

From Crisis to Opportunity: A Google Trends Analysis of Global Interest in Distance Education Tools During and Post the COVID-19 Pandemic

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Abstract

This study investigated the impact of COVID-19 on global attention towards different distance education tools. We used Google Trend search queries as a proxy to quantify the popularity and public interest in different distance education solutions under 11 sub-segments, which include collaboration platforms, online proctoring, and resources for psychosocial support. The study employs both visual and analytical approaches to analyse global web search queries during and post the COVID-19 pandemic. Through cross-correlation analysis and dynamic time-warping analysis, the study confirms the contemporaneous and lead-lag relationships between COVID-19 and distance education-related search terms. Furthermore, the study highlights the critical role of psychosocial support in promoting the well-being of students and teachers during a pandemic. The study emphasizes the importance of Google footprint analysis in determining the most popular online education resources designed for different educational goals. This feature allows educators to gain insight into prominent distant education options, boosting their online teaching.

Keywords: *Online Learning; Online Teaching; Distance Education Solutions; COVID-19 Pandemic; Google Trend Search Queries; Psychosocial Support in Education*

1. Introduction

Despite a long history of substantial changes and improvements to the delivery and communication processes, COVID-19 has ushered in a new era of distance education, leading numerous educational stakeholders to take the concept seriously (Hosen, 2022; Richmond et al., 2020; Al Karim et al., 2022). The unexpected move from schools to homeschooling on a massive scale left children, educators, and parents vulnerable, resulting in millions of education-

related internet searches during the pandemic (Andrews, Richmond, & Marciano, 2021). Surprisingly, search spikes for distance education-related inquiries (Figure 1(c)) coincide with increased COVID-19 cases (Figure 1(a)) and related internet searches (Figure 1(b)), even though distance education has a longer history than the COVID-19 pandemic.

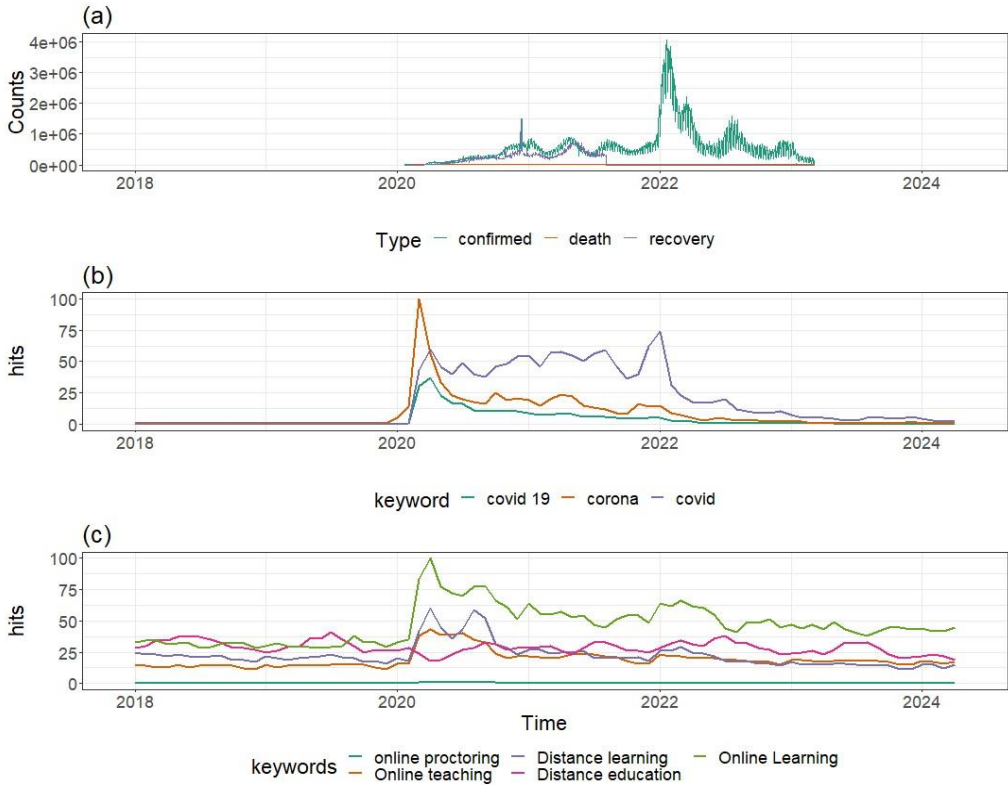


Figure 1. Visualization of data from Google search trends. (a) COVID-19 cases worldwide (b) Google search trends of COVID-19 related terms (c) Google search trends of distance education-related terms.

Google Trends, an open-source web analytics tool, offers users access to internet search data, providing valuable insights into population behaviour (Nutti et al., 2014). With ongoing discussions about the most suitable technology to support student learning, we explore whether Google Trends search queries can serve as a proxy for gauging the popularity and public interest in various distance education options. Our analysis primarily focuses on quantitative digital footprint data from December 2019 to April 2024. This study addresses two critical questions in distance education: (1) What solutions have emerged to meet the demands of distance education during and post the COVID-19 pandemic? (2) Which distance learning solutions have garnered widespread attention and public interest amid and in the aftermath of the COVID-19

pandemic? Through our examination, the resulting Google Trend footprint serves as an initial guide for identifying popular distance education tools across different educational purposes, including digital learning management systems, platforms compatible with basic mobile phones, options with robust offline functionality, Massive Open Online Course (MOOC) platforms, self-directed learning content, mobile reading applications, and collaboration platforms supporting live-video communication. This resource allows educators to streamline their search efforts and explore prominent distance education solutions to enhance their online teaching practices.

2. Methodology

Data on COVID-19 cases were collected from the coronavirus package in the R software which extracts information from the Johns Hopkins University Center for Systems Science and Engineering (JHU CCSE) data repository (Dong, Du, & Gardner, 2020). We utilized weekly Google Trends search queries as a proxy to examine the attention given to various distance learning solutions during and post the COVID-19 pandemic. All searches were conducted within the timeframe from December 1, 2019, to April 30, 2024, encompassing both the duration of the pandemic and the subsequent period.

According to Vaughan and Romero-Frías (2014), refining Google Trends searches to a specific category, such as education, enhances the relevance and accuracy of the data by minimizing noise. In this study, we concentrated on the education category. Google Trends offers relative search volume rather than absolute search numbers for a given term, adjusted based on the total searches within the specified geography and time frame (Cebrián et al., 2023). The resulting series ranges from 0 to 100, with each data point representing search interest relative to the highest point in the series for the chosen region and time. A value of 100 indicates the peak popularity of a term within the specified time frame.

Deciding on the appropriate search term in Google Trends is crucial, as each term carries different search volumes. Various strategies have been employed in previous studies to determine suitable search terms. Some studies relied on intuition or brainstorming processes for term selection (Vaughan & Romero-Frias, 2014). In our study, we considered the list of distance learning solutions published by UNESCO when choosing our search term (UNESCO, 2020a). Although these solutions are not explicitly endorsed by UNESCO, they typically possess extensive reach, a sizable user base, and evidence of effectiveness (UNESCO, 2020a). We conducted worldwide search queries for each keyword, using the keyword itself as the "search term." This approach enabled us to search for the exact text strings entered by users. However, Vaughan and Romero-Frias (2014) noted that abbreviations or acronyms generally have higher search volumes than their corresponding full names. Nonetheless, we opted not to use acronyms in our study, given our focus on specific tools and techniques available in the market to address distance education needs. Using acronyms could lead to confusion with other entities.

Our analysis encompassed 11 distinct sub-categories, including digital learning management systems, platforms designed for basic mobile phone usage, solutions with robust offline capabilities, Massive Open Online Course (MOOC) platforms, self-directed learning resources, mobile reading apps, collaboration platforms facilitating live-video communication, tools for educators to generate digital learning content, external repositories of distance learning resources, online proctoring tools, and resources aimed at offering psychosocial support. This segmentation was primarily guided by UNESCO's compilation of distance learning solutions issued in response to the COVID-19 pandemic.

In Google Trends, users are limited to searching for up to five queries simultaneously (Vaughan & Romero-Frias, 2014). To address this limitation, we conducted our analysis by entering up to five distance learning tools at a time under each segmentation and recording their relative ranking scores. Utilizing an iterative pairwise comparison method, we initially identified the series with the highest search volume during the study period. This iterative process allowed us to determine the tool with the highest relative ranking score, which served as a reference point for obtaining the relative ranking scores of other tools within the same segmentation (Vaughan & Romero-Frias, 2014). Our analysis employed both visual and analytical techniques to examine shifts in web search queries globally and identify emerging evidence regarding the impact of the COVID-19 pandemic on distance education. Furthermore, we assessed the correlation between weekly web searches and the global COVID-19 case count. Cross-correlation analysis and the dynamic time warping algorithm (Giorgino, 2009) were employed to explore the relationship and similarities between the search volume data related to COVID-19 and distance education.

3. Results and Discussion

According to Jarynowski et al. (2020), public concerns regarding various issues can follow a pattern akin to an epidemic, progressing from an initial phase of increasing interest, termed "early adoption," to a subsequent phase of widespread interest, referred to as "majority," and eventually declining in popularity, described as the "lagers stage." This life-cycle explanation of Google Trend search patterns is further supported by the observations depicted in Figures 1(b) and 1(c).

A pairwise comparison was conducted using the Dynamic Time Warping (DTW) algorithm, which involves stretching or compressing two time series locally to align them as closely as possible. The resulting distance between the two series is computed by summing the distances of individual aligned elements (Giorgino, 2009). Specifically, two pairwise comparisons were made: "corona" with "online learning" and "covid" with "online learning," aiming to assess the impact of COVID-19 on distance education. Both comparisons revealed significant areas of overlap and exhibited similar dynamic patterns. The DTW analysis yielded normalized

distances of 0.1326197 and 0.1828299 for the "corona" with "online learning" and "covid" with "online learning" comparisons, respectively. A normalized distance closer to 0 indicates a higher degree of similarity between the sequences, while a value closer to 1 suggests greater dissimilarity.

Furthermore, the close relationship between COVID-19 related search patterns and the search patterns for terms such as "Online learning," "Distance learning," and "Online teaching" was clearly established through time series cross-correlation analysis. Notably, the significant cross-correlation coefficients at lag zero provide strong evidence confirming the contemporaneous relationship between the search terms associated with COVID-19 and those pertaining to distance learning. The UNESCO-published list offers diverse distance education solutions for various educational needs. Figures 2 and 3 present Google trend footprint, reflecting global attention towards these solutions and aiding in identifying popular tools. However, the Google Trends series over multiple panels is incomparable because they indicate "relative" search volume for given terms. They are comparable only within a given panel.



Figure 2. Google trend footprint analysis of distance learning solutions during and post the COVID-19 pandemic.

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Figure 3. Google trend footprint analysis of distance learning solutions during and post the COVID-19 pandemic.

During the COVID-19 pandemic, Google Classroom gained widespread attention for its user-friendly features. However, public interest in systems designed for basic mobile phones is

notably limited, punctuated only by occasional, significant spikes. Kolibri garnered attention for its offline functionality, crucial for learners in underserved areas. Canvas stood out among MOOC platforms, while Quizlet excelled in self-directed learning. Reads emerged as a preferred mobile reading app, and WhatsApp surpassed Zoom in live-video communication platforms. Collaboration tools like Nearpod and EdPuzzle also gained traction. External repositories like Brookings and Education.Nation received significant attention for their extensive resources. Online proctoring tools such as Pearson VUE saw increased interest amid the pandemic. Peaks in March 2020 aligned with school closures (UNESCO, 2020b), reflecting the urgency for remote learning solutions, while spikes in August 2020 indicated ongoing challenges in reopening schools fully (UNESCO, 2020b).

Effective psychosocial assistance is critical in improving the mental health and overall well-being of both students and teachers during a pandemic. This is evident from the considerable jumps in Google search volume index graphs for the phrase 'Psychosocial support' during academic breaks in the third quarter of 2020, 2021, 2022 and 2023 (Figure 4), particularly in the 'Education' category. The unexpected spike in the first quarter of 2022, diverging from the typical third-quarter patterns, aligns with the global peak of COVID-19 cases recorded during that same period. This surge underscores the profound impact of the pandemic on education, resulting in widespread partial school closures due to the significant disruptions to conventional onsite classroom teaching. These surges highlight the compelling need to address and resolve these challenges. Analyzing secondary data in this manner is critical, as these characteristics may be overlooked due to decreased engagement and communication between students and educators during school closures.

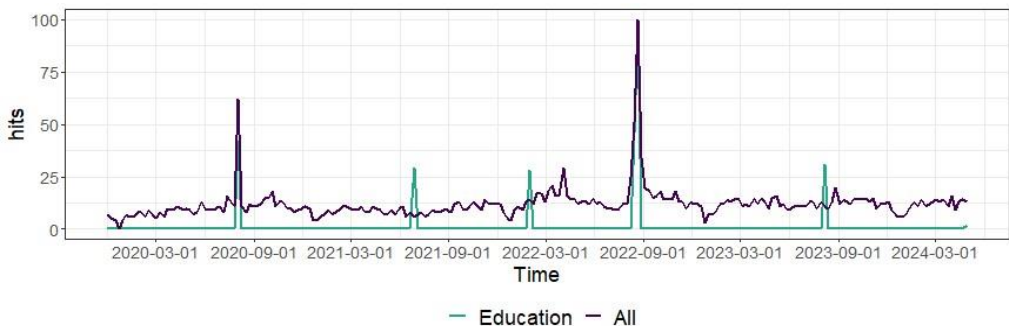


Figure 4: Google search trend of the term psychosocial support under 'All' categories and 'Education' category during and post the COVID-19 pandemic.

4. Conclusions and Further Work

The primary aim of this research was to explore the utility of Google Trend search queries in gauging the popularity and public interest surrounding various distance education solutions. This study represents a pioneering effort, being the first comprehensive analysis of web search

behaviour concerning distance learning solutions during and post the COVID-19 pandemic. While prior studies have examined Google Trend search queries related to education, they have typically focused on a limited number of search terms or different research objectives. In contrast, our investigation extends this research by analyzing a broader array of relevant search terms and conducting a more detailed examination of the popularity and interest in distance learning solutions amid the pandemic.

Our findings underscore the substantial impact of the COVID-19 pandemic on global interest in distance education, as evidenced by the strong correlation between COVID-19-related search terms and those pertaining to distance education in Google Trend queries. Moreover, our thorough analysis of Google Trend data reveals a surge in the popularity and public attention toward diverse distance learning solutions during this period. These insights offer valuable guidance for educators seeking to navigate the myriad options available in the market and identify the most effective tools for different educational needs. Furthermore, our study highlights the crucial role of learning tools in enhancing student engagement in online learning, a point emphasized in previous research. Consequently, our findings hold particular relevance for developers and educational institutions, providing them with valuable information to identify competitors in the market and enhance existing tools. Additionally, the challenges posed by the high costs of distance learning solutions, inadequate financial support, and limited understanding of available options during and post the COVID-19 pandemic underscore the importance of our study's insights. By offering valuable guidance to stakeholders in education—including teachers, administrators, policymakers, and students—our research facilitates informed decision-making with limited time and effort.

Moreover, our study emphasizes the critical importance of psychosocial support in promoting the mental health and well-being of both students and teachers during a pandemic, as evidenced by spikes in search volume during academic breaks and school closures. Addressing these overlooked aspects through effective measures is paramount, as demonstrated by our analysis of secondary data, which enables the identification and prioritization of areas requiring attention. By prioritizing psychosocial support, educational institutions can contribute to fostering a healthier and more resilient school community.

While our analysis of Google Trends data serves as a valuable proxy for quantifying the popularity and public interest in distance education solutions during the pandemic, it is essential to acknowledge that popularity alone does not guarantee quality. Future research endeavors should focus on evaluating the efficiency and effectiveness of the most popular tools to ensure engaging and effective online learning experiences. Additionally, considering the limitations of Google Trends data—including its capture of search behaviour from a subset of the population with internet access and its relative volume representation—further investigation is warranted at the national and regional levels to identify specific measures for ensuring the quality of distance education on a broader scale.

Furthermore, as highlighted by Cebrián et al. (2023), there is a need for future research to delve deeper into the data quality aspects of Google Trends search queries. While our study has provided valuable insights into the popularity and public interest in distance education solutions during and post the COVID-19 pandemic, there remains a gap in understanding the accuracy, reliability and coverage of Google Trends data. Exploring the scope and determinants of potential inaccuracies in Google Trends data across various contexts would be instrumental in enhancing its utility for educational research and decision-making.

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