

The Impact of Digital Technologies on Entrepreneurship Education

A Literature Review for Progress and Prospects

Zhenfei Zhang^{1,*}

¹ Department of Economics and Management, Wuhan University, Wuhan, China

* Email: 961044839@qq.com

ABSTRACT

After the outbreak of COVID-19, the digital transformation of entrepreneurship education has received considerable critical attention. In this context, this paper aims to stand in the intersection of technology and education, and conduct a systematic analysis regarding the impact of digital technologies on entrepreneurship education. This paper first reviewed the recent developments of digital technologies and their practical applications on academic entrepreneurship. Furthermore, to conduct a structured literature overview, four hundred and five papers were selected and extracted from the Scopus and Web of Science database and were analyzed from multiple perspectives. Results indicated that although there is a growing trend in digital entrepreneurship literature, future efforts are still required to explore their practical applications according to the needs of times and society.

Keywords: *Entrepreneurship education, digital technologies, digital transformation, literature review, future trends*

1. INTRODUCTION

Entrepreneurship education has long been regarded as one of the most potential subjects because of its irreplaceable role in bridging the gap between theory and sincere practices and its profound impact on cultivating future generations of innovative talents. It not only refers to the process of helping people develop the knowledge, skills, attitudes, and personal competencies to accomplish their goals, but also relates to the industry connections and hands-on practices that are essential to encourage entrepreneurship success in the future [1]. Its inherent nature of interactive teaching and experience-based learning greatly differentiates itself from other educational activities. And educational institutions have established extensive cooperation with the industry, including renowned firms, startup companies, and business incubators [2]. Therefore, it would of critical importance to design its own style of teaching method and target efforts at innovative courses to maximize the effectiveness of entrepreneurship education.

Meanwhile, the mind-blowing technological advancements and their disruptive effects have brought about tremendous changes in virtually all aspects of our

society. Needless to say, the new wave of digital transformation empowered by smart plus technologies, including the Internet of Things, augmented reality, and artificial intelligence, has opened up fresh opportunities for innovators and enterprisers. The disruptive force of digitalization is also fully utilized in the academic context to support educational research and fulfill the universities' third mission [3].

After the outbreak of COVID-19, the worldwide education and research communities are looking for viable solutions that combine digital technologies and entrepreneurship education, with the aim to counter off the detrimental impacts of social distancing. They also place great hopes on a higher level of penetration of innovative technologies to enhance the development of academic entrepreneurship, such as a broader spectrum of teaching methods, the identification of possible venture opportunities and emerging forms of entrepreneurship.

Although the academic circles have held a strong interest in this topic for nearly a decade, the digital revolution of entrepreneurship education in the new era of technology still remains an issue to be resolved. Meanwhile, the recent developments of digital

technologies and unexpected changes in the situation also proposed new directions for future research regarding the far-reaching implications of digital technologies on entrepreneurship education. Thus, this paper summarized the latest development over the years and conducted a holistic review of available literature to analyze the academic landscape on the topic investigated. In addition, another purpose of this paper is to explore the current progress and any possible research gaps, hoping to make positive contributions to future studies.

2. DIGITAL TECHNOLOGIES AND ENTREPRENEURSHIP EDUCATION

2.1. The Use of Online Technologies in the Pre-COVID world

Digital technologies have been widely acknowledged as an incredible tool that supports and reshapes the field of education in the last decade. On the one hand, it opens up a new channel to access a diverse range of information through the internet without actually traveling to learning centers. Multiple online learning platforms, which include Khan Academy, Massive Open Online Course (MOOC), and online degree programs, to name just a few, have increasingly become a blossoming market and a rich source of fresh ideas [4]. On the other hand, digital technologies dramatically changed the ways of communication and cooperation. Teachers are empowered to utilize online-based methods to deliver lectures, assign homework, and email questions to class. At the same time, students could work on group projects via Zoom Meetings, Chegg, and Google docs regardless of their location. They can also share their thoughts and experience with students from other universities who are following the same academic path.

However, as technology may seem promising for future education, it is still not a panacea for all kinds of courses, especially when it comes to entrepreneurship education. It would be hard for online learning to completely replace physical contact and hands-on practice, such as to implement entrepreneurship ideas and create university-based innovation ecosystems. Therefore, during the pre-COVID period, the use of digital technologies in entrepreneurship education was limited and only occupied a relatively small part of students' learning activities.

2.2. Important Catalyst for Change: COVID-19 Pandemic

In the early 2020s, the outbreak of COVID-19 has created the largest disturbance in the social and economic activities so far in history. It started in Wuhan, Hubei, China, and soon evolved to become a global health crisis due to its high infectiousness through

respiratory droplets or close personal contact with COVID-19 patients. In response to this emergency, many countries were forced to put in place policies of social distancing and home quarantine or isolation to slow the spread of this contagious disease [5].

Meanwhile, this coronavirus pandemic also posed a series of challenges in the field of management education [6]. The city lockdowns and even school closures made it less likely to continue traditional in-class teaching. Social activities, experiential courses, and hands-on practices can be extremely difficult to take place under the restrictions on large gatherings and public events. Furthermore, closed borders and reduced international flights limited the possibility of international students coming from abroad. To deal with this unprecedented situation, universities, colleges, and schools have gone through a massive shift to online teaching and distant learning [7].

A variety of digital technologies and communication methods came into play to redesign the existing teaching methodologies and implement new education processes. As online education was slipping into the mainstream, MOOC platforms began to take the lead in providing systematic academic courses and high-quality educational resources to serve the pressing needs of teachers and students who have been affected by the global pandemic. A majority of universities have upgraded their infrastructure, launched online courses, and implemented remote education programs to offer effective, timely, and customized learning experiences [8].

2.3. Digital Transformation of Entrepreneurship Education and Its Impact

As mentioned in the previous sections, since the huge trends towards international entrepreneurship were interrupted by the outbreak of COVID-19, a national tide of business and the entrepreneurial boom was greatly supercharged, which also marked the dawning of a new era of entrepreneurship education. Meanwhile, the remarkable size of online learning and the advance in technical competence offer novel models and tools to carry out enterprising education.

The strategic importance of enterprising education and the smart use of cutting-edge technology further speeded up the digital transformation process. Firstly, learning analytics is introduced to measure the academic performance of students with the aim to understand and optimize the overall learning process [2]. By looking at their critical data and key metrics retrieved from time on task, progress curve, research output, etc., researchers and learning managers could fully grasp the learning process and make constant adjustments to maintain a suitable path of entrepreneurial learning. Students can also take advantage of web-based self-diagnostic tools

to evaluate their strengths and weaknesses and identify their areas of interest. Secondly, the augmented reality and artificial intelligence could supplement the existing online teaching methods by filling the gap in real-life immersion. They are expected to replicate diverse campus activities and some certain practical experience in the digital environment. In several STEM subjects such as engineering, some schools prepared a set of tools based on augmented reality to conduct experiments and simulate results, help students develop inspiring attitudes towards entrepreneurship [9]. Lastly, the blended online and offline courses would also serve as a bridge to close the chasm between theory and

applications. Online educators are encouraged to use integrative communications, including live feedback, student polls, and break-out discussions. It would be equally important to give students a greater amount of freedom by choosing their own style of learning. Furthermore, taking advantage of the geographic flexibility, entrepreneurship education would require to enhance community engagement and social participation. This hybrid learning model and “crowd-sourced” activities can continue to promote the process of digital transformation.

A summary of the major developments and their educational impact is presented below:

Table 1. Major developments pre and post COVID-19 and their educational impact

Time	Pre COVID-19	During COVID-19	Post COVID-19
Teaching method	Classroom/Face-to-face teaching	Online education/e-learning courses	Virtual education and face-to-face instructions
Technology/Platforms/Tools	MOOCs, Khan Academy, Coursera, Udemy, etc	Learning management systems, mobile learning, communication technologies	Augmented reality, artificial intelligence, big data analytics, virtual laboratories
Impact on entrepreneurship education	Open access to rich resources; Flexibility to take courses anywhere and anytime	Emergency fill during the crisis; Expand usage scenarios to support regular learning	Digital transformation; Bridge the gap between theory and practice

3. LITERATURE ANALYSIS AND FUTURE TRENDS

This section analyzed the impact of digital technologies on entrepreneurship education from the perspective of literature review and analysis. Although the online learning framework on innovation and entrepreneurship is a critical aspect of the higher education system, its academic research is rather scattered and immethodical to support meaningful implications and future guidance. Therefore, this study aims to provide a systematic review and descriptive analysis in this field of research and shed light on trends and gaps.

To conduct the literature review, this paper conducted bibliometric analysis through text search and database querying in Web of Science and Scopus from Elsevier, two of the largest abstract databases in the academic community. All the retrieved and reviewed literature is English publications related to

entrepreneurship education. To determine the precise scope of our work, this paper identified several search strings and relevant keywords (entrepreneurship education in combination with digital technologies), which are presented in the table below.

Table 2. Search strings and keywords

Category	Search queries
Entrepreneurship education	“entrepreneurship education” OR “academic entrepreneurship” OR “innovation education” OR “entrepreneurship university”
Digital technologies	“digital technolog*” OR “high technolog*” OR “digital transformation” OR “digitalization*” OR “augmented reality” OR “artificial intelligence” OR “big data*” OR “internet of things” OR “digital”

The results showed that there are 405 documents in total, including published book chapters, journal papers, conference reviews, etc. In order to navigate a clear

trend of current progress, this study carried out a descriptive statistics analysis of publication date, focused areas, geographic distribution, and citation analysis.

As can be seen from Figure 1, it is a clear trend that the number of publications is increasing year by year, which indicated a growing interest among scholars and researchers in investigating the intersection of entrepreneurship education and digital technologies. Although the first paper was published in the year 1989, the annual increase didn't begin to surge until 2015. This implies that the digital impact on entrepreneurship has received popular concern in recent years. The year 2019 and 2020 witnessed academic achievements flourishing as a result of the COVID-19 crisis. The research topics have also been extended from purely theoretical questions to real-life applications and best practices.

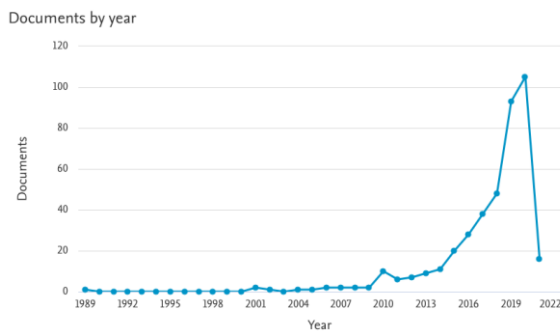


Figure 1 Number of Publications By Year

Apart from the number of annual publications, this paper also delved into the citation overview. Compared with Figure 1, Figure 2 showed that there is a similar trend in the number of citations due to the growth of scientific productivity. The rising number of cited works means that they are well recognized in both scientific and educational communities, and researchers are exploring the use of digital technologies in entrepreneurship education with keen interest.

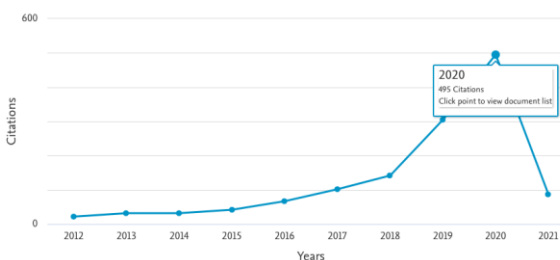


Figure 2 Citation Overview

Meanwhile, by looking at the subject area, the study observed that this topic has garnered popular attention in the field of Social Science, Computer Science, Arts and Humanities, Education, and Engineering. Therefore, entrepreneurship education and its adoption of digital technologies is a multidisciplinary subject and expected

to propel the development in areas besides teaching and learning.

Documents by subject area

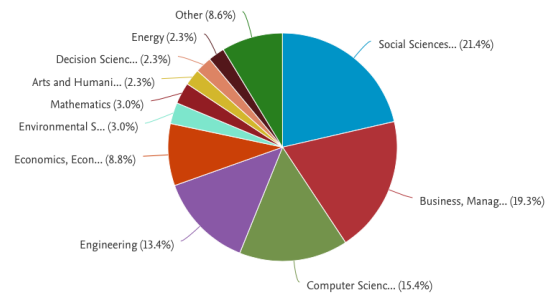


Figure 3 Publications By Subject Areas

Lastly, this study attempts to look at the geographic distribution of available publications. Figure 4 listed eleven countries with the highest number of papers. A majority of these papers were published in the United States and several European countries. Though only 41 articles were published in China, most of them focused on foreland research fields and progressed with new technical commitments that have been put into use, such as network-based innovation, entrepreneurship training system design, and entrepreneurship education in digital media. Besides, a bunch of countries at the bottom of the list only published one paper, but this demonstrates that the digital issues of entrepreneurship education are widely analyzed around the world.

Documents by country or territory

Compare the document counts for up to 15 countries/territories.

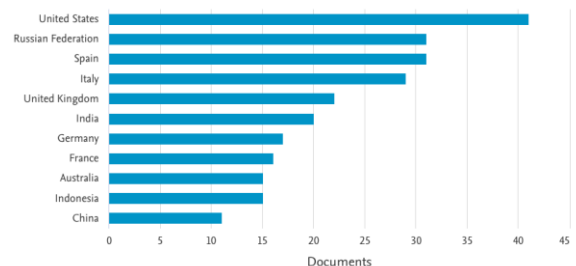


Figure 4 Number of Publications By Country

4. CONCLUSIONS

Under the dual function of technological innovation and macroscopic social change, universities are now undertaking a critical role in building and affecting entrepreneurial ecosystems. The impact of digital technologies on entrepreneurship education is definitely the most dominant factor in this process. Based on our structured literature review, this study has found that the quantity and quality of papers published on the relationship between digital technologies and entrepreneurship education exhibited a general trend of steady rise. Taken together with findings on the annual number of publications, citations, subject areas, and geographic distributions, it seems that this research

community is quite dispersed all over the world, but the topic was broadly examined with condensed results. Therefore, it is promising to see this field flourishing in the coming years. Meanwhile, current work and results are still limited to theoretical and empirical contributions, and the existing practices in the past few years have not had enough time to show effects. Their practical value shall be observed over a longer period of time.

REFERENCES

- [1] "What is Entrepreneurship Education | IGI Global", *Igi-global.com*, 2021. [Online]. Available: <https://www.igi-global.com/dictionary/from-a-traditional-to-an-entrepreneurial-university/51032>. [Accessed: 27- Feb- 2021].
- [2] G. Secundo, P. Rippa and R. Cerchione, "Digital Academic Entrepreneurship: A structured literature review and avenue for a research agenda", *Technological Forecasting and Social Change*, vol. 157, p. 120118, 2020. Available: 10.1016/j.techfore.2020.120118.
- [3] G. Dalmarco, W. Hulsink and G. Blois, "Creating entrepreneurial universities in an emerging economy: Evidence from Brazil", *Technological Forecasting and Social Change*, vol. 135, pp. 99-111, 2018. Available: 10.1016/j.techfore.2018.04.015.
- [4] G. Secundo, P. Rippa and M. Meoli, "Digital transformation in entrepreneurship education centres: preliminary evidence from the Italian Contamination Labs network", *International Journal of Entrepreneurial Behavior & Research*, vol. 26, no. 7, pp. 1589-1605, 2020. Available: 10.1108/ijeb-11-2019-0618.
- [5] S. Yoo and S. Managi, "Global mortality benefits of COVID-19 action", *Technological Forecasting and Social Change*, vol. 160, p. 120231, 2020. Available: 10.1016/j.techfore.2020.120231.
- [6] T. Varis, "New technologies and innovation in higher education and regional development", *RUSC. Universities and Knowledge Society Journal*, vol. 4, no. 2, 2007. Available: 10.7238/rusc.v4i2.309.
- [7] V. Ratten, "Coronavirus disease (COVID-19) and sport entrepreneurship", *International Journal of Entrepreneurial Behavior & Research*, vol. 26, no. 6, pp. 1379-1388, 2020. Available: 10.1108/ijeb-06-2020-0387.
- [8] W. Assaf, G. Elia, A. Fayyumi and C. Taurino, "Virtual eBMS: a virtual learning community supporting personalised learning", *International Journal of Web Based Communities*, vol. 5, no. 2, p. 238, 2009. Available: 10.1504/ijwbc.2009.023967.
- [9] C. Watts and K. Wray, "Using toolkits to achieve STEM enterprise learning outcomes", *Education + Training*, vol. 54, no. 4, pp. 259-277, 2012. Available: 10.1108/00400911211236118.