
Forging Connections in a Digital World: Are Educational Organizations Maximizing Their Position in the Twittersphere?

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Abstract: *This study aims to investigate how educational organizations utilize social media, specifically Twitter, to interact and communicate with their audiences. Using text mining techniques, the researchers analyzed messages from top Twitter accounts of educational organizations in the U.S. The study sheds light on which types of messages receive more engagement on Twitter, such as likes, comments, and retweets. Furthermore, the study examines the characteristics of the most popular tweets. The findings of this research provide insights to educational organizations on how to improve their social media strategy for effective communication and audience engagement.*

Keywords: Twitter, social media, customer engagement, text mining

1. Introduction

Social media, defined as web-based platforms designed for content sharing and social interaction, has become an indispensable part of a brand's communication strategy (Kietzmann et al., 2011). Social media allows organizations to create content and deliver messages directly to mass and specific audiences (Wallace et al., 2011). Therefore, more organizations are adopting social media as a marketing tool to enhance brand awareness, promote communication with

customers, increase reputation and customer loyalty (He et al., 2013; Kwon & Sung, 2011), and establish authentic dialogic relationships with their audiences (Kwok & Yu, 2013). Similarly, with the increasing competition among universities around the world, many educational institutions and organizations are turning to Internet marketing communication tools (e.g., social media) as an innovative way to communicate and interact with their students and maintain connections with other stakeholders (Masrom et al., 2021; Peruta & Shields, 2017). Research indicates that social media can help a university enhance students' sense of connection and build a positive relationship with the university's stakeholders (Clark et al., 2017; Rutter et al., 2016).

As a major global social media platform, Twitter is one of the most used tools in strategic communications (Tang & Hew, 2017). While recognizing that Twitter has been rebranded as X, with tweets now referred to as posts and re-tweets as reposts, the authors will use the term Twitter in this article. The study predates the name change, and the new terminology may not be universally familiar.

Due to the close connection between Twitter and branding, Twitter can also measure the communication between brands and their target audiences (Rutter et al., 2016). Even though Twitter has been investigated most of the time regarding its influence in supporting learning experiences (Liu et al., 2019), this study looks at how Twitter impacts educational organizations when they communicate and interact with their audiences.

Twitter offers organizations opportunities to exchange knowledge and build learning communities and networks (Malik et al., 2019; Peruta & Shields, 2017; Wang, 2016). For instance, many U.S. colleges and universities, elementary and high schools, and federal and state education agencies have created Twitter accounts for public engagement (Kimmons et al., 2017; Wang, 2016). Other educational organizations, including non-profit foundations and for-profit companies, have focused on providing education-related services, sharing learning resources and tools, and aiming to help educators and support learners (McCabe & Weaver, 2018). Several recent studies confirmed the role of Twitter as a robust communication tool for formal and informal learning to gain learning knowledge and increase relevant capabilities (Greenhalgh et al., 2020; McPherson et al., 2015). Twitter has provided an effective mechanism to support educational networking, communication, and educational resource exchange with both peers and professionals, ultimately improving teaching, learning, and collaboration (Malik et al., 2019).

However, research on educational organizations' adoption of Twitter has scarcely been conducted. As a result, this study seeks to understand how U.S. educational organizations use social media to communicate and interact with their audiences. By adopting text mining methods to analyze messages of top Twitter accounts of U.S. educational organizations, this study uncovered the type of messages that get more engagement (e.g., likes, comments, and retweets) on Twitter. This study also explored the characteristics of the most popular Tweets posted by these educational organizations. It is one of the first studies to examine how U.S. educational organizations adopt social media to communicate and connect with their audiences and how social media messages impact audiences' engagement with these organizations.

2. Research Questions

The goal of this study is to understand how U.S. educational organizations interact with their audiences on Twitter and to provide practical insights for educational organizations to leverage Twitter as a valuable channel to expand their reach and present their value to society. To achieve this goal, the following two research questions (RQ) were addressed:

RQ1. From a quantitative perspective, how were the characteristics of Tweets associated with their number of likes, replies, retweets, and total customer engagement?

RQ2. From a qualitative perspective, what are the main themes, hashtags, and keywords of the “most popular” Tweets?

3. Social Media Usage

As Kaplan and Haenlein (2010) and Filo et al. (2015) explained, social media is based on the ideological and technological foundations of Web 2.0 and refers to a set of Internet-based applications that enable the creation and exchange of user-generated content among and between organizations and individuals. Researchers interpret the concept of social media marketing in various ways. Tuten and Solomon (2015) defined social media marketing as the process of creating, communicating, distributing, and exchanging valuable offerings for stakeholders in an organization through social media technologies, platforms, and software. Social media marketing is the new generation of marketing that gives more attention to customers by using social networks (Jara et al., 2014). Dwivedi et al. (2015) considered social media marketing a conversation usually initiated by receivers or providers of a business/product/service and continues among these parties. These conversations aim to spread promotional information and learn from the user experience. Thus, it benefits all participating parties.

Drawing on dynamic capability theory, the literature suggested that social media marketing can be considered company technological resources, which play an essential role in improving customer relationship management and developing new marketing capabilities to increase customer satisfaction and firm performance (Wang & Kim, 2017; Venciūtė, 2018). Dynamic capabilities theory proposes that a firm should be able to constantly integrate and reconfigure its resources to match the dynamic changing environment and achieve competitive advantage (Chien & Tsai, 2012). For dynamic capabilities, Wang and Kim (2017) examined how social media interacted with the company’s customer relationship management system and facilitate marketing capabilities. They analyzed companies’ social media usage with their firm performance, social customer relationship management, and customer engagement. They confirmed the role of social media marketing as a crucial firm-level capability to enhance dynamic customer relationships and firm value. Similarly, Venciūtė (2018) defined media marketing capability as “a firm’s competency by generating, disseminating and responding to information gathered from customers via social media channels to improve customer engagement and thus satisfaction, loyalty, and retention” (p. 139). Venciūtė (2018) emphasized that social media marketing should be viewed as a marketing capability of an organization, not just a tool or technique for communicating with customers and managing customer relationships. Moreover, the close relationship between social media marketing capability and customer relationship management is highlighted with overall marketing capability.

As the role of social media gradually evolved from a single marketing tool to one of a company’s marketing capabilities, it has become critical for marketers to understand how customers interact with social media and how they can strategically use and leverage social media platforms to enhance their customer engagement (Gao et al., 2018). Many researchers have adopted customer engagement theory to investigate the effectiveness of social media marketing strategies to better engage customers with services, products, and brand image (Hollebeek et al., 2014). Customer engagement theory has conceptualized customer engagement as an activity, such as a “collection of experiences” (Calder et al., 2009, p. 322), “intentions to give online recommendations” (Hopp & Gallicano, 2016, p. 129), or refers to some “activities related to specific consumer/brand interactions” (Hollebeek et al., 2014, p. 154). Building on customer engagement theory, previous literature has developed social media marketing strategies that include social media use motivations, information and resources, and customer engagement (Li et al., 2021). In another social media study, Ashley and Tuten (2015) analyzed the social media platforms used by the top 28 brands and the content they posted. They found that the posts that garnered the highest customer engagement were those involving the functionality of a product or service, followed by those that offer an echo between image and words, and those related to the experience of using the product or service. Constantly updating information and providing incentives for sharing content can also improve customers’ participation. Similarly, experiential and image-word echo messages are positively associated with customer engagement.

Alternatively, Vries et al. (2012) and Khan et al. (2016) investigated strategies used in social media marketing from a different perspective. Specifically, these researchers looked at the impacts of vividness, interactivity, information, entertainment, position, the sharing of comments (Vries et al., 2012), and corporate social responsibility (Khan et al., 2016) on the brand’s post popularity and customer engagement. This was measured by the number of likes, comments, and shares. Both studies showed that keeping a brand’s post longer at the top of its fan page could attract more attention from customers, thereby increasing the number of likes and comments. Highly vivid brand posts, such as videos, increase the number of likes, and highly interactive brand posts, such as questions, increase the number of comments. Interestingly, post contents, namely information and entertainment, did not improve the popularity of a brand’s posts in the study conducted by Vries et al. (2012), while they were positively related to the number of likes and comments in the other study by Khan et al. (2016).

Delivering personalized messages is another strategy that has been used widely. Shanahan et al. (2019) indicated that perceived personalization is positively related to customers’ brand engagement and attachment, enhancing their brand and increasing perceived quality. When customers receive personalized information that meets their product preferences on social media platforms, they pay more attention to the information and grow to trust the brands (Cheung et al., 2018).

Although numerous social media marketing strategies have been explored, it is worth noting that different social media platforms play different roles in social media marketing (Pham & Gammoh, 2015). Customers’ social media and advertising engagement across those platforms are also distinct (Voorveld et al., 2018). Thus, reasonable to conclude that the strategies applied in social media marketing may vary from platform to platform. Social media is not an umbrella concept; each platform should be studied separately (Voorveld et al., 2018). In this study, Twitter

is the social media platform analyzed.

3.1. The Use of Twitter in Social Media Marketing

Twitter is a microblogging service that allows users to share information and interact with others in real-time through “tweet,” “retweet,” “like,” “following,” “at (@),” and “hashtag (#)” (Tang & Hew, 2017). As a major social media platform globally, Twitter has reached 353.1 million active users per month and 187 million active users daily (Dean, 2021). Twitter is a good option for developing brand performance and judgment (Pham & Gammoh, 2015). Twitter can also help companies understand how customers feel about individual brands, their products, and their competitors. Paying close attention to these insights can allow brands to post in ways that enhance customer relationships and improve overall brand awareness and image (Ibrahim et al., 2017; Jansen et al., 2009). Thus, Twitter plays a vital role in electronic word-of-mouth (eWOM) branding, and it should be considered a part of a company’s brand strategy (Jansen et al., 2009).

Personifying and visualizing a brand on Twitter have been considered a strategy to establish brand images and manage customer relationships in social media marketing. Kwon and Sung (2011) investigated brand anthropomorphism on Twitter. They found that marketers used human representatives, personal pronouns, verbs in imperative forms, and nonverbal cues to build and demonstrate brand personality. Through these methods, brands can enhance their interaction with customers, convey their human characteristics, and develop and maintain customers’ long-term relationships (Kwon & Sung, 2011). Kinney and Ireland (2015) further explored this strategy from the perspective of brand spokes characters. After analyzing tweets from 20 brand spokes characters representing various product categories, they concluded that spokes characters could be seen as brands’ public social media faces. These public social media faces can help brands demonstrate a playful, innovative, and interactive side. More serious spokes characters can convey a more knowledgeable, expert, or high-end brand image.

When using Twitter as a marketing tool, the extent and way brands engage on Twitter must also be considered. Brands’ engagement on Twitter can impact customers’ engagement with eWOM communication (Zhang et al., 2011) and customers’ perceptions of brand image and customer service (Ibrahim et al., 2017). To maximize marketing effects and reach as many target audiences as possible, some brands post on Twitter every 1.5 to 4 hours, delivering numerous messages (Zhang et al., 2011). Handling customer complaints properly, providing positive and lengthy replies, and offering rich information content can help brands gain positive sentiments from customers and build strong online communities (Ibrahim et al., 2017). Also, evenings and weekends are recognized as prime times for marketing activities on Twitter as these periods can evoke more customer interaction (Ibrahim et al., 2017; Kinney & Ireland, 2015).

In addition to researching how to use Twitter in social media marketing from the perspective of brands themselves, researchers also studied the influence of external factors on brands’ Twitter marketing effects. Kim et al. (2014) explored how brand-customer relationships impacted customers’ engagement with brands on Twitter from customers’ perspectives. The findings revealed that customers with close relationships with brands were more likely to retweet brand posts than those who did not. Thus, developing and enhancing customers’ relationships with brands in eWOM communication was crucial. Lahuerta-Otero and Cordero-Gutiérrez (2016)

turned their focus to Twitter influencers and investigated the characteristics of these influencers. Because influencers have strong social influence and more complex social networks, it is crucial to identify and collaborate with them to favor brands’ marketing campaigns, product improvement, and customer services (Lahuerta-Otero & Cordero-Gutiérrez, 2016).

3.2. The Use of Twitter in Education

Twitter has quickly become one of the most popular tools for educational purposes across different educational landscapes (Kimmons et al., 2017; Malik et al., 2019). The power of Twitter has been reported in the extent of education literature, and it has been recognized as an essential communication and marketing platform. For example, as summarized by Kimmons et al. (2017), educational institutions use Twitter as a platform to spread news, recruit prospective students, and manage public relations. A review conducted by Malik et al. (2019) examined 103 educational studies on Twitter. It addressed its benefits, including improving teaching and learning performance, supporting professional collaboration and networking, and promoting the sharing of educational information.

Prior research on the usage of Twitter in education ranges from formal learning environments (e.g., schools, universities, classrooms) to informal learning environments (e.g., museums and libraries). Several existing articles have investigated Twitter’s practice, value, and influence in formal learning settings. Twitter has been recognized as an effective learning tool (Fernández-Ferrer & Cano, 2016; Malik et al., 2019; West et al., 2015). By learning through Twitter, students can easily access learning materials and resources, collaborate with their teachers and peers, and have a fun and innovative learning experience (Fernández-Ferrer & Cano, 2016; West et al., 2015). As Twitter was being used by higher education institutions, Palmer (2014) depicted the social media network of six Australian universities and analyzed how they used Twitter for social communication. This study highlighted the relationships between the number of tweets, retweets, and account followers and emphasized the importance of retweeting and the regular and sustained use of Twitter. In addition, massive open online courses (MOOCs) gained popularity. Researchers used this time to investigate tweets related to MOOC learning to identify trends and participants’ perceptions (Shen & Kuo, 2015). Shen and Kuo (2015) suggested that practitioners pay close attention to the peak period of MOOC discussion on Twitter, investigate the reasons behind negative tweets, and actively interact with influencers.

Considering informal learning environments, Vassilakaki and Garoufallou (2015) reviewed existing research and discussed libraries’ use and adoption of Twitter. They found that libraries used Twitter to facilitate their daily work, interact with users, and improve users’ library experience. To ensure that the delivered content meets the needs and interests of audiences, Light and Cerrone (2018) focused on the followers of science organizations Twitter accounts. They studied their following motivation and engagement patterns. They claimed that the followers consisted of science communicators and informed citizens. Although both groups are interested in science, the former wants to join the scientific conversations on Twitter, and the latter does not. This study serves as a prime example of how organizations should adjust their social media strategies based on the characteristics of their followers.

3.3. The Use of Text Mining to Analyzing Social Media Content

A text mining technique was used in this study as a direct and effective approach to analyzing social media content. Text mining, also known as text data mining, is an emerging data analysis approach that attempts to extract significant patterns or generate meaningful knowledge from textual documentation without formal organization or structure (Aggarwal & Wang, 2011; He et al., 2013). Twitter features short messages with no more than 280 characters. This microblogging approach has attracted researchers' attention to exploring valuable patterns from its massive amount of textual data using text mining techniques (Ibrahim et al., 2017; Kimmons et al., 2018; Wang et al., 2021). Text mining is a primary and effective technique to analyze social media data, which allows researchers to explore many unstructured and fuzzy social media datasets and discover trends, models, patterns, or rules regarding researchers' objectives and preferences (Irfan et al., 2015). Several social media studies have used a text mining approach to analyze social media data to understand customer experience towards a brand, product, industry, business environment, or organization's marketing and communicating strategies (Ganesan et al., 2021; He et al., 2013; Kwok & Yu, 2015). For instance, using text mining, He et al. (2013) performed a comprehensive competitive analysis based on unstructured textual data from the three largest pizza chains' Facebook and Twitter accounts. They confirmed the value of text mining as an effective technique to uncover business strategies or decision-making plans from a large amount of social media data, particularly for engaging with customers and understanding brand perception. In education, the text mining technique has been widely used to analyze students' learning experiences regarding their motivations, emotions, and concerns shared on social media platforms (Ganesan et al., 2021). Although text mining is an extension of data mining, it is more complicated as natural language is ambiguous, and people might have different understandings (Tan, 1999). Therefore, text data is essentially ill-structured compared with numerical data and must be processed before mining. According to Tan's framework (1999), there were two main phases in the text mining process: (1) text refining, which meant collecting individual text documents and converting them into an intermediate form, and (2) knowledge distillation, or the extracting of patterns or inferring conclusions from the transformed form of data.

4. Methods

The five characteristics that represent different types of Tweets include: (1) if the post is a retweet, (2) if it contains a photo, (3) if it contains a Uniform Resource Locator (URL), (4) if it contains a video, and (5) the number of hashtags. The authors examined these characteristics under RQ1 (From a quantitative perspective, how were the characteristics of Tweets associated with their number of likes, replies, retweets, and total customer engagement?).

The authors followed a seven-step procedure to achieve the goal of this study. First, 20 U.S. educational organizations' Twitter accounts have been selected based on the research objectives and the descriptive information, including the number of followers and posts, which allowed the researchers to fully leverage the dataset to understand the dynamics of social media posts and their impacts of social media on audience engagement. They were Apple Education, Association for Supervision and Curriculum Development, The Chronicle of Higher Education, Common Sense Education, EdSurge, EdTech K-12 Magazine, The Education Trust, Education Week, Edutopia, Education Week Teacher, Google for Education, MindShift, National Council of Teachers of English, Office of Educational Technology, PBS Teachers, Teacher2Teacher,

Teaching Channel, TeachThought, U.S. Department of Education, and WeAreTeachers. These Twitter accounts have large numbers of Twitter followers, ranging from 56,335 to 1,354,068, with an average of 399,460 followers. The number of followers on Twitter is the number of users who follow these educational organizations; the number of followings refers to how many Twitter accounts these organizations follow. The researchers initially selected 30 Twitter accounts for U.S. educational organizations that had more than 10,000 followers. Of the 30 selected, they were narrowed down to 20 based on their social media activities. Ten of the original 30 were because of the low number of interactions (i.e., the total number of comments, likes, and retweets was less than 10) with their followers. The number of followings of these accounts ranges from 194 to 68,789, with an average of 8,586. The data was collected in April 2020.

Second, the researchers developed a computer program to automatically retrieve the tweets initiated by these organizations using the Twitter-scraper library in Python (Python Software Foundation, 2021). All the tweeted and retweeted content from the selected accounts in April 2020 were retrieved. The number of likes, comments, retweets, and frequency of posting was identified as one dataset for each tweet.

Third, based on the data, the researchers calculated the number of engagements representing the sum of the number of comments, retweets, and likes during April 2020. The engagement rate represents the average number of interactions with the number of followers during the selected period. This metric has proven appropriate for measuring social media engagement in prior social media studies (Yost et al., 2021). Each message type was identified as a photo, status, video, hyperlink, and more using Python programming.

Fourth, upon the completion of data collection and cleaning, the researchers ran a series of multiple regressions using the software package SPSS to test whether there were any correlations between message types and their number of engagements. The results of this step answered RQ1.

In the fifth phase, the authors compared the popularity of all the tweets based on the z-scores of the total amount of engagement and extracted the "most popular" messages. With a finer-granularity qualitative analysis in the sixth phase, Tweets were coded into six categories manually, which were (1) Call for Action, (2) Educational Advice/Suggestion, (3) Emotional Appeal, (4) Product/Service Promotion, (5) Provoke Comment/Feedback, and (6) Share Resource/Information (Ashley & Tuten, 2015; Kwok & Yu, 2015; Wang et al., 2021). Finally, the authors extracted and ranked the most frequently appearing themes, hashtags, and keywords used in the most popular messages. The results of this step addressed RQ2.

5. Results

The following paragraphs describe the main results of this study. The authors start with a description of the data, move to the type of messages and audience engagement, and end with a discussion of the characteristics of the "most popular" tweets.

5.1. Data Description

Duplicated messages were removed by using the Twitter-scraper library in Python to

automatically retrieve the tweets initiated by educational organizations. A total number of 3,109 tweets posted by these 20 educational Twitter accounts was analyzed. Each Twitter account's information was collected, including the message body, the number of followers and followings, the total number of tweets, and message media type (i.e., "retweet," "link," "video," and "photo"), the number of people who clicked the "Like" button on the message, the number of comments on the message, the number of people who retweeted the message, and the total number of engagements. Although the 3,109 tweets were collected from these leading educational Twitter accounts, their number of retweets (Max=1,683; Mean=23), likes (Max=2,834; Mean=52), and replies (Max=675; Mean=2) varied drastically. The total audience engagement of each tweet, measured by the total number of retweets, likes, and replies, was also calculated. The average engagement of this sample is about 76, though the highest engagement reached 4,479 (see Table 1).

Table 1
Descriptive Statistics of the Tweets Collected (n = 3,109)

	Min	Max	Mean	Std. Deviation
Number of followers	56,335	1,354,068	363,642	304,858.66
Number of followings	194	68,789	8,586	15,114.51
Number of hashtags	0	9	1	1.35
Retweets	0	1,683	23	77.57
Likes	0	2,834	52	169.74
Replies	0	675	2	15.76
Total engagement	0	4,479	76	249.22

5.2. Message Types and Audience Engagement

Regarding the types of messages and audience engagement, the researchers first explored which type of messages receive more engagement from the target audiences. Secondly, they investigated whether the relations were dependent on the influences of the Twitter accounts as their number of followers varied. Multiple regression and moderation tests were conducted. The constructed models gave an estimate of the expected number of engagements of each tweet based on its characteristics and the corresponding Twitter account information.

Previous studies on social media message types (e.g., Kwok & Yu, 2013) grouped messages into different categories and compared the differences between groups. These included messages with only text descriptions, link messages that contained a hyperlink, photo messages that contained a photo, and video messages that contained videos or a link to a video in addition to text. Because there are other reasons regarding how people communicate on social media, these may impact audience engagement. In this study, exploring the relationship between the characteristics of messages and engagement instead of comparing different categories of messages had been conducted. A series of multiple regression tests to see whether the number of likes, replies, retweets, and total engagement was associated with the five characteristics that represent different types of messages: (1) if the post is a retweet, (2) if it contains a photo, (3) if it contains a Uniform Resource Locator (URL), (4) if it contains a video, and (5) the number of hashtags (see Table 2).

Table 2
Descriptive Statistics of the Types of Messages (n = 3,109)

Variables and Scales	n	%
isRetweet		
True	41	1.3
False	3,068	98.7
isPhoto		
True	1,008	32.4
False	2,101	67.6
isURL		
True	2,700	86.8
False	409	13.2
isVideo		
True	69	2.2
False	3,040	97.8
isHashtag		
True	1,608	51.7
False	1,501	48.3

Table 2 showed that 41 messages were retweeted from other Twitter accounts, and the rest, 3,068, were original messages generated by the selected 20 accounts. Among the 3,109 messages, only 85 (2.7%) of the messages have text only descriptions. In contrast, a total of 3,024 messages (97.3%) were identified with a valid media type as follows: URL (2,700 or 86.8%), photo (1,008 or 32.4%), video (69 or 2.2%), and hashtag (1,608 or 51.7%). Different from these four dummy variables, the specific number of hashtags in each tweet was also measured (see Table 1), and the mean number of hashtags was 1, ranging from 0 to 9.

The relationships between each message characteristic and audience engagement were tested using multiple regression tests (see Table 3).

Table 3
Coefficients for Regression Model Predicting Total Audience Engagement

Independent Variables	B	SE	β	t	Sig.
isRetweet	647.449	38.833	.276	16.673	.000
isURL	-103.198	14.135	-.132	-7.301	.000
isPhoto	34.090	10.005	.060	3.407	.001
isVideo	286.145	30.421	.160	9.406	.000
no_hashtags	-15.940	3.293	-.081	-4.840	.000
Interaction Effects					
logFollower X isRetweet	986.860	197.248	2.390	5.003	.000
logFollower X isURL	-434.821	34.432	-3.077	-12.628	.000

logFollower X isPhoto	235.696	29.932	2.248	7.874	.000
logFollower X isVideo	358.164	78.552	1.123	4.560	.000
logFollower X no_hashtags	-3.380	9.209	-.089	-.367	.714

On average, each of the five characteristics contributed to the regression model fitting significantly better than the grand mean model to predict the audiences' engagement ($F(5,3142) = 107.81, p < .000$). Table 3 lists the coefficient of each message type in the multiple regression model. The results showed that the Retweet produces about 647 more engagement than the original tweet ($p < .000$), proving that choosing and retweeting quality messages from other accounts positively impacts engagement. The embedded Photo ($B = 34, p = .001$) or Video ($B = 286, p < .000$), when other parameters were consistent, also led to audience engagement significantly better than tweets that did not contain photos or videos. However, using a URL in a tweet was significantly associated with a decrease in engagement ($B = -103, p < .000$). When the tweet contained one more hashtag with other parameters constant, the total engagement expected to significantly decrease ($B = -16, p < .000$).

By adding the number of followers as a moderation predictor to the relationship between engagement and the use of retweets ($R^2 \text{ change} = .007$), photos ($R^2 \text{ change} = .018$), videos ($R^2 \text{ change} = .006$), URLs ($R^2 \text{ change} = .043$), a significant additional percentage of the variance for each model ($p < .000$) could be explained. However, there was no significant change in the model using the number of hashtags to predict the total engagement ($p = .714$). The interactions between the number of followers and the use of videos ($B = 358.16, p < .000$), URLs ($B = -434.82, p < .000$), photos ($B = 235.70, p < .000$), and the attribute of retweet ($B = 986.86, p < .000$) were statistically significant, suggesting that the relations are strengthened when a Twitter account had more followers. However, the moderating effect of Twitter followers on the number of hashtags used was negative, and there was insufficient evidence to distinguish this moderating effect from zero ($B = -3.38, p = .714$).

5.3. Themes, Hashtags, and Keywords of the "Most Popular" Tweet

To uncover the message characteristics of the posts that attracted customers, analyzing the most engagement, themes, hashtags, and keywords of the most popular tweets occurred. The researchers also compared the popularity of all the tweets based on the z-scores of the total amount of engagement. As suggested by Kwok and Yu (2013), the following standardized formula to calculate z-scores was used:

$$z = (x - \mu) / \sigma$$

x = value of an item (number of engagements).

μ = population mean (average number of engagements).

σ = standard deviation.

By ranking all the tweets by their number of engagements, the z score indicated that the first 124 tweets with the highest number of engagements were the most popular tweets for further analysis. According to previous social media studies that categorized social media messages, the

tweets were recorded manually into six themes aligned with previous studies (Ashley & Tuten, 2015; Kwok & Yu, 2015; Wang et al., 2021). They became (1) Call for Action, (2) Educational Advice/Suggestion, (3) Emotional Appeal, (4) Product/Service Promotion, (5) Provoke Comment/Feedback, and (6) Share Resource/Information (see Table 4). Among the 124 most popular tweets, 42 of them were "Share Resource/Information," 35 of them offered "Educational Advice/Suggestion," 31 of them dealt with evoking "Emotional Appeal," 14 of them were about "Product/Service Promotion," seven tweets aimed to "Provoke Comment/Feedback," and six of them were a "Call for Action."

One timely consideration is the emotional appeal used in social media messages. That could be created by using a funny character or a joking quote. During this study, the world was struggling with a global health crisis, and messages within the "Emotional Appeal" category were even more important to draw users' attention and incite engagement.

Table 4

Tweet Content Categories, Definitions, and Examples

Categories	Definitions	Example
Call for Action	A tweet that asks the audience to do something (which is not directly associated with any sales or marketing effort).	NCTE members, we have a very special event just for you. Join us on Monday, April 27 for a live discussion with @JasonReynolds83 and @DrIbram about their latest book Stamped! Moderating the conversation is the fabulous @SonjaCherryPaul. RSVP now! https://ncte.org/rsvp-stamped/ (NCTE)
Educational Advice/Suggestion	A tweet that offers useful or helpful advice or suggestions on teaching and learning to the audience.	The U.S. Department of Education has issued guidance on how schools can provide special education services during this crisis, including using digital tools to hold meetings. https://www.edutopia.org/article/8-tips-conducting-virtual-iep-meetings (edutopia)
Emotional Appeal	A tweet that meets the audiences' psychological or social needs; how it will make them feel.	I want to get out and back to my classroom. Tired face#missmystudents (WeAreTeachers)
Product/Service Promotion	A tweet that directly promotes a product or service offered by the educational organization or the brand itself.	Ensure instructions don't get lost in digital translation by explaining your assignments with illustrations. Learn how to embed #GoogleDrawings in blogs and pages for #RemoteLearning via @edublogs: http://goo.gl/2S2FBw2 (Google for Education)

Provoke Comment/ Feedback	A tweet that asks the audience to comment or seek feedback.	#TEACHERS: What’s one thing you miss about school that you thought you’d NEVER ever miss? (WeAreTeachers)
Share Resource/ Information	A tweet that offers useful information or resources that can immediately be used to inform or educate the audience.	With kids at home and parents looking for educational activities, many authors are offering online read-alouds and activities on social media. @WeAreTeachers made a list of over 50 virtual author activities. https://www.weareteachers.com/virtual-author-activities/ (MindShift)

Additionally, the researchers analyzed the most popular hashtags and keywords posted by the selected educational organizations. These tweets received more attention from Twitter followers (see Table 5). Text mining on the hashtags of these popular tweets had been conducted to understand the influence of hashtags on Twitter. Table 5 lists the most frequent hashtags used and the number of times they are used. The “#DistanceLearning” and “#elearning” were the most popular hashtags and used more than ten times. Table 5 also shows the top indicative keywords used by these popular Tweets. The results suggest that the top keywords on the most popular tweets included words like “students,” “distance learning,” “learning,” and “teachers.”

Table 5
The Most Popular Hashtags and Keywords

Category	Top Hashtags and Keywords	Number of times used
More Popular Hashtags	#DistanceLearning #elearning	above 10
	#GoogleMeet #homeschool #RemoteLearning	5 to 10
	#edchat #ally	
	#GoogleClassroom #GSuiteEdu #CreativityForKids	below 5
	#homeschooling #HangoutsMeet #edtech	
	#TeachFromHome #AppliedDigitalSkills	
More Popular Keywords	#GrowWithGoogle #DYK #CSFirst #teachers	
	to, pic, twitter, and, the, http, students, for, ...	above 40
	https, of, are, you, a, in, with, distancelearning, can, on, your, from, we, that, this, learning, teachers	21-40
	learn, how, is, out, more, about, activities, weareteachers, educators, have, some, as, online, their, at, our, they, help, or, tips, edutopia, these, up, via, kids, #elearning, be, re, features, what, using, during	below 20

6. Discussion and Conclusions

This study aimed to understand better U.S. educational organizations’ use of social media to communicate and interact with their audiences. It also revealed the types of messages that get

more engagement (e.g., likes, comments, retweets) on Twitter and explored the characteristics of these educational organizations’ “most popular” tweets.

A total of 20 educational organizations’ Twitter accounts were examined. On average, these organizations had 399,460 Twitter followers in April 2020 (see Table 1). A total number of 3,109 tweets posted by these 20 educational Twitter accounts were analyzed using the Twitter-scraper library in Python. Kimmons et al. (2018) applied a similar text mining technique to investigate social media divides of K-12 institutional Twitter accounts in the U.S.

Researchers found two key results in this study. First, when looking at the types of messages and audience engagement (see Tables 2 and 3), educational organizations must consider the different types of messages when creating a tweet. For example, retweeting from other accounts not only assists organizations in building strong relationships but is also an effective strategy to engage with their audiences. Integrating photos and videos in tweets is also beneficial for capturing attention, gaining followers, and increasing users’ interaction with these educational organizations. Moreover, accounts with many followers are significantly impacted by the inclusion of photos and videos in the organizations’ tweets. This impact translates into more likes, retweets, and replies, as well as mentions (tagged or not) and followers. In other words, it increases the popularity of the educational organization not only on Twitter but across the social media sphere of influence. This happens because when users share tweets, it helps build exposure within the organization’s followers’ feeds. In addition, users are often connected to other social media platforms, and sharing screenshots of tweets and conversations on these other platforms has the potential to expand the organizations’ impact even more.

Conversely, using URLs or hashtags in tweets may negatively impact the number of likes, replies, and retweets, especially for accounts with many followers. Careful considerations must be made when inserting a URL in a tweet because this can decrease users’ engagement. Especially for those accounts with many followers, the insertion of a URL in their tweets may negatively impact users’ engagement.

Second, by looking at the categories of the “most popular” tweets (see Tables 4 and 5), the “most popular” tweets were ones that shared resources and information. These were followed by the ones that offered educational advice and suggestions and by the tweets that evoked emotions, meaning that they met the users’ psychological or social needs. The emotional appeal was created using a funny character, a joking quote, or a fun activity/game. In 2020, the world was struggling with a global health crisis, and users particularly welcomed messages within the “Emotional Appeal” category. They turned into a critical way to elicit users’ attention and engagement. The extra emotional support from these messages was critical for teachers, students, and other audiences. Different educational organizations posted “call for action” tweets during this crisis, asking audiences to support social causes. Surprisingly, tweets promoting a product and service or soliciting comments, feedback, or a “call for action” were not among the most popular. Concomitantly, the “most popular” hashtags and keywords explicitly mention distance learning, eLearning, students, learning, and teachers.

One limitation of this study is that the data collection took place during a limited time and only targeted 20 educational organizations restricted to the U.S. Despite these implications,

the results have potential implementation implications. For example, the Twitter accounts of educational organizations should develop social media strategies that attract their audience, keep their followers, and communicate with them effectively. Retweeting from other accounts not only helps educational institutions build strong connections with their audiences but is also a way to potentially allow for more engagement along with the integration of multimedia in tweets, including photos and videos.

6.1. Significance of the Study & Implications for Practice

Twitter increasingly attracts the attention of educational organizations, as it provides them with innovative and affordable avenues to communicate, interact, and maintain relationships with their peers and stakeholders (Palmer, 2014; Wang, 2016). However, Twitter is underutilized as a medium for educational organizations to expand their reach and further present their value to society (Kimmons et al., 2017). To improve this situation, organizations should develop appropriate plans and strategies to enhance their Twitter usage's marketing, communication, and branding strength while being aware of the associated challenges. This study focused on how U.S. educational organizations adopted social media to communicate and connect with their audiences and how social media messages impacted audiences' engagement with these organizations.

Potential concerns about using Twitter in educational organizations include its content quality and accuracy vulnerability, the loss of control and integrity, and resource barriers to account management and implementation of high-quality posts, engagements, and media content (Ghosh et al., 2012; Kimmons et al., 2017). Based on the results of this study, the following are recommendations for educational organizations, social media managers, and educators to be used for Twitter implementation and management. These recommendations also apply to the use of other social media platforms.

First, as socially responsible institutions with strong educational missions, educational organizations should establish standards to guide the creation of their Twitter content and the evaluation of retweeted content. The study results indicate that retweeting is the most engaging message type while resources/information sharing is the "most popular" tweet category. Considering the complexity of the online social media environment, educational organizations need to review the quality and accuracy of the shared content systematically and rigorously before sharing or retweeting. Meanwhile, these organizations should also assess the credibility and professionalism of the source of the shared content. When creating original tweets, such as providing educational advice and guidance, it is also necessary to ensure high quality original content.

Second, constant monitoring and moderation of online communities to allow different voices and perspectives, address critical feedback, and foster active engagement are required. Using Twitter's interaction functions (e.g., comment and retweet) and posting tweets with thought-provoking comments/feedback provide educational organizations with opportunities to hear from peers and stakeholders. Those voices may be positive or negative. Educational organizations should value both voices as the former indicates affirmation from others while the latter offers a chance for improvement. Additionally, social media teams must continually monitor the pulse of their online communities to regulate malicious or inappropriate behaviors and guide the creation

of a healthy online environment (Ghosh et al., 2012).

Finally, a professional social media team should be established, and adequate resources for Twitter implementation and management should be protected. Twitter usage and specific strategies to increase audience engagement should vary based on each educational organization's unique needs and characteristics (e.g., size and location) and its stakeholders (e.g., age and identity). Creating an official Twitter account is only the first step, and the following implementation and management require human and financial resources. Educational organizations must allocate resources according to their needs to use Twitter successfully.

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Declaration Statements

Contribution Statements

All authors contributed to the implementation of this study and the writing of this manuscript. RQ designed the methodology and collected and analyzed most of the data. APC conceptualized the study and co-wrote the literature review, method, results, discussion, and conclusions sections. CL and FX worked with RQ on data analysis and interpretation of results. TL assisted the team with the text-mining technique. All authors read and approved the final manuscript.

Availability of Data and Material

The data will be shared upon request. Currently, it is not available in any publicly available repositories.

Conflict of Interest Disclosure

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