"We Are Trying to Communicate the Best We Can": Understanding Districts' Communication on Twitter During the COVID-19 Pandemic

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While educators' uses of social media for purposes such as professional learning and networking are now well-established, our understanding of how educational institutions use social media—including to engage key stakeholders during periods of crisis—is limited. In this study, we used a public data mining research approach to examine how K–12 school districts in the United States used Twitter as a communication tool during a critical period of the COVID-19 pandemic, March-April, 2020. Through a three-step grounded theory approach of 1,357 district tweets from 492 school districts, we found that districts worked to build community and share time-sensitive announcements in alignment with social media crisis communication recommendations. Announcements were more common during the early stages of the pandemic (and were engaged more collaboratively), with community-building posts more common later on. This study demonstrates how researchers can use publicly available (social media) data to understand districts' communication priorities and strategies during and beyond periods of crisis.

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DURING the COVID-19 pandemic, unprecedented school closures required educational institutions to shift quickly to new modes of instruction (Geiger & Dawson, 2020; Gross et al., 2021; Peterson et al., 2020). Teachers and administrators switched instructional modalities to teach remotely, some breaking new ground by expanding the use of technology for individual students (Malkus et al., 2020; Peterson et al., 2020), while others built on an established technological foundation, using school buses to provide neighborhood WiFi (e.g., Christensen & Alexander, 2020; McCrea, 2015) and rolling out a more wide-spread implementation (Al-Arshani, 2020). For still others, especially in low-income areas, disparities in district funding for technology and student internet access hampered rollouts of remote learning, delaying or effectively ending synchronous instruction for the year (Gandolfi et al., 2021; Herold, 2020), despite preparation and recommendations in some

areas instigated after previous crises (LaPrairie & Hinson, 2006).

Communication shifted modalities as well. No longer being physically present in a school setting relegated communication between schools and their communities to the digital realm, including social media platforms. Past research inside and outside of education has shown that social media is used during times of crisis to seek information (Austin et al., 2012; Mazer et al., 2015; Payne et al., 2018, Stieglitz et al., 2017) indicating that social media has a role in modern crisis communication, and an examination of K–12 educational institution's social media use may provide insight into how, beginning in March 2020, they communicated about their response to the pandemic.

While the methods in which schools and educators have responded to crises have been documented (Carpenter et al., 2020; Greenhalgh & Koehler, 2017; Mazer et al., 2015;

Thompson et al., 2017), K–12 school districts' social media-based communications—specifically their crisis responses—have been previously investigated mainly about school shootings (Mazer et al., 2015; Payne et al., 2018) and for outbreaks of the *H1N1 influenza* strain (Nasrullah et al., 2012). Consequently, there is the need to understand their communication surrounding a very different—and salient—type of crisis, a long-term, gradually unfolding challenge around a global pandemic. Analyzing how school districts communicated responses to a global crisis may reveal how they desire to be seen by the community and how they prioritized different services and goals for students and their families.

In this study, we examined how a large set of K–12 institutions used social media to communicate their response during the COVID-19 pandemic. Thus, we took districts' communication as a focal point, leveraging a large, publicly available corpus as a lens through which we could understand districts' priorities and their changes over time. To do so, we used a public data mining approach (Kimmons & Veletsianos, 2018) in which we considered records of district posts over a crucial first few months of the pandemic as the source of data for our analysis.

Literature Review

Social Media in Education

Social media (and social networking sites, particularly) have experienced increasing scholarly interest as teachers, administrators, students, parents, schools, and education scholars have followed broader social trends of adoption and begun using these tools to communicate and share information (Greenhow et al., 2016; Greenhow et al., 2020). Twitter has been heavily studied, as it is used by 22% of U.S. adults (Perrin & Anderson, 2019) and 39.7% of U.S. schools (Kimmons et al., 2019), making it a ripe space for analyzing communication between parents and school personnel.

Twitter is a social media platform that focuses on short (limited to 280 characters) *posts* that may include text as well as links, images, and hashtags. These posts are typically interacted with through a user's *feed*, which consists of posts by those that a user chooses to follow. For the most part (as some users can choose to restrict their posts to be viewable only by those they approve), users can choose to follow any other user, making Twitter well-suited to individuals' or organizations' aim of sharing information with a wide audience. In addition to being well-suited to broadcasting information, Twitter also affords interactions: Users can "retweet"—share to their followers—and like other users' posts, and can also reply to or mention other users to dialogue with them. Thus, Twitter is not only suited to sharing information (such as school-related updates) widely but also engaging with members of the school community and answering their questions. Though useful and widely used, Twitter is but one social media platform among many; while many use it, most U.S. adults do not use it, and its users may be politically more liberal than those of other platforms (Pew Research Center, 2019).

One reason that Twitter has been the focus of many studies is that its data are generally public, and it provides researchers with relatively easy access to large swathes of data.[1] Implicit in much of this new scholarly work is the idea that the benefits of tools like Twitter to educational institutions go far beyond traditional purviews of educational technology. Instead, these tools may also be having profound impacts as organizational, communication, community-building, and sharing tools (Daly et al., 2019; Greenhalgh et al., 2016; Kimmons et al., 2018; Kimmons et al., 2021; Rosenberg et al., 2020). For instance, before the pandemic, individuals and interest groups used social media to "frame" (Supovitz & Reinkordt, 2017) messages in such a way that may have had a substantial bearing on public support for the Common Core State Standards (Daly et al., 2019; Supovitz, 2017), with scholars noting it as a key reason for the opposition they met (Edgerton, 2020). During the pandemic, schools and districts posted the greatest number of posts of any month (since 2010) during one of the most turbulent periods of the pandemic, March 2020 (Kimmons et al., 2021). We differentiate these communicative and community building uses of social media use from sometimes controversial classroom social media use by teachers and students (e.g., Chapman & Marich, 2021; Greenhow & Gleason, 2012; Howard, 2013) as two separate uses of social media which both warrant consideration.

As another way in which social media has had an impact as communication-related tools, Kimmons et al. (2019) found that U.S. schools use Twitter to share information on a variety of topics in a primarily unidirectional manner, rather than in a way that supported or was found to be associated with two-way engagement. These and other findings suggest that educational institutions benefit from using Twitter to communicate, invite participation, and shape public discourse (Carpenter & Krutka, 2014; Greenhalgh & Koehler, 2017; Kimmons et al., 2019; Kimmons et al., 2021; Rosenberg et al., 2020; Wang, 2016; Willet, 2019). For these reasons, it is important to better understand how school districts are using these tools to engage with their communities but given the onset of the COVID-19 pandemic in 2020, the importance of such work seems to be elevated as districts have had to communicate even more quickly and adapt to novel situations and unforeseen circumstances, such as remote teaching phases.

How Districts Communicate About Their Mission and Work

Providing a range of services to students and their communities is an important part of schools and districts' mission—including, indirectly, their academic mission (Kronick, 2002; Lucas et al., 2017; Schwartz & Rothbart, 2020). These

essential services include not only meals but also include counseling and career guidance services (Falco & Steen, 2018; McKenzie et al., 2011) and community support (Hausburg, 2020), among others, which might be especially important because their functions are less-frequently studied than the instructional aspects of educational institutions. In addition to such provisions, how K–12 educational institutions communicate about and make these services known to parents and students is important. For one, such messaging framing can build or damage public and community support (Shonkoff & Bales, 2011).

How districts communicate through technology is particularly important in the present era. In a study of districts' activity on Twitter, Wang (2016) found that communication via Twitter on the part of large school districts was comparable to how other large institutions and organizations used social media, namely, engaging the public in two-way communication: district representatives can communicate with parents and community members, and parents and community members can communicate with or respond to communications by a district representative. Other past research has demonstrated that parents hold positive views toward their children's K–12 institutions' communication with them when they promote effective communication (Bordalba & Bochaca, 2019). Indeed, technology is a key part of how schools and districts communicate with parents (Beeman & Henderson, 2012; Rogers & Wright, 2008), as well as how individual teachers communicate with parents (Graham-Clay, 2005; Kraft, 2017), though there is debate over educational social media use as both a communicative and community-building tool as well as one that is used by teachers and students in classroom contexts, highlighting concerns about student privacy, safety, legality, the role of capitalism in education, and mental health (Howard, 2013; Krutka, Heath, & Willet, 2019; Krutka, Manca, et al., 2019; Rosenberg, Borchers, et al., 2021; Rosenberg, Burchfield, et al., 2021).

Social Media and Crisis Communication

During periods of crisis, people rely not on information from a single source, but rather on a variety of sources including social media and traditional media (Austin et al., 2012; Briones et al., 2011; Liu et al., 2012). This research around the social media crisis communication model has elucidated who reads and potentially amplifies messages from organizations as well as what factors organizations should consider when they communicate about a crisis through social media. For previous disaster and crisis research, social media has been seen as an efficient and effective method of communication. Individuals can turn to social media to provide or find accurate, up-to-date, and personally relevant information more quickly than through

traditional media sources (Palen, 2008; Palen et al., 2010; Shklovski et al., 2010).

Studies have indicated how the use of communication changes throughout a health crisis, with each of the crisis stages being associated with messages that meet their audience's needs by varying emotional tone and content (Meadows et al., 2019). A review by Houston et al. (2014) identified how social media is used over the life cycle of a disaster or crisis. Social media is used during the "before" stage to provide or receive disaster warnings and signal or detect crises, among other purposes. During the disaster or crisis "event," social media is used to send or receive requests for assistance, deliver and consume news coverage, coordinate volunteering, and provide and receive information. During the "post-event" phase, social media is used to reconnect communities, facilitate discussions of causes of the crisis, and discuss implications of the crisis.

In the context of this description of how social media has been and can be used during a crisis, there are also normative accounts of how social media *should* be used by organizations during crises. Eriksson (2018) gleaned five lessons for using social media for crisis communication from a review of published research, including the need to take advantage of the positive attributes of social media, particularly the opportunity for two-way communication, having a social media communication strategy or plan, proactively monitoring what people are saying concerning the crisis, and continuing to use traditional communications channels. This research helps us understand what organizations like districts have done and can or should do concerning crises and social media. Next, we consider K–12 institutions' crisis communication and what the role of social media may be for these organizations.

Crisis Communication From K–12 Institutions

Research on K–12 educational institution's crisis communication has primarily emphasized their ability to manage the challenges (immediate and longer term) facing students and parents after an event such as a school shooting (Mazer et al., 2015) or a natural disaster (Kubicek et al., 2008). During such crises, communication with parents during a crisis is a major concern (Kubicek et al., 2008), necessitating preparation on the part of institutions to have a media plan to be able to respond quickly (Payne et al., 2018).

School districts are recommended to include social media in their crisis communication plans by researchers (Cox, 2012; Cox & McLeod, 2014; Locklear, 2019), and professional organizations (Centers for Disease Control and Prevention, 2014; National Education Association, 2018; Trump, 2012). According to these entities, an established social media presence is vital to aid in communicating with stakeholders during a crisis (National Education Association,

2018), and is a way for districts to establish and control their public image (Cox, 2012; Cox & McLeod, 2014).

While there is much research and many resources on short-term crisis response for school personnel, extended school closure due to community contagions is not included in all crisis planning resources (Steeves et al., 2017; Virginia Department of Education, 2002). Therefore, any crisis management response to this long-lasting viral pandemic would likely rely on recommendations and planning for other types of crises and in all reviewed literature, there was no direct guidance about what to post specifically on social media, only that it should be used (Cox & McLeod, 2014). In summary, social media use in school communication is always recommended, including during a crisis such as the COVID-19 pandemic. But, whether and how social media has been used—and to what ends—has not been explored in past research.

Purpose

Though we believe that districts' communication may be important, especially during a crisis, this conjecture has not been explored in detail. As an example of how and why this gap might matter, there has been some research on how meals were provided during the COVID-19 pandemic—and how districts and schools innovated to continue to provide meals during this time (Kinsey et al., 2020; McLoughlin, Fleischhacker, et al., 2020; McLoughlin, McCarthy, et al., 2020). However, it is unknown how districts communicated about their provision of meals to students—and whether some districts may have served students in their communities better than in others.

Social media use in education goes beyond pedagogical applications and is ripe for study, even during a pandemic, as districts communicated during the early, volatile stages of the COVID-19 pandemic, while striving to continue to provide essential services. In this study, then, our purpose is to understand the nature of school districts' crisis communication and to document how their communication on Twitter reflected or differed from those documented in past research. More specifically, this study was guided by three research questions:

Research Question 1: What did districts communicate through Twitter during the COVID-19 pandemic?
Research Question 2: How did this communication change—if at all—over time?
Research Question 3: How did these messages promote engagement from the public?

Method

In this study, we used a public data mining approach (Kimmons et al., 2018) to access data to understand districts'

responses and ways of communicating to the public during the pandemic.[2]

Data Sources

We utilized the Twitter Application Programming Interface (API) to collect all tweets and metadata from a pre-existing list of 7,744 school-related accounts (Kimmons et al., 2018), limiting the analysis to only the 1,103 accounts that had the word "district" in their description, name, or screen name. We further limited our sample of tweets to only those that were created over 8 weeks between March 1, 2020 and April 25, 2020 to focus our efforts on the height of educational changes associated with the pandemic in the United States. Our further sampling process resulted in an analytic sample of 1,357 tweets from 492 districts from 44 states and the District of Columbia.[3] See Figure 1 for a map representing the locations for 403 of the districts that we could identify.[4] We also performed descriptive statistics on the activity of districts included in our sample.[5]

Data Analysis

The creation of fourteen thematic codes (and three groups) comprised our primary answer to the question of how districts communicated during COVID-19 to Research Question 1. To present these themes, we described each coded theme in-depth, using our understanding of the theme that developed through the coding process to describe what the messages were about, as well as the most frequent subjects included in tweets of each theme. We also included an example message for each theme. We then aggregated quantitative descriptive results of all 1,357 tweets to understand the relative frequency and representation of different types of tweets.

Qualitative Coding Overview. To determine how districts communicated through Twitter, we used an inductive (Hatch, 2002), grounded theory (Charmaz & Belgrave, 2015) approach to qualitatively code the $n = 1,357$ tweets in our sample. To begin, we analyzed a random subsample of original tweets ($n = 670$). Coding the data proceeded in three stages: (1) open-coding, (2) axial coding, and (3) thematic coding. During *open-coding*, we wrote a summary of each tweet, focusing on using the verbiage of the tweet. For *axial coding*, we simplified the summary to a short phrase to capture the general purpose of each tweet. Through the process of *thematic coding*, we reviewed and grouped axial codes into a list of codes for our final stage before applying them to the initial data sample. Last, we grouped these thematic codes based on their similarities in purpose.

Many of the tweets contained images, video, or links or were quoting another tweet, and coding these tweets required a thoughtful approach because linked content or a video could potentially cover many more topics than the 240
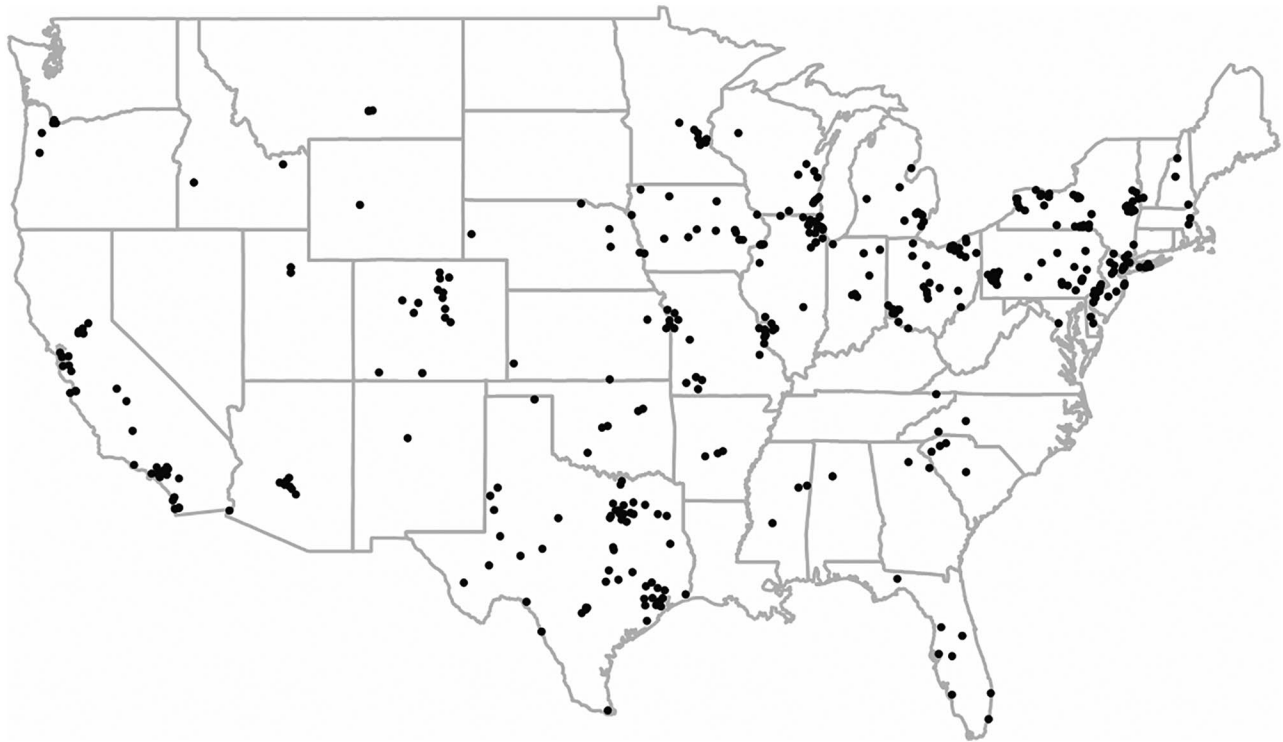
FIGURE 1. *Map of sampled districts' location.*

Note. There were no districts in Hawaii included in our sample and only two districts from Alaska, and to facilitate interpretation those states were not included in this figure.

character limit could convey. Our process to code these types of tweets was to focus first on the included text of the tweet if present. If there was not enough information in the tweet text, or if the tweet consisted only of a link, we examined the additional content (i.e., followed the link to determine the content, examined the image, watched the video, or read the quote tweet text). In this way, we sought to maintain a focus on the district's intended message rather than analyzing the linked artifact. We include an example of our coding process for one tweet[6] (Figure 2) and discuss our strategies for obtaining interrater reliability.[7]

Tweet Frequency Over Time. Having examined the focuses of districts' communication, we then examined changes in the frequency of the themes across the 8 weeks (for Research Question 2). To analyze changes in messaging themes over time, we calculated the frequency of each of the codes during each week for which we collected data.[8] We then used these frequencies in a descriptive, quantitative analysis to determine which themes were posted in different temporal ways. We identified the median date of state-mandated school closures as March 17 and treated that as a benchmark for determining before- and during-pandemic

tweets (Education Week, 2020). The earliest date with a mandated closure was March 16 for many states; the latest was March 24, for Idaho.

Public Engagement With Messages. To determine the extent to which members of the public engaged with messages (for Research Question 3), we calculated the number of likes, quote tweets and retweets (combined), and replies received by each post, as well as the sum of these different types of interactions. While prior research has considered likes to reflect *receiving information* in a mode that reflects a *one-way flow of information*, from sender to receiver, replies indicate a form of *two-way engagement*, and quote tweets and retweets can represent *collaboration* on the part of the public in sharing information (Mergel, 2013); thus, these different interactions spoke to different ways the public could engage. We then grouped the messages by their theme and calculated the mean and standard deviation for the different types of interactions (and their total) for each theme. Last, to speak to whether there were differences in patterns of engagement from the public at the level of the three groups, we estimated three statistical models to determine whether there were differences between announcement,

FIGURE 2.   *An example tweet from a district's Twitter account.*

community-building, and unrelated posts and the number of likes, quote tweets and retweets, and replies. We described the models we estimated.[9]

Positionality. The authors in this study are connected to the field of public education as former or future public school teachers and are involved in preparing future teachers. The familiarity with school systems was important as it allowed us to understand the context and information contained in many of the messages and how districts operate. Our experiences and access to technology, and expectations may also have predisposed us to interpret these messages in certain ways and give more weight to some types of messages, especially those that fit easily into our current schema. We addressed this through our practice of frequent group discussions about our interpretations of the messages and how they differed within the group. We did not find interpretive consensus on all tweets, though we did reach acceptable levels of interrater reliability. We see this approach as allowing for multiple perspectives and having no one person's experience and perspective serving as the ultimate arbiter.

Findings

Findings for Research Question 1: How Districts Communicated via Twitter During the Pandemic

We first present an overview of the themes and then describe each in-depth. Throughout the coding process, we found that themes fell into three overarching groups, which we used to structure this article:

- *Announcements*: Variations of an announcement containing updates and/or important information.
- *Community*: Messages focused on building or engaging with the school community through highlights of staff, students, and alumni or invitations for participation in various initiatives.
- *Unrelated or ambiguous*: Posts wholly unrelated to COVID-19 or ambiguous posts.
- The themes and groups are presented in Table 1.

As can be seen, our coding process resulted in the identification of 15 distinct themes, which ranged in frequency from comprising just more than one quarter of the tweets (for tweets unrelated to COVID-19, the theme of 365—around 27%—of all posts) to less common themes, such as community highlights (the theme for just 36, or 3%, of posts). After tweets unrelated to COVID, the next most frequently messaged themes were for three kinds of announcements, followed by three types of posts that served to build community and spread positive messages.

Next, we present the themes by group, describing each in greater detail. We anonymized the content of the example tweets.[10]

Announcements: School Closings. Twitter was one of several methods for school districts to quickly communicate their decisions around initial dates and extensions of closings due to COVID-19. Some tweets contained specific dates or updates from governors about state-wide closings.

Announcements: Remote Learning. As school districts transitioned to new learning situations, these tweets communicated everything from both optional and mandatory remote learning resources to starting dates and remote learning practices. Others included information regarding technology distribution, the availability of wireless internet connections, and advice for internet safety.

Announcements: Events. Districts tweeted about events, including those which occurred in a different format, such as virtual Spirit Week and school board meetings, and live streaming events. This theme also contained districts' sharing of student participation in the aforementioned events. Others included tweets that provided updates on canceled events, such as field trips, athletics, concerts, and dances.

Announcements: Meals. Many students rely on schools for at least one meal during the school week, and this theme applied to tweets related to these services that schools continued to provide for students during closure. Districts shared instructions for meal distribution including eligibility

TABLE 1
The Frequency of the Themes of School Districts' Posts on Twitter

Group	Theme	*n*	%
Unrelated	Unrelated to COVID	365	26.9
Announcements	Universal announcements	156	11.5
Announcements	Events	125	9.21
Announcements	Remote learning	109	8.03
Community	Staff highlight	108	7.96
Community	Student highlight	89	6.56
Community	Spreading positive messages	83	6.12
Announcements	Meals	80	5.9
Announcements	Health resources	57	4.2
Announcements	School closings	54	3.98
Community	Direct reply	39	2.87
Community	Community highlight	36	2.65
Community	Requests	30	2.21
N/A	Multiple	22	1.62

requirements, times, locations, pick-up procedures, and other community resources related to meals.

Announcements: Health Resources. School districts posted advice on health and safety, including public health guidelines regarding social distancing, hand washing, and household cleaning. Tweets shared recommendations for helping students' mental and physical health, including tips for talking to students about the pandemic, mental health advice, and ways for students to remain active at home.

Announcements: Universal Announcements. This theme included broad administrative announcements on multiple topics including policies about grading practices, item retrieval from school grounds, newsletters, and updates from the school board or superintendents. Districts also occasionally tweeted information from other entities such as resources from community organizations and updates from the local and state government. Any tweet containing two or more categories that were different types of announcements was placed within this theme.

Community: Student Highlights. Posts associated with this theme include what districts referred to as senior spotlights—containing photos and information about graduating students—as well as scholarship awards, and college decisions. Other student highlights shared examples of students participating in remote learning activities such as virtual meetings, showing examples of student work, or performing community service.

Community: Staff Highlights. Districts highlighted teachers, administrators, and various other staff members for their work to support students and families. Tweets in this theme

contained features of successful remote learning as well as district-wide highlights of pandemic response and community service. Also included were expressions of gratitude for work during the pandemic, including "We miss you" messages to students and "Thank you" tweets to meal providing and other staff members.

Community: Community Highlights. Districts also highlighted community members for their contributions, thanking parents and families for supporting students in their remote learning. Others expressed appreciation for school alumni, local organizations, and members of the community who contributed during the transition. These contributions included work on the front lines of the pandemic, donations of remote learning materials, and providing meals to families in the community, such as when a district highlighted an alumnus for their work as a nurse during COVID-19.

Community: Spreading Positive Messages. School districts used their Twitter platforms to spread positivity among students and families. They posted videos, images, and quotations to encourage students to stay strong during this difficult and stressful time.

Community: Requests. Districts utilized Twitter to seek out participation in various opportunities and projects. These requests included donations to local community outreach, participation in surveys, and images of students engaging in remote learning and virtual events.

Community: Direct Reply. Twitter allowed school districts to communicate with individuals in their communities directly. They were able to answer specific questions, provide positive feedback, and ask questions to engage with their parents and community members. Direct replies covered many different subjects, some of which were unrelated to the other identified themes, and thus were placed into a single category to have a consistent approach for coding.

Community: Multiple. This theme was reserved for tweets that had multiple purposes and included information falling into more than one of our categories.

Unrelated or Ambiguous: Unrelated to COVID-19. Tweets coded as unrelated to COVID included those related to another theme (e.g., announcements, athletic events) which occurred before the school district closed and/or did not mention the impact of COVID-19 or the district's response. This theme included "schooling-as-usual" tweets posted after the shutdown, including job postings, holiday observances, and nonpandemic-related achievements.

Unrelated or Ambiguous: Ambiguous. This limited theme included tweets for which it was impossible to identify a

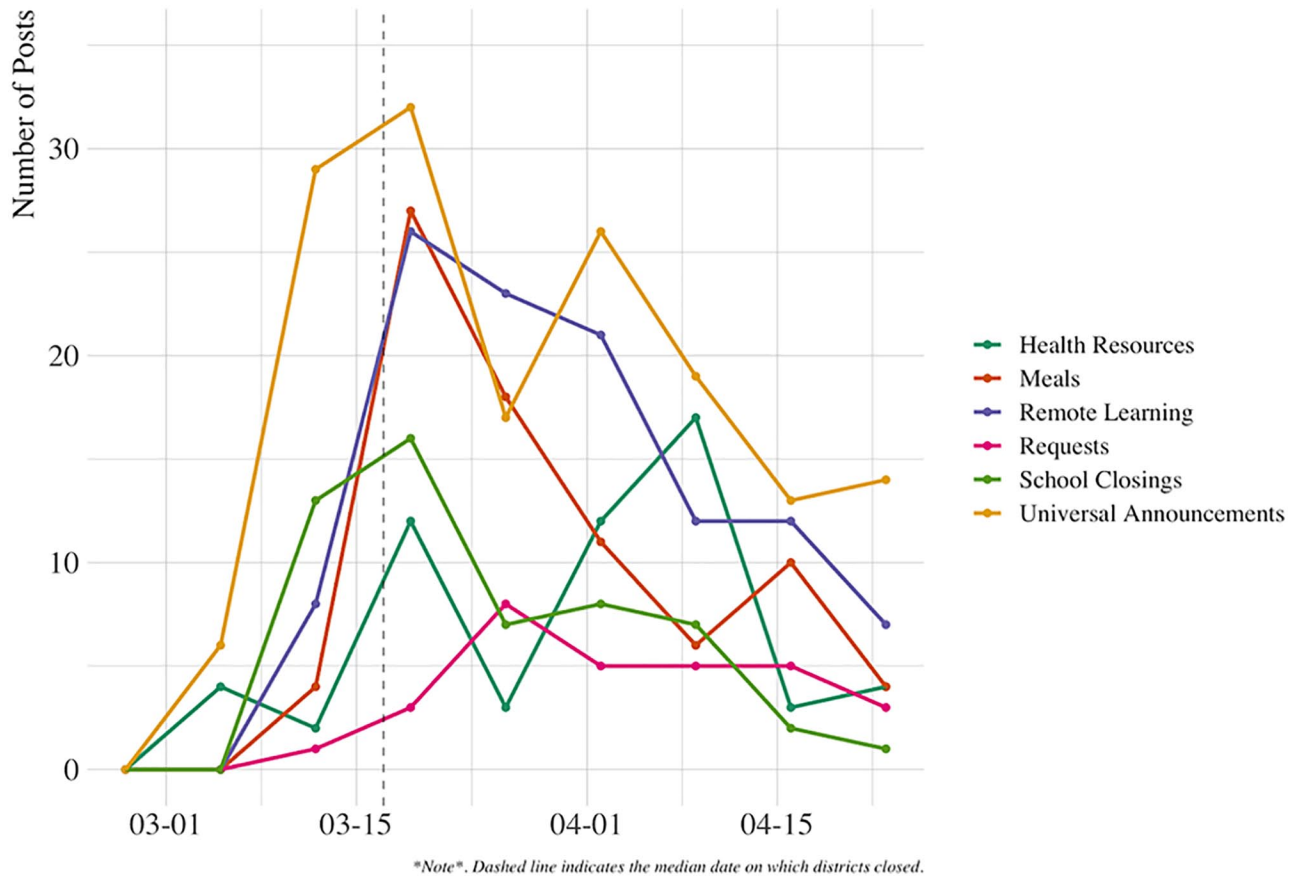*Note*. Dashed line indicates the median date on which districts closed.

FIGURE 3. *Posts with announcement themes over time.*

theme due to a lack of information. In one example, we saw that the district opened preschool enrollment online, but it is unclear whether this opportunity was due to the shutdown or whether online preschool enrollment was their usual approach. Because of the limited number of ambiguous posts ($n = 4$) and their unclear meaning, we did not include these in the analyses for Research Questions 2 and 3.

Findings for Research Question 2: Changes in Themes Over Time

In this section, we present findings for patterns of change in messages over time across the three groups through a descriptive analysis of the frequency of the themes by week. For the figures portraying these frequencies over time, we identified the median date on which U.S. districts closed (Education Week, 2020).

The first group we present is for the themes we considered to be announcements. As presented in Figure 3, messages about school closures, remote learning, and meals, as well as the more generic universal announcements peaked in frequency on or within 1 week of the week that state-wide closures were announced. The nature of these themes reflected the use of messaging in a crisis communication

manner, whereby districts shared posts that were of importance and urgency to those receiving them. Health resources and requests were posted more frequently later, suggesting that these were less urgent (or were not as salient) than the announcements that were more common around the time schools were closing. While these posts continued after closures were announced, they were rarely posted before closures, and they slowly tapered in frequency beginning around 2 weeks after most schools first closed.

The frequencies for the second group, community-building posts, are presented in Figure 4. The three themes within this group that highlighted key individuals—staff, students, and community members—increased in frequency after the majority of school closures. This pattern was also observed for posts about events and those spreading positive messages. We found the themes of these posts (e.g., highlighting students) to be associated with less urgency than those that peaked around closures (e.g., announcements about school closures). These posts broadly serve the purpose of engaging the community to direct support and encouragement to those involved with the district and community.

The final group was for posts that were unrelated to COVID-19. As presented in Supplementary Material 1 (available in the online version of this article), messages that
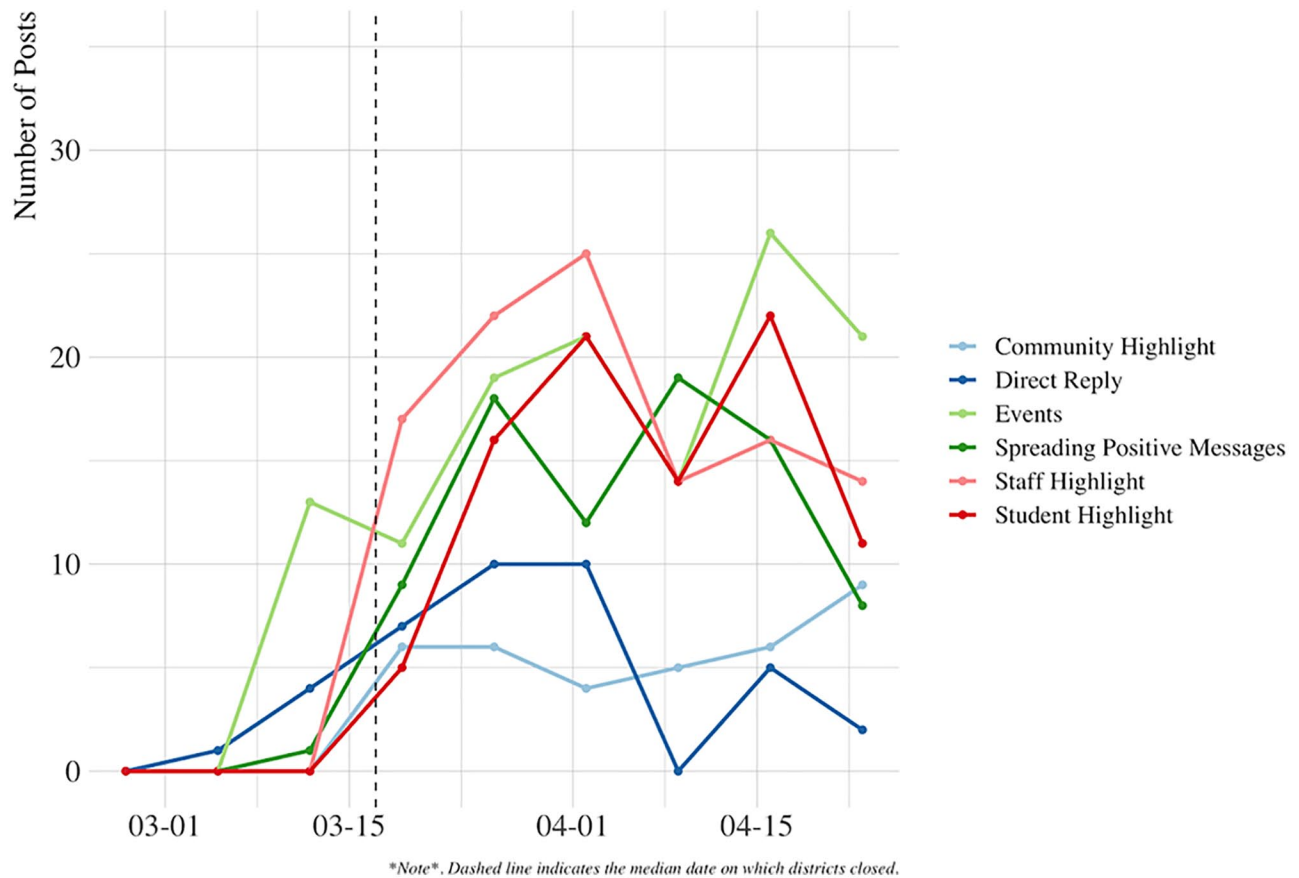
FIGURE 4. *Posts with community themes over time.*

were unrelated to COVID-19 were posted very frequently prior to when closures began. This is unsurprising; while COVID-19 was a part of the national discourse prior to the beginning and middle of March 2020, schools' daily operations were not yet affected by it—and their social media use reflected this reality. Posts with the Ambiguous theme were not included as there were only four in the data set.

Findings for Research Question 3: Public Engagement With Messages

For this analysis, we explored engagement with messages about different themes. In Table 2, we present the mean as well as the standard deviation of the number of three types of interactions—likes, quote tweets and retweets, and replies—as well as their sum (the total number of interactions). Online Supplementary Material 2 presents the means and standard deviations by the groups of themes (announcements, community, and unrelated) for each of the types of interactions. To interpret this table, consider the first row for school closings. Each of these posts was interacted with, on average, nearly 50 times. These interactions were mostly likes (around 28 on average), indicating that information shared by districts was acknowledged, and retweets and quote

tweets (around 9), indicating a degree of collaboration in the sharing of information as well as a few replies, indicating two-way engagement (Mergel, 2013). For all three interaction types, there was substantial variation in the estimates (indicated by the standard deviations).

Overall, these patterns show that a number of themes within the announcements group were interacted with very frequently, specifically school closings, meals, remote learning, and universal announcements, each of which were interacted with, on average, more than 20 times. Following announcements in the number of interactions were community-building posts, including staff, student, and community highlights, and spreading positive messages; these were also interacted with around 20 times each. There were, furthermore, differences in the specific types of interactions. Our hypothesis testing approach showed that community-building posts received more likes than announcements ($p = .013$), but that announcements were quoted/retweeted and replied to more ($p < .001$ for both types of interactions; see Note 9 for more detail). The coefficient estimates and standard errors for the Generalized Linear Models predicting the number of interactions with posts are presented in the online Supplementary Material 3.

TABLE 2
The Frequency of the Themes of Districts' Messages

Group	Theme	Total interactions, M (SD)	Favorites, M (SD)	Retweets and quotes, M (SD)	Replies, M (SD)
Announcements	School Closings	48.59 (91.1)	27.78 (50.9)	18.81 (35.49)	2 (6.38)
Announcements	Meals	32 (72.43)	19.23 (39.9)	12.26 (33.09)	0.51 (1.65)
Announcements	Remote Learning	20.34 (45.86)	12.5 (30.28)	7.21 (13.3)	0.62 (3.57)
Announcements	Universal Announcements	20.24 (47.06)	12.36 (28.79)	6.63 (15.14)	1.25 (7.05)
Community	Staff Highlight	20.06 (27.62)	16.9 (23.41)	2.82 (4.4)	0.34 (0.82)
Community	Student Highlight	19.94 (31.65)	16.58 (26)	2.79 (5.07)	0.57 (2.06)
Community	Spreading Positive Messages	19.29 (28.3)	15.75 (23.15)	3.27 (6.15)	0.28 (0.65)
Community	Community Highlight	19.17 (20.67)	15.86 (17.09)	3.03 (4.11)	0.28 (0.85)
Community	Requests	15.07 (30.59)	10.57 (23.2)	3.7 (5.05)	0.8 (3.12)
Announcements	Health Resources	14.95 (25.35)	10.21 (17.97)	4.39 (7.31)	0.34 (1.21)
Community	Multiple	14.41 (15.97)	10.32 (11.19)	3.64 (5.27)	0.45 (0.6)
Unrelated	Unrelated to COVID	14.2 (48.39)	11.53 (39.64)	2.37 (7.39)	0.29 (2.14)
Announcements	Events	13.16 (25.34)	8.7 (16.06)	4.13 (9.16)	0.33 (1.21)
Community	Direct Reply	5.31 (19.03)	3.41 (12.57)	1.28 (5.79)	0.62 (1.09)

Note. There were four ambiguous posts not included in Table 1. Online Supplementary Material 2 shows the descriptive statistics presented in Table 1 for the groups of themes (rather than the themes).

Discussion

In this study, we examined Twitter use by K–12 districts across the United States during the early—perhaps most uncertain—period of the COVID-19 pandemic. Our findings revealed that districts used Twitter in alignment with research recommendations and focused their communication on messages for one of three main purposes: broadcasting announcements, building community, and conducting regular school business that was unrelated to the pandemic. As suggested by research on social media use in crisis communication, district messaging changed over the nearly 2 months of posts that comprised our sample. Announcements were much more common in the earliest stages of the pandemic (March and early April) and community-building posts were more common in the time after schools first closed (April). Finally, while posts were, overall, engaged with by the public, the predominant mode of engagement was to acknowledge or collaborate on the sharing of posts, especially those that were oriented toward the community, rather than announcements, with which the public engaged more by quoting or retweeting or replying. In the remainder of this section, we discuss the implications of our findings and methodological approach in detail.

The Foci of Districts' Communication via Social Media

Our findings suggest that districts are purposeful and responsive in their use of social media messages during a time of emotional and societal upheaval, adjusting to the changing circumstances and prioritizing the focus of their communications with staff, students, and families. Given that the period of our data collection covered just the early stages of the shut-down, we argue that our themes represent early district communication priorities, those things that were most urgent and important to make known to the school community at a time of change and confusion. As one district (that we quoted in the title of this article) posted, "This is a situation that is evolving rapidly and we will keep everyone updated as much as possible." With the future still uncertain, districts shared what was known and temporally pertinent, following crisis communication guidelines of being open and candid. Thus, we interpret their priorities to include continuing to provide essential services and sharing crucial information directly with the community at large.

Districts prioritized communication about the services they were still able to provide from a distance, particularly remote learning opportunities (8%) and meals (6%). Thus, districts prioritized services that are widely used and that have benefits above and beyond the immediate problems they solved; for example, districts continued to provide meals, which over 26 million students across the United States were eligible for in the 2019–2020 academic year (National Center for Education Statistics [NCES], 2020). Even during an unprecedented disruption, when districts had to obtain waivers to modify how they distributed meals (Kinsey et al., 2020; McLoughlin, McCarthy, et al., 2020), districts communicated about meals to maximize their use, sharing widely and publicly the vital details for eligibility and distribution procedures on the web (McLoughlin, Fleischhacker, et al., 2020).

Districts shared many timely announcements (accounting for 42% of all posts) about their updated day-to-day procedures. Districts also used Twitter to perform administrative functions by communicating about their policies during the lockdown through general announcements, comprising 12% of all messages. It is also worth noting that districts continued necessary operations, posting messages about job openings, board meetings, and new hires, all of which were coded as unrelated. This suggests that districts have information sharing as a long-standing priority with their constituents, though still, as past research has shown, in a primarily unidirectional way (Kimmons et al., 2018; Wang, 2016).

Districts used messaging in a way that could build community engagement and therefore public support for education, especially through events, requests, and direct replies (discussed in the following section). Through event-themed messages, districts focused on maintaining a sense of normalcy by sponsoring virtual Spirit Weeks, contests, and other initiatives. Many requests solicited sharable content from parents (e.g., pictures of student participation in remote learning, senior pictures, or other participation challenges). However, these types of requests constituted the third lowest category, comprising only 30 messages (2%). Districts' posts may represent an appropriate balance between sharing information and two-way communication, especially during a time in which reliable information is highly valued. Districts' uses of Twitter may mirror educators', who use this single tool for several different functions, including socializing, sharing one's work (and about one's classroom), building a professional network, and crafting a professional identity (Aguilar et al., 2021; Carpenter et al., 2019; Carpenter & Krutka, 2014; Greenhalgh et al., 2020; Kimmons & Veletsianos, 2014; Rosenberg et al., 2020; Trust et al., 2016; Veletsianos & Kimmons, 2016).

Districts prioritized messages about essential services, important announcements, and building a community presence. Taken together, these priorities suggest that districts used social media for several purposes, with one overarching potential purpose being to craft a positive presence. Among our themes, 6% of messages were noticeably focused solely on the positive, and none were negative or pessimistic in content or tone, though several acknowledged the obviously stressful and chaotic period. This is directly in contrast with Twitter accounts from other leaders who showed high levels of fear and sadness in their pandemic tweets (Goel & Sharma, 2021). In this way, districts may have been *framing* messages (Supovitz & Reinkordt, 2017) in such a way as to bolster the positive public perception of and support for their efforts during the crisis.

Changes in Communication During the Stages of the COVID-19 Pandemic

The focus and content of district messages changed over the course of the pandemic, similarly to how the communication of other institutions can change across different periods of a crisis (Meadows et al., 2019). Once states began mandating school closures, districts' Twitter messages understandably began referencing the pandemic at high rates. That messages with announcements about policies and procedures for remote learning and meal distribution peaked soon after schools shut down indicates that districts were communicating important and likely new information during the initial stages of the crisis. Having established new procedures and expectations, these types of messages declined in the next few weeks as teachers, parents, and students adjusted to the new system. The higher volume of messages about the new procedures and policies indicates that districts had to talk more about what closing school meant than announcing that fact of the closure itself.

District messages focused more on community building after the initial stage of the pandemic. As suggested by Mazer et al. (2015), districts provided support in dealing with traumatic events. The shift to higher rates of positive and uplifting messages highlighting students, staff, and community members indicates motivation to accentuate the successes and build a sense of normalcy. Announcements sharing health resources, both physical and mental, peaked later in the collection period than other types of announcements, indicating the potential role of district communication approaches in dealing with future public health crises—particularly as large-scale (and, arguably unethical) experimental research studies have shown that others' emotions expressed via social media can influence individuals' emotions (Kramer et al., 2014). We also saw districts, in a small measure, reaching out to their several communities through recognition of diverse religious holidays and posting announcements in multiple languages. If districts are seen as trusted sources of information, their communication and policies could be leveraged to influence communities at a local level.

Crisis Communication and Public Engagement With District Posts

Twitter is typically used as a primarily one-way communication tool during a crisis (Eriksson & Olsson, 2016) and we saw that the vast majority of tweets were treated as unidirectional, though some districts encouraged two-way communication through direct replies to queries, as seen next.

> Hi [name], thanks for asking! These activities involve remaining in cars and being in driveways—following social-distancing protocol.

In this way, districts evidenced some (two-way) community engagement, a strategy past research has recommended organizations use during crises (Houston et al., 2014; Seeger, 2006), though these make up a very small percentage (2.87%) of the total number of tweets.

Members of the public engaged with district Twitter one-way information through liking messages, as well as engaging in bidirectional communication through retweets, quote

tweets, and replies. We found relatively high (for our sample) levels of overall engagement with messages announcing closing dates and meal information, though, in terms of general Twitter engagement where a tweet might receive thousands of likes, engagement with district tweets was comparatively low. This engagement points to the information priorities of the wider school community, and the number of followers—around 2,000 per district account—suggests that many more individuals may have seen (but did not like) these posts. Taking quote tweets and retweets (together) and replies as indicators of collaboration and two-way engagement, respectively (Mergel, 2013), we saw less, but still notable engagement in these forms with tweets across both the announcement and community groups.

We found uneven patterns of engagement by message group. Leaving out the messages about school closings and meals as unique high-flyers and comparing the groups of themes in announcements and community, we saw that in general, community-focused messages had higher passive engagement and lower interactive engagement, while announcements generally had higher rates of retweets and quote tweets and replies. This may indicate that communities approved of community-building efforts by the districts—even though such posts did not represent actionable information. Informational tweets, on the other hand, represented an opportunity to amplify district messages, which viewers did through their sharing.

How Districts' Communication Over Time Aligned With Crisis Stages

District social media use aligned with the three crisis stages as identified by Houston et al. (2014). In the earliest stages of the pandemic, before any shutdowns had occurred, districts tweeted about their preparations and precautions for dealing with the imminent health threat. These preparatory tweets, such as the announcement example below, fell mostly into our themes of health resources and announcements:

> #[school district] COVID-19 Update: State/local agencies say no action is required at this time. Continue to use illness-prevention tactics. Soap/sanitizer are available as well as a review of excused absences/exemptions. More info: [Link]

Sharing information before a crisis fully unfolded aligns with prior research that organizations should foster partnerships with the public through information sharing in an ongoing manner to build credibility (Center for Disease Control and Prevention, 2018; Seeger, 2006). We also saw many posts of this kind in our meals, remote learning, and events themes in later stages.

After the shut-down, arguably during the COVID-19 crisis "event" (Houston et al., 2014), districts encouraged volunteering through posts in the direct reply theme, facilitated

donations in posts coded with the events theme, expressed emotions through spreading positive messages, and shared resources on mental and emotional health in our health resources theme. For example, the following theme shows a district expressing emotions.

> We see you, hear you, and love you. And we are sorry for what you are losing right now. RT @[handle]: A message to the students of @[district account] #[district hashtag].

Though, as of the writing of this article, we are still in the throes of the pandemic and cannot technically say that we are in a fully postevent phase, we see this expression of emotion and other similar posts as examples of efforts to reconnect and build community—typically a postcrisis activity (Houston et al., 2014), as seen in the themes of making requests, highlighting students, staff, and members of the community. Community building in schools is an important element of consideration for every school leader (Sergiovanni, 1994). It makes sense that districts would consider community building a focus of their approach throughout every stage of a crisis since emotional safety and relationships are vital to any effective learning environment (Darling-Hammond & Cook-Harvey, 2018).

While we saw districts communicating about their preparations and building community during the crisis, the crisis communication literature also has found and recommends that organizations facilitate ongoing interaction with the public, outside of any crisis event (Eriksson, 2018; Houston et al., 2014; Seeger, 2006). While we do not have direct evidence of districts having an advance plan for how they would use social media during a crisis—a recommendation made by Eriksson (2018) on the basis of a systematic review of the literature—the districts we studied did have a Twitter account in use such that when the COVID-19 crisis began, they could leverage this communication channel to share timely information—which may be especially important when other means of communication were either unavailable or not rapid enough to be effective.

In sum, during this lengthy, unusual crisis, districts used social media strategically in ways that aligned with research-based practices. Though our themes did not match exactly with the social media uses, we did find uses spread across themes, over time. Specifically, the K–12 school districts we studied used Twitter to build community after the immediate crisis of transitioning to remote learning had taken place (Houston et al., 2014) and to support students through regular communication across the stages of the temporal stages of the crisis (Eriksson, 2018; Seeger 2006).

Implications and Directions for Future Research

Little past research has focused on districts' general communication on social media. This may be important given the widespread use of social media and districts' apparent

response to the widespread use of social media by extensively utilizing these platforms. Moreover, as this study showed, districts use social media for a variety of purposes. This study suggests that researchers can and should consider social media to be a context through which not only communication but also perhaps efforts to shape public perception and support for schooling, are taking place, which is notable given how public support can influence (or direct) education and educational improvement efforts (Cohen & Mehta, 2017). In this study, we used a particular public data mining approach, enabled by access to data on Twitter. Comparable programs are now available to access data from Facebook (CrowdTangle, 2021), and this study shows one example of how this data can be informative for research purposes. Particularly, this data allowed us to examine unfolding patterns in the themes of posts over time and in an in-situ way—in a way that may provide a different account than if representatives of districts were asked following the period of crisis or in the present about what they prioritized in their work and communication.

Our account of districts' posts is largely a positive one, in that districts were responsive and communicative amid the uncertainty they faced. Nevertheless, this study raises questions that are less positive, or at least are more critical in nature: How do these communications affect the services that students receive—particularly the students who are the most underserved in their communities and in our country? What difference does it make for districts that do or do not engage with their community through Twitter and other social media? What are districts not communicating about, including other noteworthy events of the moment? How do districts attend to their diverse audiences through social media? What role can and should two-way communication play in district social media use?[11] And, how effective were the changes districts and schools made during an emergency period over the coming year?

Conclusion

In this study, we examined a sample of school districts' Twitter posts during the early stages of the COVID-19 pandemic in 2020 through a process of qualitative coding and quantitative analysis. We found that districts used Twitter to share important announcements and build community through an overwhelmingly positive approach. District's community-building efforts through social media are evidence of their continued focus on this as a priority, even when physically distanced from the members of their communities. As predicted by crisis communication research, the type of posts differed across time as the pandemic's impact was realized and districts made functional adjustments to their delivery of educational services. Districts actively engaged with stakeholders through Twitter on a relatively small scale and though their posts received

relatively little active engagement, they did find other ways to invite participation through sharing successes.

There remain large gaps in our understanding of district Twitter use in general, outside of the COVID-19 pandemic. We call upon other researchers to build on our efforts to document districts' and schools' responses and their communications about their responses in the years ahead with the aim of continuing to understand and support our educational system during a period of change.

Open Practices

The analysis files for this article can be found at https://www.openicpsr.org/openicpsr/project/158082/version/V1/view. To request access to our data set, please use this form: https://forms.gle/qpMN9BqxSuefxTG76

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Notes

1. At present, both Twitter and Facebook have programs for academic researchers to access their full archive of posts (only posts from public pages in the case of Facebook). See https://developer.twitter.com/en/solutions/academic-research (for access to Twitter data) and https://help.crowdtangle.com/en/articles/4302208-crowdtangle-for-academics-and-researchers (for access to Facebook data). These data has been used to study education-related topics such as public sentiment toward educational reforms (Rosenberg et al., 2021; Wang & Fikis, 2019), teacher professional development (Carpenter, 2015; Carpenter & Krutka, 2015), digital divides (Kimmons et al., 2018), education trends (Kimmons et al., 2021), teacher identities (Carpenter & Krutka, 2014; Carpenter et al., 2019), geographic-based communities (Rosenberg et al., 2016), and educator and student responses to crises (Greenhalgh & Koehler, 2017), including the COVID-19 pandemic (Greenhow & Chapman, 2020; Kimmons et al, 2021; Literat, 2021; Trust et al., 2016).

2. Public data mining is a research methodology that involves the use of digital trace data to more efficiently collect, randomize, and analyze generalizable samples of data representing people in authentic learning or communication settings. This enables both qualitative and quantitative analysis of artifacts (Kimmons & Veletsianos, 2018). Different from learning analytics or educational data mining-driven approaches, public data mining can be used to collect and analyze data that may not be inherently teaching- and learning-focused (such as the social media posts of educational institutions) to gain insights on educational problems and solutions.

3. We further bounded our sample to better reflect the central focus of our inquiry in other key ways. For example, because we wanted to focus on district-generated messages, we excluded

retweets, which would have introduced messaging from many other entities, resulting in a sample of 57,159 tweets. We then randomly sampled 1,500 tweets from this set and then identified and removed 143 tweets from nondistrict accounts (e.g., school or individual accounts that were included in the original sample because the word district appeared in their profile).

4. Using a technique described further in Kimmons et al. (2021), we used R (R Core Team, 2021) to match website URLs for districts associated with their Twitter accounts to a list of school district contact information acquired from the National Center for Education Statistics (NCES, 2020). For example, a district with the Twitter handle #BestSchoolDistrict had an accompanying website URL, https://www.thebestschooldistrict.org. We reduced the URLs from both data sets to "thebestschooldistrict" and combined the Twitter URLs to the NCES list. From the NCES list, we identified latitude and longitudinal coordinates to map the locations of each district. We were able to link only 403 districts out of the 493 originally sampled, due to differences in the website urls, so the map is missing the location of some districts.

5. As of March 2021, when we accessed and reported this data, the districts in our sample had a median of 1,965 (min. = 26, max. = 155,292, SD = 13,054) followers and had posted a median of 3,894 (min. = 136, max. = 81,988, SD = 7,575) tweets. While the ranges for these two variables is sizable, the SDs are more modest relative to the mean, indicating that a few districts had very few or very many followers and posts, but that most districts had generally comparable numbers of followers and posts. Particularly for posts, only three districts had greater than 100,000 followers; only eight had more than 50,000 followers, and only 46 had greater than 10,000 followers. The quantiles build on this exploration to show that 95% of the follower counts range from 286 to 15,855. On average, the median account creation date was February 2, 2012; the earliest an account was created was April 2, 2008, while the latest was September 28, 2016. Messages included a median of 185 characters (min. = 21, max. = 320, SD = 85.54) and were interacted with (by retweets or likes) a median of 6 times (min. = 0, max. = 599, SD = 41.30 times).

6. We provide an example of our coding for the tweet presented in Figure 2. An open code from one of the coders for the above example tweet was, "Video of chalk art and words of encouragement on the asphalt where students come to pick up their meals." The process of reducing the open codes to summaries led to the axial code "Highlight encouragement for students during meal pick up." Though this tweet mentions meals, it did not provide information about meal distribution—instead of focusing on the chalk art that had been drawn near the school for students to see when they arrived for meal pick-up. The words in the tweet did, however, involve the act of encouraging students, which suggested to us that the code may be an instance of several posts that served the function of spreading positive news and updates. This, coupled with viewing the video embedded in the tweet, showed chalk drawings on the sidewalk and parking lot, and bolstered our confidence in our interpretation of the thematic purpose, leading us to apply the thematic code "Spreading Positive Messages."

7. To establish the reliability of our coding process during the coding of the early data sample, we engaged in interrater reliability practices, double-coding 25 new tweets with thematic codes. The agreement between the coders was 65%. Disagreements were noted and resolved in the whole group and paired discussions, resulting in changes to the codebook, including examples and nonexamples for each code, expanded descriptions, and procedural steps for analysis. The second round of interrater coding with 25 previously uncoded tweets resulted in at least 80% agreement between each of the four coders, after which we coded the second subsection of the sample, resulting in a total of 1,357 coded tweets. Throughout this process, we maintained an open discussion of the application of the coding frame to individual tweets and met as needed to discuss questions, compare results, and retroactively apply any changes to the codebook.

8. First, the interaction measures are temporally sensitive; we collected these interaction statistics in March 2021, and it is possible that posts sent later in the data collection period may have received additional interactions (relative to those posted earlier), as they have been publicly available for longer. However, we think that the relatively long time (10–12 months) that these measures were constructed minimizes any differences and potential biases in these measures. Related to users, accounts may be closed or users may unlike a tweet, meaning that the interaction statistics are rarely perfectly stable over time. This meant that the interpretation of such metrics had to be treated carefully.

9. Because the outcome variable for the three types of interactions (likes, quote tweets and retweets [combined], and replies) was a count (i.e., 10 likes, or 2 replies), we specified generalized linear models with a Poisson outcome distribution. These models were estimated with the number of data points equal to the number of tweets that we coded (n = 1,357) and included a single predictor variable, a categorical variable representing the three groups of themes: announcements, community-building, and unrelated. The comparison level for this categorical variable was specified as the announcements group; thus, these models informed us as to whether announcements and community-building posts and announcements and unrelated posts differed in their counts of likes, quote tweets, and retweets, and replies estimated in three separate models—one each for each interaction type.

10. In each example, any words revealing the identity of the district, a school, or person have been replaced with a general term in brackets, and small words within the tweet have been changed (without altering the meaning of the tweet) to protect the privacy of the school districts and any individuals included in the tweet.

11. We also take this opportunity to recommend an expansion of how district social media engagement is conceived in future research. It may be necessary to broaden the definition of social media engagement for schools, considering their organizational and communicative purposes. Simple metrics consisting of likes, comments, and retweets cannot capture the full picture of engagement as we saw districts create opportunities for digital participation through events or requests for pictures of remote learning successes. Two-way engagement can be a two-edged sword on social media and should not be viewed exclusively as a good or end unto itself. We shudder to think of school district accounts responding to every negative or trolling comment on their posts or engaging in public back-and-forths with upset students to participate in two-way communication. This type of engagement might increase metrics through sheer spectacle or novelty, which we saw in this

study as posts with the highest engagement were the announcements about school closures, but it would be far from the district's evident purpose of building positive relationships and community connections.

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