publication on EduTech?

METHOD

The Scopus scientific database was used in this bibliometric research to look for papers that included the term EduTech or education technology in a pattern approach. This research used all types of documents from 1947 to 2022 that were published in the Scopus database. Scopus is one of the most comprehensive abstracts and databases of intellectual literature citations, with over 24,000 titles, 360 periodicals, 750 book series, 195,000 non-serial volumes, and 60 million entries from an array of disciplines. The database could provide a broad overview of global research findings as well as detailed trends. The international scientific community also considers Scopus one of the most important sources of useful information.

This study uses bibliometric analysis, in line with quantitative and statistical analysis to describe the trends of research articles in specific topics and time periods (Martí-Parreño, Méndez-Ibáñez, & Alonso-Arroyo, 2016). This process involves identifying keywords for search purposes. We use the term "education technology" when searching in the Scopus database to get information about the article's title only. The search was conducted on October 5th, 2021. No search limitations determine results published from 1947 to 2022. Scopus yielded 2,024 document results from our search, and we found various terms linked to "Technology Education" study, such as Technology, EduTech, ICT, CALL, and Technology Education. Figure 1 depicts a data analysis flow chart using the keyword "Education Technology."

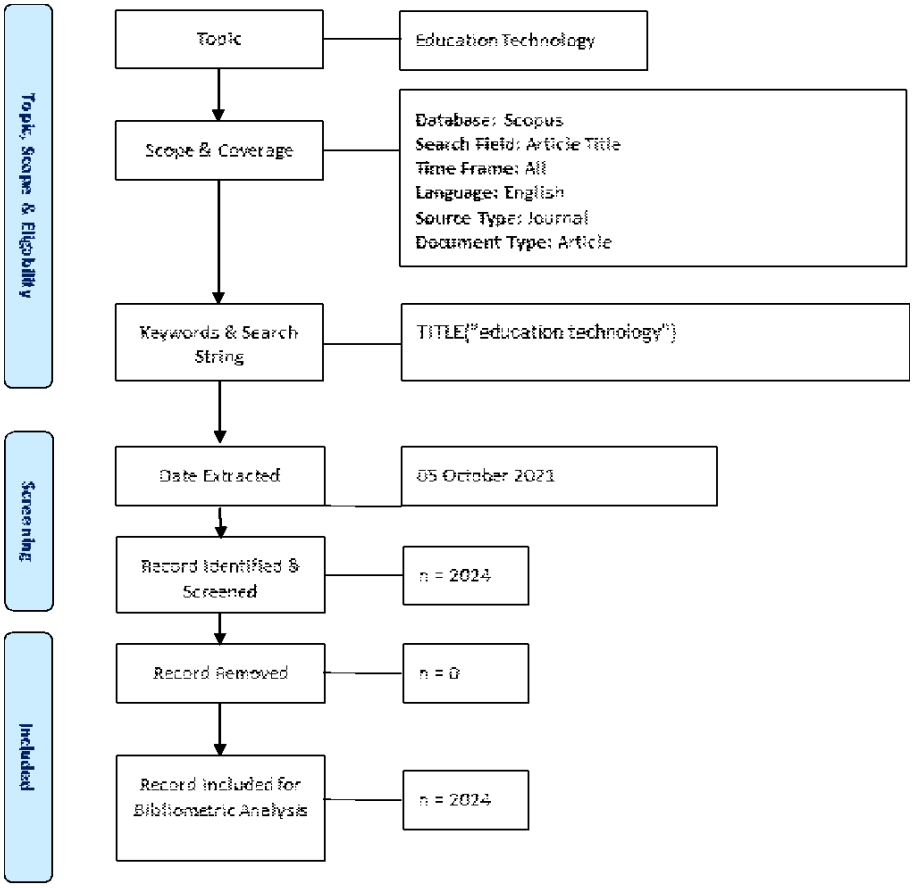

Figure 1: Data analysis flow chart

There are three research questions in this study, which correspond to the three phases of research analysis. Table 1 shows the analytical data for the three phases:

Table 1: Three phases of analytical data

Phase	Research Question	Data Analysis	Action
One	QR 1: What is the current publication trend on EduTech?	Document title; Type of document; Document by subject area; Keywords	Frequency
Two	QR2: Which themes are the most popular among scholars on EduTeach?	the most frequently used keywords; the most used words found in article abstracts; the distribution of the used words in article abstracts by year	Frequency
Three	QR3: What is the current citation pattern of publication on EduTech?	citations by documents; citations by author; citations by source; citation by country	Frequency and Cite Score

RESULT AND DISCUSSION

The study's findings are based on these three research questions: QR 1: What is the current publication trend on EduTech? QR2: Which themes are the most popular among scholars on EduTeach? QR3: What is the current citation pattern of publication on EduTech? Bibliometric results comprise the documents profiles, the keywords and trend of publication, and the citation pattern of publications on education technology in Scopus Data Based. Visualisation maps were also used to show the trend of publications based on keywords and the citation pattern of publications on documents, authors, sources, and countries.

Documents Profiles

To answer Research Question 1, the finding's document profile comprises data on documents by year, document type, and document subject area. This finding's document profile includes data on documents by year, document type, and documents by subject area. A total of 2024 articles were published and the first study was conducted in 1947. Figure 2 shows the total number of Scopus publications. While there has been an increase in the number of studies from the past to the present. The graph illustrates that while EduTech publishing has been low since 1947, it has begun to increase after 2015. With 156 documents, the year 2020 has the most publications.

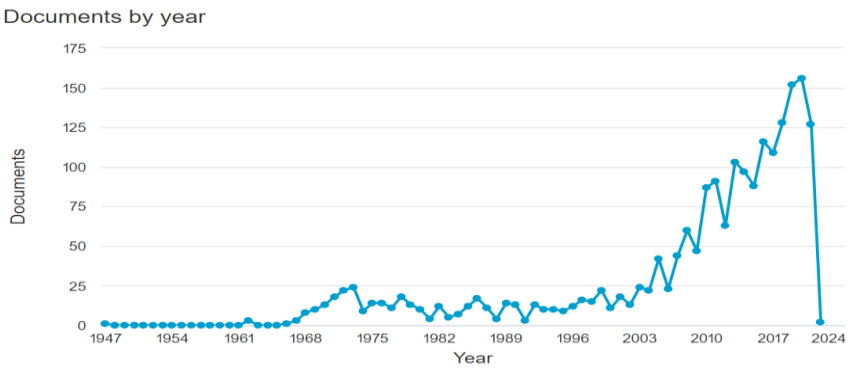

Figure 2: Document by year (this figure is obtained from scopus.com)

Between 1947 and 2022, Scopus published thirteen different types of documents in this study. Figure 3 illustrates a graphical representation of the document distribution by type from 1947 to 2022. More than half of the documents published, 1109 (54.8 %) of the total, were articles. Among various types of publications, article-type documents will be the most widely published in 2020. This is projected to be the result of the Covid-19 pandemic, which impacts education and necessitates the use of technology to support the educational system, particularly for remote and online learning.

An article by Annis et al. (2020) on evaluating early lessons from a remote patient monitoring engagement and education technology solution for patients with coronavirus disease was one of the articles that received a lot of citations in 2020. Also, Kamal et al. (2020) published an article assessing the feedback of students who shifted to totally online learning as a result of the lockdown and campus closure. The following articles publications were 462 conference papers (22.8), 150 book chapters (7.8%), 114 reviews (5.6%), 73 editorials (3.6%), 26 books (1.3%), 23 conference reviews (1.1%), 23 erratum (1.1%), 22 notes (1.1%), and others such as retracted, short survey, and letter. One document was undefined by Scopus.

Fried et al. (2004) and Tondeur et al. (2004) were two of the most cited works published in conference papers. Fried et al (2004) discovered that the McGill Inanimate System for Training and Evaluation of Laparoscopic Skills (MISTELS) is a practical and low-cost inanimate system designed to teach and measure technical laparoscopic skills. This approach is dependable, accurate, and educational. Tondeur et al. (2012) applied a meta-ethnography technique to examine qualitative research that focused on strategies to equip pre-service teachers to integrate technology into their lectures.

For the document type book chapters, Dillenbourg and Jermann (2010) explain 14 design factors connected to the concepts of classroom orchestration and learning ecosystems, and show how they are manifested in three learning environments. The design factors give teachers a teacher-centered, integrated view of educational technology design for face-to-face classroom activities that works successfully. Koehler et al. (2014) present a framework called technological pedagogical content knowledge (or TPACK for short) that explains the types of knowledge that a teacher needs to effectively integrate technology. These two book chapters had the greatest number of citations in the database.

In the category of review in education technology research, both Mishra and Koehler (2006) and Issenberg et al. (2005) reviews were notable. Mishra and Koehler (2006) presented a conceptual framework for educational technology by extending Shulman's formulation of "pedagogical content knowledge" to the phenomena of instructors incorporating technology into their pedagogy. Issenberg et al. (2005) review and synthesise existing educational science studies on the use and efficacy of simulation technology in medical education.

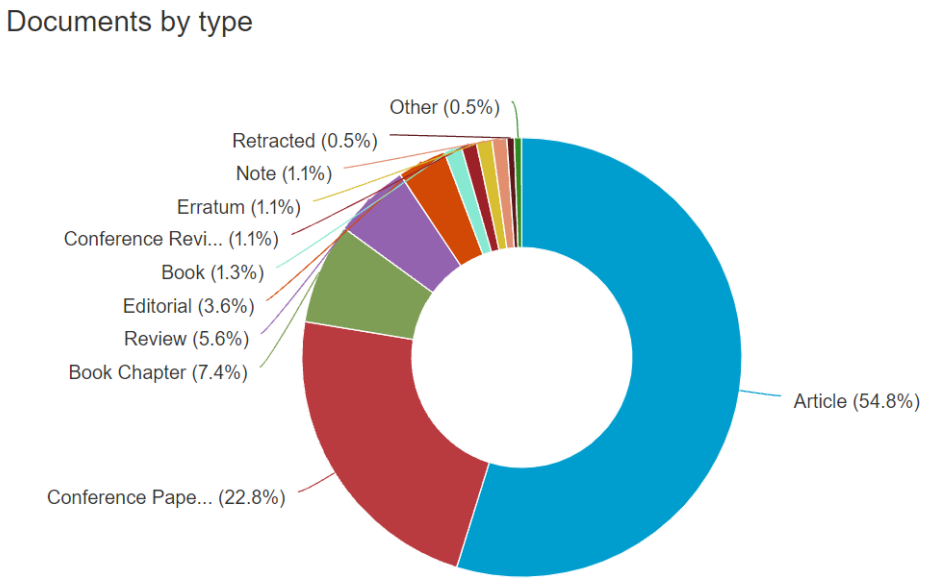

Figure 3: Document Type (this figure is obtained from scopus.com)

The document type on the subject in the Scopus database was also examined. The relevant data are presented in Figure 4.

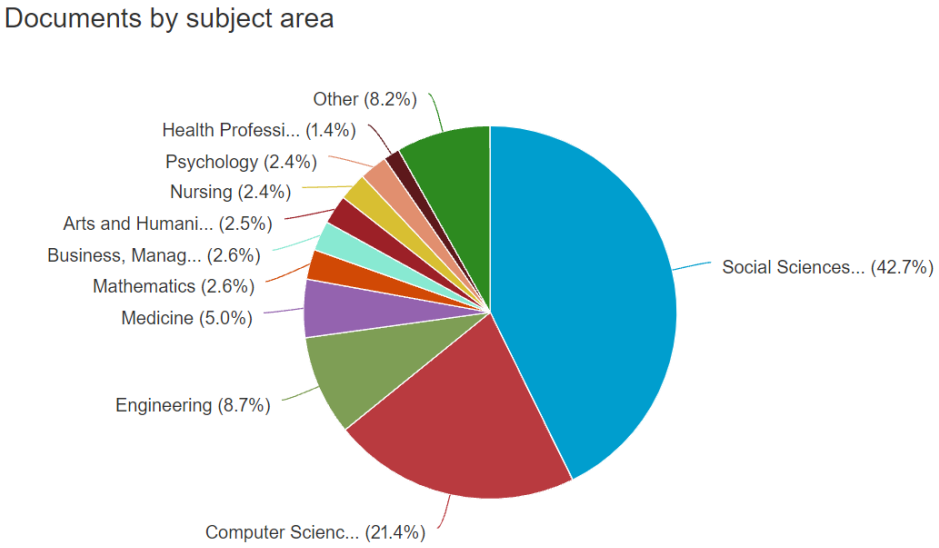

Figure 4: Document by subject area (this figure is obtained from scopus.com)

Figure 4 shows that the majority of publications' subject areas are in the social sciences (1365 (42.7%), followed by computer sciences (685 (21.4%), engineering (277 documents (8.7%), and medicine (161 (2.6%). Business, management, and accounting, art and humanities, nursing, psychology, and health professions are examples of fields with fewer than 100 publications. Other areas with fewer than 30 publications include agricultural and biological sciences, biochemistry, genetics and molecular biology, chemical engineering, chemistry, decision sciences, earth and planetary sciences, economics, econometrics and

finance, energy, environmental science, materials science, multidisciplinary, neuroscience, pharmacology, toxicology and pharmaceutics, and physics and astronomy.

Selwyn (2010), Anshari et al. (2017), Holden and Rada (2011), Caswell et al. (2008), and Perkins et al. (2006) are among the publications in the subject of social science that have received widespread notice, each one has over 150 citations. Selwyn (2010) argues for academic study and writing that goes beyond the learning potential of technology to provide social scientific descriptions of the often compromised and restricted realities of education technology use "on the ground." Anshari et al. (2017) used a survey and an interview with a focus group of students and discovered that students utilize their smartphones to access teaching materials or supporting information that is often only available via the Internet. Smartphones are used as learning tools by students for a variety of reasons, including convenience, portability, comprehensive learning experiences, multi sources and multitasking, and environmental friendliness. They also use smartphones to communicate with teachers outside of class and to manage their group projects. However, integrating smartphones into a classroom setting is a difficult undertaking.

Holden Rada (2011) explored the impact of perceived usability and technology self-efficacy on teachers' acceptance of new technology. The inclusion of perceived usability into the Technology Acceptance Model (TAM) explained more variance and had a significant influence on TAM elements than its absence, according to Holden andRada (2011), demonstrating the importance, positive effect, and the need of evaluating usability when researching educational technology acceptance and usage behaviour. And Caswell et al. (2008) explored the new distance education technologies, such as OpenCourseWares as a fulfilment of the promise of the right to universal education. Also, Perkins et al. (2006) explored the Physics Education Technology (PhET) as Interactive simulations for teaching and learning physics

The publication of authors such as Billinghurst and Dünser (2012), who assess AR experiences in an educational setting provide insights into how this technology can enhance traditional learning models and what obstacles stand in the way of its wider use, is among the significant publications in the field of computer science.

KEYWORD AND TREND OF PUBLICATION

The examination of the most frequently used keywords, the most used words found in article abstracts, as well as the distribution of the used words in article abstracts by year, were utilised to address Research Question 2, which was to track the trend of publication in education technology. The analysis was built by VOSviewer software. Figure 5 provides a visualization of the most frequently used keywords by the authors on Scopus database. There are 353 keywords in all documents related to educational technology, with 7993 links. Each of the colours in this figure represents a cluster.

The keyword “educational technology” has the highest occurrence of 760. The keyword "educational technology" was frequently used in the co-occurrence of one or more other keywords. According to the analysis, there are six cluster keywords, with the keyword "education technology" having the largest cluster (100 keywords) in Figure 3.4. “Educational technology” (Billinghurst & Dünser, 2012; McGowan et al., 2012; Iyer, Aziz, & Ojcius, 2020; Clunie et al., 2018), “teaching and learning” (Bahcivan et al., 2019; Wong, 2016; Barbera, Gros, & Kirschner, 2015; Chimalakonda & Nori, 2012), “teaching” (Gudanescu, 2010; Shakirova & Valeeva, 2016; Hurst, 2014; Loui, 2005), “technology” (Zepp, 2005; Dexter & Riedel, 2003;

Heinecke et al., 2001; Laurillard, 2001), "motivation" (Al-Ahdal, Alfauzan & Al-Sa'egh, 2021; Garaika, 2020; Mejía, 2019; Sapuh, 2018) and other keywords appeared in the first cluster (red).

Cluster 2 (green) has 75 keywords, including "article", "curriculum" (Xue & Nan, 2011; Hamidi et al., 2021; Huang, 2010), "university education" (Povzun & Apokin, 2018) "audiovisual aids", "teaching material" (Zhang, Shi & Hui, 2014; Cagiltay et al., 2019; Da Silva et al., 2018) and etc. Cluster 3 in blue colour included 55 keywords, which are "modern education technologies" (Cai et al., 2017; Yu, 2015; Zhang, 2014), "modern educations" (Li & Yang, 2013; Yang, Cai & Song, 2020; Massyrova et al., 2018), "curricular" (Almaden & Ku, 2017), "education computing" (Eisenberg & Jacobson-Weaver, 2015), "digital technologies" (Samedov et al., 2020; Liu et al., 2015) and other keywords. There are 49 terms in Cluster 4 (yellow) in Figure 4, including "blended learning" (Puttasem, 2019; Cai et al., 2017; Kornilov, et al., 2017), "technology accepted model" (Osman & Köhler, 2013; Osorio-Saez, Eryilmaz, & Sandoval-Hernandez, 2021), "technological change" (Tatnall, 2008; Brumbaugh, 1992), "learning technologies" (Basogain et al., 2016; Schwendimann et al., 2015; Arenas, 2014), "online learning environment" (Antonenko, Toy & Niederhauser, 2012; Chizhu et al., 2011; Oyelere et al., 2021) and others.

Cluster 5 (purple) contained 39 keywords, comprising "human" (Riojas, Lysecky & Rozenblit, 2012; Yu, Du, & Li, 2020; Rodrigues et al., 2014), "health education" (Sousa & Turrini, 2012; Martins et al., 2011; da Costa et al., 2020), "female", "nurse", "age" and others. The final light blue cluster has 35 terms such as "technological development" (Shmeleva, 2018), "problem solving" (Stevens, Galloway & Berka, 2007; Elliott & Kennedy, 2006; Ching, Hsu & Baldwin, 2018), "teaching methods" (Zhao, 2010; Gonge et al., 2021), "technology enhanced learning" (Scanlon, 2021; Latif, 2017), "innovation" (Kalman, 2016; Riley, 2007) and so forth.

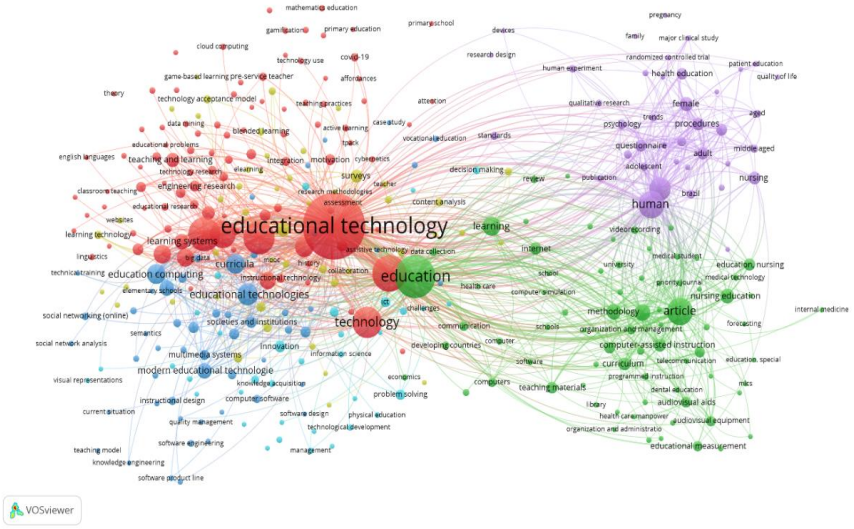

Figure 5: The most used keywords in articles relating to Edutech (this figure was generated from VOSviewer)

Figure 5 presents the distribution of the articles using the keywords by year in this study. The examination of the frequency of key works by year allows for the observation of the most frequently discussed subjects in publications, allowing for the identification of

research trends. From 2000 to 2005, the focus of the publications was on articles, audiovisual aids, and education measurement, all of which are keywords in Cluster 2. Referring to the years of 2005 to 2010, the documents were concentrated in the topics of education, technology, internet, cybernetics, problem-solving, learning, and developing countries. Between 2010 and 2015, educational technology was heavily covered in publications, with topics such as blended learning, technology to enhance learning, teaching and learning, artificial intelligence, and motivation.

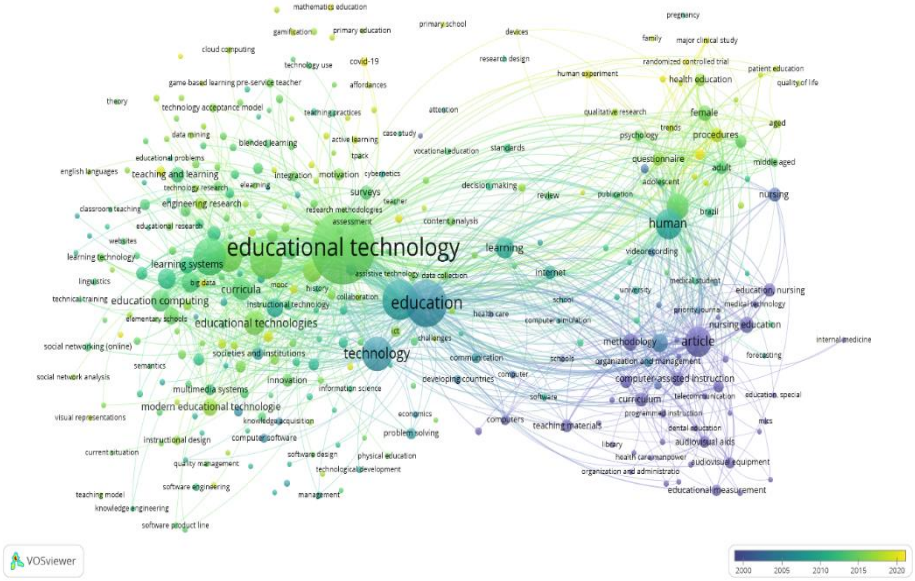

Figure 6: Distribution of the number of articles using the keywords by year
(this figure was generated from VOSviewer)

As shown in Figure 6, a map was generated to depict the distribution of the most commonly used words in article abstracts. It indicates that there were six clusters that were interconnected and generated intermediate colours. The words most used in article abstracts were “content”, followed by “questionnaire”, “educator” and “implication”. The analysis reveals that the word “educator” has the largest number of occurrences in the Scopus database and is linked to other words, such as “ implication”, “chapter”, “journal”, “future research” and etc. The second largest cluster was green in colour and contained 100 words such as "society," "organisation," "reform," "educational process," and other words. The third cluster (blue) stands for "questionnaire" and includes 72 words such as "difference," "attitude," "perception," "acceptance," "intention," and so on. The word “content” was the 4th cluster in the map, with 61 words including “interview”, “domain”, “expert” and others. Following is "ict" in cluster 5 (purple), which has 43 words including "game," "engagement," "behaviour," and others. The last cluster was in light blue colour with 12 words including “professional development”, “dilemma”, “phenomena”, “transformation” and others**.**

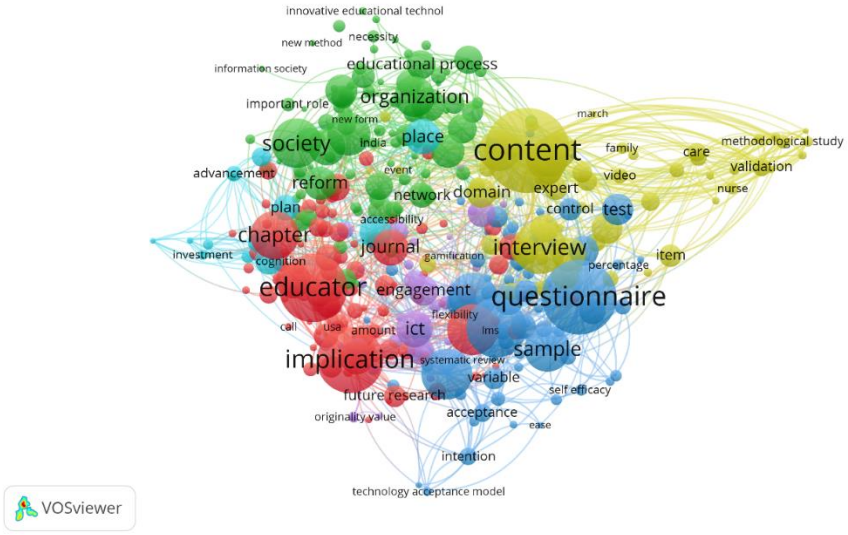

Figure 7: Most used words found in article abstracts (this figure was generated from VOSviewer)

The map in Figure 7 depicts the distribution of the most commonly used words in article abstracts by year. When the distribution of these words is plotted year by year, it becomes clear that more recent publications are more likely to focus on methodological study. Between 2014 and 2018, the most commonly used words were "content," "questionnaire," "sample," "technology acceptance model," and others. The words such as "educator," "implication," and "professional development" were the most commonly used words in the article abstracts between 2010 to 2012.

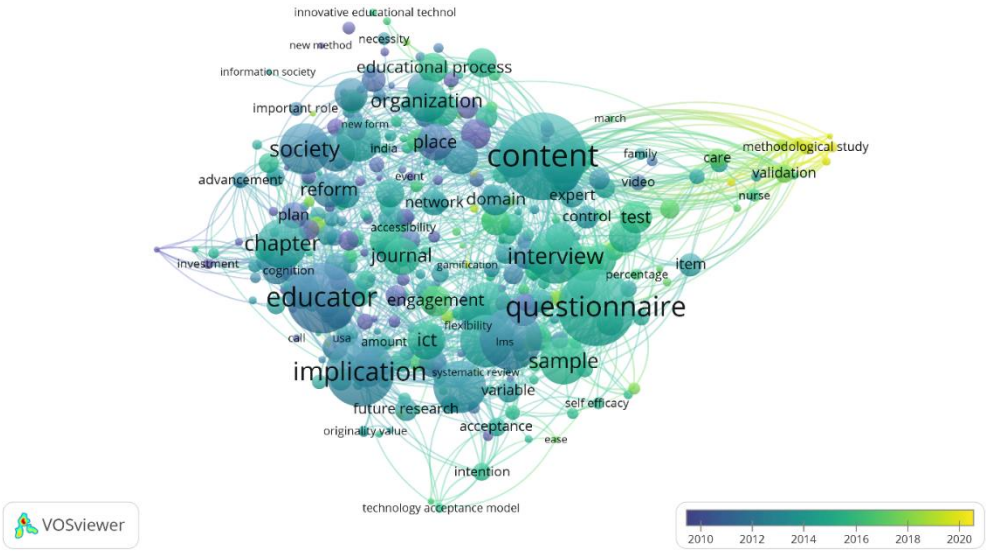

Figure 8: Distribution of most used words in article abstracts by year
(this figure was generated from VOSviewer)

Citation Pattern of Publication on Edutech

The evaluation pattern of publication on Eduteach comprises analysing citations by documents, author, source, and country in order to address the third research question in this study. The Figure 8 presents the mapping of the most cited document by year. The

research article by Koehler (2005), titled What Happens When Teachers Design Educational Technology? Knowledge of Technological Pedagogical Content Development was the most cited document with 518 citations. They define Technological Pedagogical Content Knowledge (TPCK) as a way of showing what teachers need to know about technology and argue that authentic design-based activities play an important role in the development of this knowledge. Participants in the study thought that working in design teams to solve real-world problems was valuable, engaging, and enjoyable. More importantly, the participants appeared to have improved greatly in their understanding of technology applications as well as their TPCK, both individually and as a group.

This is followed by Sang et al. (2010) article with 360 citations, titled Student teachers' thinking processes and ICT integration: Predictors of prospective teaching behaviours with educational technology. Sang et al. (2010) examined the impact of gender, constructivist teaching beliefs, teaching self-efficacy, computer self-efficacy, and computer attitudes on projected ICT use among Chinese student teachers. Except for gender, the results demonstrate that prospective ICT integration is highly correlated with other teacher-related characteristics.

With 326 citations, Dillon and Gabbard (1998)'s article was the third most cited in the Scopus databases, titled Hypermedia as an Educational Technology: A Review of the Quantitative Research Literature on Learner Comprehension, Control, and Style. Dillon and Gabbard (1998) study emphasises hypermedia technology as a significant step forward in the creation of educational tools to improve learning. Back in the 1990s, researchers discovered that the benefits of hypermedia in education are confined to learning activities that need repetitive manipulation and searching of information, and that they are distributed differently among learners depending on their ability and chosen learning style.

Notably, a recent work by Bond et al. (2020), titled Mapping research in student engagement and educational technology in higher education: a systematic evidence map, has 62 citations despite the fact that it was only published one year ago.

Figure 9 visualises the most cited author by year. The most cited author was Spector who was cited in 1794 documents, and followed by Rushby who was cited in 169 documents. The most recently cited authors were Bond and Zawacki-richter who were both cited in 6 documents.

The most cited document by Spector was Teacher Beliefs and Technology Integration, which looked into how teacher beliefs were related to technology integration practises. Twenty-two instructors took part in the study, who were part of a four-year professional development project supported by the US Department of Education. The authors reveal specific relationships between teachers' beliefs and technology integration strategies (Kim et al., 2013). And, Rushb's most cited document was an editorial in the British Journal of Educational Technology titled Editorial: An agenda for mobile learning.

Bond and Zawacki-Richter (2018)'article titled Systematic review of research on artificial intelligence applications in higher education – where are the educators? form these two authors were the most cited document. Through a systematic review, this article provides an overview of research on Artificial Intelligence (AI) applications in higher education. The researchers discovered that there is essentially little critical thought on the problems and risks of AIEd, a weak relationship to theoretical pedagogical viewpoints, and a need for more ethical and educational exploration (Zawacki-Richter, Marín, Bond, & Gouverneur, 2019).

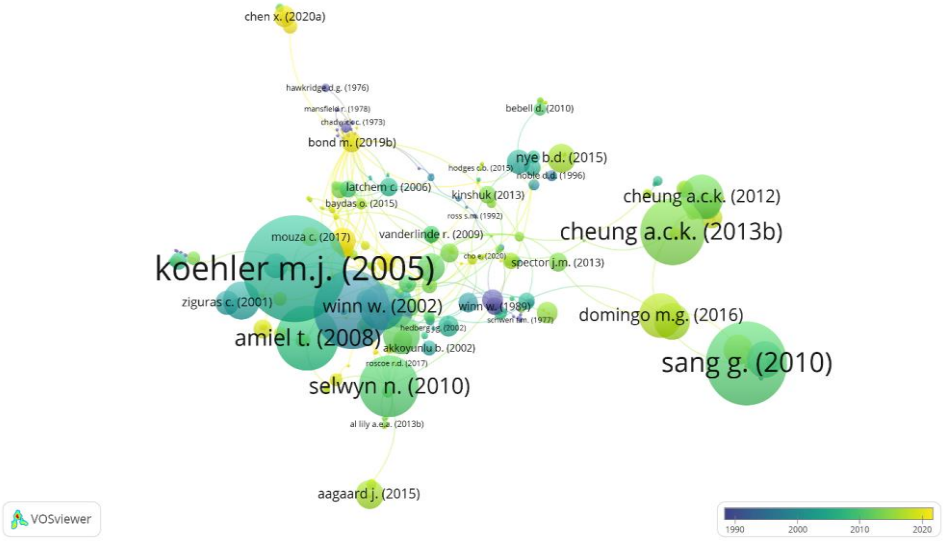

Figure 9: Most cited document by year (this figure was generated from VOSviewer)

In the Scopus database, documents on education technology were published by 159 different sources. The most cited sources on education technology are mapped out by year in Figure 9. The British Journal of Educational is the most cited source, with 199 documents published between 1998 and 2000. Educational Technology Research and Development came in second, with 58 documents published in 2007. Learning, Media, and Technology, as well as the International Journal of Educational Technology in Higher Education, were the most recently cited sources, with a total of 12 documents.

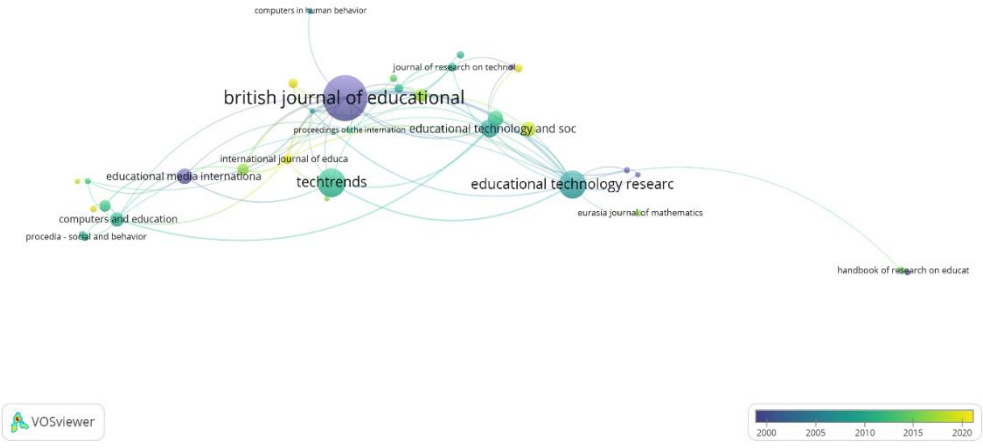

Figure 10: Most cited author by year (this figure was generated from VOSviewer)

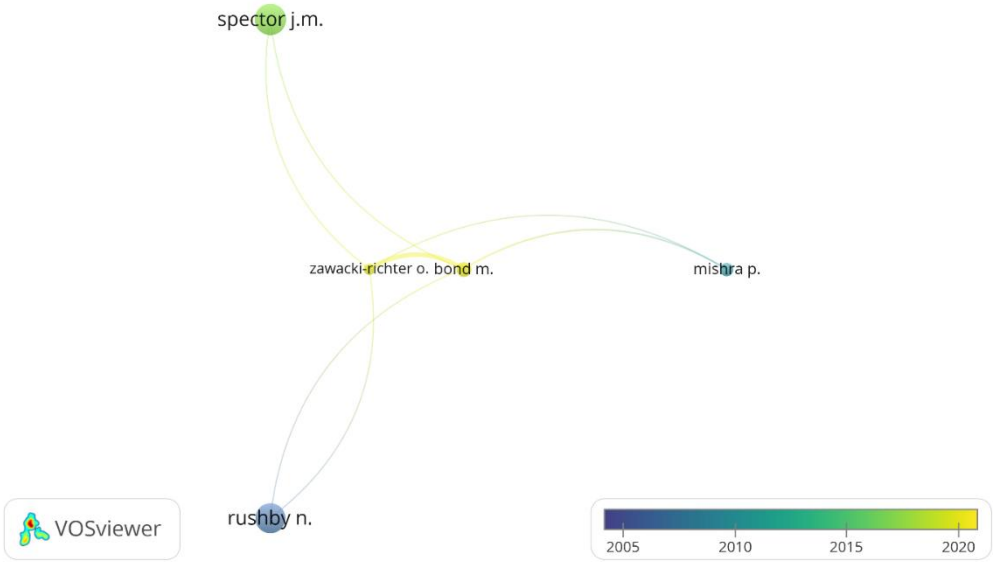

Figure 11: Most cited source by year (this figure was generated from VOSviewer)

Between 1947 and 2021, 92 countries/regions contributed to the publication of 2024 documents on education technology research. The documents reveal a wide range of geographical origins; Figure 3.11 depicts the top cited countries/regions by year based on the number of published articles. The United States is the most cited country, with 578 papers, followed by the United Kingdom with 139 documents, and both countries with documents published between 1998 and 2000. China has 188 documents among the top three most cited countries, all of which were published in 2015. In addition, the most recently cited documents come from the Russian Federation and Spain.

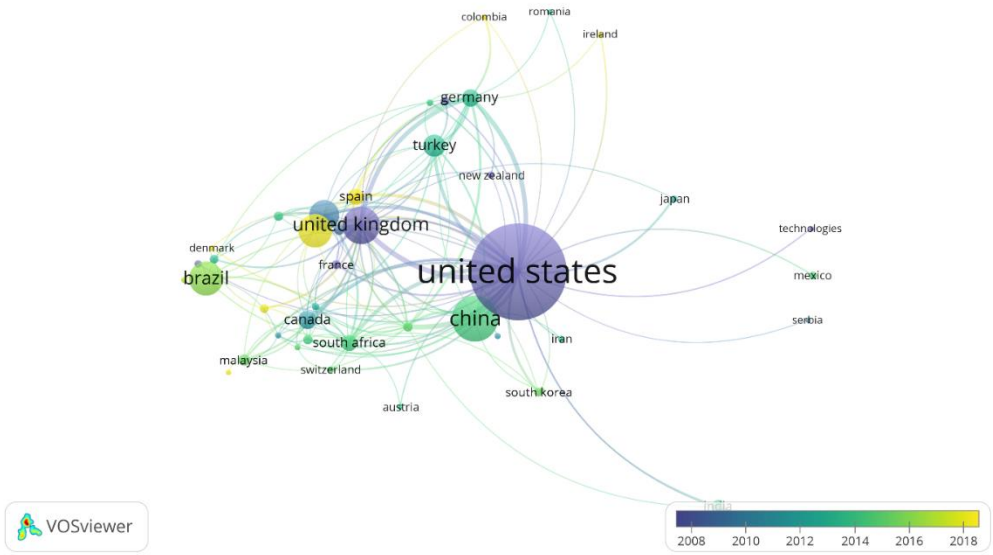

Figure 12: Most cited Countries by year (this figure was generated from VOSviewer)

Bibliometric analysis approaches were used to uncover publications on education technology in the Scopus database to answer the aforementioned research questions. To address research question 1, this study discovered that there has been some research on

educational technology over the previous 60 years, but it has not been extensive. After 2015, the number of academic articles increased, showing a growing interest in research in the area of education technology. Trend analysis indicates that this trend will continue, particularly in light of the epidemic condition and technological advancements.

This is demonstrated by studies published in 2020, many of which are related to the impact of the COVID-19 pandemic, such as the challenges of online learning during the crisis (Cai & King, 2020; Badar et al., 2020; Kaloostian et al., 2020; Kumar et al., 2020; Hidayati & Saputra, 2020), the use of technology tools in the online implementation of the curriculum (El Gourari et al., 2020), and the impact of COVID-19 on various levels of education and disciplines (Currie et al., 2020; Linjawi & Agou, 2020), to name a few. This also leads to the database Scopus having the most publications in the field of educational technology in 2020. This suggests that educational technology is a viable research field in multi-subject areas, with a growing research community and a thriving academic competitive force. The "article" and "conference paper" category led the others when it came to the types of papers most commonly published on the subject. As a result, it is projected that the number of publications of this sort will continue to increase in the future, as it has for several years.

The aim of research question 2 is to identify the themes that are the most popular among scholars on EduTeach. The analysis of 3 categories of keyword mapping are used to identify the popular themes in EduTeach. The authors' most frequently used keywords in this study were "education technology", "article", "modern education", "blended learning", "human", and "technology development". To summarise, the study of how the use of technology teaching materials in the curriculum promotes student motivation is the most popular theme among EduTeach scholars. This is followed by the research on student adaptability to technology education. Besides, education technology in the field of health education is also a popular theme among scholars. This study identified that recent publications are more likely to focus on methodological study such as the study from Hara et al. (2021); de Oliveira Cabral Melo et al. (2021); Rocha et al. (2021); Soares et al. (2021); de Campos et al. (2021) and others. This was illustrated by the key descriptors in the bibliometric map, indicating that the most used keywords and words in abstract articles by year are "interview", "domain", "expert", "survey questionnaire", "systematic review", and others. Notably, most of the methodological studies were in the field of health education. Methodological studies are currently viewed as the frontrunner in education technology research, and this study suggests that it might be applied to another discipline of study.

For study question 3, citation analysis by documents, author, source, and the country was used to evaluate the pattern of publication on EduTeach. The most cited document was a research article by Koehler et al. (2005), which focused on learning by design activities as an effective instructional technique for developing deeper understanding of the complex web of relationships between content, pedagogy, and technology, as well as the contexts. They provide the Technological Pedagogical Content Knowledge (TPCK) as a manner of describing what teachers should know about technology. Based on the findings, Spector was the most cited author with 216 co-authors in the field of education technology research. His documents were cited in 1692 documents, the majority of which were articles, editorials, and book chapters. Following that, the US was the most cited country followed by the UK and the most recently cited documents were from the Russian Federation and Spain. Apart from Europe, greater research in the field of EduTeach was identified in the Asia countries such as Malaysia and China, according to this analysis. Even before COVID-19, an increment in the studies of

EduTeach revealed that integrating technology into education received a high response in developing countries.

CONCLUSION

The current rate of technological innovation makes it easier to convey data from one person to another. As technology progresses, it becomes easier for everyone to access social media, to the point where some news organisations seek to exploit it as a news source. Meanwhile, in order to avoid public panic, it is critical to educate society at a young age about the impact of fake news on social media (Uran, Mohamed, & Abdul Aziz, 2022). Information and communication technology (ICT) is already used in almost every aspect of life, and its global significance is expected to increase in the future. Information and communication technology (ICT) is now widely used in many aspects of society, including education. The term "Education 4.0" was coined as a result of Industry 4.0's inescapable impact on the educational system. The incorporation of technology into nearly every aspect of educational education characterises the era of Education 4.0. Education nowadays is primarily reliant on the internet, as well as mobile devices, computers, and virtual worlds, as the primary medium for knowledge sharing.

This bibliometric analysis research highlights current publication trends, the most popular themes and citation patterns in the field of studies in EduTech. The number of publications in this subject has increased since 2005, and it is expected that this trend will continue because integrating technology into education is a necessity that offers significant benefits in the teaching and learning process. Furthermore, a recent prominent theme has been an emphasis on methodology studies, with most researchers focusing on developing methods for data collection, particularly in the field of health education. As a result, our findings imply that similar methodological study could be applied to other disciplines such as mathematics, social sciences, business, and others.

The analyses identified that Koehler et al. (2005) article about activities design was the most cited document and Jonathan Michael Spector was the most cited author. Despite the fact that the study by Koehler et al. was published over two decades ago, it had a significant impact on this subject, particularly in terms of structuring teaching and learning activities. In addition, EduTeach research from other countries is required to uncover the development, educational efficiency and efficacy, methodological study, significance, and challenges of technology integration in education. With the never-ending development of technology and the increasing integration of this technology into all disciplines, EduTech studies tend to be on the rise. As a result, extensive studies and innovation in this subject is demanded.

The limitations of this study being identified are 1) The reviewer is unable to draw conclusions regarding the quality of research or specific research findings because the bibliometric analysis does not analyse study findings. 2) This study only focuses on the Scopus database. Therefore, the findings in this study may not reflect the whole research trends on Education Technology.

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