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Indonesian perceptions on online learning amidst COVID-19: a Twitter sentiment analysis

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ABSTRACT

The objective of this research is to uncover Indonesians' perceptions of online learning during the COVID-19 pandemic by determining the polarity of language texts (positive, neutral, or negative) compiled from Twitter. The data required to reveal the Indonesian people's opinion on online learning during the COVID-19 pandemic is a tweet on Twitter with the hashtag #Pembelajaran daring (Online learning); #Pembelajaran jarak jauh (distance learning); #Belajar dari rumah (learning from home); #Belajar di rumah (learning in the home) (learning at home). The time frame for collecting these tweets is March 2020 to November 2021. The data was then analyzed using lexicon analysis and analytical tools that used Part of Speech Tagging. According to the results, 77.58% of the tweets are positive, 17.97% are negative, and the remainder are neutral. People prefer to refer to learning support, teachers, schools, education, students, and distance learning. Distance learning is the most positively received category among online learning. However, learning support is the most widely discussed topic among the general public. The overwhelming positive sentiment across all categories suggests that the majority of Indonesians have high hopes for online learning during the pandemic.

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1. INTRODUCTION

Due to the dynamic character of our modern technology society and the more recent global COVID-19 pandemic, which caused schools all over the world to switch to online learning. Online learning has expanded at an astounding rate [1]. To overcome COVID-19, the Indonesia government enacted a broad-scale social restriction policy. People are told to work from home, study at home, and worship at home [2], [3]. People are increasingly reliant on the internet to carry out their daily activities. The COVID-19 pandemic has had a significant impact on education, particularly the learning process. Almost all learning activities are carried out in a digital environment. Students enroll in an online course to receive materials, submit assignments, or take exams without having to leave their homes [4]. Even without proper preparation, the transition from offline to online learning is very noticeable. Almost all levels of society who are in contact with education feel the same shock. However, not all people can express their anxiety about the changes in the learning process openly.

The pandemic and the isolation period at home have caused the duration of internet access to increase [5]. The internet and related platforms are increasingly being used by Indonesians. By July 2021, online penetration in Indonesia will be around 70% [6], with 170 million of whom are digital media users with YouTube, WhatsApp, Facebook, Instagram, and Twitter as the five main platforms [7]. It can be seen that 25% of youth in Indonesia are Twitter users, and more than 20% of them access Twitter more than four hours a day [8]. Therefore, it is predicted that the number of tweets on Twitter will increase during the COVID-19 pandemic in Indonesia. Twitter is a real-time network that allows users from all over the world to share information via private and public messages that are limited to 140 characters [9]. The survey revealed that Twitter is most popular for those who want to share their work, follow other people's discussions in their field, and communicate with friends [10]. Twitter is used for a variety of purposes, including updating current statuses, starting conversations, promoting products, and even spamming [11]. The enormous amount of shared opinions on this platform has prompted many researchers to collect data from the platform in order to examine sentiments on a variety of social issues[12]–[16]. Thus, Twitter can be used as a rich source of data related to public opinion and perspectives in Indonesia about online learning during the COVID-19 pandemic.

The phenomenon of online learning during COVID-19 has been widely revealed and studied by researchers around the world. Many researchers have studied in terms of public opinion and perspective from the side of students, teachers, stakeholders, and parents. Research from [17]–[22] there has already been research into students' perceptions of online learning, and the results have been mixed. Some studies show positive student perceptions of online learning, while others show reservations about it as a learning mode. In addition, at the higher education level, students' perspectives on online learning during the COVID-19 pandemic have also been studied [23]–[31]. Previous researchers mostly used survey methods to reveal the opinions and perspectives of parents, teachers, and stakeholders [32]–[36]. Nonetheless, the majority of students in the preceding studies have favorable attitudes toward online learning. However, three of these studies used quantitative methods, and while quantitative approaches are excellent for providing descriptive data, they can be difficult to interpret at times, especially with regard to opinions and perspectives. However, these studies have not revealed public opinion in Indonesia yet. In Indonesia [37]–[41] have researched teachers' and students' opinions related to online learning during the pandemic using online questionnaires. In addition, these studies only reveal opinions and perceptions from the side of students, teachers, and education stakeholders. Meanwhile, public opinion and perception have not been exposed much. Therefore, research that can reveal public opinions, perspectives, and concerns about online learning conducted during the COVID-19 pandemic is necessary.

Newer methods, such as combining data mining and sentiment analysis, are being developed to better understand the sentiment of a specific subject. Instead of requiring specific settings, this method could capture messages from a wide range of audiences [37]. In information retrieval, an automated system that predicts the sentiment of textual data is known as sentiment analysis. This field refers to a broad area of natural language processing, computational linguistics, and text mining. These sentiments can be categorized into two categories: positive and negative; or on an n-point scale, for example, very good, good, satisfactory, bad, or very bad [42]. In this case, the task of sentiment analysis can be interpreted as a classification task in which each category represents a sentiment [43]. Many studies have successfully used sentiment analysis and Twitter stream application programming interface (API). For example, Kharde and Sonawane used the Naive Bayes algorithm to classify 45.000 tweets from Stanford datasets, while the used of 19.000 tweets from public streaming Twitter API and various sentiment analysis algorithms such as support vector machine and maximum entropy by Rosenthal [44], [45]. However, there are some researchers such as [46]–[48], also use sentiment analysis by utilizing the Twitter platform as a data source. The purpose of this research is to reveal the perceptions of the Indonesian people by determining the polarity of language texts (positive, neutral, or negative) related to online learning during the COVID-19 pandemic compiled from the Twitter. The results of this study will provide benefits to educational policy makers, particularly those related to distance learning or online, in order to make this public opinion one of the considerations in determining the next online learning-related policies.

2. METHOD

The data needed to reveal the opinion of the Indonesian people regarding online learning during the COVID-19 pandemic is a tweet on the Twitter platform with the hashtag *#Pembelajaran daring* (Online learning); *#Pembelajaran jarak jauh* (distance learning); *#Belajar dari rumah* (learning from home) *#Belajar di rumah* (learning at home). The specified time range for gathering these tweets is between March 2020 to November 2021. The data that has been obtained then analyzed using lexicon analysis with analytical instruments using part of speech (POS) Tagging [42]. POS Tagging is the process of marking words in a text/corpus according to a certain part of the speech, based on their definition and context. POS Tagging can categorize word classes into nouns, adjectives, verbs, and others. The cleansing process, sentiment analysis, and polarity visualization using Python 3.10.0 software for Windows. The research process is presented in Figure 1.

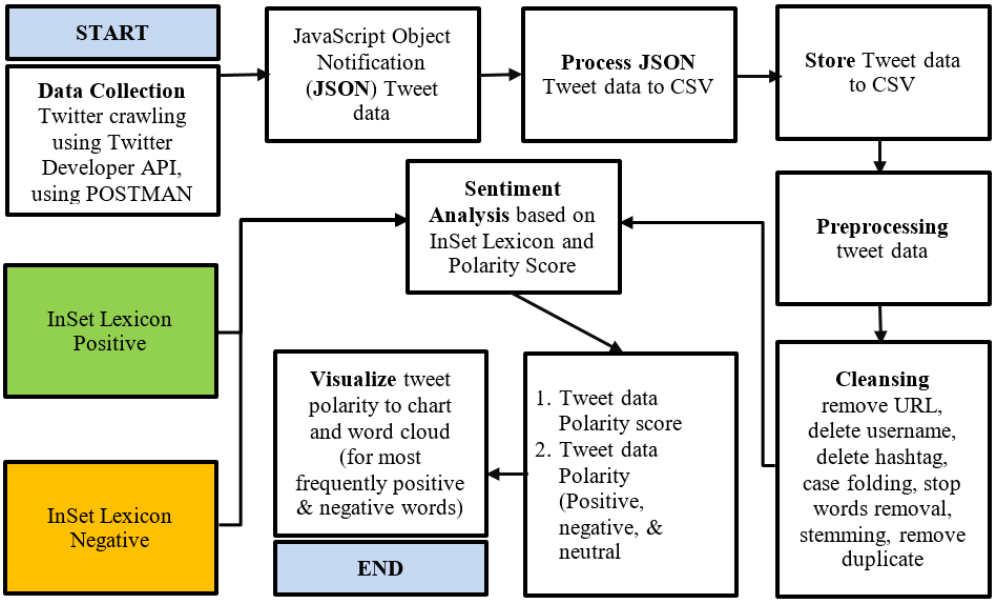

Figure 1. Research process diagram

3. RESULTS AND DISCUSSION

3.1. Dataset

We collected 89,635 tweets for this study. All tweets were gathered between March 2020 and November 2021 using the Twitter streaming API and the keywords listed in the method section using POSTMAN software. Table 1 displays examples of these tweets.

Table 1. Tweets sample

Hashtag	Text
#*Pembelajaran daring* (Online learning)	*Sejak awal pembelajaran daring, mereka anak-anak yang sangat menyenangkan* Translation: Since the beginning of online learning, they are very fun kids
#*Pembelajaran jarak jauh* (distance learning)	*Menarik untuk mencatat di sini apa saja yang berbeda pada pembelajaran jarak jauh dan pembelajaran tatap muka?* Translation: It is interesting to note here what is the difference between distance learning and face-to-face learning?
#*Belajar dari rumah* (learning/study from home)	*Siapa yang yg terkena hipertensi akibat anak belajar dari rumah?* Translation: Who is affected by hypertension due to children studying from home?
#*Belajar di rumah* (learning/study at home)	*Tolong kuota gratis untuk anak-anak belajar di rumah jangan disalah gunakan* Translation: Please don't abuse the free internet for kids to study at home

3.2. Processing

To prepare the data for sentiment analysis, we first cleaned the tweet content as shown in Figure 1, removing hashtags, usernames, duplicates, stemming, and unnecessary spacing, and setting stop words and case folding. Although the tweets were cleaner than before, we must admit that not every one of them expressed an opinion about online learning. So, in order to improve the accuracy of the results, we separate tweets containing opinions about online learning or employ the Python algorithm. Using training results from sample educational tweets, the algorithm was trained to filter out opinions favoring online learning and those opposing it. The results show that 81.57% of tweets are labeled as opinions about online learning, leaving only 73,120 tweets available for sentiment analysis. Each tweet's sentiment will be further analyzed using a different Python algorithm. Using the Python algorithm, we train the classifier to classify opinions toward online learning. Table 2 shows examples of tweets classified as opinion or non-opinion about online learning by our algorithms.

Table 3 shows the top 10 features or tokenization from our training set that we use to classify tweets as positive or negative. The most common semantic based on words in a dataset represented in different font sizes is a word frequency count. The most frequently occurring words in the dataset are defined in larger fonts namely word cloud that presented in Figure 2. Based on the research objectives, these words are typically the authors' primary focus.

Table 2. Opinion and non-opinion tweets sample

Opinion			Non-opinion
Positive	Negative	Neutral	
Mudah mudahan belajar onlinenya beneran dilakuin efektif ya Translation: I hope the online learning is really effective, right?	*Anak-anak sekolah di Jakarta belajar online gara-gara corona* Translation: Schoolchildren in Jakarta study online because of corona	*Kampus ngeluarin pengumuman belajar online* Translation: Campus issues online study announcements	*Apakah acara belajar dari rumah digeser dengan acara olahraga?* Translation: Are study from home events being replaced by sport events?

Table 3. Top 10 positive and negative features (translation)

Positive features	Negative features
Sekolah (school)	Ajar (teach)
Rumah (home)	Anak (child)
Banget (very)	Tugas (task)
Guru (teacher)	Kelas (class)
Siswa (pupil)	Pandemi (pandemic)
Dalam (inside)	Didik (educate)
Kerja (work)	Masuk (enter)
Pas (suitable)	Kuota (quota)
Semoga (hopefully)	Semangat (passion)
Nilai (score)	Kasih (affection)

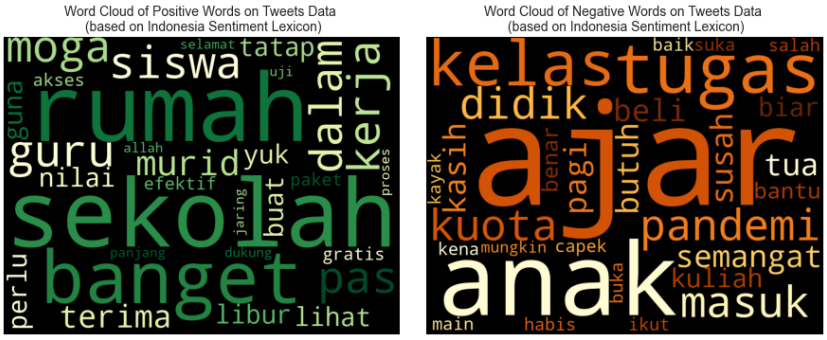

Figure 2. Word cloud of the positive and negative words on Tweets data

3.3. Sentiment analysis result

The results show that 77.58% of the tweets are positive, 17.97% are negative, and the rest are neutral. This demonstrates that Indonesians who actively use Twitter have a positive attitude toward online learning during the pandemic. Visualization of sentiment analysis results as a percentage is presented in Figure 3.

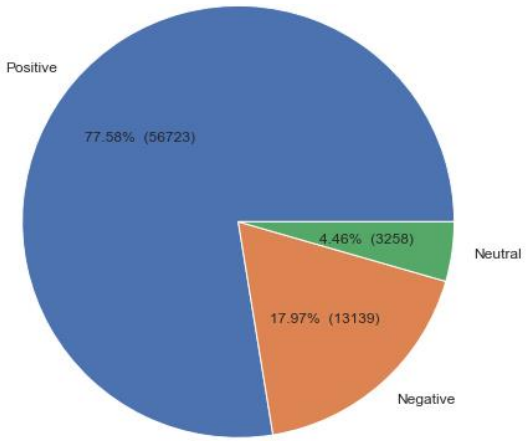

Figure 3. Tweets sentiment polarity

We attempted to classify what people refer to in their tweets and their sentiment toward the topic using cluster analysis technique, using NVivo 12 Plus, in order to conduct a more detailed analysis. Cluster analysis was carried out with the research problems in mind. Using an unsupervised approach, the varying themes were explored with word similarity within the dataset based on word frequency. The identified themes were then manually selected and hierarchically clustered (supervised learning). The cluster analysis resulted in six categories, namely: distance learning, education, learning support, teacher, school, and student. With keywords used for each category are presented in Table 4. We analyze the polarity of the sentiment again in each category to obtain more detailed information about the polarity. Figure 4 depicts the polarity of each category by percentage.

Table 4. Keywords category

Category	Keywords
Distance learning	*Jarak jauh, sinkronus, asinkronus, platform* Translation: distance, syncronus, asyncronus, platform
Education	*Mengajar, belajar, pembelajaran, kurikulum, kemudahan* Translation: teaching, learning, instruction, curriculum, convenience
Learning support	*Orang tua, sistem, internet, laptop, smart phone, biaya, fasilitas, pemerintah* Translation: parent, system, internet, laptop, smart phone, cost, facility, government
Teacher	*Guru, pendidik, fasilitator, tutor* Translation: teacher, educator, facilitator, tutor
School	*Sekolah, jadwal, peraturan, institusi, kelas* Translation: school, schedule, regulation, institution, class
Student	*Siswa, anak, anak-anak, belajar* Translation: student, child, children, study

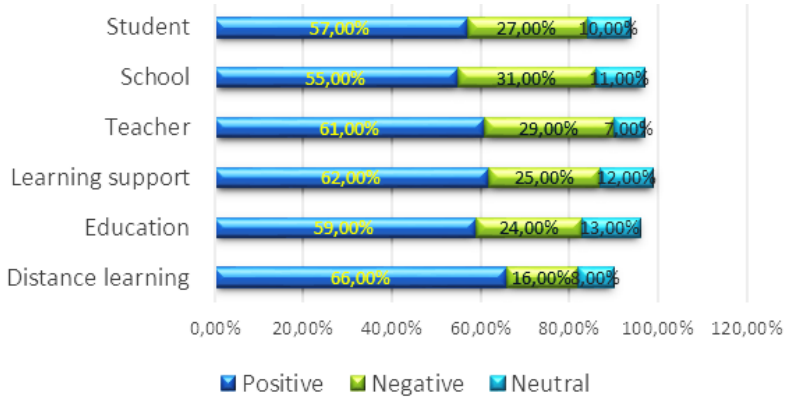

Figure 4. Percentage of sentiment analysis by category

As shown in Figure 4, people prefer to talk about learning support, teacher, school, education, student, and distance learning respectively. Distance learning is the number one category from online learning with the most positive sentiment. However, learning support is the most talked about by the public. The high number of positive sentiments across all categories indicates that the majority of Indonesians have high expectations for online learning during the pandemic. Table 5 shows examples of positive, neutral, and negative tweets classified as category about online learning.

3.4. Discussion

The main objective of this study was to investigate people's opinions and perceptions on COVID-19 and online learning-related issues in Indonesia from March 2020 to November 2021 using the Twitter platform. Twitter was chosen for this study due to its popularity and ease of data collection. Multiple analysis techniques, including world clouds, sentiment analysis, and cluster analysis, were used to identify useful insights. The most frequently used words in Indonesia, according to the study, were 'distance learning,' 'education,' 'learning support,' 'teacher, 'schools,' and 'student.' Positive sentiment (77.5%) outnumbered negative sentiment (17.97%) and neutral sentiment (4.46%). In addition, the majority of the information in the tweets was based on opinions rather than facts.

Table 5. Examples of positive, neutral, and negative tweets classified as category about online learning

Category	Positive	Neutral	Negative
Distance learning	*sekolah online atau belajar jarak jauh membuat bunda harus kreatif menjelaskan pelajaran sekolah* Translation: online school or distance learning makes mothers have to be creative in explaining school lessons	*belajar dari rumah perlu diawasi orang tua masing masing sistem jarak jauh online bukan sekedar memberi soal banyak banyak tapi kasih juga modul pembelajarannya* Translation: learning from home needs to be supervised by parents, each online remote system not only gives lots of questions but also gives learning modules	*minggu ini aku stress karena sekolah online sudah berbulan bulan* Translation: This week I'm stressed because online school has been months
Education	*program ini sangat bagus, semoga materi pelajarannya sesuai dengan kurikulum yang ada dan memperluas pengetahuan siswa* Translation: This program is very good, hopefully the subject matter is in accordance with the existing curriculum and expands students' knowledge	*tayangan program belajar dari rumah tidak mengejar ketuntasan kurikulum melainkan menekankan pada aspek kompetensi literasi numerasi dan karakter* Translation: Programs for learning from home do not pursue curriculum completeness but emphasize aspects of literacy, numeracy and character	*saya banyak mendengar keluhan teman yang anaknya belajar dari rumah, belum lagi permasalahan kurikulum yang berbeda dengan zaman orang tua nya* Translation: I hear a lot of complaints from friends whose children study from home, not to mention the curriculum problems that are different from the time of their parents
Learning support	*orang tua sudah ikhlas berdamai dengan diri sendiri maka juga siap memfasilitasi anak untuk belajar dari rumah, seperti penyediaan gadget* Translation: parents are willing to make peace with themselves, so they are also ready to facilitate children to learn from home, such as providing gadgets	*keluarga memiliki andil yang sangat penting dalam keberhasilan proses belajar dari rumah bagi peserta didik penyandang disabilitas selama pandemi* covid Translation: families have a very important role in the success of the learning process from home for students with disabilities during the covid pandemic	*pada masa pandemi ini penggunaan internet menjadi sangat penting bagi rakyat indonesia bekerja dan belajar dari rumah mengharuskan diri mengkonsumsi data internet dalam jumlah besar hal itu memakan biaya* Translation: during this pandemic, internet use is very important for Indonesian people, working and studying from home requires that they consume large amounts of internet data, it costs money.
Teacher	*selama belajar dari rumah, kegiatan belajar masih berlangsung lancar, guru tetap memberikan materi melalui video call jadi tidak hanya sekedar memberi tugas saja* Translate: while studying from home, learning activities are still going smoothly, the teacher continues to provide material via video calls so it's not just giving assignments	*kebijakan belajar dari rumah sangat merubah kebiasaan siswa dan guru selama ini belajar dirumah pada saat ini menuntut peran aktif siswa dan guru untuk mencari sumber belajar* Translation: the policy of studying from home has greatly changed the habits of students and teachers during this time studying at home at this time requires the active role of students and teachers to find learning resources	belajar melalui proses *sekolahku bukan sekolah di pemukiman orang orang berada bu gurunya pusing mikirin cara belajar dari rumah yang seefektif mungkin* Translation: my school is not a school in a residential area where people are wealthy, the teacher is confused about how to study from home as effectively as possible
School	*lebih pilih efektif sekolah online yang benar dan disiplin sesuai waktu dan jadwal sekolah biasa, tugas dan materinya seimbang daripada dipaksa langgsung sekolah offline di situasi seperti saat ini* Translation: prefer effective online schools that are correct and disciplined according to time and regular school schedules, balanced assignments and materials than being forced to go directly to offline schools in situations like today	*belajar dari rumah dengan memanfaatkan gadget tiba tiba menjadi jalan yang tidak bisa dihindari oleh sekolah maupun kampus termasuk institusi pendidikan* Translation: learning from home by using gadgets has suddenly become an unavoidable way for schools and colleges, including educational institutions	*perubahan rutinitas buah hati yang tidak lagi pergi ke sekolah kadang membuatnya merasa sedang berlibur dan tidak mau belajar dari rumah* Translation: changes in the routine of the baby who no longer goes to school sometimes makes him feel like he is on vacation and doesn't want to study from home
Student	*walaupun sekarang lagi sekolah online tapi aku tetap semangat untuk belajar* Translation: even though I'm currently studying online, I'm still excited to learn	*murid guru ataupun orang tua murid harus sama- sama berjuang untuk berlangsungnya pembelajaran apalagi yang orang tuanya gagap teknologi* Translation: students, teachers or parents of students must both struggle for learning to take place, especially those whose parents are technology stuttering	*sepertinya sekolah online benar-benar tidak efisien buat semua orang, tidak semua guru punya fasilitas memadai dan tidak semua siswa bisa patuh dan mengerti tugas hanya lewat media online* Translation: it seems that online schools are really inefficient for everyone, not all teachers have adequate facilities and not all students can obey and understand assignments only through online media

This finding confirms that people had favorable attitudes toward online learning even during the pandemic. While reactions to the reopening of schools have been mixed, online learning appears to be a viable option in these unprecedented times [49], [50]. The most commonly discussed topics were 'distance learning,' 'education,' 'learning support,' 'teacher, ‘schools,' and 'student.' The research has shown that COVID-19 has disrupted the education system around the world, raising concerns about the policies and measures required for educational systems during these unprecedented times. Thus, the most frequently mentioned theme was 'learning support,' followed by 'teacher, ‘school, 'education, ‘student,' and 'distance learning.' This finding suggests that education systems, governments, and stakeholders should take immediate action to implement strategic measures to capitalize on the significance of online learning as schools reopen.

The study on online learning using the Twitter platform proved to be an excellent source of information about COVID-19 issues. Despite the pandemic, people preferred online learning, according to the study. The most frequently mentioned theme in this study was 'learning support.' Furthermore, the close relationship between 'learning support,' 'teacher,' and'school,' as well as the'student' themes, demonstrates the need to support our disrupted school system. As a result, in order to combat the pandemic, this study suggests that educational institutions, educators, students, parents, and other stakeholders work together to ensure efficient and effective online learning policy, implementation, and utilization [51]–[53]. In practice, this would assist students, teachers, and administrators in overcoming some of the difficulties associated with online teaching and learning during these difficult times.

Furthermore, schools should consider offering additional support to educators and students by hosting workshops on the significance and effective use of online learning systems in pedagogical practices. Furthermore, students' and teachers' attitudes and dispositions are heavily influenced by the support they receive from their colleagues and school administration [51]. As a result, it is strongly recommended that counselling services for educators and students be made available online in order to boost their teaching and learning morale, as well as their positive attitudes and intrinsic motivation. Government agencies are urged to provide financial assistance to educational institutions and students affected by the pandemic. Tuition waivers for most affected students and students nearing graduation who are experiencing financial difficulties as a result of the pandemic could be among the financial assistance provided. As we move beyond this pandemic, technology companies and governments should make more affordable and subsidized teaching and learning devices, such as laptops and computers, available to low-income households as incentives for online learning [54]. Finally, more varied and inclusive online course technologies should be designed to address accessibility of web content concerns in order to make all digital learning facilities available, inclusive, and diverse for accommodated and disabled students [54].

The COVID-19 pandemic has increased the number of studies carried out in various fields of study such as healthcare, business, and services, but education has received little attention. In the midst of the pandemic, this is the initial study that utilizes a dataset from social media platforms to contribute to COVID-19 and online learning. By exploring word frequency, discussed topic, public sentiments, and identified themes, this study, in theory, corresponds to literature on COVID-19 and online learning. As a result, the empirical results from this research may be used as a reference for subsequent research on online learning.

Future study could build on this work by attempting to address the restrictions listed below. To begin, we principally drew our sample from the Twitter platform, with no representation from other social media platforms such as Facebook, Instagram, or YouTube. Future research could try to expand the conversation by studying public sentiments about school reopening and COVID-19 through user opinions and perceptions on various social media platforms. Because of the mixed reactions to school reopening, the United States may be considered for this future study. Moreover, future research may employ quantitative analysis to forecast their impact on teaching and learning performance using the themes 'distance learning,' 'education,' 'e-learning,' 'learning support,' 'online learning, ‘schools,' and 'students.' Because 'online learning' is here to stay [55], [56], these themes could be thoroughly investigated using various research methods and statistical analyses such as questionnaires and scanning electron microscopy (SEM). In addition, future research should consider using the search term emergency remote learning (ERL), which officially represents the COVID-19 emerging educational landscape [57]. Finally, a country-level examination is advised. This could be related to the country-specific literature review presented by the study's authors.

4. CONCLUSION

Notwithstanding the study's findings that people possess positive perspectives on online learning during these uncertain times, people are calling for more learning assistance to guarantee their life - long learning journey. The study's findings are consistent with previous research on the public's different responses to school re-openings; thus, online learning is the most effective option during these times. As a result, this research will help educational institutions, government agencies, individual organizations, educators, students, and other stakeholders make better-informed choices about school reopenings while taking online learning indicators into consideration.

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