Getting personal! Twitter communication between school districts, superintendents, and the public

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ABSTRACT: The purpose of this study is to examine the Twitter communication between school districts, superintendents, and the public. Content analysis of the tweets posted by the 100 largest U.S. school districts and those district superintendents was performed to investigate how the districts and the superintendents communicated with the public on Twitter. Next, paired sample t-tests were performed to compare the differences between public sentiment toward the districts and the superintendents. The findings suggest that the districts and their superintendents primarily used Twitter for one-way information broadcasting, leaving Twitter's two-way communication functionality largely untapped. Further, the public expressed significantly less negative sentiment toward the superintendents than the districts, whereas no statistical difference existed in the public's positive or neutral sentiment toward the districts and the superintendents. The findings provide novel insights into educational institutions' and leaders' Twitter communication. More importantly, the findings offer research-based guidance on districts' and superintendents' Twitter communication. Recommendations were provided for districts and leaders to use social media effectively and thus engage the public and garner social support for education.

KEY WORDS: Communication, Public Sentiment, School Leadership, Social Media, Superintendent
agencies, including the District of Columbia, established their presence on Twitter with an attempt to engage the public in education (Wang, 2016). Educational administrators, including district superintendents and school principals, use Twitter to communicate with stakeholders, share and acquire resources, and build professional and personal learning networks (Cox & McLeod, 2014a; Cox & McLeod, 2014b; Wang, Sauers, & Richardson, 2016). These educational institutions and leaders used Twitter as an alternative communication tool—along with traditional communication channels (e.g., website, email, newsletter, and telephone) and other social media tools (e.g., Facebook, YouTube, and Instagram)—to communicate with parents, communities, and the general public.

Considering that communication inherently involves the sender and the receiver (Foulger, 2004; Grunig, 2009; Plowman, Wakefield & Winchel, 2015; Shannon & Weaver, 1949), one problem looms large: the receivers of educational institutions’ and leaders’ Twitter communication have been largely overlooked in the extant literature in the field of education. At the state level, Wang’s (2016) recent study, perhaps for the first time, called attention to the receivers (i.e., educational stakeholders and the public) in state education agencies’ Twitter communication. At the school district level, Cox and McLeod (2014a) noted that superintendents used social media to strengthen the relationship with local stakeholders, build professional and personal learning networks, and enhance transparency in districts’ decision-making and budgeting processes. Yet it remains unknown how stakeholders and the public communicate to districts and leaders.

To fill the gap in the existing literature, this study not only investigated how Twitter was used by the 100 largest U.S. school districts and their superintendents for communication, but also examined the sentiment expressed by the public toward the districts and the superintendents on Twitter. Specifically, this study sought to answer four research questions:

- To what extent did the 100 largest U.S. districts use Twitter for two-way communication?
- To what extent did the superintendents in the 100 largest U.S. districts use Twitter for two-way communication?
- What was the sentiment expressed in the public’s tweets referencing the districts and the superintendents?
- Was there any difference between public sentiment toward the districts and the superintendents on Twitter?

The answers to these questions are a step forward to understand the social media communication paradigm between educational institutions, leaders, and the public. The empirical evidence uncovered in this study provides
novel insights into what constitutes the fruitful and impactful practices in districts' and superintendents' social media communication, and offers the sorely needed research-based guidance for educational institutions and leaders to engage the public and thus garner social support for education.

THEORETICAL FRAMEWORK

Using an ecological lens, this study applied Foulger's (2004) ecological model of communication—a model developed before Twitter was created—to the Twitter communication between school districts, superintendents, and the public. To ground the inquiry in the current study, here, I elaborate the four key communication components in the ecological model—medium, language, message, and people, coupled with the literature on social media communication in education and other disciplines. In the remainder of this section, I present the role of each key communication component in the Twitter communication between districts, superintendents, and the public.

MEDIUM: TWITTER

First and foremost, Twitter is the communication medium examined in the current study. Fougler (2004) defined a medium as a system that enables the construction and consumption of messages. Unlike websites that are usually limited in the collaborative scope, Twitter empowers real-time communication through two major features: the brevity of tweets and multiple access portals. First, the brevity of no more than 140 characters in each tweet encourages Twitter users to post instantaneous updates. A tweet often consists of one short sentence, such as a district's tweet, "stolen ipads also can be tracked.", "@UserID @UserID @UserID We agree!", and "@UserID We can assure you that the meals we serve have been tested by students." Second, Twitter is readily accessible with different portals, including desktop computers, laptops, smartphones, and tablets (Twitter, 2015a). In particular, approximately 80% of Twitter users accessed Twitter via mobile devices (Twitter, 2015b). As a corollary, the two aforementioned features of Twitter speed up information diffusion and add to the immediacy of communication, prompting users to create abundant, instantaneous updates in tweets that serve as a source of information and a proxy for public opinion. Indeed, tweets are now considered as real-time "social sensors" for event detection and public opinion mining (Crooks, Croitoru, Stefanidis, & Radzikowski, 2013; Preethi & Ajit kumar, 2015; Siqi, Lin, Jehan, & Venue, 2011; Weiler,
Grossniklaus, & Scholl, 2015), including detecting seasonal flu trends (Achrekar, Gandhe, Lazarus, Yu, & Liu, 2011) and depression (Yang & Mu, 2015), identifying public opinion on healthy food (Widener & Li, 2014), as well as predicting political elections (Jahanbakhsh & Moon, 2014; Wang, Can, Kazemzadeh, Bar, & Narayanan, 2012) and stock market price (Bollen, Mao, & Zeng, 2011).

Educational institutions and leaders have been using Twitter as a medium to harness its communication potential. The U.S. Department of Education created 14 Twitter accounts to communicate to particular interested publics as of February 2015 (U.S. Department of Education, 2015). At least 40 state education agencies used Twitter to not only have conversations with their stakeholders and the public, broadcast student achievement, but also to communicate with the governors and commissioners of education on Twitter (Wang, 2016). While it is unclear how many superintendents are using Twitter, a recent study identified that 151 district superintendents and school principals, both in the United States and other countries, used Twitter actively as measured by the number of tweets exceeding 2,000 (Wang et al., 2016). Assuming that the districts with larger student enrollments need to communicate with a larger number of stakeholders and the public, this study zeroed in on the 100 largest U.S. school districts and their superintendents to investigate how Twitter was used for communication between districts, superintendents, and the public.

LANGUAGE: #, RT, T.CO., VIA, AND @

Language, in Foulger's (2004) model, is invented to construct messages. Following this definition, the language of the Twitter communication is contextualized as the unique “Twitter language” used by millions of Twitter users. In comparison with the languages (e.g., English, Spanish, and French) that Twitter users speak in their offline, face-to-face conversations, the “Twitter language” is novel in many ways. As previously noted, each tweet must not exceed 140 characters, which explains why Twitter is also called microblogging. Despite the 140-character limit, fine-grained information can be communicated if a Twitter user is proficient in “Twitteracy”—the competence in using Twitter language for conversations, developing and maintaining relationships, and mobilizing social sources (Greenhow & Gleason, 2012). Twitter language is characterized by the symbols #, RT, t.co., via, and @. Below, I explain how each symbol in Twitter language is used for one-way information broadcasting or two-way communication. Table 1 presents examples and descriptions of the symbols in “Twitter language.”
Table 1. Examples and Descriptions of the Symbols in the Tweets

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Example tweet</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>#</td>
<td>Robotics, edtech &amp; STEM programs are changing students’ lives—preparing them for the jobs of tomorrow. VIDEO: <a href="http://t.co/U4tQHIJrpc">http://t.co/U4tQHIJrpc</a></td>
<td>edtech is the hashtag (i.e., the keyword or topic) in this tweet.</td>
</tr>
<tr>
<td>RT</td>
<td>RT @UserID: #CO grad rate improved from 72% in 2010 to 77% in 2013. #KIDSCOUNT coleg #edcolo <a href="http://t.co/ljxQ9alXG">http://t.co/ljxQ9alXG</a></td>
<td>The Twitter user @UserID’s tweet was forwarded to another user’s Twitter followers.</td>
</tr>
<tr>
<td>t.co</td>
<td>Learn about your child’s options at our School Choice Open House at Northwest Mall tomorrow from 10 a.m.—1 p.m.! <a href="http://t.co/TugCreeEyFf">http://t.co/TugCreeEyFf</a></td>
<td>A webpage link—Uniform Resource Locator (URL)—was referred in the tweet.</td>
</tr>
<tr>
<td>Via</td>
<td>Reading, Writing, Arithmetic, and Lately, Coding featuring CPS via @nytimes <a href="http://t.co/OK7eAFGnk">http://t.co/OK7eAFGnk</a></td>
<td>The content in the tweet came from the New York Times (@nytimes).</td>
</tr>
<tr>
<td>@</td>
<td>@UserID: We’ve got an all-star lineup of 1.1 million students. Join us in welcoming them BacktoSchoolNYC tomorrow, 9/4/14!</td>
<td>A Twitter user was mentioned in the tweet.</td>
</tr>
</tbody>
</table>

Three symbols in Table 1—hashtag (#), retweet (RT), and shortened hyperlinks (t.co)—are considered as the indicators of one-way information broadcasting (Lovejoy, Waters, & Saxton). The first indicator is hashtag, which is a word or phrase preceded by the # symbol. With a hashtag helping categorize and organize tweets, a tweet is more readily accessible to Twitter users if otherwise. For instance, using the hashtags #CommonCore and/or #CCSS, Twitter users can readily locate the Common Core State Standards–themed tweets. The second indicator of one-way information broadcasting is retweet, characterized by the symbol RT, which further disseminates the initial tweet by forwarding the tweet to another Twitter user’s followers. The third indicator is the shortened hyperlink, characterized by the symbol t.co, which bypasses the 140-character limit. A Twitter user can refer to a hyperlink—Uniform Resource Locator (URL)—in a tweet so that the tweet readers are directed to a webpage that provides rich information. Twitter automatically shortens all URLs to a http://t.co link, so the symbol t.co becomes another indicator of one-way information broadcasting. Finally, following the recommendation in the literature (Wang, 2016), in addition to these three one-way information broadcasting indicators, the current study adds the “via @username” symbol as the
fourth indicator which suggests that the content in the tweet comes from a particular Twitter user, as shown in Table 1.

The two-way communication in tweets, on the other hand, is indicated by the @ symbol (Adi, Erickson & Lilleker, 2014; Goggins & Petakovic, 2014; Lovejoy et al., 2012). For instance, a tweet in this study’s dataset replied to a Twitter user by saying, “@UserID Thanks for pondering #LAUSD’s progress. We view iPads very much as teacher tools! May we suggest an FAQ http://t.co/b212OsqW6t?” Another example is a district superintendent’s tweet: “@UserID @UserID In 2013, [district name] retained 86.1% of our teachers; 88.5% of our school administrators; and, 89.8% of our total employees.” Granted, the mentioned Twitter users might not necessarily carry on the districts’ or the superintendents’ initiated conversation on Twitter by replying to their tweets. However, the tweets characterized by the @ symbol at least showcase the districts’ and the superintendents’ responsiveness and invitation to Twitter users to engage in two-way communication.

MESSAGE: PUBLIC ENGAGEMENT & PROFESSIONAL GROWTH

Public engagement in education is the central message in the Twitter communication between districts, superintendents, and the public. As the pivot of Foulger’s (2004) ecological model, the message is the most fundamental product of the interaction between language, media, and people. In fact, public engagement—as the message of state education agencies’ Twitter communication (Reform Support Network, 2012; Wang, 2016)—is very similar to the messages of a wide variety of organizations’ communication on social media, including enhancing government openness and public engagement as the message of government agencies (Lee & Kwak, 2012), community building as the message of the nonprofit advocacy organizations (Auger, 2013), the awareness of the charities’ mission and fundraising as the messages of the 200 largest U.S. charitable organizations (Barnes, 2010), and the awareness of health issues and public health emergencies or outbreaks as the messages of public health organizations (Sutton, 2010; Vance, Howe, & Dellavalle, 2009). Following this line of messages, the current study contextualizes the message of the school districts’ Twitter communication as public engagement in education—the fundamental product of the districts’ communication with stakeholders and the public.

In addition to public engagement, superintendents as individuals send one more message in their Twitter communication: individual professional growth. As Cox and McLeod (2014a) asserted, it would be too limited to use social media solely for the communication with stakeholders. Social media presents extensive opportunities for superintendents to build
professional and personal learning networks in which fellow educators share and acquire resources to advance their professional knowledge (Cox & McLeod, 2014a; Wang et al., 2016). Therefore, this study distinguished superintendents' individual Twitter communication from districts' institutional Twitter communication, and then examined whether stakeholders and the public expressed different sentiments toward the institutions and the individual leaders on Twitter.

**PEOPLE: THE SENDER AND THE RECEIVER IN TWO-WAY SYMMETRICAL COMMUNICATION MODEL**

The people, in Foulger's (2004) ecological model of communication, are primarily the message creators and consumers at either end of the communication process. Message creators and consumers are not set in stone. Rather, their relationships are reflexive. The reflexive relationship is established when message consumers reply or provide feedback to message creators, and when message creators listen to the feedback and adapt the messages accordingly. Hence message creators become consumers, and vice versa.

To see this reflexive creator–receiver relationship in Twitter communication more clearly, consider the U.S. state education agencies' (SEAs) use of Twitter as an example (Wang, 2016). As message creators, 40 SEAs primarily used Twitter to disseminate the existing information on non-Twitter websites. Additionally, there were 15.04% of 40 SEAs' tweets deemed as conversational tweets characterized by the @ symbol. These conversational tweets, albeit in a small percentage, suggested the SEAs' initiation to become the consumers of the messages created by a large base of Twitter users (Wang, 2016). Likewise, given Twitter's functionality to encourage two-way, transparent communication, districts and superintendents should be not only message creators but also message consumers. That is, districts and superintendents become the message consumers when they ask for and listen to feedback from stakeholders and the public. This communicative behavior demonstrates districts' and superintendents' communication competence—the adequate ability of effective communication in a given situation (McCroskey & McCroskey, 1988; Spitzberg, 1983). Hinging on the given situation, the communication competence evolves as the situation changes. In a technology-enriched communication environment, pens are traded for computer keyboards; paper is traded for smartphones and tablets. In this case, our ever-evolving digitally connected world adds an additional layer to districts' and superintendents' communication competence, particularly on an open, transparent communication medium such as Twitter.
In the current study, following the paradigm of the ecological model of communication, Twitter is the communication medium, with school districts and superintendents on one end, stakeholders and the public on the other end. By using a unique “Twitter language”—characterized by the symbols #, RT, t.co., via, and @, districts and superintendents construct the messages in an attempt to engage stakeholders and rally public support for education. Twitter users then receive and interpret the tweets, and have the opportunity to communicate with the districts and the superintendents on Twitter. As a result, the communication process becomes an ongoing loop between districts, superintendents, and the public on the medium of Twitter. In this study on Twitter communication, the 100 largest U.S. districts were chosen according to the district student enrollment. This is because a district with a larger number of student enrollment is assumed to have a higher number of parents and community members, and thus a higher number of senders and receivers in two-way symmetrical communication. Further, the extant literature consistently indicates a higher percentage of urban dwellers using Twitter than suburban and rural residents (Pew Research Center, 2013; Pew Research Internet Project, 2014), and a positive correlation between the county population and the number of Twitter users in the corresponding county (Mislove, Lehmann, Ahn, Onnela, & Rosenquist, 2012). Therefore, considering Twitter users' demographic profile, this study focuses on the Twitter communication of the 100 largest districts, superintendents, and the public because these districts and their stakeholders are more likely to resort to Twitter as a communication medium than their suburban and rural counterparts.

METHODS

The purpose of this study is to examine the Twitter communication between school districts, superintendents, and the public. To fulfill this purpose, I first investigated the tweets posted by the 100 largest U.S. school districts in terms of student enrollment size, as well as the tweets posted by the superintendents, in order to determine the extent to which Twitter was used for two-way communication. Next, I performed sentiment analysis to classify the sentiment of the public's tweets referencing the districts (i.e., @district) and the superintendents (i.e., @superintendent), according to the emotion expressed in the tweets. Lastly, I compared three categories of sentiments (positive, neutral, and negative) between the districts and the superintendents by performing paired sample t-tests. The data collection was conducted in February 2015. In the following paragraphs, I present the details of the procedures used in data collection and analysis.
TWITTER ACCOUNT IDENTIFICATION

In this study, the 100 largest U.S. school districts by student enrollment were chosen to examine their Twitter communication. The 100 largest districts were identified according to the data on 2012–13 student enrollment from the National Center for Education Statistics (NCES). Then, the districts' Twitter webpage was located through the districts' website that usually displayed the hyperlink of the districts' Twitter webpage. If the district's Twitter webpage was not featured on the districts' website, a search on Twitter website (Twitter.com) was performed by using the district name. Then, the district's Twitter webpage was confirmed by matching the district's geographic location displayed on the Twitter webpage with the geographic location in the NCES' dataset. By doing so, 99 of the 100 largest districts' Twitter webpages were located. The same procedure was followed to locate the Twitter webpage of the superintendents (chancellor or chief executive officer in some districts) in the 100 largest districts. A total of 34 superintendents' Twitter webpages were identified for the current study.

TWEET RETRIEVAL

The Twitter REST Application Programming Interface (API) v1.1 (Twitter, 2015c) was used to retrieve all the tweets analyzed in this study. In comparison with collecting Twitter data from Twitter website, the interface of Twitter REST API provides a more efficient access to retrieve up to 3,200 tweets posted by a given Twitter user and the corresponding metadata. Specifically, to retrieve the tweets posted by the 99 districts and the 34 superintendents, Twitter's limit of providing a maximum of 3,200 recent tweets of a given Twitter account was taken into consideration. If a Twitter account shows that less than 3,200 tweets were posted, then all the past tweets were retrieved at the time of data collection. If a Twitter account shows that more than 3,200 tweets were posted, then the most recent 3,200 tweets were retrieved. I also collected the metadata of each of the 99 districts' and 34 superintendents' Twitter accounts, including the number of tweets and when the Twitter account was created. A total of 203,342 tweets posted by 99 districts and 29,405 tweets posted by 34 superintendents were retrieved for the content analysis to examine the extent to which Twitter was used by the districts and the superintendents for two-way communication.

Next, I looked at how stakeholders and the public communicated with the districts and the superintendents at the other end of Twitter communication. The proxy to this end is public sentiment expressed in the public's tweets referencing the districts or the superintendents. To detect
and compare public sentiment toward the districts and the corresponding superintendents, I collected the public's tweets referencing those 34 schools districts whose superintendents also had a Twitter account (i.e., the tweets that mentioned one of the 34 districts' Twitter username), as well as the public's tweets referencing the 34 superintendents (i.e., the tweets that mentioned one of the 34 superintendents' Twitter username). Using Twitter Search API (Twitter, 2015c), a part of Twitter's v1.1 REST API that provides access to the tweets containing the specified search terms (the Twitter usernames of the 34 districts and their superintendents in this case), I retrieved 33,173 tweets referencing the 34 districts and 8,487 tweets referencing the 34 corresponding superintendents. All these tweets were then classified into positive, neutral, and negative sentiments by performing sentiment analysis. There were, however, five superintendents who were not referenced by the public on Twitter; thus no tweet was available for sentiment analysis. This left 29 pairs of districts and the superintendents for the paired sample $t$-tests to detect the difference in public sentiment toward the districts and their superintendents.

**DATA ANALYSIS**

To answer the questions on the extent of two-way Twitter communication by the districts and the superintendents, respectively, the content analysis was performed to identify the prevalent Twitter communication patterns. Based on the recommendations in the extant literature noted previously, the indicators of one-way information broadcasting (i.e., #, RT, t.co, and via) and two-way communication (i.e., @) were used to code the 203,342 tweets posted by 99 districts and the 29,405 tweets posted by 34 superintendents.

To answer the questions regarding the difference in public sentiment, if any, between the districts and the superintendents, sentiment analysis was first conducted to detect the sentiment (i.e., positive, neutral, and negative) in each tweet referencing the district or the superintendents, which will be explained in the remainder of this section. Next, the paired sample $t$-tests were performed to examine whether a statistical difference existed between public sentiment toward the districts and the superintendents.

Sentiment analysis is the automatic computer-based analysis to extract the sentiment in a given text (Das & Chen, 2004; Nasukawa, Bunescu, & Niblack, 2003). Sentiment analysis is one of the fast-growing areas in the emerging field of computational social science that uses computational modeling to analyze massive amounts of complex digital data, providing an alternative mode of inquiry for social scientists to enrich their understanding of social phenomena (Lazer et al., 2009; Shah, Cappella & Neuman,
In the current study, SentiStrength—the algorithm with high validity for tweet sentiment detection based on a lexicon-based method (Pfitzner, Garas & Schweitzer, 2012; Stieglitz & Dang-xuan, 2013; Witherspoon & Stone, 2013)—was used to perform the sentiment analysis of all the public’s tweets referencing the districts and the superintendents. SentiStrength not only provides the result of sentiment in trinary format (positive, neutral, and negative) based on the emotional words in tweets, but also takes into consideration the factors in the linguistic rules such as negation (e.g., not amazing), booster words (e.g., very amazing), amplifications (e.g., amaaaazing), emoticons (e.g., :)), and spelling corrections (see Thelwall, Buckley, Paltoglou, Cai & Kappas, 2010, for a thorough explanation of the SentiStrength algorithm). Here I present some examples of tweet sentiment classification by using the tweets in the current study’s dataset. The words that show positive or negative sentiment are in bold font followed by the signs “+” suggesting positive and “-” suggesting negative.

- Positive sentiment tweets
  - ![school name] Honor Roll #inspiring [+] excellence [+] @UserID @UserID @UserID @UserID
  - Thank [+] you @UserID for surprising one of our amazing [+] teachers today who knocked your socks off. Mrs. [name] rocks!

- Negative sentiment tweets
  - Fear [-], retaliation [-] ruled @UserID HR department, ex-employees say | @UserID http://t.co/qj7kifKW7Y @UserID
  - @UserID the roads in the city are sheets of ice, let alone the county. we NEED to close. it’s dangerous [-] and life threatening [-]

- Neutral sentiment tweets
  - @UserID Must read. http://t.co/eUJqNEGZSm Is this where we are headed? Lots to think about.
  - @UserID wants to simplify magnet school application http://cjky.it1DNRxCu @UserID @UserID @UserID

By conducting the sentiment analysis, each of the tweets referencing the 29 districts and the superintendent was determined to be positive, neutral, or negative. The percentages of positive, neutral, and negative tweets for each district and the corresponding superintendent were then paired for the paired sample t-tests to determine whether the statistical difference existed between public sentiment toward the districts and the superintendents. To eliminate the contextual variation from district to district, the paired sample t-tests were chosen so that public sentiment toward the superintendents were compared with the sentiment toward the corresponding districts. In the t-tests, the percentages of each public sentiment—positive,
neutral, and negative—were compared between the two groups (districts and superintendents), respectively. It is important to note that in this study, public sentiment is referred to the sentiment expressed by all Twitter users, except for the districts and the superintendents, in the tweets referencing the districts or the superintendents. Those Twitter users, who could be parents, teachers, communities, government agencies, to name a few, are collectively termed as “the public” from here onward.

RESULTS

The purpose of this study is to examine the Twitter communication between school districts, superintendents, and the public. In this section, I first describe how Twitter was used by the 100 largest U.S. school districts and their superintendents. Next, I present the results of examining the difference between public sentiment toward the districts and the superintendents on Twitter. I then turn to a discussion of the results.

TWITTER ADOPTION: DISTRICTS OUTPACED SUPERINTENDENTS

Twitter was far more widely adopted by the 100 largest school districts than their superintendents. At the time of data collection, a total of 99 of the 100 largest districts, in comparison with 34 superintendents, used Twitter to communicate with the stakeholders and the public. Figure 1 illustrates that the pace of the districts’ Twitter adoption first peaked in
April 2009 when eight districts created their official Twitter accounts. By the end of 2009, nearly half \((n = 46)\) of the 100 largest districts had created the districts’ official Twitter account. Then the districts’ Twitter adoption pace leveled off after 2011. In contrast, the superintendents adopted Twitter at a more even pace: no more than two superintendents from the 100 largest districts created Twitter accounts each year. Overall, the districts’ Twitter adoption consistently outpaced the superintendents’ adoption from 2008 to 2011; in the ensuing years, the 100 largest districts and their superintendents adopted Twitter at almost the same pace. Regarding tweeting activity, the districts posted on average two tweets per day, whereas the superintendents on average posted one tweet per day.

In addition to the districts’ widespread adoption of Twitter, the districts used Twitter in two notable ways. First, some districts created separate Twitter accounts for different purposes. For instance, one of the districts has separate Twitter accounts for the district, the district’s Human Resource Services, Beginning Teacher Support & Assessment, and Math. Second, in addition to English as the dominant language used in the tweets posted by 99 districts, some districts tweeted in multiple languages, including Spanish as the most used language in non-English tweets, as well as Chinese, Korean, Russian, and Arabic.

A wide variation was found in the superintendents’ Twitter communication. On one end of the spectrum, some superintendents had a large base of Twitter followers, such as one superintendent who used Twitter in a fairly active fashion by posting on average five tweets per day and had almost 170,000 Twitter followers as of February 2015. On the other end of the Twitter-use spectrum, some superintendents had less than 10 tweets posted and only five Twitter followers.

**TWITTER USE: ONE-WAY INFORMATION BROADCASTING OUTWEIGHED TWO-WAY COMMUNICATION**

The districts and the superintendents primarily used Twitter for one-way information broadcasting, rather than two-way communication. As seen in Table 1, over half of the tweets had a hyperlink: 64.88% of 203,342 tweets posted by 99 school districts, and 58.81% of 29,405 tweets posted by 34 superintendents. The tweets with a hyperlink suggest that the tweet readers are guided to a webpage containing richer information than the 140 characters—the character limit imposed by Twitter. For instance, a superintendent directed his tweet readers to a webpage of *The New York Times* by having the hyperlink in the tweet “For Schools, Long Road to a Level Playing Field http://t.co/hAmfQpQDdB”. In contrast, only 18.97% of the tweets posted by the districts and 24.34% of the tweets posted by the
superintendents suggest two-way symmetrical communication. The tweets characterized by the @ symbol indicate the conversation or at least the initiation of a conversation between the districts/superintendents and the public. The low percentages of conversational tweets posted by the districts and the superintendents imply that Twitter’s two-way communication functionality was not fully tapped by the districts and the superintendents.

COMMUNICATION ON TWITTER: SUPERINTENDENTS MORE INTERACTIVE THAN DISTRICTS

Despite the small percentages of conversational tweets posted by the districts (18.97%) and the superintendents (24.34%), it appears that the superintendents were more interactive than the districts on Twitter, as seen in Table 2. For instance, a superintendent mentioned the Sheriff’s Office in the tweet “Many thanks to Sherif [name] @UserID for speaking to our students today at #thinkb4upost event on proper use of social media.” Another superintendent conversed with a curriculum coordinator according to the user’s Twitter profile, in the tweet “@UserID they have responded well over time but it’s been a long process involving trust, relationships and courageous conversations!”

PUBLIC SENTIMENT: MORE POSITIVE THAN NEGATIVE, EVEN LESS NEGATIVE TOWARD SUPERINTENDENTS

Up until this point, we have only focused on one end of communication—the districts and the superintendents as the message creators. What was the sentiment expressed by the public, on the other end of communication, toward

<p>| Table 2. Comparison of the Tweets Posted by the 100 Largest U.S. Districts and Their Superintendents |
|---------------------------------|---------------------------------|---------------------------------|---------------------------------|
| Tweets posted by the districts  | Tweets posted by the superintendents |</p>
<table>
<thead>
<tr>
<th>(n = 203,342)</th>
<th>(n = 29,405)</th>
</tr>
</thead>
<tbody>
<tr>
<td>n</td>
<td>%</td>
</tr>
<tr>
<td>--------------------------------</td>
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</tr>
<tr>
<td>Two-way communication indicator</td>
<td>Concernational tweets (@)</td>
</tr>
<tr>
<td>One-way information broadcasting indicators</td>
<td>Tweets with hyperlinks (t.co)</td>
</tr>
<tr>
<td>Retweets (RT)</td>
<td>56,651</td>
</tr>
<tr>
<td>Tweet Content from other Twitter user (via @username)</td>
<td>2,730</td>
</tr>
</tbody>
</table>
the districts and the superintendents on Twitter? Public sentiment toward the districts and the superintendents is notably more positive than negative. As shown in Table 3, the average percentage of the positive sentiment tweets referencing the 29 districts ($M = 38.01, SD = 18.70$) is approximately three times as high as that of the negative sentiment tweets referencing the districts ($M = 12.06, SD = 10.14$). The public expressed even more pronounced positive sentiment toward the 29 superintendents than the negative sentiment. Specifically, the average percentage of the positive sentiment tweets referencing the 29 superintendents ($M = 39.66, SD = 23.02$) is around five times as high as that of the negative sentiment tweets referencing the superintendents ($M = 7.02, SD = 6.68$). In other words, more positive sentiment tweets referencing the superintendents by the public—like the tweet in which the superintendent was referenced positively, “Congrats! @UserID @UserID I'd love to help you @UserID “21st Century style” in math (via technology)! #anything4youtwo”—were observed than the negative sentiment tweets—like the tweet in which the same superintendent was referenced negatively, “@UserID I agree which most teachers should do. Teachers are stressing it to the students to the point the student begin to worry.”

Was there any difference in public sentiment toward the districts and the superintendents? The results from the paired sample $t$-tests indicate that the average percentage of the public's negative sentiment tweets referencing the superintendents ($M = 7.02, SD = 6.68$) was significantly lower than that of the tweets referencing the districts ($M = 12.06, SD = 10.14$) at the 0.05 level ($t = 2.60, df = 28, p = 0.02$, Hedges' $g = 0.59$). In terms of positive or neutral sentiment, however, no statistical difference was found between public sentiment toward the districts and the superintendents.

**DISCUSSION**

Building on the recent studies on Twitter used by educational institutions and leaders (Cox & McLeod, 2014a; Cox & McLeod, 2014b; Wang,
2016; Wang et al., 2016), this study not only examined how Twitter was used by the 100 largest districts and the superintendent for communication, but also investigated the other end of Twitter communication: How did the public express sentiment differently toward the districts and the superintendents? Several findings emerged from the analysis of the Twitter communication between school districts, superintendents, and the public. First and foremost, Twitter was far more widely adopted by the districts than their superintendents. The districts’ adoption of Twitter is somewhat reminiscent of school district websites. It is, in fact, commendable that an overwhelming majority (99%) of the 100 largest districts have been using Twitter to communicate with the stakeholders and the public, in comparison with only 34 superintendents using Twitter. Second, some districts created separate Twitter accounts for different purposes, such as the Twitter accounts for the district and multiple departments. Moreover, in addition to tweeting in English language, some districts tweeted in multiple languages, including Spanish, Chinese, Korean, Russian, and Arabic. This appears to be part of the districts’ response in the Twittersphere to the districts’ demographic change with a growing body of Hispanic and foreign-born students (Berube, Frey, Singer & Wilson, 2009; Fry, 2009).

Twitter’s two-way communication functionality was not fully tapped by the districts and the superintendents. The districts and their superintendents primarily used Twitter for one-way information broadcasting, rather than two-way communication, as evidenced by the low percentages of conversational tweets posted by the districts (18.97%) and the superintendents (24.34%). This asymmetrical communication indicates that the districts and the superintendents have much room for improvement in building the reflexive creator–receiver relationship—an essential component in Foulger’s (2004) ecological model of communication. That is, most of the districts and the superintendents may have not mastered Twitter language to effectively communicate with the public, which is part of communication competence (McCroskey & McCroskey, 1988; Spitzberg, 1983) in the digital age. Notably, despite the dominant one-way information broadcasting in the districts’ and the superintendents’ communication on Twitter, it appears that the superintendents were more interactive than the districts on Twitter. This finding can be explained by the existing literature claiming that superintendents use social media to not only communicate with stakeholders, but also to advance professional knowledge in school leadership (Cox & McLeod, 2014a). Thus, using Twitter for professional learning, as one of the merits of Twitter communication, elucidates why some superintendents use their personal Twitter accounts, even when the districts’ Twitter accounts are at disposal. To learn from fellow educators and leaders by broadcasting and
acquiring resources in the professional and personal learning networks on Twitter, the superintendents might have to interact with other Twitter users by reaching out to specific Twitter users who have certain expertise, and even participating in Twitter chat such as the weekly #edtechchat that takes place on Monday evenings from 8–9 p.m. EST (EdTechChat Wikispaces, 2015).

With regard to public sentiment, the public expressed more positive than negative sentiment toward the districts and the superintendents, and the public expressed even more pronounced positive than negative sentiment toward the 29 superintendents. The fact that the public's positive sentiment exceeds the negative sentiment on Twitter presents ample opportunities that the districts and the superintendents can capitalize on and translate the positive sentiment into the districts' social capital. Further, results of the paired sample t-test indicate that the mean percentage of the public's negative sentiment tweets referencing the superintendents was significantly lower than the districts, whereas no statistical difference was found between the public's positive or neutral sentiments toward the districts and the superintendents. These findings indicate that the public expressed less negative sentiment toward the individual leaders than the leaders' institutions on Twitter. One explanation for this finding is that some stakeholders in large school districts are not familiar with, or could not even identify, their superintendents. It is also quite plausible that the public feel a more personal connection to the leaders' Twitter account than the institutions', and thus the public tend to refrain from posting the tweets containing negative sentiments. Following this logic, in the case of building and strengthening the districts' relationship with the public, using the superintendents' individual Twitter account might be more effective to evoke less negative emotion among the public.

IMPLICATIONS

The current study is part of a broader effort to address the social media communication between educational institutions, leaders, and the public (Wang, 2013, 2015; Wang et al., 2016). At the intersection of educational leadership and the inexorable march of technological advances, there has been very limited literature addressing the role of technology in educational leadership (McLeod & Richardson, 2011). The dearth of educational technology leadership scholarship has, unfortunately, contributed to the lack of research-based guidance to fully tap the social media's communication value that can be translated into social capital (Wang, 2013). The findings from this study have several implications for districts' and superintendents' use of Twitter for communication with the public.
Creating social media-based public engagement in education pivots on two-way symmetrical communication rather than one-way asymmetrical information broadcasting, as indicated by Foulger's (2004) ecological model of communication. While educational institutions' and leaders' aim of using social media is to engage the public in education (Reform Support Network, 2012; Wang, 2016), this aim may not be fully fulfilled. Instead of proactively using social media to engage the public in the discourse on education, the tweets examined in this study suggest that the districts and their superintendents still primarily used Twitter for one-way information broadcasting. This communication pattern suggests that in our digitally hyper-connected world, most districts and superintendents still follow the classical administrative communication model that promotes one-way, directive information flow, rather than relationship-enhancing communication (Kowalski, 2000, 2005; Kowalski & Keedy, 2005; McGregor, 1967).

This study does not discount the importance of one-way information broadcasting on Twitter. However, prior studies of government agencies' Twitter communication consider one-way information broadcasting on Twitter as the initial stage of social media-based public engagement, followed by (1) co-production in which government agencies and the public collaboratively develop and deliver government services, and (2) crowdsourcing solutions in which government agencies leverage public knowledge and talent to develop innovative solutions to large-scale social issues (Bertot, Jaeger, Munson & Glaisyer, 2010; Lee & Kwak, 2012). Likewise, one-way information broadcasting on Twitter is solely the first step for districts and superintendents to nurture Twitter-based public engagement. To have an impactful Twitter presence rather than a token presence, districts' and superintendents' social media communication should underscore two-way symmetrical communication by seamlessly inserting social media efforts and digital outreach into the districts' overall communication strategy. As a result, districts and superintendents should take a further step, for example, by inviting the public to participate in conversations, requesting public feedback, listening to the public's voices, and responding accordingly. By doing so, Twitter functions as a medium through which the public are not simply treated as the consumers of the message broadcast by districts and superintendents in the Twittersphere. Rather, in Foulger's (2004) ecological model of communication, the public are given opportunities to become the message creators on one end of the communication, and districts and superintendents become the message consumers on the other. These symmetrical relationships between the message creators and consumers on Twitter help foster a sense of
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inclusion and yield true public engagement in an open, responsive communication environment on social media.

Translating Public Sentiment to Social Capital

Social media, if used effectively, has the capacity to engage people, shape public discourse on education, and rally public support for education. A key implication of this study is that the public's positive sentiment prevailing over negative sentiment poses both opportunities and challenges for the districts and their superintendents to translate the positive sentiment into social capital. A recent study on the emotional contagion on Facebook indicates that emotional contagion does not necessarily require in-person interaction or nonverbal cues, because the emotion expressed in the textual content are sufficient enough to influence others' emotion (Kramer, Guillory, & Hancock, 2014). In particular, according to Kramer et al. (2014), both positive and negative emotions are contagious: positive emotion yields more positive emotion and less negative emotion on social media, and vice versa. Similarly, public sentiment toward the districts and the superintendents might be contagious as well, having the propensity to stir up more sentiment on Twitter. In light of this study's finding that the public's positive sentiment exceeded negative sentiment, the districts and the superintendents are challenged to leverage the public's positive sentiment which might yield more positive sentiment on Twitter and thus rally public support for education.

Further, regarding negative sentiment, the public expressed even less negative sentiment toward the superintendents than the districts. One explanation for this finding is that when superintendents participate in an open, transparent conversation on Twitter, the public might be apt to appreciate the leaders' willingness and interest in engaging with them. This public appreciation may then diffuse the public's negative sentiment. Another explanation is that the public's communication with the superintendents on Twitter, instead of the districts' Twitter account, is instrumental for the public to feel a sense of us. Psychologically speaking, this sense of us—a shared social identity among group members and leaders—has the capacity to energize and motivate the group members to work for the common goal (Haslam, Reicher, & Platow, 2011). As the educational institutions and leaders forge into the social media realm, one challenge arises: How to differentiate and maximize the institutional (i.e., districts) and the leader's individual (i.e., superintendents) Twitter use? The finding that the public expressed less negative sentiment toward superintendents than the districts provides a hint that warrants further inquiry to find a clear answer. Another challenge for districts' and leaders' social media
initiatives is how to allocate the human resources needed to galvanize public engagement in education. Should all large districts hire a full-time social media director like the Los Angeles Unified School District did (Quillen, 2012)? Is hiring a social media director a sensible human resource allocation, especially in financially challenged districts? If not, what are the alternatives to mobilize human resources for developing social media–based public engagement in education? Clearly, these are the research questions awaiting answers provided by future inquiry.

Finally, the superintendents’ Twitter communication should by no means detract the attention from strong leadership. The findings of this study indicate no statistically significant difference in the public’s positive or neutral sentiment toward the districts and the superintendents. The superintendents who made an effort to communicate with the public on Twitter were appreciated and valued, as evidenced by the public’s lower percentage of negative sentiment toward the superintendents than the districts. Truly, on a medium as fluid as Twitter, superintendents are provided with an alternative platform to extend and exercise influence in the social media realm. However, the non-significant difference in the public’s positive sentiment toward the superintendents and the districts demonstrates that the public’s positive sentiment might still be rooted in leadership practices. Social media communication gives leaders an edge in connecting and communicating with the public, but its importance should not be overstated. After all, social media is merely one of many communication tools in a toolbox, and social media communication is merely one layer of the multitude of leadership practices. To that end, leaders’ use of social media is a necessary but not a sufficient requirement for effective leadership.

LIMITATIONS AND RECOMMENDATIONS FOR FUTURE INQUIRY

Although this study produced new knowledge about the Twitter communication between districts, superintendents, and the public, there are several limitations that should be addressed in future research. First, even with the large number of tweets analyzed in the current study, like many studies using social media data, this study is limited to the representation of a snapshot of the Twitter communication between the districts, the superintendents, and the public. New Twitter data are generated when new tweets are posted by districts, superintendents, and the public. The ever-increasing volume of Twitter data not only poses challenges to capture the real-time Twitter communication between districts, superintendents, and the public, but also offers exciting opportunities for a new line of inquiry focusing on real-time public sentiment toward districts and superintendents on social media.
Second, this study could be enriched by in-depth individual interviews with the people involved in the Twitter communication between districts, superintendents, and the public. The findings in this study shed light on the lack of two-way symmetrical Twitter communication, as well as public sentiment toward the districts and the superintendents on Twitter. Nevertheless, this study would be richer if the analysis of individual interview data is added. These individuals could include, but are not limited to, the people who manage and maintain the districts' Twitter account, the superintendents who use Twitter actively, and those who interact with the districts and the superintendents on Twitter. Investigating these individuals' perspective is highly encouraged in future research undertakings.

Third, this study only examined the Twitter communication by the 100 largest U.S. districts by the size of student enrollment. It remains unknown of how generalizable the findings of this study are to all districts and even at the school level. This study chose to focus on the 100 largest U.S. districts partly because the districts with a larger number of student enrollment need to communicate with a higher number of stakeholders and the public, and partly because Twitter users' demographic profile suggests large districts and their stakeholders are more likely than their suburban and rural counterparts to resort to Twitter as a communication medium. Future studies may extend the scope of the current study by examining more districts and schools, coupled with the demographics, to uncover the effective Twitter communication practices for a wide range of educational institutions and leaders.

SIGNIFICANCE OF THE STUDY

This study might be the first study that assessed the Twitter communication between school districts, superintendents, and the public. The findings provide districts and superintendents with novel insights into how to effectively use Twitter for communication. This study found that the 100 largest school districts and their superintendents primarily used Twitter for one-way information broadcasting, leaving Twitter's two-way symmetrical communication functionality largely untapped. It is also found that the public expressed more positive than negative sentiments toward the districts and the superintendents on Twitter, and even less negative toward the superintendents than the corresponding districts. These findings are important because as districts and superintendents wade into the uncharted waters of institutional and individual Twitter communication, the empirical evidence on what constitutes effective social media communication practices would help districts and superintendents avoid blind efforts in social media communication, and put conscious effort into creating social media–based
public engagement. More importantly, as we salivate at the prospect of social media communication, new communication tools will be developed, thanks to the inexorable march of technological advances. For school districts and all educational institutions, single-mindedly chasing after technology tools is perilous, because technology is a tool not a strategy. It is the two-way symmetrical communication strategy that motivates the public to engage in education—a strategy that does not turn a deaf ear to public opinion, a strategy that dose not discount and dismiss different voices, but a strategy that strives to be both the sender and consumer in the communication ecology.

In addition to the practical guidance for districts and superintendents on effective Twitter communication, this study introduces the techniques from computer science for social media data collection (e.g., Twitter API) and text data mining for data analysis (e.g., sentiment analysis). These techniques have been increasingly used in other fields. For instance, in political science, social media data are used to examine the digital public’s political expression and participation (Bernhard & Dohle, 2015; Bode, Hanna, Yang & Shah, 2015; Schwartz & Ungar, 2015). In public heath, the seasonal flu is predicted and tracked by monitoring tweets that mention flu indicators (Achrekar et al., 2011). In criminology, the geolocation-tagged Twitter data, along with weather data, are used to predict the time and location in which a specific type of crime will occur (Chen, Cho & Jang, 2015). However, the techniques in social media data acquisition, mining, and analysis have not attracted much attention in the school leadership research. Therefore, the techniques introduced in this study enrich the interdisciplinary research capacity, as they scale up the analytical capacity by automating the process of social media data acquisition and analysis in the school leadership research.

REFERENCES


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