Visualizing Google and YouTube Search Trends for COVID-19, Instructional Design, and Remote Learning

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Abstract

As educational institutions switched from in-person to Remote Learning or Emergency Remote Teaching (ERT), this study explores the search popularity indices of three search terms globally and in the USA from January 2020 - April 2021. Google search terms, such as *COVID-19*, *Instructional Design,* and *Remote Learning*, showed considerable search interest in Google Trends at the peak of the pandemic on Mach 11, 2020 (WHO, 2020). Pytrends was used to extract search interest of the primary and related terms from Google and YouTube Search globally and in the USA (Pytrends, n.d.). The search interest of the three search terms and associated terms exhibited similar peaks and dips of interest at the beginning of the pandemic and the 2020-2021 school year. Educational technology tools, including *SeeSaw Learning* and *Zoom,* were present as related search terms for *Remote Learning*. Search queries in YouTube revealed educational channels that host various lecture materials related to K-12 and professional development. The interactive visualizations in Tableau Public enable users to explore the search trend patterns of the three main terms and related queries. This project serves as an archive of users' conscious information seeking to highlight the pivotal roles of Instructional Design and Remote Learning observed in search popularity indices in light of the pandemic. The project can be accessed at edtechtrends.javierleung.com or on Tableau Public (Leung, n.d-a, n.d.-b).

Keywords: Instructional Design, Remote Learning, COVID-19

Introduction

The World Health Organization (WHO) declared the novel coronavirus (COVID-19) outbreak a global pandemic on March 11th, 2020 (WHO, 2020). Since the beginning of the pandemic, 1.3 billion learners are still affected by the school, and university closures as institutions implement entirely online and hybrid solutions (UNESCO, 2020). As instructors in higher education and K-12 adapt their face-to-face curricula to distance delivery formats, the role of Instructional Design and Technology has been a critical element in creating equitable access to learning experiences for all kinds of learners.

This study reports on a data visualization project of global and USA search trends related to *Instructional Design, Remote Learning,* and *COVID-19* before the pandemic and at the peak of the pandemic across Google and YouTube Search. This project explores popularity indices in a single interactive interface using Tableau Public by querying the Google Trends API. The

project also enables users to explore search popularity indices of multiple search terms over time from January 2020 through April 2021. In these visualizations, the audience can interact with the search popularity indices for trending searches and related queries for three search terms (i.e., *Instructional Design, Remote Learning,* and *COVID-19*). Although Google Trends provides a way for exploring the popularity index (0% - 100% being the most popular) of an individual search term for the past 12 months or since 2004 for specific search terms, the interface of Google Trends does not allow for exploration of multiple related terms. This project provides a better understanding of the pivotal role of Instructional Design, Remote Learning, educational technology tools in the context of the COVID-19 popularity index.

Literature Review

The following literature review is divided into two sections. The first section describes the needs of educators in ERT during the COVID-19 pandemic. The second section describes the applications of Google Trends in academic and clinical research.

Emergency Remote Teaching and Learning

During the Spring of 2020, K-12 schools and institutions of higher education moved face-to-face classes to online formats to prevent the spread of the virus that causes COVID-19. As the 2020-2021 school year has progressed, schools have faced the difficult transition to emergency remote teaching (ERT) while keeping students, faculty, and staff safe. Hodges et al. (2020) clearly defined the differences between ERT and online learning. ERT is the shift of instructional delivery to alternate delivery modes due to crisis circumstances. In contrast, online learning involves design decisions for effective online learning based on Instructional Design choices that generally require six to nine months before the course is delivered (Hodges et al., 2020). Furthermore, Barbour et al. (2020) identified the four phases of educational institutions responding to the COVID-19 pandemic. The first phase involved a rapid transition to remote teaching and learning where the health and safety of students and educators were the most critical aspect while transitioning course materials to synchronous (e.g., video over Zoom or WebEx) and asynchronous (e.g., Google Slides and VoiceThread) online formats in four weeks. The second phase required ERT to include essential components, including (1) course navigation, (2) equitable access, (3) student support mechanisms, and (4) academic integrity. As face-to-face courses were transitioned to ERT with acceptable mechanisms for delivering quality learning experiences, the third phase involved careful planning in supporting students and educators for a full term for online delivery. In the fourth phase, K-12 schools and institutions of higher education had new levels of online learning infrastructure to support students and educators.

Supporting the Needs of Educators

Recent studies have identified the needs and challenges of educators (e.g., faculty in higher education) and staff (e.g., Instructional Designers and Technologists) in delivering ERT to students and supporting the professional development needs of educators in the light of the ongoing global COVID-19 pandemic. Redstone and Luo (2021) reported the types of professional development (e.g., teaching, community, and organization support) that instructors

in higher education needed during ERT. Their principal findings included a centralized information hub for resources to support ERT transition and community support for self-directed and peer-to-peer social activities (Redstone & Luo, 2021). Also, Vollbrecht et al. (2021) identified design considerations for ERT delivery. Seven suggestions include (1) considering learners in different time zones, (2) team-based teaching in synchronous sessions, (3) increasing faculty availability for student questions, (4) providing specific time for troubleshooting technical difficulties and classroom breaks in synchronous sessions, (5) providing several learning opportunities in both synchronous and asynchronous formats, (6) considering the well-being of students and educators, and (7) findings ways to engage students virtually.

Google Trends for Research

Google Trends is widely used to complement traditional academic and clinical research to predict or forecast outcomes (e.g., economic activity, disease tracking, and user's search behavior) in a given geographical area (Levinthal, 2021). In epidemiology, several studies using Google Trends data helped predict the spread of respiratory diseases in geographic regions of interest (Polgreen et al., 2008; Brownstein et al., 2009; Valdivia & Monge-Corella, 2010; Mavragani & Gkillas, 2020). Google Trends can also be used as a surveillance system to detect disease outbreaks. For example, Carneiro and Mylonakis (2009) argued that Google Trends could detect regional influence outbreaks 7-10 days before conventional surveillance systems used at the Centers for Disease Control and Prevention. In economics, Google Trends is used to predict several economic metrics, including unemployment claims in the US, Germany, and Israel (Choi & Varian 2009; Askitas & Zimmermann, 2010) and consumer and consumption sentiment (Huang & Penna, 2009; Schmidt & Vosen, 2009).

Problem Statement

The COVID-19 crisis brought immense challenges to educators and instructional staff around the globe. It is hypothesized that Instructional Design, Remote Learning, educational technology tools are critical knowledge and skills for ERT delivery. Therefore, Google and YouTube searches should reflect users' information needs, especially at the beginning of the pandemic and the 2020-2021 school year.

While models of information behavior exist to explain why users seek information, this exploratory study does not adhere to a specific information behavior model due to various users' motivations, needs, and their roles in the search, and possibly avoidance, of information. Despite the lack of generalizability of information behavior captured in Google Trends, Case and Given (2016) identified the agreed-upon terminology in the information behavior literature, including information need, information seeking, and information behavior. An information need refers to the inadequate knowledge that users have. Information seeking is the conscious effort to acquire knowledge in response to the need or gap. Information behavior is complex and encompasses both conscious and unconscious information seeking, encountering, or avoidance.

Purpose & Significance of the Study

The purpose of this study is two-fold. First, this study explores the popularity indices of *COVID-19, Instructional Design, and Remote Learning* as the primary search terms from Google and YouTube Search from January 2020 - April 2021 globally and in the United States. Second, the study seeks to identify the peaks and dips of user search interest in light of the COVID-19 pandemic. The study explores the following research questions:

- **RQ 1**: What are the related search terms for *COVID-19, Instructional Design,* and *Remote Learning* from Google Search and YouTube Search globally and in the USA?
- **RQ 2**: What are the peaks and dips in popularity indices for *COVID-19, Instructional Design,* and *Remote Learning* from Google Search and YouTube Search globally and in the USA?

The study's findings allow for an exploration of search interest for knowledge in Instructional Design, Remote Learning, and educational technology tools to support the transition from face-to-face to the ERT format as educational institutions grapple with the pandemic. The following section describes the extraction methods and visualization components.

Methods

The Python Pytrends package was used to connect to the Google Trends API to extract search popularity indices of three keyword searches, *COVID-19*, *Instructional Design*, and *Remote Learning,* from Google Search and YouTube Search (*Pytrends*, n.d.). These search trend reports identify the normalized search volume of keywords and topics by state or province, country, and continent. Although Google Trends data does not indicate the real-time volume of searches, the data is normalized from 0 -100 to describe the search interest of topics (i.e., 0 being the lowest and 100 being the maximum peak of interest) for the past five years or 2004 for specific search terms (*FAQ about Google Trends Data - Trends Help*, n.d.).

For this particular study, the *TrendReq*, *Interest Over Time*, and *Related Queries* methods in the Pytrends Python package were implemented to automate the download of search trend reports from Google Search and YouTube Search from January 2020 - April 2021. Each report described the popularity indices of the keywords mentioned for the United States and globally. To further identify the related search term queries for *COVID-19*, *Instructional Design*, and *Remote Learning,* the *Related Queries* method in Pytrends allowed the extraction of the search trend data of related queries. Five known limitations of this study involved the following:

1. Filtering certain search terms
2. Extracting top search terms over rising search terms
3. Eliminating related and repeated main search terms and their variations that do not align with the context of Instructional Design and Remote Learning
4. Censorship of Google and YouTube in certain countries
5. Global search volume can be skewed

First, Google Trends filters certain types of searches, including searches with a volume of *0* or very few searches made by few people, duplicate searches, or repeated searches from the same person over a short period, and searches with special characters that use apostrophes and other special characters. Second, Google Trends allows extracting top and rising searches. While top searches are the terms with the most frequency, rising searches are the terms that have had significant growth over time. For this particular study, rising terms were not considered because of the changing nature of search volume growth. Unlike rising terms, top searches reflected the real search interest of individuals in the USA and globally. Third, the visualizations did not include related and repeated main search terms, including *breathing exercises covid-19, covid-19 vaccine, instructional materials design,* and *instructional design jobs*. However, the terms above are included in Tables 2 and 3. Fourth, certain countries do not allow access to Google and YouTube. Crimea, Cuba, Iran, North Korea, and Syria do not allow access to Google services (*Countries or Regions Where Google Workspace Is Available - Google Workspace Admin Help*, n.d.). China, Eritrea, Iran, North Korea, Sudan, South Sudan, Syria, Tajikistan, and Turkmenistan do not allow access to YouTube services (Wikipedia contributors, n.d.). Fifth, there is a possibility that search index volume from Google and YouTube Search can be skewed based on a country's search volume. For example, the majority of search volume may come from the USA and India for global search trends. For this study, the global search index includes the United States and other countries, excluding countries where Google and YouTube are banned.

Two datasets were assembled to represent the popularity indices of various search terms to describe the search trends for the primary keyword searches and related terms in the United States and globally. Each dataset was subsequently visualized on a weekly basis in Tableau Desktop. Even though trend reports are insightful in understanding the peaks and dips of search interest of specific terms, the COVID-19 pandemic adds a vital context related to the information seeking of users in understanding the need for information in Instructional Design and Remote Learning. The design of the Tableau dashboards involved following six fundamental principles of information design by Tufte (1983), including comparison, causality, multivariate, integration, documentation, and context. Each Tableau dashboard is contextualized around COVID-19 milestones and news related to vaccine development by the World Health Organization (WHO), U.S. Food Drug and Administration (FDA), United Nations (UN), and National Institutes of Health (NIH). These important milestones are annotated in the search trend data for the *COVID-19* term along with its respective search popularity index. While the beginning of the 2020-2021 school year varies in the USA, the school year was annotated on August 1st, 2020. A summary of milestones and indices is depicted in Table 1.

Table 1

Summary of Milestones and Search Popularity of Main Terms by Google and YouTube Search

Date	Milestone	Global COVID19 Index	USA COVID/ COVID19 Index	Global Instructional Design Index	USA Instructional Design Index	Global Remote Learning Index	USA Remote Learning Index
03/11/2020	**Milestone 1:** WHO declares COVID-19 a pandemic	Google 86 YouTube 67	Google (Covid) 100 YouTube (Covid19) 57	Google 37 YouTube 57	Google 51 YouTube 51	Google 100 YouTube 63	Google 63 YouTube 63

			19				
06/26/2020	WHO announces 2 billion doses of COVID-19 vaccine	Google 11 YouTube 12	Google (Covid) 82 YouTube (Covid19) 12	Google 76 YouTube 76	Google 69 YouTube 69	Google 17 YouTube 69	Google 71 YouTube 21
07/27/2020	Phase 3 clinical trial of an investigational vaccine for COVID-19 begin	Google 12 YouTube 11	Google (Covid) 73 YouTube (Covid19) 11	Google 79 YouTube 71	Google 87 YouTube 79	Google 60 YouTube 60	Google 73 YouTube 60
08/01/2020	**Milestone 2:** Beginning of 2020 school year (USA)	Google 75 YouTube 7	Google (Covid) 63 YouTube (Covid19) 7	Google 84 YouTube 84	Google 71 YouTube 71	Google 79 YouTube 79	Google 88 YouTube 79
12/18/2020	**Milestone 3:** FDA grants emergency use authorization to Pfizer and BioTech's coronavirus vaccine	Google 59 YouTube 35	Google (Covid) 85 YouTube (Covid19) 35	Google 30 YouTube 46	Google 51 YouTube 46	Google 100 YouTube 10	Google 30 YouTube 19
02/27/2021	**Milestone 4:** FDA grants emergency use authorization to J&J 's Covid-19 vaccine	Google 35 YouTube 6	Google (Covid) 67 YouTube (Covid19) 6	Google 60 YouTube 60	Google 13 YouTube 60	Google 10 YouTube 15	Google 16 YouTube 15
04/20/2021	**Milestone 5:** Global tally of deaths from Covid-19 surpasses 3 million	Google 19 YouTube 32	Google (Covid) 53 YouTube (Covid19) 32	Google 42 YouTube 42	Google 38 YouTube 42	Google 10 YouTube 10	Google 8 YouTube 14

Four Tableau dashboards were published to identify Google and YouTube search trends globally and in the United States for *COVID-19, Instructional Design,* and *Remote Learning.* The terms *Instructional Design, Remote Learning,* and *COVID-19* are selected by default in the dashboards. Also, the terms of interest contained annotations of the selected terms with their respective peaks of search interest and their average popularity indices. Multiple terms can be selected and highlighted using the selection menu to compare search trend data further. As search terms are chosen, the terms are color-coded with their respective labels on the trend chart. To better navigate the charts, it is recommended to view the dashboards in full-screen mode.

Findings and Discussion

It is essential to point out that *Covid19* had more peaks in Google Search globally than *Covid-19*. In the United States, *covid* was more prominent than other term variations (e.g.,

Covid-19, Covid 19, and Covid19) in Google Search. In the United States, *Covid* was the primary search term in Google Search, whereas *Covid19* was the prevalent search term in YouTube Search. Interestingly, the term *Emergency Remote Teaching* and its variations (e.g., *ERT, Emergency Remote Learning, and Emergency Remote Teaching and Learning*) did not appear as related terms to *Instructional Design* or *Remote Learning*. It seems that users were more acquainted with *Remote Learning* and associated educational technology tools.

RQ 1: What are the related search terms for *COVID-19, Instructional Design,* and *Remote Learning* from Google Search and YouTube Search globally and in the USA?

For *COVID-19*, the related terms included *Covid19* for global Google Search and *Covid* for USA Google Search. Also, related search terms (i.e., cases, deaths, news, symptoms, and testing) to *Covid19* were prevalent in Google Search in the United States. Related combinations such as *Instructional Design + Remote Learning* were present in both global and USA Google Search. *Remote Learning* also contained related terms, including *E-Learning + Remote Learning* in global Google Search and *covid19 + remote learning* in the USA Google Search.

Interestingly, related terms to *Remote Learning* in global Google Search included an educational technology provider (i.e., *Seesaw Remote Learning*) and a web conferencing tool (i.e., *Zoom*). Seesaw Remote Learning is an online classroom app that delivers asynchronous and synchronous learning with feature-rich communication and class management tools. In addition, Seesaw provides integration of Google Classroom and support of BYOD (i.e., Bring Your Own Device) to allow students' personal devices with access to school resources (*Seesaw*, n.d.). Zoom is better suited for synchronous remote and hybrid learning as a web conferencing tool for teaching and learning. Zoom also supports a variety of engagement strategies, including formative strategies (e.g., quizzes and surveys) and brainstorming activities (e.g., breakout rooms, screen sharing, and interactive whiteboard) (*Zoom for Education*, n.d.). Table 2 summarizes the related terms or queries for the search terms of interest (*COVID-19, Instructional Design,* and *Remote Learning*) from Global and USA Google Search.

Table 2

Related Search Terms for Global and USA Google Search

COVID-19		Instructional Design		Remote Learning	
Global	**USA**	**Global**	**USA**	**Global**	**USA**
Covid-19 *Covid19* *covid19 + remote learning*	*Covid* *Covid 19* *Covid-19* *Covid19* *Vaccine* *Covid19 Cases* *Covid19 Deaths* *Covid19 News* *Covid Symptoms* *Covid19 Us* *Covid19 Testing*	*Instructional Design* *Instructional Design + Remote Learning*	*Instructional Design* *Instructional Design + Remote Learning*	*E-Learning + Remote Learning* *Elearning + Remote Learning* *Zoom* *Seesaw Remote Learning* *School Remote Learning*	*Doe Remote Learning* *Zoom* *Seesaw Remote Learning* *Zoom Remote Learning* *Zoom For Remote Learning* *What is Remote Learning* *Remote Learning Tips* *Remote Learning Setup* *Remote Learning Fall 2020*

					remote learning covid19 + remote learning

For the term *Covid-19*, the related terms were variations of the search term (*covid* and *covid 19*), *covid-19 vaccine*, and *covid-19 + remote learning* in global Youtube Search. In contrast, in USA YouTube Search, related terms were *covid* and *breathing exercises covid-19*. In terms of *Instructional Design* in global YouTube Search, related terms were related to the design of instructional materials and jobs in Instructional Design. However, related terms to *Instructional Design* were not present in the USA YouTube Search. For *Remote Learning* in global YouTube Search, three related terms were related to *covid* and two YouTube channels that host free educational content, including Vidura and Gours. Vidura eLearning is based in Sri Lanka with approximately 19,000 subscribers and provides educational content from grades 1 through 5 (*Vidura eLearning*, n.d.). Gours eLearning is based in India with about 52,000 subscribers and offers financial education and certification resources in online instructor-led and self-paced formats (*Gour's e-Learning*, n.d.). Table 3 summarizes the related terms or queries for the primary key search terms (*COVID-19, Instructional Design,* and *Remote Learning*) from Global and USA YouTube Search.

Table 3

Related Search Terms for Global and USA YouTube Search

COVID-19		Instructional Design		Remote Learning	
Global	**USA**	**Global**	**USA**	**Global**	**USA**
covid covid-19 vaccine covid 19 covid-19 + remote learning	covid breathing exercises covid-19	instructional materials design instructional design jobs	N/A	covid vidura elearning gours elearning	N/A

RQ 2: What are the peaks and dips in popularity indices for *COVID-19, Instructional Design,* and *Remote Learning* from Google Search and YouTube Search globally and in the USA?

A total of ten findings were found in comparing popularity search indices for Google and YouTube Search in the United States and globally. Overall, this study's terms of interest and related terms exhibited similar peaks and dips of search interest at the start of the pandemic in March 2020 and the 2020-2021 school year. The section below highlights the findings by global and USA Google Search and YouTube Search.

Global Google Search

Finding #1. The search term *Covid19* had more peaks than *Covid-19*. *Covid19* received more search interest than *Covid-19* in Google Search globally.

Finding #2. The search terms *Covid19, E-Learning + Remote Learning, Elearning + Remote Learning, Instructional Design + Remote Learning,* and *Remote Learning Fall 2020* exhibited similar peaks of interest in Google Search globally.

Finding #3. *Remote Learning* had two significant peaks of interest at the beginning of the pandemic and the 2020-2021 school year, followed by a downward trend in Google Search globally.

USA Google Search

Finding #4. The term *Covid* was the most prominent with an upward trend than any other variation of the term (*Covid-19, Covid 19, and Covid19)* in USA Google Search.

Finding #5. The term *Instructional Design* was at its highest peak (100) on July 12th, 2020. Then it levelled off in 2021 with search interest approximately at 65 in USA Google Search. *Instructional Design* remained independent of the pandemic's peaks of interest for *Covid* and its related terms.

Finding #6. The terms *Covid* and *Remote Learning* terms exhibited similar peaks of interest at the beginning of the pandemic and the 2020-2021 school year. About *Covid, Remote Learning* was at its highest after 18 days of the beginning of the pandemic and after 32 days at the beginning of the school year in August 2020. After October 2020, the *Remote Learning* term experienced a drastic downward trend by the end of 2020 and the beginning of 2021. It would be possible that public and private institutions have leveraged educational technologies to deliver learning in online and hybrid formats at the beginning of the Fall of 2020.

Global YouTube Search

Finding #7. The terms *E-Learning + Remote Learning, Elearning + Remote Learning, Remote Learning,* and *remote learning* had similar peaks and dips search interest in YouTube Search globally.

Finding #8. *Remote Learning*, *remote learning,* and *Instructional Design + Remote Learning* experienced two significant peaks at the height of the pandemic and the 2020-2021 school year, followed by a downward trend in early 2021. Global YouTube Search interest for *Instructional Design* did not seem to show significant peaks and dips in 2020 and early in 2021.

USA YouTube Search

Finding #9. In the USA YouTube Search, *Zoom, Zoom Remote Learning, Covid19, Covid-19, Instructional Design + Remote Learning,* and *covid19 + remote learning* exhibited significant peaks at the beginning of the pandemic in March 2020 and the 2020-2021 school year in August 2020.

Finding #10. In the USA YouTube Search, *Instructional Design + Remote Learning* and *Zoom* showed similar search interest with peaks of interest at the beginning of the pandemic and

2020-2021 school year. However, *Instructional Design* exhibited no significant peaks or dips in search interest on YouTube and experienced two significant peaks (100% interest) on July 12th and September 20th, 2020.

Implications & Future Research

The study presents implications for practice and research. The significance for practitioners involves bringing awareness of centralized information hubs to help educators and students transition to ERT and establishing communication plans for resource-sharing among Instructional Designers and Technologists who support educators' professional development. The implication for researchers identifies the need to study the main search terms and their related queries to understand users' information seeking and needs in emergency situations. Research can also focus on anticipating information seeking by exploring upward and downward trends in search queries.

Conclusion

This study accomplishes two goals: (1) keeping an archive of information seeking from search engines and (2) highlighting the search interest of Instructional Design, Remote Learning, and educational technology globally and in the USA across Google and YouTube Search from January 2020 - April 2021. The search term *Remote Learning* and *Covid* had similar peaks of search interest in USA Google Search at the beginning of the pandemic in March 2020 and the 2020-2021 school year. In USA Google Search, the highest peak for *Remote Learning* occurred 18 days after the highest peak for *Covid*, and 32 days after the beginning of the school year, given the assumption that the school year began in the first week of August.

The search term variations of the *COVID-19* terms were C*ovid-19, Covid19,* and *covid19 + remote learning* in global Google Search. Related terms to *COVID-19* included *Covid19, Covid19 Cases, Covid19 Deaths, Covid19 News, Covid Symptoms, Covid19 US,* and *Covid19 Testing* in USA Google Search. Related terms to *Instructional Design* were *Instructional Design + Remote Learning* in USA Google Search. Associated terms for *Remote Learning* showed educational technologies (e.g., *Zoom, SeeSaw, Remote Learning Setup,* and *E-Learning*) in global and USA Google Search. In USA Google Search, related terms to *Remote Learning* included governmental guidance (e.g., *Doe Remote Learning*) at the beginning of the 2020-2021 school year.

The related search terms for *COVID-19* were *vaccine* and *remote learning* in global YouTube Search, whereas *breathing exercises covid-19* was present in USA YouTube Search. *Instructional Design* did not have any related terms to *COVID-19* and *Remote Learning* in global and USA YouTube Search, except for *instructional materials design* and *instructional design jobs*. In global YouTube search, related terms to *Remote Learning* included educational channels that target K-12 students and professional development resources. However, no associated terms for *Remote Learning* were present in USA YouTube Search.

As educational institutions face last-minute adaptations of face-to-face curricula to online and hybrid formats, the COVID-19 pandemic has accelerated the need for knowledge related to Instructional Design, Remote Learning, and educational technology tools.

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