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Increasing Public Interest in Online Education during the COVID-19 Pandemic in the United States: An Analysis of Google Trends Data

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Abstract

Objective: Current evidence suggests that the shift to online learning during the COVID-19 pandemic has profoundly impacted teaching and learning models. This study aims to quantify trends in public interest in different forms of education and associated online search behaviors during the pandemic. Furthermore, it seeks to "nowcast" potential future scenarios concerning the evolution of online education.

Methods: Google Trends, a publicly available database, was employed to systematically and quantitatively analyze search query data for key terms related to online education. This study involved querying multiple search volumes for online education, identifying the most commonly used terms, and extracting data from the United States for the period between

January 1, 2019, and January 1, 2023. The results are presented using the Google metric 'search volume index' in relative terms.

Results: The public search interest for keywords related to online education experienced a significant surge starting in March 2020, followed by a gradual decline beginning in August 2020. When comparing the average relative search volume (RSV) changes for terms such as "online school," "online education," "online teaching," and "online learning" in the five months preceding and following March 1, 2020, the average search volumes increased by 46.6%, 30.7%, 103.8%, and 188.3%, respectively. Online search interest in e-learning software demonstrated a similar trend. Among platforms like Zoom, Skype, WebEx, and Google Meet, the majority of Google users displayed a clear preference for Zoom.

Conclusion: During the COVID-19 pandemic, public interest in online education surged to unprecedented levels, potentially reshaping teaching and learning practices for the foreseeable future. This suggests that the integration and use of digital media in education hold significant potential and offer considerable room for further development.

Keywords: Google Trends; Online education; Search engine; Infodemiology; Date mining

1.Introduction

The COVID-19 pandemic has significantly impacted the field of education, leading to a rapid shift towards online learning platforms. Educators have faced various challenges during this transition, including issues related to communication, student assessment, technology tools, online experience, pandemic-related anxiety, time management, and techno-phobia (Rajab, Gazal, & Alkattan, 2020). As a result, there is a growing need to analyze the impact of the pandemic on online education practices and to identify potential improvements for the future (Korkmaz, & Toraman, 2020). Studies have explored the user experience with online education platforms in China, highlighting the importance of access speed, reliability, video information transmission, course management, communication, interaction, and technical support (Chen, et al. 2020). Additionally, the role of character education in learning during the pandemic has been emphasized as a crucial aspect of education in these unprecedented times (Intania, & Sutama, 2020). Medical education has also been significantly affected by the COVID-19 pandemic, with challenges arising in areas such as communication, student assessment, technology tools, online experience, anxiety, time management, and techno-phobia (Rajab, Gazal, & Alkattan, 2020). Medical students have had to adapt to online teaching methods, with suggestions for incorporating team-based and problem-based learning formats to enhance the efficacy of medical education in the future (Dost, et al. 2020). While online platforms have provided a means to continue education during the pandemic, they also present challenges for students, teachers, and society (Bhasin, Gupta, & Malhotra, 2021). Barriers and facilitators to online medical and nursing education have been explored, particularly from the perspectives of international students from low- and middle-income countries, highlighting the importance of quality education and factors influencing satisfaction with online learning (Li, et al. 2021). Emerging evidence suggests that the majority of students prefer online learning, although some highlight the negative effects (Wijetunga, 2024). Thus, it is urgent to analyse the attitudes and behaviour of teachers and students in the search for adequate educational resources.

Both Google and Baidu are popular search engine. It is compared Google Trends and Baidu Index (Schmidt, & Vosen, 2011), focusing on their features and functions (Vaughan, & Chen, 2015). It was proposed a forecasting framework using machine learning and internet search index, comparing the forecasting performance of Baidu and Google (Sun, et al., 2017). It was founded a significant correlation between offline petitions and Baidu Index for petition (Xue, & Liu, 2017). It was used optimized neural networks with Google Trends to predict stock market directions (Hu, et al. 2018). It was studied the relationship

between Google Trends data and index returns for NIFTY (Kruthika, Balasubramanian, & Sureshkumar, 2018). It was investigated the impacts of disaster events on company stock prices using Google Trends and Baidu Index (Liu, et al. 2020). It was evaluated general interest in rosacea in the United States and China using Google Trends and Baidu Index (Zhang, et al. 2020). It was analyzed forest restoration effects on ecosystem resiliency to drought using Google Earth Engine (Sankey, et al. 2020). It was discussed the role of sports in the transnational public sphere (Xu, et al. 2021).

Google Trends is utilized in this study to investigate online education. While previous research has examined various aspects of online education, this study represents the first instance of using Google Trends as a tool for exploring this topic. Here, we assume that public interest in various aspects of online education has increased.

2.Methods

Similar with Baidu Index, Google Trends is a web-based tool that has been utilized in various research fields, including disease surveillance and forecasting private consumption. And it is a freely available tool that researches online search interest in keywords and topics over a period of time (Nuti, et al. 2014). It was discussed the use of Google Trends for real-time surveillance of disease outbreaks, emphasizing the need for specialized tools to track infectious diseases (Carneiro, & Mylonakis, 2009). Various applications of Google Trends have been explored across different research fields. For example, survey-based indicators were compared with Google Trends data for forecasting private consumption (Schmidt & Vosen, 2011). The capability of Google Trends to track a wide range of diseases beyond influenza was highlighted (Pelat et al., 2009). In the healthcare domain, a systematic review of studies using Google Trends was conducted, and a checklist for methodological documentation was provided (Nuti et al., 2014). Additionally, the ARGO model was introduced for accurately estimating influenza epidemics using Google search data, outperforming previous tracking models (Yang, Santillana, & Kou, 2015).

The evolution of research utilizing Google Trends over the past decade was discussed, with a focus on its applications in big data research (Jun, Yoo, & Choi, 2018). The reliability of Google Trends in different clinical settings was examined, revealing modest reliability for mapping the epidemiology of common diseases with minimal media coverage (Cervellin, Comelli, & Lippi, 2017). A methodological framework for using Google Trends in infodemiology and infoveillance was presented, emphasizing the importance of a robust methodological foundation for producing valid results (Mavragani & Ochoa, 2019). More recently, changes in public interest related to major depressive disorder (MDD) during the

COVID-19 pandemic were analyzed in the United States, Brazil, and India—three countries most severely affected by the pandemic—using Google Trends data (Li et al., 2022). Overall, Google Trends has been demonstrated to be a valuable tool for analysis and forecasting across various research fields, providing real-time data for diverse applications.

This study aimed to quantify public interest and online search behavior for various keywords related to online education and online learning software since the onset of the COVID-19 pandemic. The keywords included "online education," "online school," "online learning," "online teaching," and platforms such as Zoom, Skype, WebEx, and Google Meet. Data were collected using Google Trends, focusing on a period spanning January 1, 2019, to January 1, 2023, in the United States. The results are presented as relative search volume (RSV) values ranging from 0 to 100, where "100" represents the peak search volume within the specified time frame and location. Details of the methodology have been published elsewhere (Bhimavarapu, 2023). All searches were conducted on October 29, 2024.

3.Results

Since the onset of the COVID-19 pandemic, the RSV for keywords related to online education has surged dramatically. Comparing the average RSV changes for terms such as "online school," "online education," "online teaching," and "online learning" in the five months before and after March 1, 2020, we observed increases of 46.6%, 30.7%, 103.8%, and 188.3%, respectively. However, in the three months following August 1, 2020, public interest in these terms decreased by -46%, -50%, -60%, and -50%, respectively, and stabilized around November 2020 (Fig. 1). A similar trend was observed for search interest in e-learning software (Fig. 2). Among various platforms, Zoom emerged as the preferred choice for users, as indicated by its higher search volume compared to Skype, WebEx, and Google Meet (Fig. 3). Public search interest in online education saw a significant increase from March to October 2020, followed by a gradual decline and stabilization in November 2020.

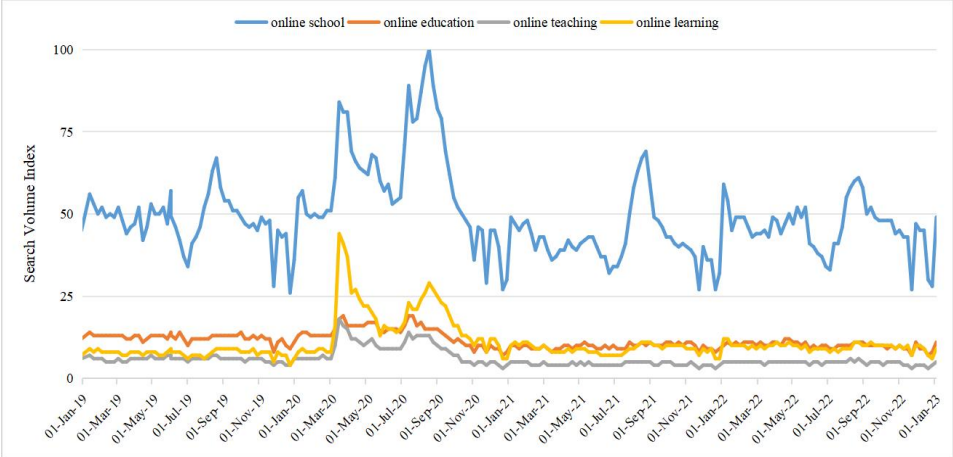

Fig. 1. Interest in search terms related to online education in the United States

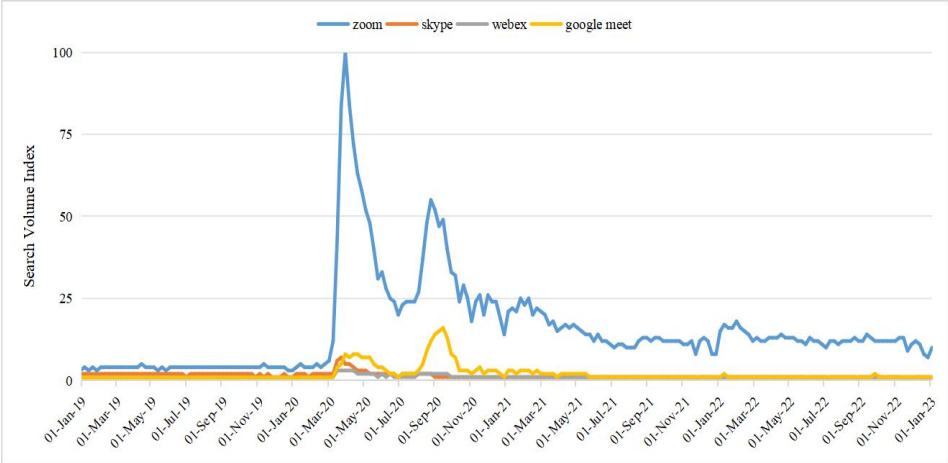

Fig. 2. Search interest in commonly used e-learning software in the United States

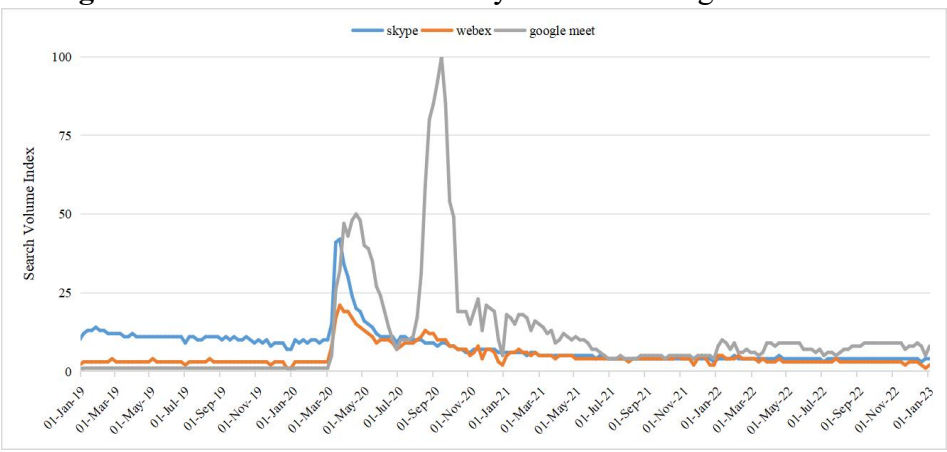

Fig. 3. Search interest in Skype, WebEx, and Google meet in the United States

4.Discussion

Since the emergence of the COVID-19 pandemic, online education has been launched at all levels of education around the world. This study highlights a significant increase in public interest in keywords related to online education and online learning platforms, particularly online schools and Zoom software. While public interest fluctuated during this period, these changes may correspond to the evolving nature of the pandemic. Our findings indicate that public interest in online education is substantial and persistent. Although search interest has since declined from its peak, it has stabilized at a notable level, suggesting that the use of digital media for education and teaching may represent an irreversible trend in the educational landscape.

The rapid emergence of online learning in the public sphere can be reflected through online search interest data. The increase in search interest highlighted here signals a heightened public awareness of digital education driven by COVID-19 lockdowns, which may have potential long-term implications (Adelhoefer et al., 2021). Firstly, e-learning offers

positive environmental benefits. By reducing the need for teachers and students to travel, online learning helps lower carbon emissions and other pollutants. Additionally, it reduces the demand for paper-based materials, contributing to resource conservation and environmental protection. However, e-learning also poses potential risks to students' mental and physical health. Prolonged online learning can lead to social isolation and reduced academic performance, potentially resulting in anxiety and depression. Moreover, extensive use of electronic devices for study purposes may cause eye strain and fatigue of the neck muscles, negatively impacting physical well-being. These circumstances highlight the necessity of developing strategies that enable long-term adaptation to the evolving needs of digital education. Online education has gained widespread recognition and adoption among educators and learners of all ages. For many teachers, this presents an opportunity to leverage innovative teaching methods powered by big data to bridge the gap between teachers and students. By enhancing communication and fostering deeper connections, teachers can better address the personalized learning needs of their students.

The Confucian concept of teaching students in accordance with their aptitude can be put into practice here. The Confucian principle of 'education for all without discrimination' emphasizes the importance of providing educational opportunities to every person, aiming to cultivate virtue across all societal levels (Hagen, 2022). This idea, first proposed by the ancient philosopher Confucius, is that teachers choose the learning method that suits the characteristics of each student according to their cognitive level, learning ability and motivations (Li, 2022). Online education embodies this ideal by promoting educational equity and inclusive education as online education embodies this philosophy in a way that is not limited by time and space. It was founded that during the pandemic, distance education became an important way to fill educational gaps, providing broader learning opportunities for remote areas and low-income groups (Chen, et al. 2022). It serves as a vital pathway toward achieving the United Nations Sustainable Development Goals (SDGs) by ensuring that all learners have equal access to education and opportunities for growth (United Nations, 2015；United Nations Development Programme, 2020).

The scholars examined how open, distance, and digital education promotes educational equity, emphasizing the critical role of technology in enhancing accessibility while advising policymakers to ensure equitable distribution of technological resources and supportive measures for all learners (Czerniewicz, & Carvalho, 2023). It was explored that during the COVID-19 pandemic, factors such as cultural characteristics, economic situations, skills, and knowledge all have a positive and significant impact on the development and success of

cloud-based e-learning systems (CELS) (Teng, Tan, & Ehsani, 2022). It was highlighted the significant challenges facing inclusive education in China while emphasizing that these challenges could be addressed through collective efforts across policy, school, community, and societal levels to build a more equitable and inclusive educational system for all students (Tan, 2021).

This study has certain limitations. First, online education trends reflected through search engine data do not necessarily replace or reflect the entirety of search data associated with traditional teaching models. Second, in our analysis, the selection of keywords and e-learning software related to online education was not exhaustive; instead, we focused on capturing data for the most commonly used keywords and learning platforms. Third, we acknowledge that selected query terms may have been entered for purposes unrelated to education, such as the use of Zoom by the e-commerce industry for virtual meetings. Additionally, terminology related to specific topics may evolve over time and is not limited to specific geographic regions. Nevertheless, we believe that our approach captured the most representative search terms for online education at the time of the study. Finally, while search data provides valuable insights for the education industry and is generally representative of broader trends, younger individuals may be overrepresented due to their more frequent internet use.

5.Conclusion

Public search interest in online education surged to unprecedented levels during the COVID-19 pandemic, followed by a decline beginning in November 2020. This heightened interest underscores the public's recognition of and expectations for online education. In the long term, the increased emphasis on online education, along with a substantial rise in the adoption of digital learning platforms, may reshape traditional teaching practices. The shift toward digital media for education appears poised to become an enduring trend in the educational landscape.

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