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Digital and Entrepreneurial Education Research is a Different Framework

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Abstract

The research aims to provide a conceptual framework to demonstrate the difference between digital and entrepreneurial education and its development, especially for young individuals. For this purpose, a bibliometric analysis method was employed in the literature for digital and entrepreneurial education research. Research data were taken from the WoS database. Authors who have conducted intensive research on the subject in the literature, keywords they frequently emphasize, country addresses, organizations, the most relevant sources, trending topics, and productivity times are included. The most frequently emphasized terms in digital and entrepreneurial education research are ranked as follows, entrepreneurship, education, entrepreneurial, digital, innovation, digitalization, entrepreneurial intention, entrepreneurship education, digital transformation, and higher education. In research on digital and entrepreneurial education, in the network of co-occurrence relationships of the most emphasized words by the authors, it has been found that entrepreneurship, education, digital, entrepreneurial, innovation, technology, business, digitalization, digital technology, university, digital transformation, entrepreneurial intention, entrepreneurial ecosystem, entrepreneurship education, and entrepreneurial orientation have the strongest relationships. The strongest relationships in terms of centrality and density have been understood as between entrepreneurship, education, entrepreneurial, digital, innovation, digitalization, entrepreneurial intention, digital transformation, COVID-19, and digital entrepreneurship. Inferences and suggestions were made regarding the research results.

Keywords: digital education, entrepreneurial education, new approaches, bibliometric analysis.

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Digital and Entrepreneurial Education Research is a Different Framework

Introduction

In recent years, the concepts of entrepreneurship and digital education has been in constant development. Many countries have been trying to integrate their education systems with a digital and entrepreneurial education approach. According to the European Commission (2016) reports stated that between 2014 and 2020, the aim was to teach and develop 450,000 internships under the Erasmus program across EU countries. The Eurydice (cited in EACEA, 2016) report for 2014-2015 highlighted that specific strategies for entrepreneurial education had been developed in Scandinavian countries, with Denmark, Sweden, Finland, and Norway ranked first in innovation. Additionally, it was noted that Bosnia and Herzegovina, Montenegro, and the Former Yugoslav Republic of Macedonia in the Western Balkans also had specific strategies for entrepreneurial education. Kocaman-Karoğlu et al. (2020) stated that the concept of digital education, especially with the onset of COVID-19, began to develop both in Türkiye and other countries.

People worldwide need the continuity of digital and entrepreneurial education to create more social added value. The continuous development of digitalization necessitates the emergence of innovations in the educational literature. The development of entrepreneurship alongside education creates the need to highlight the integration of digitalized educational practices. In this regard, research on digital and entrepreneurial can offer valuable new perspectives to the academic literature. The digital transformations occurring in higher education may have characteristics that encourage the emergence of new entrepreneurs. The integration of the entrepreneurial education approach into higher education policies can, during the digital transformation process, primarily help students clarify their future goals.

The strongest societal structures of the future will be those countries that invest in their education systems, crown technology with entrepreneurial activities, and can raise strong generations. Education, especially, keeps the entrepreneurial spirit alive among young people. Encouraging entrepreneurial education will create an innovative, competitive, and sustainable society. In this regard, young people who acquire the right skills through education can have a positive impact on global economies and societies (Ahmad, 2023). Digitalization in education and entrepreneurship is highly effective in preserving and developing the tangible and intangible values of countries. It particularly enables young people to engage in innovative activities that are aligned with technology. The research emphasizes that digital and entrepreneurial education should develop together, and specific insights are gained from the literature.

Educational institutions have many stakeholders such as students, university staff, families, employers, and community representatives. These stakeholders believe that the education students receive prepares them for future business activities and improves their creativity and understanding of innovation (Bauman & Lucy, 2021). Educators contribute to transforming education into a more dynamic process and harmonizing it with the needs of society (Maruntelu, 2023). Social changes also lead to changes in educational activities. This requires translating future predictions into action beginning now. The concept of digital and entrepreneurial education enables the implementation of future activities in the present. As technological advancements continue, the needs and expectations of societies are constantly changing. This accelerates the implementation of new-generation educational practices and guides innovations. The ability

of education systems to be shaped by digital and entrepreneurial education enhances the functionality of both technology and entrepreneurial activities.

In studies focusing on educational development through the use of instructional materials, purposeful collaboration, structured support, reflection, and opportunities are emphasized (Grigg, 2021). The entrepreneurial education approach is a system that enables students to develop a sense of identity, evaluate opportunities, be encouraged to learn and trust their abilities (Miço & Cungu, 2023). The concept of digital education prepares students for the rapid advancement of technology (Alenezi et al., 2023). In other words, digital education is essential for preparing individuals capable of coping with the dynamic factors of the modern era (Alzboun et al., 2023). In this respect, digital and entrepreneurial education reviews can be especially effective for students studying at the university level. Future-oriented entrepreneurship activities and digital transformations taking place in the world increase the importance of this training day by day. In terms of education, being able to quickly adapt to technological changes requires alignment with digital transformations. This adaptation contributes to individuals educating themselves through a digital and entrepreneurial approach changes.

Besides university students, many people, such as women and people with disabilities, have the opportunity to become entrepreneurs (Xin & Ma, 2023). In the past, rational thought processes based on certain criteria for entrepreneurship were taught. This school of thought has changed with the emergence of the need for flexibility because it does not adapt to all conditions. Entrepreneurial education emerges from the application of intuitive sense (Ratten & Usmanij, 2021). Entrepreneurship education integrated with digital technology is more effective in enhancing individuals' entrepreneurship and entrepreneurial performance than traditional entrepreneurship education (Hsieh & Maritz, 2023). In this respect, digital technology helps overcome difficulties in the world of entrepreneurship as well as the creativity of individuals (Lukita et al., 2023). This shows that digital and entrepreneurial education together can produce systematic results. In addition, training to be provided for different people in different fields will also contribute to the formation of new entrepreneurial activities.

Within the scope of the research objective, the guiding qualities of the relational outcomes of the concept of digital and entrepreneurial education have been considered. In other words, the aim was to guide the development of design-based, technological, innovative, and education-focused thought structures through digital and entrepreneurial education. From this perspective, the literature highlights the lack of integration of digital and entrepreneurial education into the educational system and discusses what measures can be taken to ensure its ongoing implementation. As in many areas, the relationship between digital transformation and entrepreneurship in education can create valuable insights. Sitaridis and Kitsios (2024) state that the concept of digital and entrepreneurial education is among the core needs of the 21st century. In this context, the rapid development of digital technologies, which makes adoption and monitoring challenging, is a limitation in scientific research in this field. Entrepreneurial education not only develops expertise in the latest technologies and diversifies it but also makes it urgent to base digital entrepreneurship pedagogy and education on broad theoretical foundations.

Digital education

Digital education is defined as the integration of virtual reality, augmented reality, cloud computing, and

various other technologies into the educational process, with big data being automatically adapted to support learning (Bilyalova et al., 2019). Digital education is not just an area where educational experiences are expressed by being online. Understanding these innovations is important for the effectiveness and education of individuals. However, it is also valuable to evaluate how the digital education field is created for what purposes (Emejulu & McGregor, 2019). In this regard, the concept of digital education has influenced societies and individuals based on technological developments and changes. This has added different dimensions to the educational approach and affected individuals' future activities. Digital education especially influences the learning habits of young individuals or students and their behaviors in applying what they have learned to practice. Ioseliani et al. (2023) emphasized that there is a lack of research examining the long-term effects of digital education on students' learning outcomes. The researchers stated that inequalities in access to and use of digital education could lead to undesirable outcomes for students.

Digitalization includes digital tools in terms of education and artificial intelligence applications that can be measured or widely used (Mavlutova et al., 2020). As the world becomes digital, it becomes important for entrepreneur candidates to have digital competence to navigate and benefit from technological opportunities (Abaddi, 2023). It is vital to understand how digital education contributes to the success of entrepreneurs. Entrepreneurs who use digital tools and strategies often have a competitive advantage. The success of entrepreneurs contributes to economic development (Abbasi et al., 2023). In this respect, digital education creates strategies that benefit from digital developments to strengthen societies and achieve economic growth (Judijanto & Imanirubiarko, 2023). Digital education involves the innovative use of digital technology and tools in education (Alenezi et al., 2023). This situation necessitates the provision and implementation of technological opportunities in digital education.

Digital environments that make it easier to be included in the entrepreneurial culture provide better quality education and enable you to benefit from opportunities. Experiences gained in technology and business simulation environments contribute to preventing financial losses and reducing costs (Garcez et al., 2023). There are some obstacles to the use of internet-based digital environments in education. Especially among young individuals, the unproductive use of the internet for purposes unrelated to digital education may lead to negative outcomes. Although the prevalence of internet access increases digital education opportunities, it also causes a loss of time with non-educational activities. In this respect, digital training for individuals' entrepreneurial activities should be prioritized. In addition, families and educational institutions need to correctly digital education practices correctly to ensure social awareness.

Such digital platforms are particularly advantageous for university students with limited financial resources who intend to engage in entrepreneurial activities. Digital platforms provide these students with new entrepreneurial opportunities (Xin & Ma, 2023). Digital education platforms are understood to have qualities that make educational content more visible, understandable, and applicable, alongside cognition and decision-making (Decuypere et al., 2021). In this regard, the combined implementation of digital education and entrepreneurial education can contribute to students engaging in more active entrepreneurial activities. The necessity of digital education in many fields (such as education, health, sports, entertainment, culture, and tourism) helps the entrepreneurial education concept mature further. Technological application and usage knowledge in the digital realm can support entrepreneurial activities.

Entrepreneurial education

In many OECD countries, access to education generally starts from low education levels and is compulsory (OECD, 2015). For Türkiye, compulsory education presents an important advantage for entrepreneurship education. The presence of many young individuals of school age suggests that the potential number of entrepreneurs could be high. The ability to integrate entrepreneurial education down to the primary school level may contribute to an increase in entrepreneurial activities in the future.

Education plays an effective role in developing the intention to pursue entrepreneurship as a profession (Ilies et al., 2023). Entrepreneurial education encourages individuals to develop entrepreneurial skills and launch their own businesses. It also changes individuals' attitudes toward entrepreneurial behavior in different organizations (Ratten & Usmanij, 2021). To train the workforce for the future, entrepreneurial education provides the ability to use innovation, creativity, and entrepreneurship in any field. As workforce demands evolve in response to future challenges, entrepreneurial education plays a critical role in cultivating flexibility, adaptability, and resilience—key competencies essential for long-term professional success (Munawar et al., 2023). In summary, entrepreneurial education has a complex, fragmented, and newly developed structure. In this respect, it covers professional and economic aspects as well as changing personal and social developments (Rodrigues, 2023). This shows that entrepreneurial education is needed to create innovations in different fields, expand the production capacity of goods or services, and provide individual or social contributions.

Entrepreneurship education can be taken into consideration not only in the field of economics but also in all educational programs starting from primary education (Miço & Cungu, 2023). In this respect, entrepreneurial training programs for young individuals provide practical skills such as experiential learning, evaluation, skill effectiveness, judgment, research, and scanning. Organizational tours and meetings with managers can make individuals' entrepreneurial activities more realistic (Singh et al., 2023). In this respect, entrepreneurship education helps students develop their entrepreneurial competencies and become highly responsible social entrepreneurs (Xiang et al., 2023). The entrepreneurial education approach supports young individuals in developing their talents, broadening their life perspectives, and fostering innovative thinking. The responsibility created by entrepreneurship helps individuals keep their need for success alive.

Entrepreneurship education especially enables students to have an entrepreneurial spirit through their education. These trainings have recently been included in academic studies to strengthen students' entrepreneurial intentions after university graduation (Montes-Martínez & Ramírez-Montoya, 2023). Students' perception of the existence of common entrepreneurial values contributes to their intention to start a new business (Primario et al., 2024). Entrepreneurial education benefits society by promoting entrepreneurship and developing an entrepreneurial culture. Promoting entrepreneurship education attracts the attention of economic and political decision-makers. For example, the European Commission supports the development of entrepreneurship education and training programs in higher education institutions through programs such as the European Regional Development Fund, the European Social Fund, the European Globalization Adaptation Fund, and Erasmus. The European Commission aims to popularize entrepreneurship and create new entrepreneurs (Sousa et al., 2019). This situation increases the importance

of entrepreneurial education day by day. Many community and country politicians are trying to integrate the concept of entrepreneurial education into their education systems. This shows that entrepreneurs who grow up with an entrepreneurial education approach can make serious contributions to their social development.

Relationship between digital and entrepreneurial education research

Digital and entrepreneurial education reviews have an increasing development momentum. They provide foresight in terms of designing educational opportunities suitable for future needs (Sitaridis & Kitsios, 2024). Digitalization is quite valuable in terms of entrepreneurship education because technology offers solutions that improve individuals' quality of life (Soegoto & Luckyardi, 2020). Digital learning facilitates inclusive approaches to entrepreneurship education. Entrepreneurship education is typically conducted in face-to-face and traditional environments (Hamburg & Brien, 2023). Some sources emphasize that entrepreneurship education is effective in encouraging young individuals to exhibit digital entrepreneurial behavior (Li et al., 2024). In this regard, digital education and entrepreneurship education are understood to have complementary features.

The increase in digital activities day by day due to technological developments has contributed to the development of entrepreneurship practices. Digital entrepreneurship has helped individuals renew themselves and carry out their activities using technological opportunities. Xin and Ma (2023) revealed that gamification of online entrepreneurial education has a positive effect on digital entrepreneurship intention. Wibowo et al. (2023b) stated that individuals with developed intuition can overcome the uncertainties of digital entrepreneurship and feel safe. Researchers have emphasized that these individuals can identify opportunities, take calculated risks, and make effective decisions. Simovic et al. (2023), in their comparison of Serbia and Kuwait, revealed that university students' digital entrepreneurship competencies are low, particularly in terms of opportunity recognition. Duong et al. (2024) emphasize that the digital age goes beyond simple technological advancements in education and is a revolutionary force reshaping entrepreneurial educational activities. Nguyen and Nguyen (2024) state that students who receive digital entrepreneurship education have increased awareness of the risks and challenges associated with digital entrepreneurship.

Method

The research includes a type of content analysis. The study aims to draw conclusions regarding the increasingly popular awareness of digital and entrepreneurial education in recent years. In this regard, studies conducted in the international literature on the subject have been evaluated within the scope of the research methodology. In the research, reviews on digital and entrepreneurial education have been included from the WoS database. Articles published in WoS since 2008 have been examined on the subject. Only English-language publications have been included in the sample. The study sample has consisted of 500 articles. The data have been downloaded as a BibTeX file and have been analyzed using the R Bibliometric Package. R-Biblioshiny applications were used in the analysis. It is emphasized in the literature that the

WoS database has comprehensive records and is a very useful analysis tool (Ellegaard & Wallin, 2015). The R-Bibliometric Package program is stated to be very popular for the bibliometric analysis method. It has been mentioned that collaborations between researchers, countries, and institutions can be scientifically revealed using the bibliometric analysis method (Koca & Yıldırım, 2021). Donthu et al. also emphasize in the literature that applications of the bibliometric analysis method consist of performance analysis and science mapping techniques. It was stated that the contributions of the research components were clarified through performance analysis. Within performance analysis, publication-related metrics, citation-related metrics, and citation-and-publication-related metrics were included. It has been stated that the relationships between science mapping and research components are revealed. Within the scope of science maps, citation analysis, co-citation analysis, bibliographic coupling, co-word analysis, and co-authorship analysis were included (Donthu et al., 2021). For instance, it has been mentioned that clusters displayed as strategic graphics can be categorized using the thematic maps identified in bibliometric analysis. It is highlighted that information can be gathered regarding the status of a specific network, the position of the clusters that form it, and the level of development (Callon et al., 1991). Both performance analysis and science mapping techniques were applied in the research. The analysis framework for the digital and entrepreneurial education approach is as follows:

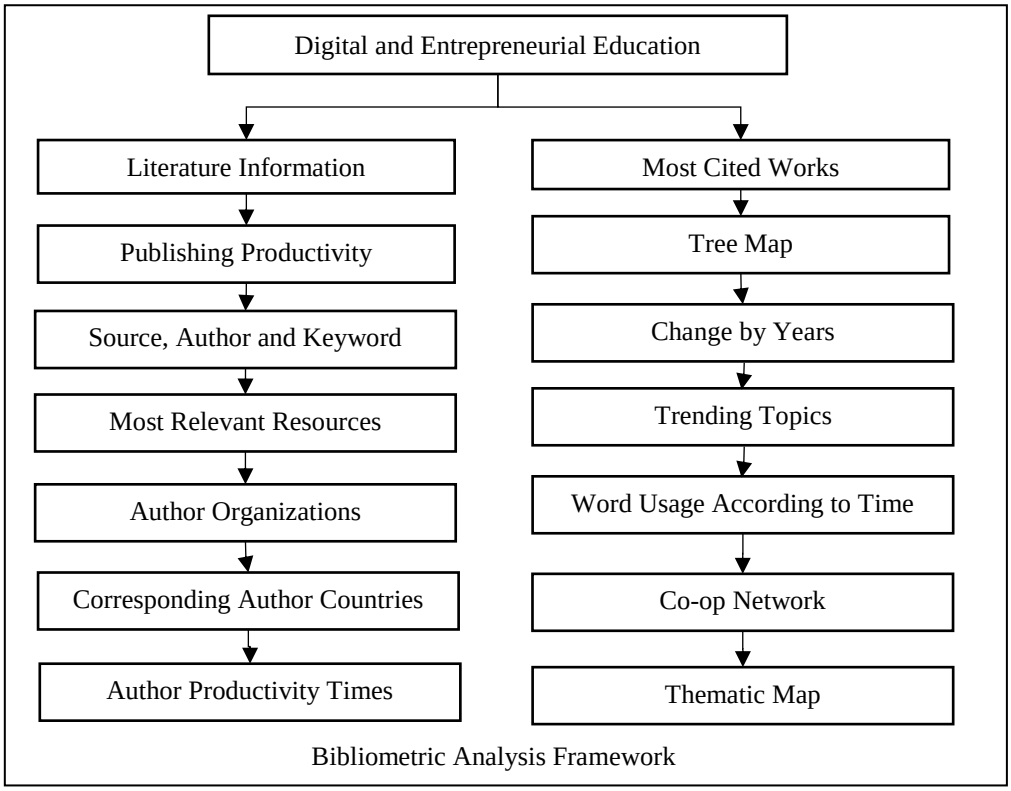

Figure 1. Digital and entrepreneurial education review bibliometric process.

Figure 1 presents a bibliometric framework to reveal the results of digital and entrepreneurial education research. In the literature of digital and entrepreneurial education research, publication productivity, author and keyword matches, the most relevant sources, authors' affiliations, corresponding author country addresses, authors' productivity over time, the most cited works, tree maps, changes over

the years, trending topics, word density over time, co-occurrence networks, and thematic map results are included. New interpretations of the obtained results have been provided alongside the literature.

The field of social sciences is becoming increasingly complex, with stronger methodologies and algorithms (Roig-Tierno et al., 2017). The R package used in bibliometric analysis provides multiple conformances that reveal the conceptual structure of the field. It also refers to K-means results for using the conceptual structure and identifying clusters that indicate common concepts (Aria & Cuccurullo, 2017). Bibliometric applications help reveal gaps in the scientific field on a specific topic, collect data, and focus on the evolution of knowledge (Pessin et al., 2022). In the study by Rogers et al., it was stated that a limited sample size of approximately 50 publications is inadequate for a national-level evaluation using bibliometric analysis—although it may still yield insights for subject-matter experts—whereas a sample size of 200 or more is likely to produce statistically significant differences in categorical outcomes (Rogers et al., 2020). Data related to the research were downloaded from the Web of Science (WoS) database as a bibtex file. The research was analyzed in the WoS database on 26.02.2024 under the title "Digital and Entrepreneurial Education". Recent concepts emphasized by authors in their research, especially in recent years, have been included in the sample. The WoS Bibtex file has a maximum limit of 500 publication entries per upload, which has been taken into account. In this regard, article limitations related to digital and entrepreneurial education research, from the present to previous years, have been considered. Articles published in the WoS database from 2008 onwards have been examined. The sample, consisting of 500 English-language articles, has demonstrated that an adequate level of sampling has been achieved.

Within the framework of tubitak, the Entrepreneurial and Innovative University Index data includes 50 universities operating in Türkiye. In the scope of the Entrepreneurial and Innovative University Index, factors such as scientific and technological research competence, intellectual property, collaboration and interaction, economic and social contributions, scientific activities, national and international projects, patents, companies, sales revenues, and student and educator activities have become important criteria in educational evaluations (TUBİTAK, 2022). According to TURKSTAT (2023), enterprises established in 2016 or later accounted in 2022 for 22.2% of total turnover, 31.5% of employment, 16.8% of exports, and 11% of imports. This information can yield results related to the research areas of the authors in digital and entrepreneurial education reviews. Primarily, making the entrepreneurial education approach functional through digitalization in the educational goals of universities, led by higher education institutions, will enable breakthroughs. Increasing the number of educated young entrepreneurs can accelerate technological development and changes (such as new investments, new employment opportunities, economic and social gains, and the production of value-added products). The potential gains in digital and entrepreneurial education methodologies are discussed through WoS-based publications.

Findings

The research included digital and entrepreneurial education articles as of 2008. In the analysis, the sources where digital and entrepreneurial education research was published, the number of articles, annual development rates, number of authors, author rates in publications, keywords used, references, and citation rates per publication were included. The relevant results are as follows.

Table 1. Digital and entrepreneurial education basic literature information.

Timespan	Sources	Documents	Annual growth rate	Authors	Number of single-author
2008:2024	306	500	9.86%	1522	50
International co-authorship	Co-authors per doc	Author's Keywords	References	Document average age	Average citations per doc
30.6%	3.77	1947	26626	3.2	11.95

Table 1 provides general information about digital and entrepreneurial education literature. Research from 2008 and later was taken into account in the analysis. A total of 500 articles have been identified in the field of digital and entrepreneurial education research. The authors had their research published in 306 different sources. The annual development rate of digital and entrepreneurial education research was 9.86%. A total of 1522 authors researched the subject and it was understood that 50 authors produced publications as a single author. The international author rate is 30.6%, and it has been observed that the co-author rate per publication is 3.77. In digital and entrepreneurial education research, the authors used 1947 keywords. The authors benefited from 26626 references. It has been observed that the average publication year of digital and entrepreneurial education publications is 3.2, and each publication has an average of 11.95 citations. The publication amounts of digital and entrepreneurial education research by year are expressed below.

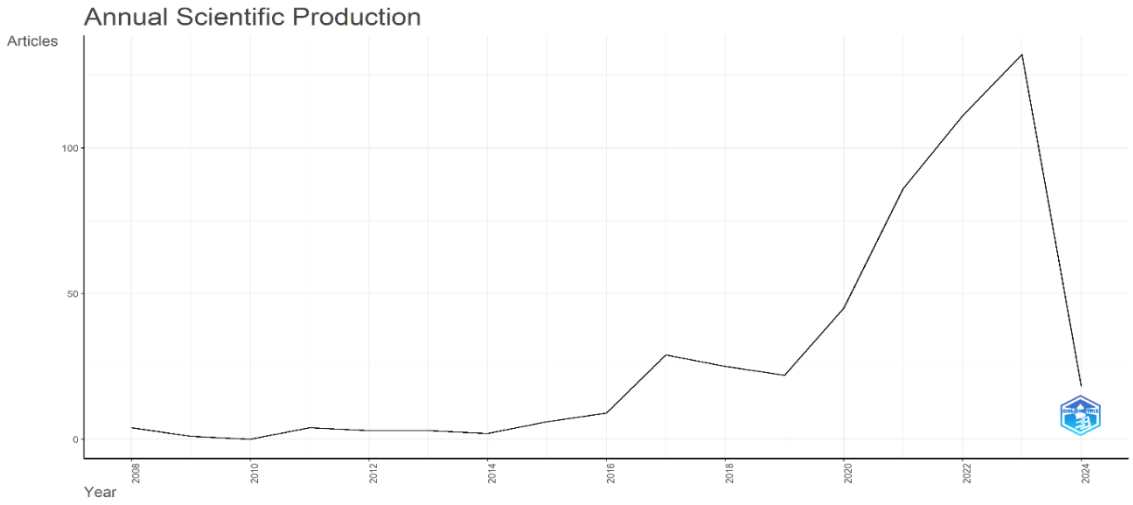

Figure 2. Digital and entrepreneurial education annual scientific publication production amount.

Figure 2 shows the changes in the authors' digital and entrepreneurial education practices over the years. The results showed that digital and entrepreneurial education research has generally increased continuously over the years. Between 2008 and 2014, digital and entrepreneurial education research followed a mostly horizontal course. Since the analysis includes only publications up to February 2024, it is expected that the total publication count for the year may increase by its end. The analysis shows that 2023 was the year of the highest number of publications by the authors. Research shows that digital and entrepreneurial education reviews have continuously increased, especially after 2014. This shows that the number of new studies on the subject may increase even more in recent years.

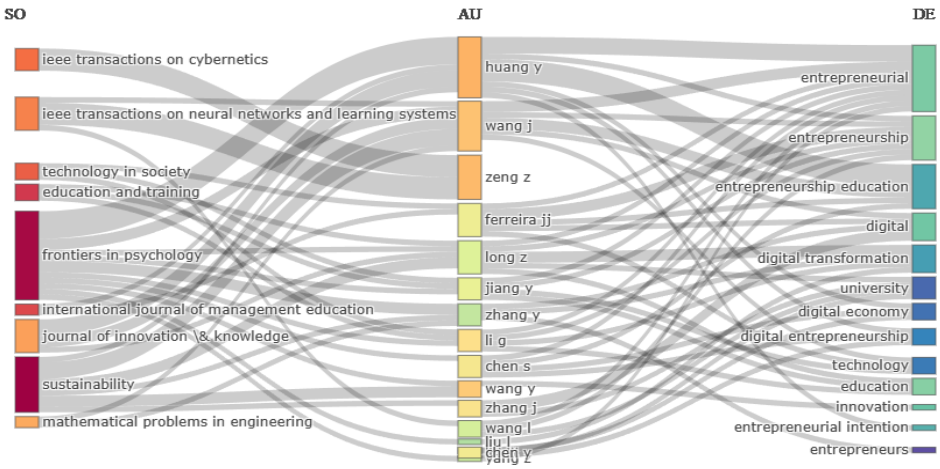

Figure 3. Digital and entrepreneurial education review source, author, and keyword matching.

Figure 3 shows the sources on which digital and entrepreneurial education research (articles) are published, the authors who have conducted intensive research on the subject, and their keyword matches. Based on the analysis of source titles, the most frequently cited journals include IEEE Transactions on Cybernetics, IEEE Transactions on Neural Networks and Learning Systems, Technology in Society, Education and Training, Frontiers in Psychology, International Journal of Management Education, Journal of Innovation & Knowledge, Sustainability, and Mathematical Problems in Engineering. Authors who have conducted intensive research on the subject include Huang Y., Wang J., Zeng Z., Ferreira J.J., Long Z., Jiang Y., Zhang Y., Li G., Chen S., Wang Y., Zhang J., Wang L., Liu L., Chen Y., and Yang Z. The most frequently used keywords in the articles are as follows entrepreneurial, entrepreneurship, entrepreneurship education, digital, digital transformation, university, digital economy, digital entrepreneurship, technology, education, innovation, entrepreneurial intention, and entrepreneurs. The ranking of the most relevant sources published on the subject is as follows.

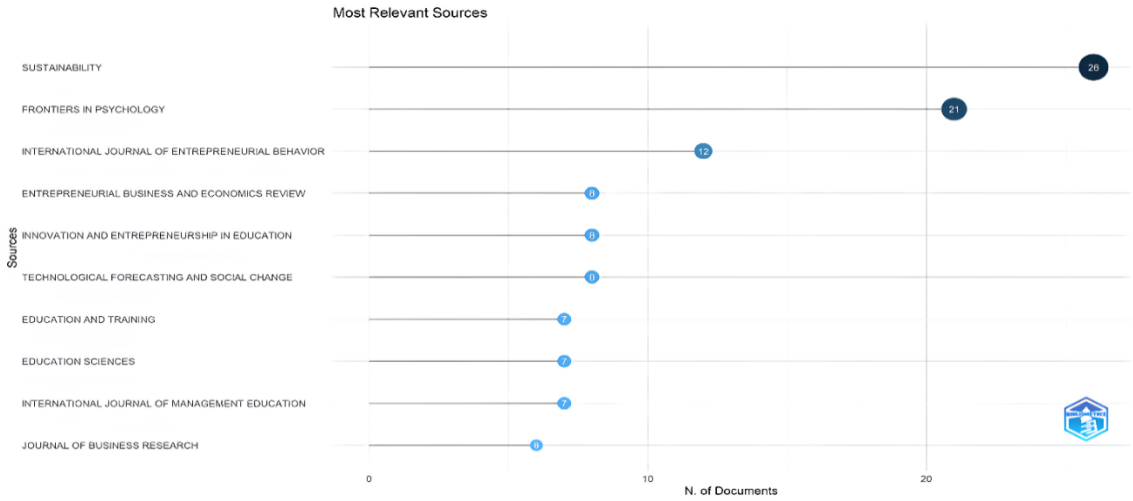

Figure 4. Digital and entrepreneurial education articles most relevant resources.

Figure 4 shows the sources where the authors publish the most in digital and entrepreneurial education articles. As a result of the analysis, it was understood that most publications on the subject were made on Sustainability. Other sources related to the articles are listed as follows, Frontiers in Psychology,

International Journal of Entrepreneurial Behavior, Entrepreneurial Business and Economics Review, Innovation and Entrepreneurship in Education, Technological Forecasting and Social Change, Education Sciences, International Journal of Management Education, and Journal of Business Research.

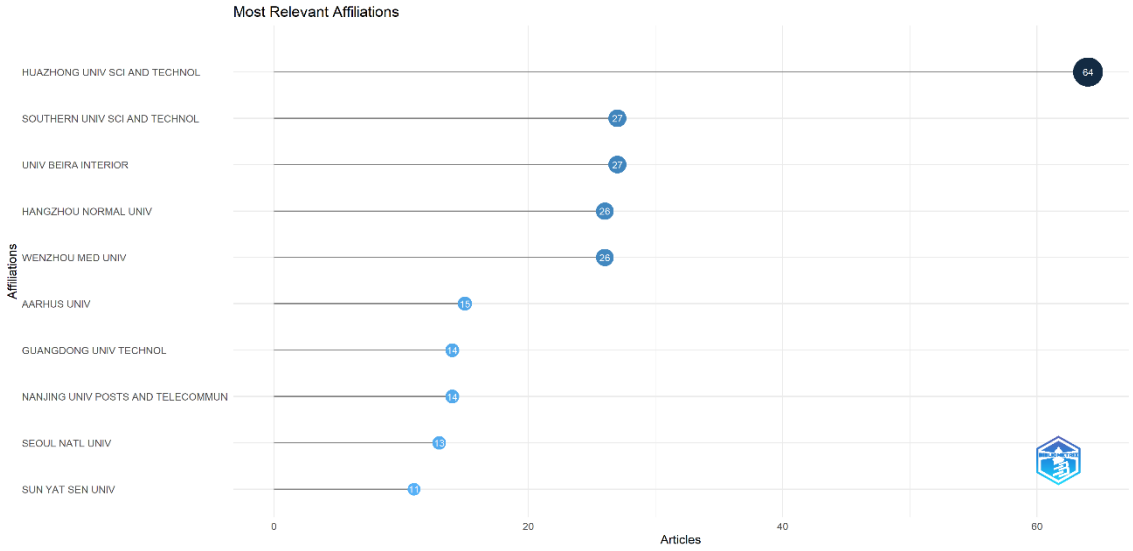

Figure 5. Organizations of authors who contributed the most to digital and entrepreneurial education articles.

Figure 5 shows that the most relevant institution contributing to digital and entrepreneurial education articles is Huazhong University of Science and Technology. Additional institutions involved in the authorship and publication of the articles are listed as follows; Southern University of Science and Technology, University of Beira Interior, Hangzhou Normal University, Wenzhou Medical University, Aarhus University, Guangdong University of Technology, Nanjing University of Posts and Telecommunications, Seoul National University, and Sun Yat-sen University. The results showed that the universities that conducted intensive research on digital and entrepreneurial education articles were generally Chinese state-addressed universities. In this respect, the country addresses of the responsible authors in digital and entrepreneurial education articles are stated below.

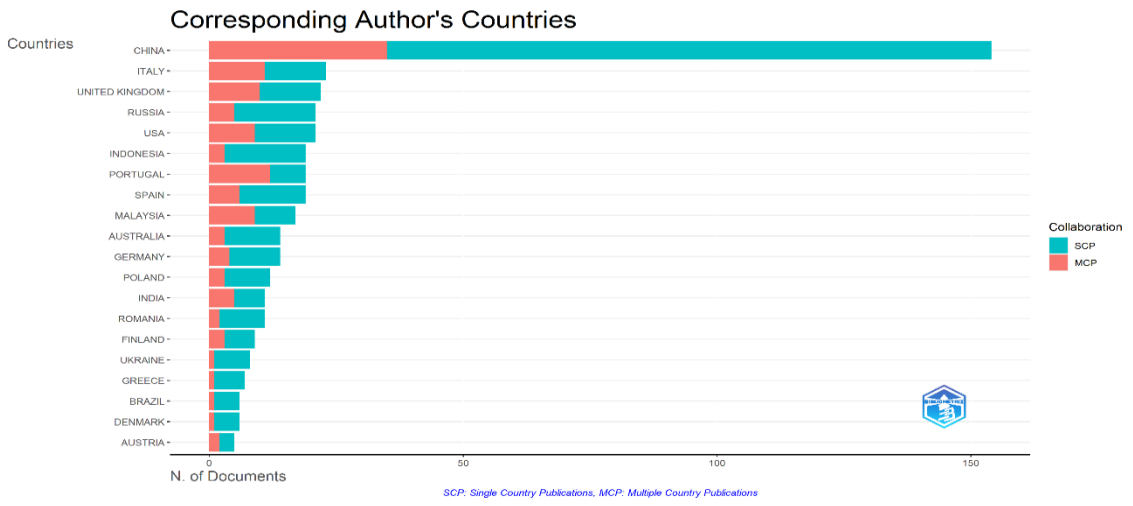

Figure 6. Digital and entrepreneurial education articles corresponding author country addresses.

Figure 6 shows single-country (SCP) and multi-country (MCP)-addressed publications in digital and entrepreneurial education research. As a result of the analysis, it was understood that Chinese authors carried out quite intensive research on the subject. In addition, it has been observed that publications from a single country occupy a very dense place in publications addressed to China. Country addresses of other corresponding authors; They are listed as Italy, United Kingdom, Russia, USA, Indonesia, Portugal, Spain, Malaysia, Australia, Germany, Poland, India, Romania, Finland, Ukraine, Greece, Brazil, Denmark, Austria. Below, the authors who conducted intensive research on the subject and their years of productivity are listed.

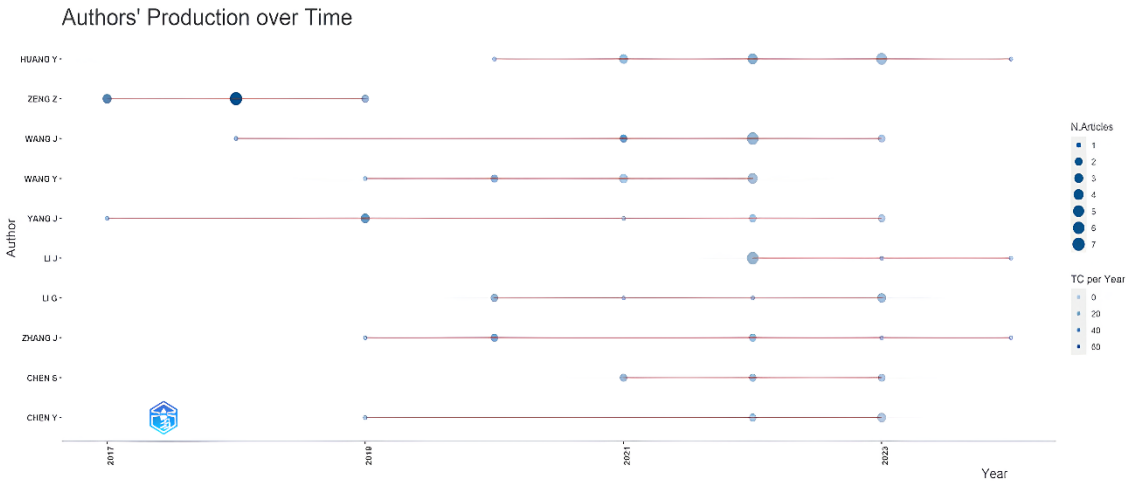

Figure 7. The most influential authors and productive times in digital and entrepreneurial education articles.

It has been stated in the literature that the most productive authors can be included in research on a subject with the bibliometric analysis method (Alkhammash, 2023). Figure 7 shows the authors who conducted intensive research in digital and entrepreneurial education studies and their productivity times. Based on the analysis, the authors and the periods during which they conducted intensive research were identified as follows; Huang Y. (2020–2024), Zeng Z. (2017–2019), Wang J. (2018–2023), Wang Y. (2019–2022), Yang J. (2017–2023), Li J. (2022–2024), Li G. (2020–2023), Zhang J. (2019–2024), Chen S. (2021–2023), and Chen Y. (2019–2023). The results indicated that Chinese researchers conducted intensive studies on the subject. Based on the institutional affiliations and country addresses of the corresponding authors, it was understood that Chinese scholars placed significant importance on the concept of digital and entrepreneurial education. In particular, the integration of digital and entrepreneurial education within the education system may enable many entrepreneurial activities to be developed by Chinese individuals in the future.

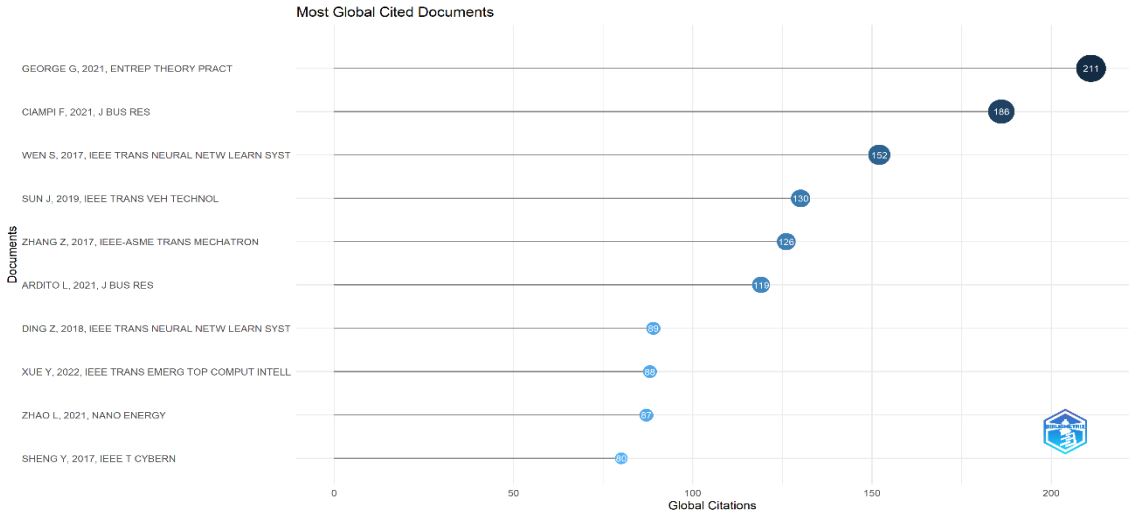

Figure 8. Digital and entrepreneurial education articles most cited works globally.

In Figure 8, the most cited works in global digital and entrepreneurial education research are listed by author, publication year, and place of publication. The analysis reveals that the most frequently cited work, in terms of the responsible author, is 'George G. 2021, Entrepreneurship Theory and Practice'. Other heavily cited works are 'Ciampi F. 2021 Journal of Business Research', 'Wen S. 2017 IEEE Transactions on Neural Networks and Learning Systems', 'Sun J. 2019 IEEE Transactions on Vehicular Technology', 'Zhang Z. 2017 IEEE/ASME Transactions on Mechatronics', 'Ardito L. 2021 Journal of Business Research', 'Ding Z. 2018 IEEE Transactions on Neural Networks and Learning Systems', 'Xue Y. 2022 IEEE Transactions on Emerging Topics in Computing', 'Zhao L. 2021 Nano Energy', 'Sheng Y. 2017 IEEE Transactions on Cybernetics'. The treemap of the keywords emphasized by the authors in their research is given below:

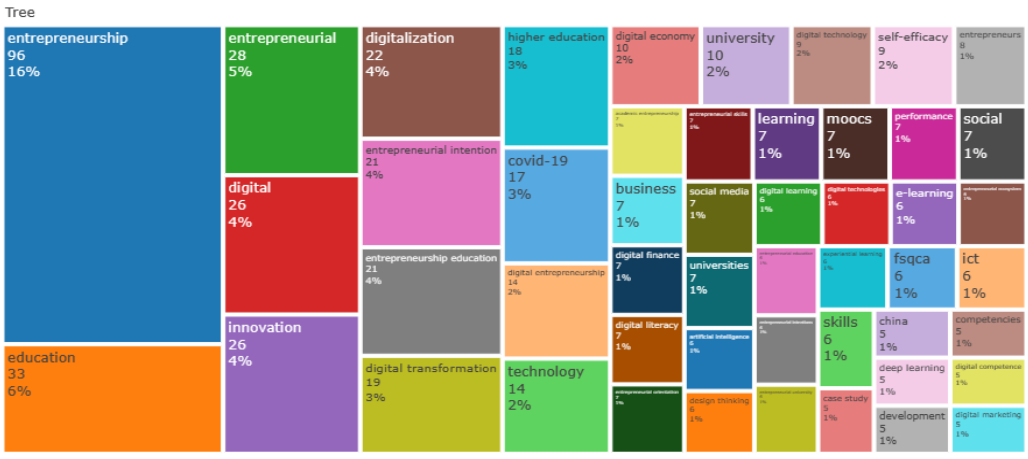

Figure 9. Tree map of keywords emphasized by authors in digital and entrepreneurial education articles.

Figure 9 shows the most emphasized keywords in digital and entrepreneurial education research. The authors mostly emphasized the concept of entrepreneurship in their research. The following highlighted words are; education, entrepreneurial, digital, innovation, digitalization, entrepreneurial intention, entrepreneurship education, digital transformation, higher education, Covid-19, digital entrepreneurship, technology, digital economy, university, digital technology, self-efficacy, entrepreneurs, academic

entrepreneurship, entrepreneurial skills, learning, MOOCs, performance, social, business, digital finance, digital literacy, social media, universities, entrepreneurial orientation, artificial intelligence, design thinking, digital learning, digital technologies, e-learning, entrepreneurial ecosystem, experiential learning, fsqca (fuzzy-set qualitative comparative analysis), ICT (Information and Communication Technologies), entrepreneurial university, entrepreneurial education, skills, case study, china, deep learning, development, competencies, digital competence, digital marketing. The analysis result showed that digitalization, education, technology, innovations, and entrepreneurial activities are effective in digital and entrepreneurial education research. The changes in the highlighted keywords over time are as follows.

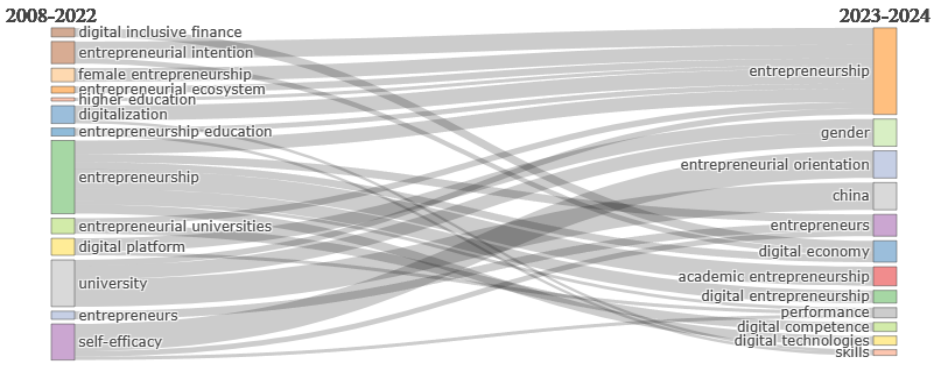

Figure 10. Changes in keywords highlighted in digital and entrepreneurial education articles over the years.

In Figure 10, it is understood that the keywords emphasized by the authors in digital and entrepreneurial education reviews differ in general between 2008-2022 and 2023-2024. The authors conducted digital and entrepreneurial education research from 2008 to 2022, they emphasized the concepts of digital inclusive finance, entrepreneurial intention, female entrepreneurship, entrepreneurial ecosystem, higher education, digitalization, entrepreneurship education, entrepreneurship, entrepreneurial universities, digital platforms, university, entrepreneurs, and self-efficacy. During the period 2023–2024, recent research on digital and entrepreneurial education frequently highlights key themes such as entrepreneurship, gender, entrepreneurial orientation, China, entrepreneurs, the digital economy, academic entrepreneurship, digital entrepreneurship, performance, digital competence, digital technologies, and skills. The results indicate that the concept of 'digital' has been extensively applied across various fields in recent years. Additionally, the growing emphasis on academic entrepreneurship, skills, performance, and orientation highlights a strong focus on change and transformation in education. The trending topics of the keywords highlighted by the authors in the research are listed below.

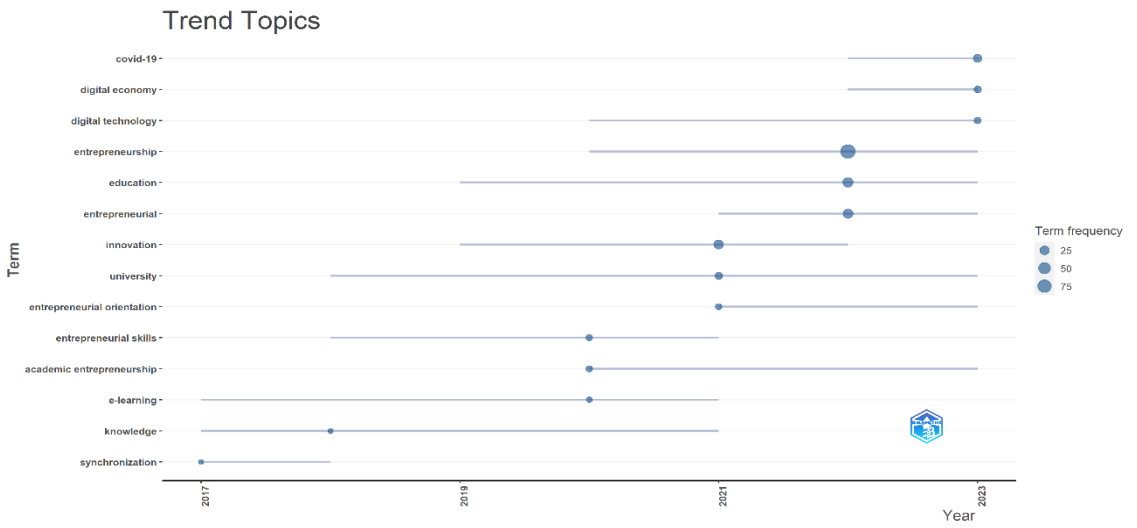

Figure 11. Digital and entrepreneurial education articles trending topics.

Figure 11 illustrates the trending periods of the keywords emphasized by the authors. The results show that 'Covid-19' emerged as a prominent trend during 2022–2023, particularly in educational practices during the pandemic. When examining other practical findings, the following topics were identified as trending in the respective years; 'digital economy' (2022–2023), 'digital technology, entrepreneurship, academic entrepreneurship' (2020–2023), 'education' (2019–2023), 'entrepreneurship, entrepreneurial orientation' (2021–2023), 'innovation' (2019–2022), 'university' (2018–2023), 'entrepreneurial skills' (2018–2021), 'e-learning, knowledge' (2017–2021), and 'synchronization' (2017–2018). The temporal frequency of these keywords, as highlighted in the authors' research, is presented below.

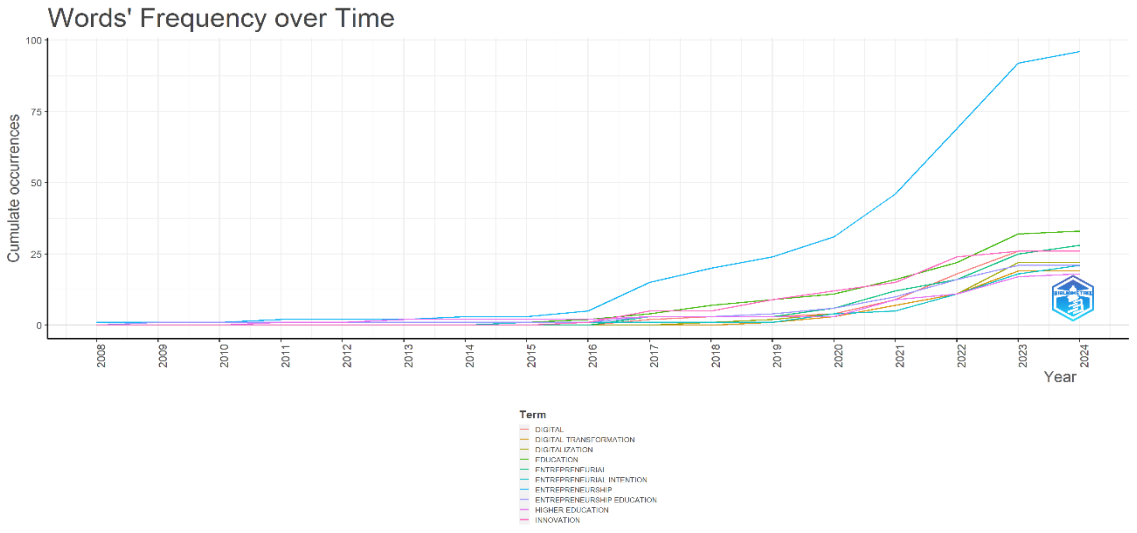

Figure 12. Frequency of use of the most highlighted keywords in digital and entrepreneurial education articles over time.

Figure 12 shows the frequency with which the keywords highlighted by the authors have been used over time. The analysis indicates that the most frequently used and emphasized keyword, particularly from 2015 to the present, is 'entrepreneurship'. Other concepts frequently used by authors, especially in recent years and over the years, are listed as education, entrepreneurial, innovation, digital, digitalization, entrepreneurship education, digital transformation, higher education, and entrepreneurial intention. The

concepts with which the keywords emphasized by the authors in digital and entrepreneurial education research have strong relationships are listed below.

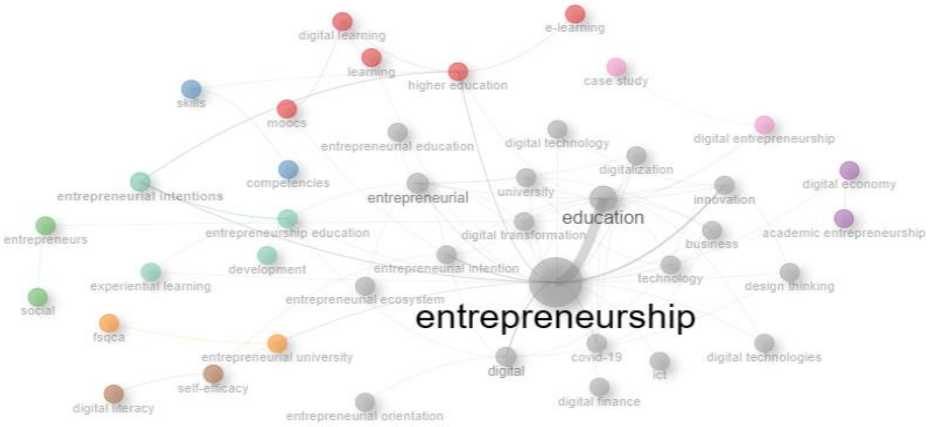

Figure 13. Co-association network of keywords highlighted in digital and entrepreneurial education research.

The reviews state that in bibliometric analyses, co-occurrence networks are constructed using specific libraries, and visualizations can be generated with the help of various tools. In research, it has been emphasized that these analyses performed with computer program codes can provide flexibility and versatility (Moral-Muñoz et al., 2020). In this respect, bibliometric analyses were carried out in the research with the biblioshiny application using the WoS database and R studio infrastructure. As a result of the analysis in Figure 13, it was understood that many concepts had strong relationships together in digital and entrepreneurial education studies. In the analysis, the concepts of entrepreneurship and education had the strongest relationships. Entrepreneurship in practice, education, digital, entrepreneurial, innovation, technology, business, digitalization, digital technology, university, digital transformation, entrepreneurial intention, entrepreneurial ecosystem, entrepreneurial education, entrepreneurial orientation, Covid-19, ICT (Information and Communication Technologies), digital finance, digital technologies, design thinking, development, experiential learning, digital entrepreneurship, and entrepreneurial intentions have demonstrated strong relationships together. As a result of the analysis, it was understood that the concepts of higher education, e-learning, learning, digital learning, and MOOCs have relations together. In the research, there were relationships between the concepts of entrepreneur and social, fsqca (fuzzy-set qualitative comparative analysis) and entrepreneurial university, digital literacy and self-efficacy, digital economy, and academic entrepreneurship, skills, and competencies. The analysis observed that the concepts of entrepreneurship and digital economy, higher education, and entrepreneurial university reveal separate relationships. In the study, it was understood that the words education and digital entrepreneurship, higher education have separate relationships. As a result, the words higher education and skills, entrepreneurs and digital transformation concepts, self-efficacy, and entrepreneurial intention also revealed separate relationships. In the research, the centrality and density levels of the keywords emphasized by the authors in digital and entrepreneurial education research were examined. The relevant results are as follows:

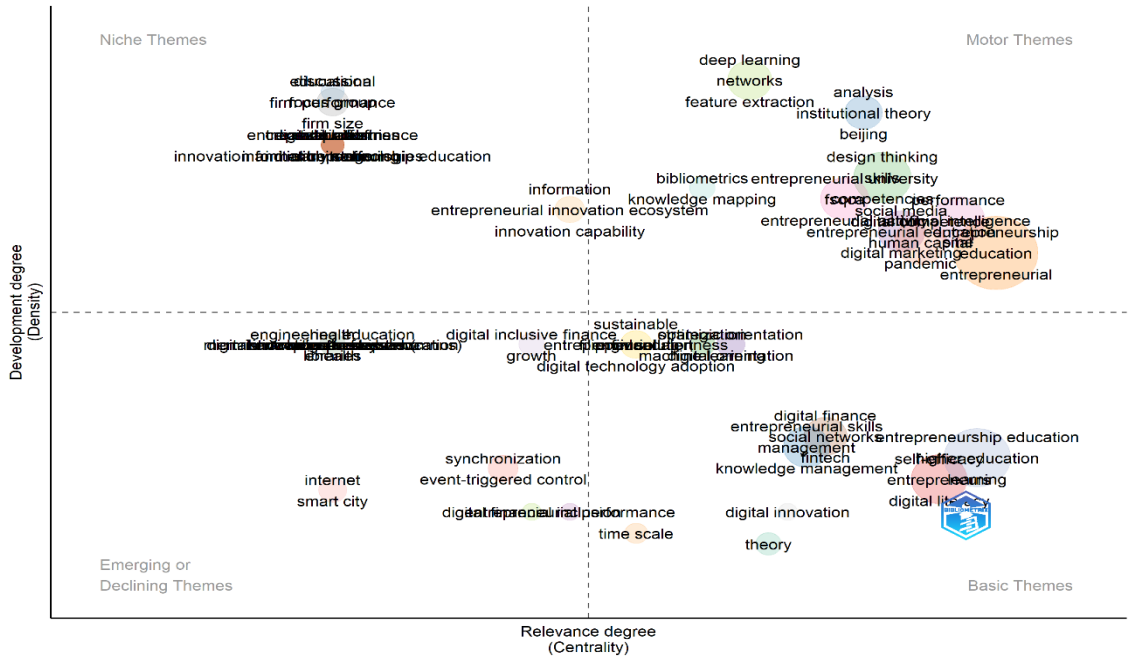

Figure 14. Digital and entrepreneurial education articles thematic map.

The literature emphasizes that thematic maps play a vital role in interdisciplinary research, indicating that movement toward the upper right signifies an upward trend, while movement toward the lower left reflects a downward trend. It further explains that motor themes (first quadrant), located in the upper right of the cluster network, demonstrate high centrality and density. These themes appear well-developed and contribute significantly to the structuring of a research topic. Niche themes (second quadrant, top left) exhibit low centrality but high density. Emerging or disappearing themes (third quadrant, bottom left) show low centrality and density, suggesting limited development and marginal significance. Basic themes (fourth quadrant, lower right) combine low density with high centrality (Alkhammash, 2023). Researchers underline that the cluster positioned in the motor themes quadrant maintains strong connections with other clusters in the overall network and demonstrates both a high level of development and dense internal linkages. This cluster forms the conceptual core of the research. Scholars examine the themes in this area strategically, systematically, and over extended periods (Callon et al., 1991). In this context, the current research aims to clarify key concepts, particularly those situated within the motor themes quadrant.

Figure 14 examines the centrality and density levels of keywords that authors frequently emphasize in digital and entrepreneurial education research. Keywords in the motor themes section, in which both centrality and density are high, were revealed. The motor themes that revealed very strong relationships as a result of the analysis are in the first group; entrepreneurship, education, entrepreneurial, digital, innovation, digitalization, entrepreneurial intention, digital transformation, Covid-19, and digital entrepreneurship. In the second group of themes; performance, artificial intelligence, sme, digitization, gender, internationalization, digital platform, entrepreneurial ecosystems, startup, and blockchain technology. The third group of motor themes; consists of the words social media, entrepreneurial education, digital marketing, entrepreneurial marketing, bibliometric analysis, international, and Malaysia. In the fourth group; the concepts of the entrepreneurial university, fsqca (fuzzy-set qualitative comparative analysis), entrepreneurial activity, female entrepreneurship, university students, cognition, entrepreneurial

attitudes, graduate, and heinnovate (innovate) are included. Fifth group; It consists of the words design thinking, skills, competencies, journalism, entrepreneurial journalism, journalism education, women entrepreneurship, digital skills, employability, and enterprise education. The sixth group of motor themes; consists of the words digital competence, human capital, pandemic, stem, academic, entrepreneurial universities, small business, strategy, clusters, and digital disruption. In the seventh group; the concepts of deep learning, networks, feature extraction, the Internet of Things, wireless sensor networks, computational modeling, intrusion detection, and lightweight neural networks were included. The eighth group consists of expressions analysis, institutional theory, Beijing, effect, and fuzzy-set qualitative comparative analysis. In the ninth group, the words bibliometrics and knowledge mapping are included.

Discussion

The research results reveal that numerous concepts are emphasized by the authors in the field of digital and entrepreneurial education. Digital and entrepreneurial education has become a prominent subject of research in recent years, with many authors contributing to the field. Chinese researchers have produced the most publications, and the concept of digital and entrepreneurial education is closely related to several other concepts that generally lead to technological outcomes. It is observed that technological innovations, working environments, educational institutions, changes in health, as well as individual and social factors, influence the understanding of digital and entrepreneurial education. The findings related to the keywords frequently emphasized by the authors are discussed in the light of existing literature as follows.

The analysis reveals that e-learning was included among the keywords emphasized by the authors, emerged as a trend between 2017 and 2021, and is closely related to numerous concepts with high centrality and intensity. E-learning has become an essential resource frequently utilized by students, educators, and society at large in the digital age. Through e-learning, individuals have gained access to various forms of education. E-learning opportunities have enabled people to quickly access information and save time. In the literature, Sousa et al. (2019) state that e-learning training aids in managing students' learning processes. Researchers emphasize that support systems for digital learning are necessary to facilitate interactions, such as video conferencing and discussion environments.

The analysis results show that the concept of entrepreneurial education is linked to various factors. Entrepreneurial education has contributed to both the material and spiritual development of societies. Entrepreneurial activities, particularly among young individuals, have emerged as a result of entrepreneurial education practices. In the literature, Bauman and Lucy (2021) argue that entrepreneurial education plays a key role in developing teamwork, problem-solving, communication, and collaboration skills. Researchers emphasize that applications such as e-learning systems, gamification, competitions, mentoring, and work-based and on-the-job training significantly contribute to entrepreneurship education.

The research reveals that the concept of networks plays a significant role in the seventh group of motor themes, which exhibit high centrality and density. It is observed that the concept of skills is included in the fifth group of motor themes and has been frequently used in recent years, along with the keywords emphasized by the authors. In digital and entrepreneurial education, both skills and networks can be crucial in achieving goals. Digital and entrepreneurial education practices can enhance individuals' skills and

networks. In the literature, Lynch et al. (2021) emphasize that students develop networking skills and expand their networks through interactions with companies. Researchers argue that related courses contribute to students' networking and skill development, as well as to their engagement in employment activities.

It is observed that the concept of digital skills is frequently emphasized in terms of centrality and intensity within digital and entrepreneurial education research. In today's digital education environments, the improved digital skills of both educators and trainees generate social benefits more broadly. Technological changes have introduced new applications across many fields, making it necessary for individuals to adapt to new technologies. Jardim (2021) emphasizes that factors such as easy access to technology, the rapid increase in social interactions, and the potential for project expansion elevate the need for individuals to develop digital skills. The researcher argues that the practices and activities of organizations have been transformed by these new communication models.

In practice, it is observed that the concept of design thinking is included in the keywords emphasized by the authors, the co-occurrence network, and the engine themes section. Design-oriented thinking can help individuals create new and useful projects. In areas where digital and entrepreneurial education is advanced, it becomes easier to develop designs quickly and in a structured manner. This, in turn, supports the implementation and sustainability of entrepreneurial activities. Lynch et al. (2021) emphasize that design-oriented thinking enhances learning within the scope of entrepreneurial education, improves knowledge and skills, and fosters positive changes in thoughts and behaviors.

It is understood that COVID-19 is included in the keywords emphasized by the authors, among the trending topics, in the co-occurrence network, and within the motor themes. The research also shows that digital technology is highlighted in the keywords, peer association networks, and concepts that have gained significant popularity in recent years. The pandemic has played a crucial role in shaping digital and entrepreneurial education activities. During this period, students have been required to use digital technologies more extensively. As a result, it has been demonstrated that digital diversity factors influence educational activities. Many educational institutions have adapted new technologies into their educational systems. Secondo et al. (2021) emphasize that with the emergence of COVID-19, students attended classes online and utilized distance education technologies, and universities were required to collaborate as a team. Researchers show that designing energy efficiency programs is beneficial for distance education and its sustainability. Abaddi (2023) states that students' entrepreneurial education, digital skills, and alertness levels may vary between the pre-and post-COVID-19 periods. Hsieh and Maritz (2023) emphasize the need for an educational guide for students' entrepreneurship education integrated with digital technology. Lukita et al. (2023) highlight that, through entrepreneurship, students can combine digital technology skills with business ventures, generate new ideas, and develop an understanding of product or service development to meet global market demands.

The research reveals that the concepts of university, universities, entrepreneurial university, entrepreneurial universities, and university students are frequently emphasized and are linked to numerous other terms. Universities play a significant role, particularly in training young entrepreneurs and generating new and original outputs. The concept of digital and entrepreneurial education contributes to how universities carry out their activities in collaboration with other institutions. This enhances the value of

universities in the context of digital and entrepreneurial education. Abbasi et al. (2023) emphasize that universities specializing in digital education make it easier for students to establish successful businesses and foster an entrepreneurial spirit. They argue that such universities support entrepreneurship, innovation, economic growth, and creativity. Lesinskis et al. (2023) argue that universities aiming to create and develop digital transformation strategies should prioritize digital transformation and artificial intelligence across all areas, including energy efficiency and sustainability.

The research reveals that digital learning is frequently emphasized by the authors, included in the peer collaboration network, and linked to numerous other concepts. Technological advances expand digital education opportunities and bring about changes in practice across many areas. This trend increases the importance of digital education daily. Digital learning can be highly effective due to the availability of digital educational opportunities. Digital training contributes to enhancing individuals' knowledge levels. Alnasip (2023) argues that educators stress the importance of incorporating technology into the education curriculum and highlight the value of digital learning in education.

It is understood that the third group of motor themes in the keywords emphasized by the authors on social media exhibits high levels of centrality and density. Contemporary social media platforms have evolved into domains where extensive information is acquired, and where new business opportunities, entrepreneurial activities, and applications are explored. Moreover, social media posts and applications enable easy access to a broad audience. This indicates that social media serves functional roles in digital and entrepreneurial education practices. Wibowo et al. (2023b) demonstrated that digital entrepreneurial education influences individuals' use of social media and their intentions toward digital entrepreneurship. Scholars have highlighted strong relationships among social media, digital entrepreneurial intention, and entrepreneurial intuition, particularly among students.

The analysis reveals that the concept of digital entrepreneurship is frequently emphasized by the authors and has gained significant popularity in the co-occurrence network, motor themes section, and in recent years. Digital entrepreneurship lies at the core of 21st-century technological transformations. To such an extent, digital entrepreneurial activities across various sectors—including education, healthcare, engineering, and the economy—have reshaped individuals' lifestyles, educational opportunities, and business practices. Darmanto et al. (2023) highlighted that digital entrepreneurial behavior plays a critical role in forming, comprehending, and advancing the decision to initiate a digital business. They further noted that research on digital entrepreneurship remains limited, underscoring the emergence of new entrepreneurs in the digital business sector and emphasizing that possessing digital competence and confidence significantly contributes to success in digital entrepreneurship.

In practice, it has been observed that the concept of the digital economy is frequently emphasized by authors. In the technological era, digital economy activities serve as valuable resources for entrepreneurs. Entrepreneurs can leverage the opportunities presented by the digital economy when implementing new business ideas. Moreover, digital and entrepreneurial education practices can play a significant role in the economic development of countries. Xin and Ma (2023) noted that the digital economy creates entrepreneurial opportunities for university graduates. Researchers have emphasized that the digital economy contributes to the emergence of new sectors and innovative forms of entrepreneurship.

Wibowo et al. (2023a) argued that entrepreneurship education fosters the development of knowledge and skills relevant to digital-based business activities.

The review revealed that the concepts of digitalization, education, and innovation were frequently emphasized by authors and were associated with numerous themes related to digital and entrepreneurial education. Digital education has introduced new dimensions to the implementation of various activities through innovations driven by technological advancements. Digitalization and innovation have played complementary roles in the enhancement of educational opportunities. Mavlutova et al. (2020) emphasized that innovative entrepreneurship education fosters entrepreneurial development. Researchers have indicated that individuals can access financial resources for entrepreneurial ventures through the use of digital software and that entrepreneurship education necessitates new approaches—such as distance learning—and modern techniques. Judijanto and Imanirubiarko (2023) highlighted that digital education positively influences online business innovation and contributes to economic independence.

The research revealed that the concepts of learning, e-learning, digital learning, experiential learning, and deep learning were prominently featured in the keywords and co-authorship networks emphasized by the authors. Educational and training activities have transformed the way individuals acquire knowledge, driven by both mandatory circumstances (such as the COVID-19 pandemic) and digital opportunities enabled by technological advancements. This transformation has also led to innovations in the understanding of entrepreneurial and digital education. Technological opportunities have played a crucial role in reshaping learning processes. Chen et al. (2021) highlighted that online or blended entrepreneurship education eliminates temporal and spatial boundaries, extending into diverse domains such as online learning, distance education, e-learning, and mobile learning. Researchers further stated that technological support systems and widely adopted educational technologies have been utilized to promote entrepreneurial learning and pedagogical approaches.

The analysis revealed that concepts such as entrepreneurship, education, higher education, universities, and innovation were frequently emphasized by authors in the context of digital and entrepreneurial education. Universities have served as effective sources of motivation in the implementation of entrepreneurial activities. Higher education institutions, which guide students' entrepreneurial pursuits for the future, have played a critical role in the realization of new and original business ideas. To ensure sustainability in entrepreneurship, innovation must also be prioritized. Munawar et al. (2023) asserted that online entrepreneurial education programs are essential for enhancing the entrepreneurial behavior and success of higher education students. Researchers have emphasized that innovative business ideas can be fostered through the establishment of entrepreneurship and innovation centers. Montes-Martínez and Ramírez-Montoya (2023) argued that university students receiving entrepreneurship education should be encouraged to develop attributes that contribute to social value and generate solutions to regional, national, and global challenges through their entrepreneurial initiatives.

In practice, the concept of the Internet of Things has been identified as a motor theme. The Internet has served as a critical resource in the advancement of digital education. Many individual activities have been shaped by the opportunities enabled by internet connectivity. Through the Internet, individuals have been able to access vast amounts of information and contribute to both digital and entrepreneurial initiatives. In this context, it is believed that digital education activities are likely to be implemented more

intensively in regions with widespread internet infrastructure. Suárez-Guerrero et al. (2023) asserted that education for digital technology is a product of the Internet. Researchers have further emphasized the importance of evaluating the effectiveness of this approach to learning, as well as to concepts such as culture, legitimation, innovation, and knowledge acquisition.

The research revealed that AI was associated with key terms and motor themes. Applications of AI in digital and entrepreneurial education have facilitated numerous processes for individuals across various domains. These applications have played a guiding role in enriching educational experiences, identifying alternative pathways, and generating solutions. Bell and Bell (2023) asserted that AI is a technology that societies will increasingly rely on to leverage growth opportunities within entrepreneurial processes. They warned that students lacking the necessary skills to engage with this technology will be at a disadvantage in their entrepreneurial and employment endeavors. Motlagh et al. (2023) emphasized the effectiveness of AI in digital education and argued that its integration should be aligned with principles of academic integrity, educational objectives, and adaptability to rapidly evolving technologies. They also highlighted the need for flexible regulatory frameworks to support the responsible use of AI in educational contexts.

In practice, the concept of self-efficacy has been shown to have significant associations within the keywords emphasized by authors and within the peer association network. Individuals with higher levels of self-efficacy are more likely to demonstrate entrepreneurial behavior. Moreover, the education and training individuals receive throughout their lives contribute to the development of self-efficacy, depending on the nature of their activities. The confidence derived from self-efficacy supports engagement in digital education and entrepreneurial initiatives. In this context, Roick et al. (2023) found that students with high self-efficacy were better able to navigate digital education during the pandemic.

The research revealed that the concept of experiential learning was highly influential within the keywords and peer association network emphasized by the authors. Experiential learning enables individuals to take practical action and engage directly in entrepreneurial activities. It offers opportunities for individuals to develop expertise, particularly in practice-oriented contexts. Rodrigues (2023) explained that experiential learning involves a process of evaluation, reflection, experience, and the reconstruction of knowledge to make sense of what has been learned. The researcher further emphasized that in experiential learning, learning by doing entails a sense of responsibility.

The analysis revealed that the concept of higher education was among the keywords emphasized by the authors and frequently appeared in the co-occurrence network. Higher education institutions are among the most effective entities for transferring the principles of digital and entrepreneurial education to students. This highlights the significant impact of policies implemented in higher education on the development of future entrepreneurs. The ability of education systems to align with technological advancements has made substantial contributions to the development of digital education and social progress, such as economic growth and job creation. Dabbous and Boustani (2023) emphasized that entrepreneurship education provided to higher education students equips them with entrepreneurial skills and enhances their ability to launch new businesses. Researchers noted that graduates feel prepared to become entrepreneurs. They further suggested that curricula should be designed to address emerging digital needs, thereby fostering students' entrepreneurial intentions.

It has been observed that the concept of digital literacy is frequently emphasized in digital and entrepreneurial education research and is included in the peer collaboration network. Digital literacy plays a pivotal role in guiding both educational and entrepreneurial activities through the advancement of digital technologies. In this context, digital literacy serves as a motivating factor in digital education and entrepreneurial training programs. Many educators, students, entrepreneurs, and other individuals enhance their knowledge levels through digital literacy. With digital literacy, individuals are empowered to engage in innovative and original entrepreneurial activities. Digital literacy also influences individuals' future decisions, contributing to its widespread popularity. Judijanto and Imanirubiarko (2023) emphasized that digital literacy, along with participation in online businesses, holds transformative potential for communities. Bulut et al. (2024) found that there are strong connections between digital literacy, technology, and education.

The study has shown that institutions conducting extensive research on digital and entrepreneurial education are primarily universities in China. The universities identified in the survey include Huazhong University of Science and Technology, Southern University of Science and Technology, University of Beira Interior, Hangzhou Normal University, Wenzhou Medical University, Aarhus University, Guangdong University of Technology, Nanjing University of Posts and Telecommunications, Seoul National University, and Sun Yat-sen University. These universities are primarily engaged in technology-focused activities and collaborate with numerous international universities and research institutes. Moreover, they are actively innovating across various fields to improve the quality of education for students. This situation underscores the value of universities' international collaborations and their ongoing adaptation to the rapid technological advancements of today, particularly in the realms of digitalization and entrepreneurship.

In terms of entrepreneurship, countries may have different priorities when it comes to purchasing digital tools or resources for investment in their education systems. In Türkiye, the procurement of educational resources is significantly supported by the public sector (through state or government policies). In particular, public-backed purchases (via projects or other resource transfers) play a crucial role in the development of young entrepreneurs. In this context, according to OECD (2023) reports, countries make public purchases to support and safeguard their digital ecosystems. Many countries contribute to the procurement of digital tools and resources for education and training. Some countries, including Türkiye, Hungary, Korea, and the Czech Republic, actively purchase digital system resources. In contrast, countries such as the United Kingdom and the Netherlands delegate the procurement of digital education services and resources to individual schools. Additionally, countries like France and New Zealand adopt mixed approaches.

In practice, entrepreneurship, education, digitalization, innovation, technology, business, digital technology, universities, digital transformation, entrepreneurial intention, entrepreneurial ecosystems, entrepreneurship education, entrepreneurial orientation, information and communication technologies, digital finance, design thinking, development, experiential learning, digital entrepreneurship, and entrepreneurial intentions have formed strong relationships within the network of concepts. In the international literature on digital and entrepreneurial education, it has been observed that universities, digital ventures, technologies and transformations, innovations, entrepreneurship education, various

learning methods, and changes in information and communication technologies play significant roles. This situation suggests that, when integrating these elements into the Turkish higher education system, universities can adopt not only digitalization and entrepreneurship-centered educational approaches but also foster an entrepreneurial climate or culture in practice. In this regard, universities can be provided with technological opportunities for digitalization. Through collaboration with the public or private sectors, universities can develop entrepreneurial plans that enable young entrepreneurial candidates to gain practical experience during their educational journey. Research laboratories or departments focused on entrepreneurship can be established to support technology and innovation-driven entrepreneurial activities. New missions, such as establishing a "young entrepreneur university," can be outlined for universities to cultivate an understanding of digital and entrepreneurial education.

Conclusion and Recommendations

As a result of the research, it has been observed that the number of researchers focusing on digital and entrepreneurial education is increasing steadily. This indicates that many authors, institutions, and countries researching the subject have begun to place greater emphasis on digital and entrepreneurial education. The research has also revealed that digital and entrepreneurial education is interconnected with a wide range of fields. It has been found that digital and entrepreneurial education research is particularly influential in various domains such as educational sciences, social sciences, health sciences, engineering, architecture, science, economics, and information technologies. The results suggest that implementing digital and entrepreneurial education approaches together, from the perspective of institutions, organizations, or sectors, may yield more effective outcomes.

The results show that in digital and entrepreneurial education, both digitalization and entrepreneurship possess characteristics that can be evaluated both together and separately. In this regard, it is evident that concepts such as entrepreneurial universities, artificial intelligence, entrepreneurial ecosystems, human capital, blockchain technology, digital skills, digital competence, women entrepreneurs, and employment contain rich content, particularly in education systems for university students. The findings suggest that there are intriguing areas to explore around these concepts. For instance, increases in new entrepreneurial activities significantly contribute to employment, the entrepreneurial ecosystem, and human capital. In terms of education, digital developments, with a focus on people, can offer valuable contributions to digitalization, artificial intelligence, blockchain, digital skills, and competencies.

For the development of countries or societies, new entrepreneurial activities integrated with technological changes are essential. Considering digital and entrepreneurial education will contribute to the formation of young entrepreneurs in the future. This creates an opportunity to adapt technological changes to the education system and transfer digital transformation to individuals' entrepreneurial activities. The education individuals receive throughout their lives influences their entrepreneurial endeavors. Easier, cheaper, and faster access to information in today's digital transformation landscape allows entrepreneurial activities to be carried out systematically. Implementing digital and entrepreneurial education in practice also contributes to technological change and development. The success or failure of entrepreneurial

activities can have significant positive or negative effects on individuals or society. As a result, providing digital and entrepreneurial education together can enhance the effectiveness of young entrepreneurs' activities in particular.

The following suggestions are included within the scope of the research:

- To develop an understanding of digital and entrepreneurial education, sections on entrepreneurship and digitalization can be incorporated into the education system curriculum. In addition to entrepreneurship courses, which are generally offered as elective courses at universities, courses or training on digitalization, artificial intelligence, and technological changes can be introduced across various departments.
- Training can be organized to ensure that educators are compatible with technological changes and have digital education and entrepreneurial education competence.
- Application areas that can embody entrepreneurial activities can be created for educators (through simulation or institution-company cooperation).
- The digital and entrepreneurial education approach can be applied to the entire educational life of students. It can contribute to change and transformation in terms of technological innovations and entrepreneurial activities.
- Like Türkiye, the high rate of young population and the number of students continuing their education can contribute to the dynamism of digital transformations and entrepreneurship movements.
- Proper management of digital and entrepreneurial education can help social, economic, cultural, and technological development, especially in the education system.
- The digital and entrepreneurial education approach can be implemented within the framework of educational institutions and organization (public-private) cooperation.
- Digital and entrepreneurial education can gain functionality with practices such as internships or project completion, which in many schools require completion of education.
- By placing the digital or entrepreneurial education approach at the center of education systems, especially universities, it can contribute to social development in general (economically, socially, culturally, and psychologically).
- Depending on technological developments and changes, digital and entrepreneurial education understanding can contribute to many fields (such as educational sciences, social sciences, health sciences, engineering, architecture, science, and psychology).

Future research can examine the effects of young individuals' internet usage habits on their entrepreneurial and digital education approaches. In addition, how the information obtained from social media platforms affects individuals' entrepreneurial ideas can be revealed. Research can also be conducted to compare face-to-face education with digital education to determine which approach fosters greater entrepreneurship potential.

Limitations

This study examines the concepts of digital and entrepreneurial education. The application data were analyzed using the R programming infrastructure, based on a BibTeX file generated from the Web of Science (WoS) database. The research sample was limited to 500 articles indexed in WoS. The analysis focused on studies published from 2008 onwards that explore digital and entrepreneurial education. In addition to providing general information on the topic, the study presents network relationships among the keywords most frequently emphasized by the authors in their research. Based on the analysis results, future studies may consider applied evaluations of digital and entrepreneurial education.

Declarations

Ethical statement: The study does not require approval from an ethics committee. Ethical principles are observed at all stages of the research.

Conflict of interest: The author(s) have no conflicts of interest.

Data availability: Data are available upon request from the authors.

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