@Digital Libraries: Harnessing Twitter to build online communities

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Keywords

Digital libraries, Twitter, social media, users

ABSTRACT

Purpose- The purpose of this paper is to investigate the types of roles that Twitter played in digital libraries (DLs) and their relationships in building DL online communities.

Design/methodology/approach– A mixed method analysis of DLs' tweets was conducted to identify the usage, roles of Twitter in DL communities, and relationships among the roles. Twitter data from 15 different DLs for one year was extracted, and an open coding analysis was performed to identify types of Twitter roles. Pearson correlation coefficient was applied to examine the relationships among the roles based on word similarities.

Findings- The results present 15 types of Twitter roles representing five main categories identified from DL tweets, including information, promotion, related resources, social identity, and social connection. Moreover, word similarities analysis identifies more strong relationships among the roles in four main categories (promotion, related resources, social identity, and social connection) but less with roles in Information.

Research implications- Characteristics of DL online communities are discussed and compared with physical library communities. Suggestions are proposed for how tweets can be improved to play more effective roles. To build a strong community, it is critical for digital librarians to engage with followers.

Originality/value- This study is a pioneering work that not only analyzes Twitter roles and their relationships in building DL online communities but also offers recommendations in terms of how to build a strong online community and improve Twitter use in DLs.

Introduction

A surge of digital libraries (DLs) has been developed in the past decade. DLs are defined as systems that encompass a wide range of multimedia materials that are born digital or converted from a variety of analog sources through digitization. DLs collect, organize, store, and disseminate digital information. Providing resources and services to patrons is the key component of every DL (Xie & Matusiak, 2016). DLs take the same premise of physical libraries and provide the accessibility and dissemination of information only in an entirely digital format. Despite DLs varying in their collections, users, outreach, and engagement remain important aspects. A question to ask is, "how do digital librarians reach to and engage with their users to create online communities?"

Twitter is used by individuals and institutions. Social media has been shown to be a marketing and engagement tool. In the age of instant information gratification, it has become culturally normative to expect information quickly. Since its conception in 2006, Twitter's international user base has grown from 30 million to 326 million users in 2018. It has a registered 49.35 million users in the United States which equates to 40% of the American population aged 18-29 years and 27% of 30-49 year olds (Statista.com, 2018). Twitter is utilized for its potential for reachability, and it is widely used as a marketing tool.

Canavagh (2016) noted that Twitter, with other social media, enables libraries to create their communities by not only strengthening their existing connections but also creating new relationships. This paper uses the basic definition of community as defined by Hillery (1955) "social interaction is a necessary element of the community" (p. 115). Within that vein, Twitter is a community despite, that "users could never know everyone on Twitter, but they are certainly aware of other users' presence, especially in their 'neighborhood" of sources'" (Gruzd, Wellman, & Takhteyev, 2011, p. 1298). Moreover, Twitter fits to the library environment because it's

quick and easy to reach out to its users. One purpose of adopting Twitter is to create a sense of community among libraries and users (Vassilakaki & Garoufallou, 2015). The field of library science was quick to begin analysis of how and why Twitter should be used as an outreach tool (Cahill, 2011; Charitonos, 2011; Kidd, 2011; Starr, 2012; Stvilia & Gibradze, 2014; Torres-Salinas, Cabezas-Clavijo, Ruiz-Perez & Lopez-Cozar, 2011).

Many researchers and librarians have conducted studies to describe how Twitter was used in libraries. However, most of these studies only illuminated physical library Twitter use. There is a difference of how Twitter is used in different types of library settings (Alsuhaibani, 2018). Despite DLs growing in the past decade, they were often not a part of the overarching Twitter library and information science research. Twitter holds the capability to be a tool for digital librarians to reach users. Twitter engages users, shares knowledge, makes connections and, most importantly, builds communities around the DL stakeholders (Rossmann and Young, 2015). Twitter and other Web 2.0 tools assist building DL communities (Verheul, 2010). The lack of previous research on the Twitter use in the DLs calls for the need to identify the roles that Twitter plays in the DL communities and their relationships.

Literature review

Twitter as a tool

Twitter is a micro-blog, and as of November 2017, each user can use 280 characters to express messages, ideas, and updates. That is called a 'tweet.' Unlike Facebook, a Twitter profile does not need to be associated with a real name. Instead, the use of a handle permits the users to create an identity that suits them. Communities on Twitter consist of 'followers," who are people receiving other people's tweets (Twitter, 2018). These people then 'follow' or are 'following' a Twitter user. When a Twitter user makes a post to Twitter, this action is called 'tweeting;' the

post itself is called a 'tweet.' 'Retweeting' is when users forward a tweet via Twitter. Both 'tweets' and 'retweets' can be tracked to see which ones are most popular; this is referred to as 'trending.' The interactive nature of Twitter makes it a perfect tool to promote interactions between DLs through digital librarian and users. In addition, users can also tweet at someone using the '@' symbol. Then the tweet is visible to the original posters' community and the Twitter users' followers, who was included in the tweet.

Twitter well suits the environment of DLs. It permits digital librarians the ability to share new information. Twitter also serves as a communication tool to enable librarians to interact with their DL users and potential users (Starr, 2012). Regarding Twitter use for a digital branch of a library, King (2012) emphasized the importance of user engagement, specifically pointing to the need to analyze content generated. Consequently, using Twitter as a community building tool is a critical part of DLs due to its ability to reach and share information with users.

Role of social media in online community building

Social media plays many roles in community building. It is imperative to understand the depths of social media and its role as a community building tool, which is why this section focuses on the general concept of social media rather than a single application, like Twitter. The literature review discusses the following roles: information, promotion/marketing, social identity, and social connection. As with many human behaviors, these roles are intertwined and complicated. Wellman and Gulia (1996) found that there are several types of support that people receive from online communities: informational, emotional, and companionship. There is certainly intersectionality between these areas, but some aspects are highlighted more than others. Below are specific examples illuminating the uniqueness of each role and draws connecting points to roles that blend into each other.

Using online resources is a key way for people to find information. Existing research focuses more on quality of the information. Hajli (2018) found a relation between a user's influence in the network and the trustworthiness of the information that user was sharing. This statement indicates that it would be significant for the entity sharing the information to provide correct information to increase trustworthiness. Finin, et al. (2008) measured the flow of information and influences within blogs and alluded to the complicated nature of the system. Regarding Twitter, they stated, "modeling influence and information flow in social media systems requires attention to many factors, including link structure, semantic metadata, named entity recognition, conversational structures, sentiment analysis, and topic classification" (p. 78). In a case study regarding Harvard's open collection's program, Madsen (2009) noted, "When scholarly communities move onto the Web, it is still the function of an academic library to support them. Libraries are no places for simple information retrieval. They are dynamic spaces for discovery, learning, knowing, and creation" (p. 7). For DLs whose space is entirely online, it becomes even more critical to understand the full scope of what information they are sharing and how it is perceived by their online communities

Word of mouth (WOM) is a significant part of both face-to-face and online communities. Interestingly, WOM in an online community can often be measured and mapped through interactions. WOM has two main roles online, for promotion or marketing and social connection. Brown, Broderick, and Lee (2007) related WOM to consumption related online communities on the basis that when individuals feel an interest in a product, that individual is most likely to be 'friends' with those who have similar like-minded individuals, thus creating a space for social and consumption behavior, and making promotion closely related to the role of social identity.

Stephansen and Couldry (2013) explored one university's use of Twitter as a community building mechanism for a digital story telling project and found through an analysis of the tweets and interviews that Twitter served not only as a community building tool but allowed the users to be exposed to even more information due to the online environment. When a user 'likes' a product on Twitter, the user's network sees that action. The user has decided to use this product to demonstrate a facet of his or her identity. This connection creates a chain reaction among the user's network. The more activity from the user, the more the user will appear on their follower's networks, thus beginning a digital version of word of mouth communication that has been popular for many years in the promotion of markets.

One of the most prominent roles of social media in online communities is that of social identity. Tajfel (1979) created the basis of social identity theory which alludes that groups are a part of one's social identity which is how the self makes sense of the world. The definition of social identity in online communities varies from one community to the next, as the constructs of identity are always complicated. In an online space, identity is just as multifaceted as in a face-to-face community. Social media is flexible and creates different ways for people to create identity.

One constant in all social media applications is that like face-to-face social settings, people behave differently when with different groups. Chris Poole, 4-chan creator, stated, "Identity is more complex than the world's largest social networks would like you to believe … We all have multiple identities" (Poole, 2011, 1:10). In the vein of multiple identities, Miller (2017) found several modes of identity construction with relation to social media use, reflection, narration, and action. Miller's research concentrated on students using social media for queer and

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disability identity and found many factors relating to social identity and social connectedness that helped drive the participants closer together.

Online communities often use social media to strengthen their social connections and grow the community. The theory of markets and the social phenomena that occur within the "wisdom of crowds" and collaborative authoring are pieces that are unique to the emergence of social media, and there is much that can be obtained from analyzing the semantic and information networks of different communities (Easley & Kleinberg, 2010). In a study regarding participatory communication and social media, Russo, Watkins, and Groundwater-Smith (2009) found that when users partnered with museums through the facility of social media, they felt that it emphasized the importance of the museum to them. Furthermore, social media communities are more than just the members who actively engage with one another. Being able to build a deeper connection with users and make them feel as though they are a part of one's institution is a paramount result that may occur from the correct facilitation of social media.

There are additional variations of roles depending on the online community. Information is a broad and depends on how the community frames the context. Promotion/marketing can be narrowly focused on a product or more diverse like the offering of a service. Social identity is complicated and has interrelationships with other roles such as, social connection, as identity is related to how users interact in that space. Social connection is about interaction, and how each community interacts is unique.

Role of Twitter in building library and DL online communities

Understanding an online community is key to engaging with that community. Much of the previous work in the library field concentrates more on the role of social media related to marketing and promoting, and emphasizes less on community building. The addition of

community development to a marketing agenda "moves from a one-dimensional online broadcast platform to a multidimensional socially connected space that creates value for both the library and library users" (Young & Rossman, 2015, p. 22). If digital librarians can make users feel connected to the DL community, DLs can be widely and better used by the public. According to Oh, Ozkaya, and LaRose (2014), a sense of community can be created if users are able to participate in quality interactions via social media. A DL needs to incorporate social media, like Twitter, to further its shift from the broadcast channel to a community that connects the DL and its users. Xie and Stevenson (2014) conducted an analysis of the use of social media applications including Facebook and Twitter to discover its usage in DL environments. They found a lack of standards and consistencies in terms of how digital librarians post information via social media tools, and the information posted is loosely oriented with the purpose of promoting the DL or making connections.

For that reason, it is critical to identify the roles that Twitter plays in developing the community. Since little research has been done on the roles of Twitter in DL online communities, the following review also incorporates the library environments that DLs are closely associated.

DLs offer an opportunity for users to have a shared experience through the information that is made available. Without understanding one's user base, it is easy to participate on Twitter but not engage with your audience (Adams & McCorkindale, 2013). To involve users, information delivery is a DL's priority. The increase of digitized collections calls for the need for libraries to use Twitter—a portal for users to access these resources. In library environments including DLs, broadcasting and information sharing are the main roles that Twitter plays (Aharony, 2010; Collins and Quan-Haase, 2014; Del Bosque et al., 2012; Shiri & Rathi, 2013).

Twitter's one-to-many information/knowledge sharing, or one-to-one communication has a positive impact on libraries for its outreach and enhancing user-librarian interactions. As a result, it promotes and increases the disseminations of information. The four types of interaction types for Twitter are: information dissemination, communication, information/knowledge sharing, and information gathering (Huang, et al., 2017).

Naaman, Becker, and Gravano (2011) analyzed various Twitter trends, and discovered that events shared on Twitter can lead to more events to be shared. For DLs, this means that digital librarians can use Twitter to promote their resources and events to build a strong community. After analyzing the use of Twitter in the Internet Public Library (ipl2), Kim et al. (2012) found that the ipl2 utilized Twitter to share its collections, which accounted for 42.4% of the content for their users and librarians related to ipl2-generated resources. Similarly, Al-Daihani and AlAwadhi (2015) identified "news and announcements," "library collections," and "library services" as the top most often posted on Twitter by libraries with "library marketing and news" as the top one for the subcategories.

Identity is also a critical aspect when developing a social media presence. A DL is an institutional place. Despite not being a person, it needs to interact with online community members, "even though a library is an organizational entity, once it enters the social realm it is perceived as a *person* and will need to act and speak accordingly" (Solomon, 2011, p. 3). One of the first instance of the integration of Twitter in DLs was discussed by librarians at the California Digital Library (CDL), "Twitter was becoming an important communication tool among certain groups we [CDL] serve . . . Twitter appeared to offer an opportunity to get CDL's news and ideas out to a wider audience" (Starr, 2010, p. 24). To avoid posting content that is not associated with CDL's brand, they decided to create guidelines to make sure their Twitter accounts

represent the DL (Starr, 2010). However, there is no specific research in terms of how identity was created in DLs.

It is incredibility critical to make a connection with users, "having an active social media presence, we are fulfilling the expectations of some users and finding users we might not connect with elsewhere" (Petit, 2011, p. 5). Studies concerning academic libraries' use of social media have found that Twitter can enhance user and staff interest (Aharony, 2010; Anwyll & Chawner, 2013; Del Bosque, Leif, & Skarl, 2012; Gunton & Davis, 2012; Sewell, 2013). After analyzing tweets, Kriesberg (2014) pointed out that archivists were more likely to 'tweet' a link shared from another site. Kriesberg also noted that 14.64% of tweets were interacting with Twitter users; interacting with users is an essential part of social media. Zhang, Sheu and Zhang (2018) explored how library and information professional organizations interacted with each other on Twitter, but the result showed that these organizations rarely connected on Twitter. Same applies to the DL environment, more work needs to be done to create more social connections.

The more we learn from the use of Twitter, the better researchers can understand the nature of Twitter use in the DL environment; the better practitioners can harness the Twitter for their institutions. Gürhan-Canli Hayran and Sarial-Abi (2016) emphasized the importance of understanding one's users as it is important to know user expectations of the organization. The following Twitter roles have been identified in library and DL environments: information, promotion, identity, and social connection. However, little research has analyzed the use of Twitter in the DL environment, and less has been done on the DL online communities. It is vital for DL researchers and practitioners to create and learn about their online communities, and the main roles that Twitter plays in these communities. While sharing information and promoting resources are the main roles that have been identified for the library and DL communities, more

specific types of roles need to be further explored. Moreover, no research has been conducted to examine the relationships among the roles of Twitter. Being able to connect and interact with one another online is the purpose of applying social media. If digital librarians can ascertain the roles of Twitter in DL online communities and their relationships, the more likely that they will be able to harness social media in building DL communities to further enhance the use of DLs.

Research questions

Based on the literature review, this study intends to investigate the following three research questions:

1) How is Twitter used in DLs?

2) What types of roles does Twitter play to form DL online communities?

3) What are the relationships of word similarities among the main types of roles that Twitter plays in characterizing DL online communities?

This study fills the gap in current research of social media application in DLs. Its significances are summarized as follows: first, the findings of this study can shed some light on Twitter use in various DLs. Its outcome is to provide researchers and practitioners with more background about Twitter use and suggestions on how to engage and build DL communities. Second, this study can offer information in relation to roles of Twitter in creating a DL community. This information can help digital librarians that have not incorporated Twitter into their DLs to see the positive impact of applying Twitter. Third, the results can identify the problems and challenges in integrating Twitter in DLs, and further offer guidance on how to use Twitter effectively.

Methodology

The purpose of this study is to conduct a mixed method analysis of DLs' tweets to identify the usage, roles of Twitter in building DL communities, and relationships among the roles based on word similarities. This section focuses on sampling and data collection, and data analysis to answer the research questions.

Sampling and data collection

This study applies a mixed method approach by conducting open coding and descriptive analysis of over 5,000 tweets made by 15 DLs. The DLs selected for this study were in English and located around the world. The period of data collection concentrates on the application of Twitter in DLs after passing its infancy level, but before the large change happened in Twitter which was the increase of characters from 140 to 280 (Twitter, November 2017). Search terms like, 'digital library,' 'digital archive,' and 'library digital' were used to search for relevant DLs on Twitter, and the searches yielded a result of 343 during the time frame. After removing of non-DL accounts based on the DL definition and all individuals—digital librarian accounts, 40 DLs remain. Then, the following criteria were applied to the selection process, which led to the final 15 DLs.

- Each DL must have its own Twitter page.

- The selected DLs must be presented in English.

- The selected DLs had to be in existence from June 30, 2012 to July 1, 2013.

These DLs represent different types of DLs including international, national, state, academic, consortium, etc. More academic DL libraries were selected because Twitter was used more in academic DLs than other types of DLs during that time. To save space, the list of the 15 DLs is presented in Results section with Twitter usage data.

The data used in this research was collected via NVivo, which is a qualitative and mixed method research tool (NVivo, 2017). NVivo's social media capture tool called "NCapture" was employed to extract tweets from the 15 selected DLs ranging from June 30, 2012 to July 1, 2013. All 5,713 tweets from the Twitter pages of 15 DLs were analyzed. Table 1 presents the data collection and data analysis plan corresponding to each research question.

[Insert Table 1 here]

Data analysis

Each tweet is the unit of analysis. Descriptive analyses were first performed to present the number of tweets, retweets, followers, and the following of each DL. All the tweets and retweets were from the DLs' Twitter feeds; the feeds consist of a DL's own tweets, tweets that were tweeted at the DL, retweets done by the DL, and tweets originally created by the DL that were retweeted by the DL follower. The followers and the following were identified from each DL's profile.

Tweets were then analyzed based on open coding which consists of the process of breaking down, examining, comparing, conceptualizing and categorizing (Strauss & Corbin, 1990). Two researchers coded the data independently by using NVivo. Based on Holsti's (1969) formula[1], the inter-coder reliability of identified types of Twitter roles between the two coders was 92.3%. For the ones with disagreement, researchers discussed them based on the definitions until the agreement was reached. The analysis resulted in the emergence of five coding categories: Information, Promotion, Related Resources, Social Identity, and Social Connection. Due to the complexities of tweets, multiple subcategories were identified as well. Fifteen types of roles representing the subcategories were emerged from the data. A sample from each main

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[1] Reliability = 2M/ (N1 + N2), where M is the number of coding decisions on which two coders agree, andN1 andN2 refer to the total number of coding decisions by the first and second coder, respectively.

category is provided in Table 2 with their associated definitions and tweet examples. These types

of roles are discussed at length in the Findings. In addition, descriptive analysis of the frequency

of tweets for each category and associated subcategories was also performed.

[Insert Table 2 here]

To identify the relationships among the five coding categories, word similarity of these

categories was analyzed by applying Pearson correlation coefficient, which is one of the

common methods for similarity measures (Agarwal & Chauhan, 2017; Huang, 2008). NVivo's

cluster analysis feature was selected for the analysis since NVivo was used to capture and

analyze data. The NVivo software performs a word similarity cluster analysis based on variables

prescribed by the researcher. For this study, the word similarity feature was used on the words

within the tweets. Then the nodes that have a "high degree of similarity based on the occurrence

and frequency of words are shown clustered together. Sources or nodes that have a lower degree

of similarity based on the occurrence and frequency of words are displayed further apart"

(NVivo, 2019). Stop words were excluded from the calculation. A stop word list was generated

in NVivo, words included, articles like 'a,' 'the,' 'and.' Likewise, truncated words were

combined, for example, the term 'digital library' was used and the plural forms of the word were

merged into the singular form. The objective of this analysis is to help researchers highlight the

unique characteristics of the online DL community.

Findings

Number of tweets, retweets, followers, and following

The DLs varied in the number of tweets from 18 to 1079 and retweets from 19 to

2987. The DLs showed a follower's range from 93 to 9,138, and a following range from 36 to

1,302. Table 3 presents the number of tweets, retweets, number of followers, and the number of

Twitter users that the DL is following on Twitter for each of the 15 DLs. In total, these DLs

consisted of 5,173 tweets, 10,810 retweets, 23,189 followers, and 8,388 Twitter users that DLs

followed.

[Insert Table 3 here]

Types of Twitter roles

The results from the open coding revealed that Twitter typically plays the following main

roles: Information, Promotion, Related Resources, Social Identity, and Social Connection.

Fifteen types of roles were emerged from the data. Here are the five main categories and 15

associated types of Twitter roles:

1. Information:

   o Information-digital library

   o Information-digital library-problem

   o Information-digital library-reference question

   o Information-institution

   o Information-digital library-job information

2. Promotion:

   o Promotion-digital library-collection

   o Promotion-digital library-event

   o Promotion-digital library-connection

3. Related Resources:

   o Related resources-digital library

   o Related resources-institution

4. Social Identity:

- o Social identity-digital library-interaction

- o Social identity-digital library-collection

- o Social identity-digital library-social media

- o Social identity-digital library-institution

5. Social Connection:

- o Social connection-digital library-interaction

Figure 1 presents 15 types of roles and their associated percentage of tweets. The largest category was Social identity, which accounted of 45% of the overall tweets with 2,579 tweets. Promotion was the second largest category at 21% with 1,196 tweets. Social connection, despite not having any subcategories, was the third largest at 18% with 1,008 tweets. Then Information was the fourth largest at 13% with 730 tweets. Finally, the smallest category was Related resources at 3% with 200 tweets.

[Insert Fig. 1. Comparison of categories and subcategories of DL tweets here]

The following section illustrates the definitions, examples, and number of tweets for each of the 15 Twitter roles. In addition, characteristics of each type are also discussed. First letter of each role is capitalized for easy recognition.

Information

The Information category has the largest number of subcategories. Information tweets refer to updates and news specifically related to a DL including the following subcategories: Information, Problems, Reference Questions, Institution, and Job information. Each one of the Information subcategories has very distinct characteristics. For example, Information – DL refers to general information about the DL, for instance, issues pertaining to access, such as the DL's

hours. This was the largest sub category with 396 tweets. These tweets provide followers with general need to know information about the DL

Information - DL - problem tweets refer to the accessibility problems related to website maintenance, DL maintenance, power outage, different formats of digital items, etc. This type contains 156 tweets. The following presents a common example related to DL maintenance, "KDL is currently down due to infrastructure issues. We're trying to get it back up and running ASAP. Thanks for your patience!" [KY]. Another example is concerned with accessibility of a digital item, "@SDAllenToronto The issue is CBC's Flash-based video player http://t.co/aVvTADWl0u."

Information – DL – reference questions had 72 tweets. These tweets occur when a reference question is asked and answered via Twitter. An interesting observation of the study was that a significant number of reference questions answered via Twitter. For example, "@FierceFab We have loads of material on youth, from hippies to GenX. DM me and we can get started" [CBC]. The reference questions first raised by followers and were subsequently answered by the digital librarian on the same medium.

Information – institution had 60 tweets. These tweets showed that DLs were part of a larger parent institution. The main theme of the tweet was still informative. In these instances, the tweets would provide information regarding an event sponsored by the parent institutions. For instance, "Come to the Easter Bunny Basket Craft at Blair-Caldwell Library Friday, March 29th 4pm Come make your own fun…http://t.co/ScgBj8xqk" [WEST].

Information – DL – job information had 46 tweets. Several job postings were shared via tweets for various DLs. The tweet would provide a link to the actual job description on the institution's website, for example, "RT @adriankingston: Couldn't ask for better team to work

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with MT @DigitalNZ opportunity at DigitalNZ, Come be the Community Manager" [NZ]. There were also many follow-up tweets regarding staff. For example, upon fulfillment of the position, the DL may tweet a photograph of the new staff.

Promotion

This category refers to tweets created to advertise new DL collections/items and related events as well as connect with users regarding the new collections or events. There are three subcategories within Promotion including Collection, Connection, and Event.

Promotion-DL-collection tweets announce a new DL collection or newly added items to the DL. There were 915 tweets in this type. For example, "Check out our latest online exhibit, ""Paper for the People," curated by @demiankatz: http://t.co/r3vkHJ3s5n #dimenovelfever #exhibits" [VIL]. Another example is, "Frank Fitch Notebooks online - We're pleased to announce several notebooks and scrapbooks from the Frank. http://t.co/Csg61ZEpLY" [KY]. Promotional tweets permit digital librarians to promote their DL collections in an already existing online space. DLs that promote via Twitter also increase the likelihood of access to collections as Twitter has the ability for many different users to gain knowledge of the DL material. As a result, a user base of a DL could be increased and enabled more users to access the DL collections.

The second subcategory was Promotion-DL-event which had 190 tweets. This is a specific type of tweet. The main purpose of Promotion-DL-events tweets is to promote an event held by the DL. Here a DL is promoting an event that is going to be held by the DL staff, "Swing by MCP N230b TODAY between 10-12p to chat with #DPLA staff and pick up DPLA swag! #ala2013" [DPLA].

The final subcategory was Promotion-DL-connection which had 91 tweets. Promotion-DL-connection tweets differ from Social connection. The purpose of promotional connection type tweets is to link to users, but through the means of discussing a promotional DL or an event. For example, here a staff of a DL answered a tweet from a follower and promoted a DL or an event, "@FrontierFiesta Beard Contest?! Will this be an event for FF2013? (http://t.co/X7smQqSd) @UH_Cougars #photoaday #UH http://t.co/ru6e97pg" [UH].

Related resources

Related resources had two subcategories. In general, related resources tweets provide their Twitter followers with DL collection information from other DLs that share some commonalities, for example, resource from another DL that has a relatable subject area.

Related resources-DL are tweets that share information with their Twitter followers regarding other DL collections that have some similarities. There were 180 tweets in this type. For example, the DL New Zealand shared information by tweeting an article from the New Zealand government, "Brilliant! LINZ are releasing their aerial imagery data for public reuse: http://t.co/HxDScrUrbe." An additional example is from Calisphere DL which shared with their Twitter followers the information from UCSC, "Grateful Dead Archive Online is now live! Explore photographs, recordings, and fan art. "Congrats UCSC Library! http://t.co/Bx1EMMuQ."

The other category in related resources was Related resources-institution, which had 20 tweets. This category is unique in the sense that the larger parent institution and other related institutions, which would tweet something regarding the DL. For example, Villanova Public Library tweeted at the Villanova DL, "A new Mrs. Miller novel has just begun the process of being transformed into an eBook — join in and help out! http://t.co/Sbq4kkNEwF."

Social identity

The category Social identity has four subcategories: Interaction, Collection, Social media, and Institution. The main purpose of this category is the creation of a social identity for the DL which builds its profile, often relayed through digital collections.

Social identity – DL – interaction had 1,814 tweets. Although this category is catered around interaction, it differs from social connection. Social identity – DL – interaction is a tweet used when a DL is interacting but is drawing specifically on their identity as a DL and the interaction is secondary. This was the largest subcategory in the study. Social identity is often harnessed through interaction with followers and can include retweeting activities. In an online setting like Twitter, the same principles apply. Here is an example. Figure 2 illustrates the interaction. This tweet illustrates identity in a few different ways. First, the DL is responding to a tweet from a follower. The tweet is also about material found in the DigitalNZ. Second, the DL is asking other followers to reply, thus encouraging engagement to continue.

[Insert Fig. 2. Screenshot of Social identity - DL - interaction tweet here]

Many tweets were observed where DLs clearly sought to build and establish their social identity through the interaction with followers and those the DL followed. There is often an initial greeting followed by information in these tweets. Here is another example from Stanford Digital Library, "@Liebenwalde Here's a project proposal form and the email to submit it to looking forward to seeing what comes! http://t.co/D6Lm72iw". There is a greeting with @ and then information for their followers. As opposed to a social connection tweet, as evidenced here in a tweet from UW Digital Collection, "@uwiscmedadmiss And it all started w/ 4-H."

Social identity - DL- collection refers to tweets that depict the type of material and subject area of the DL. There were 667 tweets in this type. These tweets illustrate to the

followers the social identity of the DL through the collection. The tweet will often include a link to a photograph, for example, Calisphere tweeted, "We are so honored to have been selected by "@US_IMLS as a finalist for the Nat'l Medal for Library Service! http://t.co/NUtrgCOX". Another example is from CBC, "On this day in 1919: Remembering the Winnipeg General Strike 50 years later http://t.co/Kr88PeNPu8."

Social identity – DL – social media had 83 tweets. This category is unique in the sense that one type of social media, Twitter, is used to demonstrate the social identity of the DL on a different social media medium, for example, Facebook or a blog, "I posted a new photo to Facebook http://t.co/DIMzw1BK28" [RING] or "The new post on the DLG Blog features the story of the Masonic Temple fire in Atlanta in 1950.... http://t.co/20jnuSVsmR" [GA].

Social identity – DL – institution had 15 tweets. It is also the smallest sub category. This category was observed in DLs with parent institutions. The authors found that DLs would promote their social identity through tweets that were connected to their larger parent institutions. For example, Stanford Digital Library tweeted, "Recently digitized by the Media Preservation Lab, this film displays the student experience at Stanford in the mid-60s http://t.co/AvbmedGI." A potential reason being, trying to expand the reach of the DL through gaining new followers. Here is an example from the University of Houston Digital Library where they tag a number of entities involved with their campus, "RT @TheStacksCat: I'm looking at pictures of Shasta, the @UH_Cougars mascot on @UHDigital. These pictures are adorable!!!! #GoCoogs."

To attract Twitter users to follow a DL, it is necessary for the DL to create a profile that depicts its characteristics. The tweets should be communicated with its community in one voice.

Tweets should demonstrate the DL's 'personality' and provide a way for followers to interact. These aspects, when put together, are part of building a social identity.

Social connection

Social connection-DL-interaction consists of tweets that represent communications that occur on Twitter, specifically related to general social interactions that are not identified in other types of roles. Social connection tweets are directly associated with interaction at general level, unlike Social identity-DL-interaction tweets which focus on building the identity of the DLs. The purpose of this type of Twitter is to increase social connection. This category contains 1,008 tweets. Social connection - DL- interaction is more from the follower's perspective, meaning that the DL answers a response from a Twitter follower, for example, Figure 3 illustrates the interaction that occurred on Twitter.

[Insert Fig. 3. Twitter interaction between DPLA and a Twitter follower here]

Relationships among five Twitter roles

To investigate relationships among the roles, word similarities between each type of roles were compared using Pearson's correlation coefficient. The following section provides a result summary of role to role analysis. The value of a strong relationship was r > 0.7, and the value of weak relationships was 0.07> r > 0.03. Since this is similarity analysis and not for hypothesis testing, only the r value is reported. All roles within each category are not discussed, instead, the emphasis is on their relationships with other types of roles. Table 4 presents the Crosstab of the results. Strong relationships between roles in different categories are highlighted in red. Figure 4 illustrates the word similarity relationships among types of Twitter roles, focusing on strong relationships amongst these roles.

[Insert Table 4 here]

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[Insert Fig. 4. Relationships among types of Twitter roles here]

Types of roles in Information have a specific purpose and have less strong relationships with Twitter roles in other categories. The tweets are meant to be informative, for instance, providing hours that a digital librarian is available to answer questions. The exceptions are the relationships between Information-digital library and Social identity-digital library-collection and between Information-DL-Job Information and Related-resources-digital library respectively; information shared in these tweets is related directly to the DL, which makes sense as to why these roles have a strong relationship.

In contrast to information tweets, types of roles in Promotion have strong relationships with majority types of roles in Related resources, Social identity, and Social connection. Interestingly, roles in Promotion do not have strong relationships with two sub categories within related resources and social identity. This sub category in both instances is related to institution. Institution is a broader context in which a DL belongs and relates to. The institution is often referring to a DL's parent institution. Therefore, the finding that roles of Promotion are not strongly related to tweets of institution in other categories illustrates that those tweets are not directly promoting the DL. Promotion has a strong relationship to Related resources-digital library which indicates that those two roles have similar end goals—sharing information about DLs.

Related resources-digital library has its strongest relationship to roles of Social identity, specifically Social identity-digital library-collection. The role of Related resources-DL is to typically provide information relating to other DL collections but can be associated with institutions. The finding of the strong relationship between Related resources-DL and Social identity-DL-collection indicates that DLs are a strong factor of identification.

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Roles in Social identity except Social-identify-DL- institution have strong relationships with Related resources-DL and Social connection. The association to social connection makes a lot of sense as identity and connection on Twitter are the main purposes of the application. These findings reveal that digital librarians have recognized the significance of ensuring that both aspects are in focus.

Social connection has strong relationships with roles of Promotion and Social identity. Promotion is all about the marketing of a DL or a DL collection, and DL is the essence of the Social Identity aspect. The relationship to social connection for these two roles is that social connection is one step closer to the user with the use of tweets. Social connection is simply that, a way for digital librarians to make that connection to a DL user or a potential user, and then connect that person to the larger DL community.

However, the data also illuminates a few weak relationships amongst the roles. Besides the largest unrelated area of Information; the two sub categories of Related resources-institution and Social identity-institution had more weak relationships with other categories. This finding shows that those tweets had more of a focus on the parent or outside institution than on the DL itself.

Discussion

The findings of the study demonstrate that Twitter serves a role by not only informing users, promoting digital collections, but also engaging users. Community research asserts that the more followers the better, which to a certain extent is true. However, each online community has its own unique traits, as is such with the DL Twitter community. Not all networks are the same, nor should the suggestions for community establishment be the same (Wellman, 1983). The

findings of this study characterize the roles that Twitter plays in DL communities. This study yields several significant findings.

Building DL online communities

First, this study demonstrates that Twitter plays a critical role in building DL communities. DLs do not have its user base as physical libraries have. Digital librarians use Twitter, one of the key social media tools, to enlarge its user base and form an online community. Twitter plays multiple roles in physical libraries (Young &Rossman, 2015); the same applies to the DL community with some unique characteristics. The five main role categories of DL highlight the unique characteristics of the online DL community. For example, Information is key to staying current and keeping one's users informed about important DL information. Offering Related resources opens a great way to share and connect with users, potentially even expanding the user base of the DL by retweeting information from another DL. Providing Related resources also creates another avenue to connect with other DLs and related cultural institutions, these related entities have followers that might have interest in this DL. Social identity needs to be established so that users know what the DL is about and made a decision whether they would like to join this community. Social connection is the main reason that Twitter exists to connect and interact. Unlike LIS professional organizations that are not connected (Zhang, Sheu & Zhang, 2018), the Social connection of this study, with 1008 tweets, helps foster the relationships among DLs, institutions, and their users. Since identity ideally should be the center for other types of Twitter roles in DLs, it is essential for DLs to have a clear identity for themselves. Finally, as identified by previous research in both physical library and DL environments (Al-Daihani & AlAwadhi, 2015; Kim, et al, 2012), this study also found that promotion was an effective way for the DL to advertise the existence of a DL and its collections.

However, the main difference is that promotion also intertwines with social identity and social connection in the DL environement.

Second, this study is the first of its kind that explicitly analyzed the content of the tweets in multiple DLs. Moreover, the analysis extended to their relationships and further identified interrelationships among the types of roles. Previous research on the roles of Twitter mostly focuses on libraries, less is on DLs (Xie & Stevenson, 2014; Young & Rossman, 2015). The analysis of tweets stays on the main categories, such as Information, Promotion, etc. (Huang, et al., 2017). This one identified and examined the subcategories of these roles. For example, the findings show that reference questions and answers are no longer one to one communication. Digital librarians answer DL related reference questions via Twitter to inform all users who check these tweets. Another important finding is that DL tweets not only cover different aspects of their own DLs but also associate with their parent institutions and other related DLs. For instance, Related resources-DL demonstrates that DLs should and can connect with other DLs as the outcome can be beneficial to both parties. The construction of an online community by communicating with Twitter followers can create new relationships. These relationships can be bridged by the similarities that DLs share and may find that other DL Twitter followers have interest in another DL's collections and may choose to follow that DL as well.

Most importantly, word similarities analysis identifies more strong relationships among the roles in four main categories (Promotion, Related resources, Social identity, and Social connection) but less with roles in Information. A DL is the center that connects different types of roles together. In addition to Information, Related resources-institution and Social identity-institution shared weak relationships with other categories. Even though tweets about institutions

do not have direct strong relationship with DLs, they are part of the DL tweets to attract users from the institutions and enhance the DL user base.

Third, the analysis of Twitter roles in DLs show their uniqueness compared with physical library communities. Digital librarians intend to create an online DL community that is not limited to its DL users. While Information, Promotion, Social identity, and Social connection are the main roles that Twitter plays for both physical and digital library communities (Collins and Quan-Haase, 2014; Del Bosque et al., 2012; Shiri & Rathi, 2013), Related resources is the unique category emerged for the DL community. Twitting and retwitting related resources from other DLs enable digital librarians to attract more potential users from these DLs and their parent institutions. Moreover, DL communities integrate the existing library users and new users of DLs together. Unlike physical libraries, DL tweets in Social identity, Related resources and Information categories try to include their parent institutions' information and bring their users to the DL community. This is an effective approach to enlarge the DL user base.

Fourth, retweeting is critical to engage DL users and build communities. There was also a high number of retweets, over 10,000. Six of the 15 DLs in this study had their retweets at least nearly doubled their tweets. That indicates that, in addition to original tweets created by the DLs, DLs and their followers also retweeted many tweets in the Twitter community they perceived relevant and interesting. Retweeting signifies engagement in the community that echoes what Hussein and Hassan (2017) found in their analysis of customer engagement on social media, "besides being useful in their lives, social media users are attracted to social media platforms because of the feeling of connectedness that it gives them to be online with all the different communities and friendships that they can develop over social media" (p. 1018).

Improving Twitter use for DL community building

Consequently, here are suggestions for digital librarians regarding how to build online communities and how to enhance the roles of Twitter in DLs that can be drawn from this study.

Even though the results demonstrate that Twitter has played a vital role in building DL communities, these tweets can be improved to inspire more effective roles. For instance, in the Information category, accessibility information needs to be incorporated to facilitate people with disabilities, such as blind, visual impaired, and hearing-impaired users to access DLs. General announcements that are made using the Information types of tweets might be lost to users who are visually impaired or hearing-impaired users to access DLs. Twitter has the potential to provide a way for DLs to communicate to all users of software updates and other maintenance and/or compatibility issues. In Promotion, the announcement of new collections should also include highlights of the collection to attract more users to access the collection. In Related resources, resources should not be limited to DLs, and the focus should be on the introduction of different types of resources in diverse formats and across different organizations. In Social connection, the interaction between DLs and Twitter users should not restrict to DLs. Building trust is the key step to bring potential users to the followers of DLs (Groundwater-Smith, 2009). In Identity, DLs should focus on what aspects of identity are most important to the DL, and create tweets associated with these aspects to attract people with diverse interests to be DL followers. DLs should also connect with other DLs and followers, as one's friends are a reflection one's identity. In one word, quality of tweets is more important than the quantity.

It is essential that the reciprocal nature of Twitter should not be ignored. Interacting with others is the purpose of using Twitter. Lovejoy, Waters & Saxton (2012) emphasized that "creating mutual ties with followers is one-way organizations can at least give the appearance of creating a community on Twitter. Conversely, an organization that does not follow anyone gives

the impression that they do not want to engage in a dialogue" (pp. 317). Clearly, many digital

librarians are using Twitter to provide a self-image of their DLs and to promote their collections.

DLs that also retweet from their communities have more interactions on Twitter. This study

clearly proves that when DLs actively participate in their online communities, the interactive

results are much higher. In other words, to build a strong community with two-way

communication, engaging with your followers is critical.

Conclusion

Twitter is a tool that is used to enhance communication and increase participation in

online communities. DL—an online entity can incorporate a known popular social media

application—Twitter to increase its awareness. The fact that the environment is digital does not

make it any easy to create an online community. The findings of this study demonstrate that

digital librarians, on behalf of DLs, become active participants in their online communities, can

engage larger and potentially more successful interactions with their user groups. The 15 types of

roles that Twitter plays in the DLs characterize the uniqueness of DL communities.

If digital librarians can continue to use platforms like Twitter to engage with users, it

increases the likelihood and the visibility of the DL. Despite the complexities that go along with

types of Twitter roles and their relationships, DLs that provide a structure for interaction provide

the public with new ways to access information. The analysis from this paper provides

researchers and practitioners with a deeper insight into how digital librarians can use Twitter to

build their own online communities and connect with their existing and potential users.

This study provides a foundation from which more analysis can be done. The Twitter

analysis illustrates that a vast array of tweets is created and shared in DLs. One limitation of the

study is its limited sample. In the future, research using a variety of samples including samples at different stages of Twitter use in DLs should be conducted to develop a rich understanding of the roles of Twitter and their relationships. Further research can also apply more advanced statistical analysis method to find hidden roles and hidden relationships from the Twitter data. Another limitation of the study is while the analysis of tweets in the DL environment is the focus of the study, the analysis cannot explain the reasons behind the use of Twitter. The next step is to investigate how to make these tweets more effective. Interviews with digital librarians and users need to be performed to learn more about the intricacies of the DL Twitter network. Qualitative interviews with the quantitative data would provide a rich amount of information that both researcher and practitioner could benefit.

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