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Analysis of Academic Libraries' Facebook Posts: Text and Data Analytics

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ABSTRACT

This research analyzed a dataset of academic libraries' posts on Facebook. It applied a text and data analytics approach to a dataset collected from the Facebook posts of academic libraries at the top 100 English-speaking universities, as listed by the 2014 Shanghai World University Rankings. The dataset is from a two-year posting history of 18,333 unique posts, 113,621 likes, and 3401 comments. Less than a quarter of the libraries had more than 2000 post-related likes, and only seven received more than 100 comments on their postings. Content analysis identified the most prevalent single word (unigrams), bigrams (two-word sequences), and trigrams (three-word sequences) in high and low engagement content. Semantic analysis identified the semantic categories for posts with high and low engagement. The findings can assist academic libraries in their social media strategies for engagement, marketing, and visibility.

Introduction

Facebook has attracted the interest of academic libraries, which see the potential for engagement and interaction with their users (Witte, 2014). Facebook provides libraries with the opportunity for social interaction and sharing. Phillips (2011) noted that Facebook helps libraries to engage with students. Facebook allow libraries to build relationships and engage with their users (Tan, Hedren, Kiat, & Somasundram, 2012). To measure usage and interaction, Facebook provides data for examining user behavior and the ways in which content affects user engagement (Luarn, Lin, & Chiu, 2015). Academic libraries could benefit from the social data that is available through their Facebook pages.

Chen, Chu, and Xu (2012) claimed that, despite the increasing adoption of social media by libraries, user engagement remains low. Aharony (2012) found that academic libraries do not use Facebook as a discussion platform with their users; rather, they use it to deliver information, suggesting a lack of engagement and interaction. Academic libraries are being pushed to use effective initiatives to engage their users with their resources and services (Tan et al., 2012). Indeed, Facebook is an effective platform for doing so (Houk & Thornhill, 2013). According to Stone (2014), social media can help to increase interaction and improve engagement.

According to Houk and Thornhill (2013), an analysis of comments and the number of likes on posts (to assess engagement and interaction) provides a clear mechanism for measuring and analyzing Facebook usage. Therefore, this study employed text and data analytics to analyze academic libraries' posts and measure their engagement and interaction. The methodology and research findings will contribute to literature on data and text mining and the development of best practices for Facebook posting by academic libraries.

Related literature

Facebook use in academic libraries

Facebook is one of the essential social media platforms used by academic libraries. Library and information science researchers have been studying academic libraries' use of Facebook since its emergence. For example, Aharony (2012) conducted an exploratory analysis of Facebook use in academic libraries that investigated the use of different sections of Facebook and the content of posts. Aharony recommended that academic librarians use various Facebook applications effectively to attract more users. Wan (2011) claimed that Facebook has great potential for library outreach, which makes it a useful tool for academic libraries to employ to reach more potential library users. Since that time, an increasing number of libraries have adopted Facebook.

The level of engagement of users with academic libraries' Facebook posts is an indicator of good or bad practices. Engagement can be measured by a simple count of comments and likes. Glazer (2012) noted that number of comments or likes on Facebook posts of academic libraries is a major indication of engagement. Gerolimos (2011) found that, of the 3513 posts from 20 academic libraries in his study, 2228 received no feedback at all and 3191 received no comments. This

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suggests that public engagement with the content of Facebook posts in academic libraries is very low. As Glazer (2012) noted, likes on a Facebook page can be used to measure interaction, as they express user engagement with the original post. Furthermore, Gerolimos (2011) stated that content with photographs attracted more likes and comments. One of the recommended engagement mechanisms is to post promotional updates about library resources and services (Parvin, 2017).

Tan et al. (2012) conducted a study of 82 academic libraries Facebook pages across 52 Asia-Pacific universities. The study investigated the content and popularity of the Facebook pages. The results showed that 83% of the interactions were likes of posts, where the remaining interactions were comments. Ayu and Abrizah (2011) studied Malaysian academic libraries' Facebook pages to identify best practices for use and concluded that these libraries are using their Facebook pages for marketing and creating awareness of library services to their users.

Houk and Thornhill (2013) used data collected from the Facebook page of a health sciences library to determine best practices for posts. The study explored user engagement with the library posts. Increased posting frequency was correlated with more page likes and more user engagement. The type of post content also considerably increased user engagement with the library's Facebook page, with multimedia posts drawing the most interest from users. The study highlighted how Facebook Insights data can be used to capture statistics about user trends and as a basis for best practice posting guidelines for greater user engagement. Winn, Rivosecchi, Bjerke, et al. (2017) investigated user engagement at four academic libraries in Montreal, Canada. The level of user engagement was measured by likes and shares over a specific period divided by the number of posts. This study demonstrated the potential of social media data for assessing library users' engagement with libraries.

Text and data mining in academic libraries

Data mining is the process of knowledge discovery of patterns from data (Han, Kamber, & Pei, 2012) and the identification of unknown or hidden information (Siguenza-Guzman, Saquicela, Avila-Ordóñez, et al., 2015). Text mining, on the other hand, is a collection of methods to uncover relationships in a large collection of unstructured text and to extract information and discover new knowledge (Zhang & Gu, 2011). Text and data mining has been used in library and information science for bibliometric studies (Delen & Crossland, 2008) and to improve collection development in academic libraries and enhance research support of faculty (Gao & Wallace, 2017). Nagarkar and Kumbhar (2015) found that the literature on text mining in library and information sciences is rapidly increasing and doubles every five years, indicating its importance in the field.

The importance of text and data mining for academic libraries, in particular, was highlighted in a review by Siguenza-Guzman et al. (2015) of the range of studies that employ this technique. Their review highlights the usefulness of these techniques for academic libraries in understanding the patterns of behavior of library users and staff, and patterns of information and resource usage. Text and data analytics provides academic libraries with insight into real data compared to surveys and feedback forms. Renaud, Britton, Wang, and Ogihara (2015) noted that data reveals patterns of use and correlations between library activities and users' achievements, as well as measuring their contribution to their academic institution's goals. Okerson (2013) demonstrated how libraries can respond to new challenges in this field and understand data to create new knowledge. This will help them to strengthen their collections and information for decision-making processes and enhance their resources and services (Lone & Khan, 2014). Finally, these techniques "help a library in the collection, analysis, and dissemination of knowledge and information" (Singh, 2016:160).

Social media are data sources that text and data analytics can investigate in depth. Olajide and Alao (2016) believe that the social media use of academic libraries can provide a measure of library users' level of engagement by extracting data about posts' likes, shares, and comments. Al-Daihani and Abrahams (2016) demonstrated the power of these analytic techniques using a dataset downloaded from a sample of academic libraries' Twitter accounts to extract data patterns and information in order to understand their use and practice.

However, there is a lack of literature that employs text and data analytics to investigate academic libraries' Facebook posts. We expect that this study, by reporting the patterns of their use, will contribute to establishing best practices for the engagement of academic libraries on social media generally and Facebook in particular.

Study aim and research questions

This study used a text and data analytics approach to investigate academic library posts on their Facebook pages. The research questions were as follows:

1. What extracted data describes the libraries' patterns of Facebook use?
2. Which library content has the highest and lowest engagement?
3. What are the semantic categorizations of the content of posts?

Methods

Dataset collection

This study examined the engagement of users with academic libraries' Facebook posts. The sample was 100 academic libraries in four English-speaking countries (Canada, the United Kingdom, Australia, and the United States), selected from the highest-ranking universities according to the 2014 Shanghai World University Rankings (Shanghai, 2014). It is assumed that the academic libraries from these top universities will have substantial resources and library users. The sample is sufficiently large to provide enough data for the analysis, and spread across the globe to capture diverse data.

The dataset for analysis comprised 18,333 posts from 100 academic libraries, covering the two-year period from January 2013 through December 2014 inclusively, downloaded on March 25, 2015. There were a total of 113,621 likes and 3401 comments on these posts. Figs. 1 and 2 show a Facebook page and post features.

Dataset processing and analysis

The researchers gathered the Facebook post data using a Microsoft Excel Visual Basic for Applications (VBA) macro to query the Facebook Graph Application Programming Interface (API) version 2.2. In order to gather the needed data, two temporary access tokens were obtained from Facebook (developer.facebook.com), which provided temporary privileges to download data. The Facebook ID of each library was manually determined and recorded in a spreadsheet to retrieve the correct posts for each library. This process involved finding each library's page manually using Facebook search, manually verifying that the correct library was found, and then recording the relevant library ID in a lookup table in a spreadsheet. The Facebook Graph API returned data in JavaScript Object Notation (JSON) format. Microsoft Excel PowerQuery was then used to flatten the JSON data into tabular format in a Microsoft Excel Workbook. Aggregate statistics were computed using Microsoft Excel Data Analysis Toolpak, Microsoft Excel PivotTables and PivotCharts, and SAS JMP v13. The dataset was downloaded over a 10-day period including the time taken to write the Microsoft Excel VBA code.

Three analyses were conducted—term prevalence (ngram), semantic, and sentiment analysis—as described in the following sections.

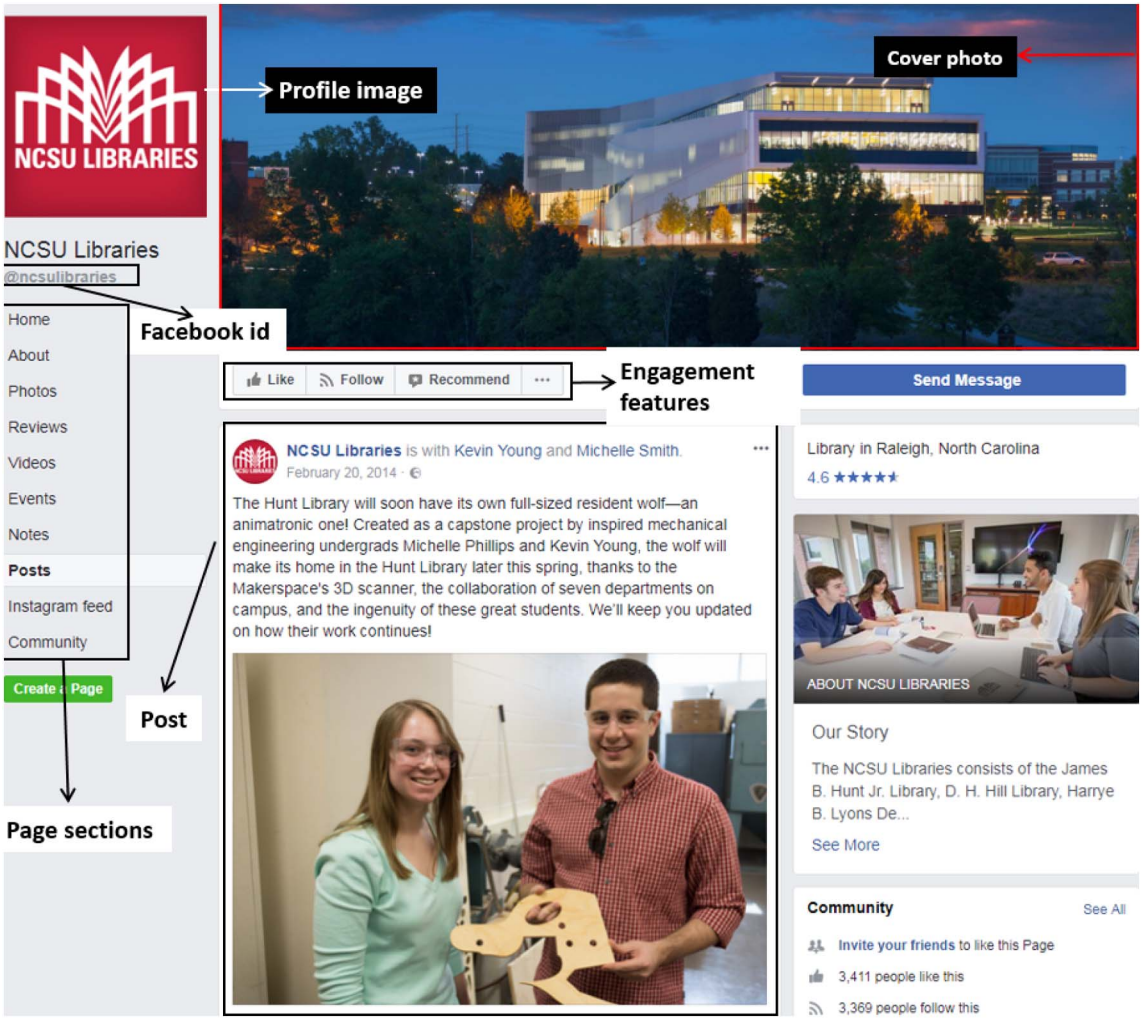

Fig. 1. Facebook page features.

Term prevalence analysis

Prevalent terms in posts with high vs. low engagement were computed using Virginia Tech's Pamplin Text Analytics Toolbox (PamTAT), with Relevance Correlation Value (RCV) as the prevalence metric, as described by Fan, Gordon, and Pathak (2005). The purpose of this analysis to determine the frequencies of single words (unigrams), two-word sequences (bigrams), and three-word (trigrams) sequences that appeared in the posts' content and attracted either high or low engagement. This allowed us to identify the information content patterns used by the libraries.

Semantic analysis

To analyze the semantic content of the Facebook posts, posts were exported from Excel into text format and analyzed using Harvard General Inquirer version 1 (Stone, Dunphy, & Smith, 1966). Harvard General Inquirer performs word sense disambiguation and counts the occurrences of words in different semantic categories. In other words, it is a general-purpose text analysis tool that allows the end-user to identify how frequently different word categories are used in source text.

General Inquirer recognizes almost two hundred word categories, including, for example, words that are positive, negative, or related to pleasure, pain, location, time, knowledge, academia, overstatement, or understatement, and so forth. Further details of the semantic categories analyzed by Harvard General Inquirer can be found at http://www.wjh.harvard.edu/~inquirer/homecat.htm

Sentiment analysis

Sentiment analysis was conducted using PamTAT to score the library posts against the AFINN sentiment dictionary, created by Finn Nielsen (2011).

Findings

Descriptive statistics

The libraries had between 122 and 11,185 page likes for their Facebook account, and between 78 and 5974 post likes for their posts. Page likes are likes of the library's account on Facebook, whereas post likes are likes of specific posts put up by the library. Table 1 shows descriptive statistics for the libraries in the dataset for page likes, posts, post likes, post likes per year, and comments. The library with the lowest (minimum) number of page likes had 122 and the library with the highest (maximum) number of page likes had 11,185. The library with the most likes, over all their posts over the two-year period, had 5974 post likes. The libraries had between 45 and 200 posts over the two-year period, with an average of 183 posts. It is notable that the average library received only six likes per post, and received comments on only one in five posts (=0.2 comments per post).

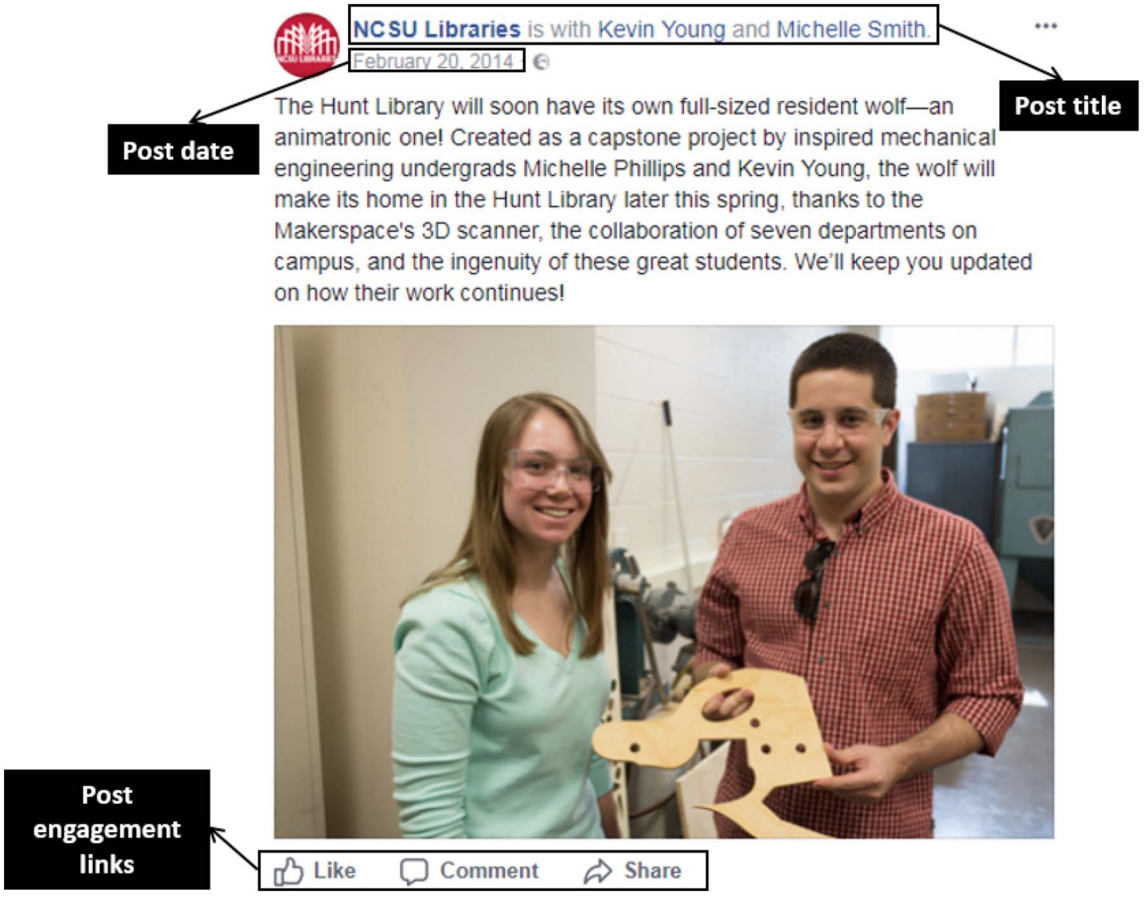

Fig. 2. Post features.

Table 1
Descriptive statistics for page likes, posts, post likes, post likes per year, and comments.

		Posts				Comments	
	Page likes	Total	Total post likes	Likes per post	Annualized likes per year	Total	Per post
MIN	122	45	78	0	44	1	0.0
MAX	11,185	200	5974	36	17,914	209	1.1
AVG	1769	183	1136	6	1732	34	0.2
STD DEV	1860	26	1081	6	2780	36	0.2
25th PCTL	736	185	452	2	405	14	0.1
MEDIAN	1198	191	765	4	930	25	0
75th PCTL	1933	195	1531	8	1812	37	0.2

It appears that 4 of the top 10 most-liked photos are animal-related, and 2 of these animals are the university mascot animals (the others are dogs and cats). Table 2 describes the nature of these posts. Thus, animals seem to build some affinity, both conventional pets, and university mascot animals. One of the top 10 most-liked posts celebrate grants to the library, and another the opening of a special topics (Architecture) library. Two of the top 10 most-liked posts discuss the local weather. In analysis of the top 50 posts, the most popular themes that seemed to emerge, in order of popularity, were:

- posts about local animals (lorikeets, owls, ducklings, kangaroos, squirrels, turtles, dogs, …),
- posts about the library winning awards, grants, or high rankings (multiple posts about different awards/rankings),
- posts about new openings such as special collections, rare book arrivals, special visitors, and renovated sections opening (e.g. new East Asia library; new banned-books collection; new Teenage Mutant Ninja Turtle sculptures; rare book arrival),
- post about history such as historical images or historical news,
- posts about the weather (snow, cold weather),
- posts about contests the library was running, and
- posts about modernization, specifically energy efficiency initiatives, by the library (e.g. highlighting new solar panel arrays on library roofs).

Table 2
Top ten most-liked posts.

	Post type
1	Webcam picture of the university's mascot, a falcon.
2	Humorous picture meme, showing a cat reading a book.
3	Photographs of therapy dogs visiting the library, with a text caption.
4	Textual notification (with image) announcing the availability of the library's annual report of news.
5	Picturesque photo of the library with blue skies and flowering trees, with a text caption.
6	Picture of a severely crumpled umbrella found on campus, after a local rain storm, with a text caption inviting users to the warm, dry library.
7	Picture of a quote, in stylized font, with text caption. The quote is that "I have always imagined that paradise will be a kind of library".
8	Picture with associated caption, of two mechanical engineering students building an animatronic wolf - the university's mascot is a wolf.
9	The image in this post is decorative and is accompanied by a descriptive textual caption that celebrates the awarding of a multi-million dollar grant in support of a new digital humanities laboratory at the library.
10	A photo, and text caption, celebrating the opening of the new architecture library as part of the university library.

Table 3 shows the distribution of libraries by country in the dataset,

Table 3
Distribution of libraries by country, with posts and likes for each country.

Country	# of libraries	Total posts	Average posts per library	Average likes per post
United States	71	13,081	184.2	0.14
Australia	7	1324	189.1	0.11
United Kingdom	16	2880	180.0	0.37
Canada	6	1048	174.7	0.40

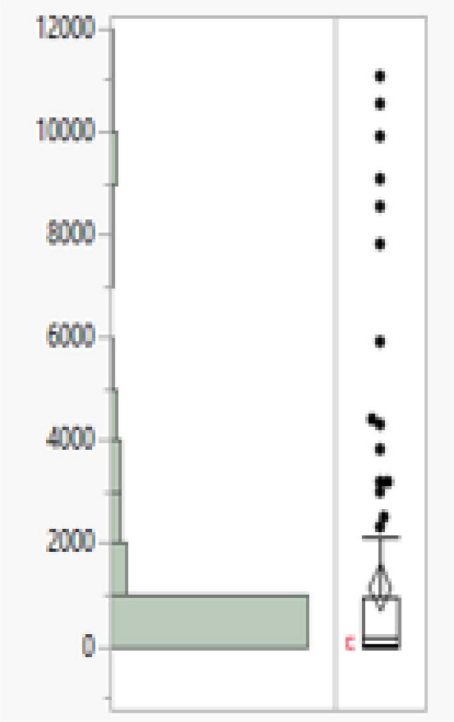

Fig. 3. Distribution of check-ins.

as well as the distribution of post and likes for each country. Most academic libraries from the dataset were from the USA (71 libraries) with a total of 13,081 posts, followed by 16 academic libraries from the UK with a total of 2880 posts. Academic libraries from Australia had the highest average posts per library (189.1) and academic libraries from Canada have the highest average number of likes per post (0.40).

The dataset analysis included the distribution of so-called check-ins and "talking about." Fig. 3 shows the distribution of check-ins (i.e., the number of people who visited the library and used the "check in" feature on Facebook). Here, the value for "talking about" refers to number of people who mention the library in their posts on Facebook, as shown in Fig. 4.

Most of the libraries have 0 to 1000 check-ins. It is rare for a user to tag a friend with them at the library. This suggests that users tend to visit alone, or that they seldom tag their friends while visiting. Nevertheless, two libraries had over 10,000 check-ins.

Almost all libraries have fewer than 100 users 'talking about' them (i.e., libraries are seldom mentioned in the users' posts). This could be an indicator of low user interest.

Post content analysis

The second research question asks the following: "Which library content has the highest and lowest engagement?" We operationalized this by determining what terms were prevalent in posts with high vs. low engagement. Engagement in this research is defined as the simple

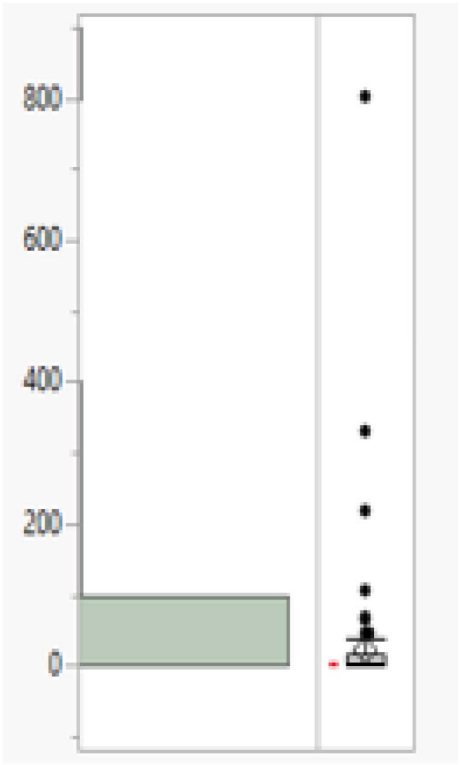

Fig. 4. Distribution of 'talking about'.

multiplicative combination of likes and comments. Thus, a post with two likes and three comments is defined as having an engagement level of six (2 × 3). The RSV term prevalence metric in PamTAT was used in this analysis. The purpose is to show significant ngrams or highly prevalent terms in posts with high engagement (post likes multiplied by post comments). In this analysis, an engagement score of six or higher is considered high and a score of two or less is considered low.

Unigram (single word) analysis was used to identify the most frequent single words from posts with high engagement scores by academic libraries. Fig. 5 shows significant unigrams in posts with high engagement. These are "photo," "collection," "congratulations," "thanks," "happy," "finals," "welcome," etc. Among the top 20 words listed in Fig. 3, there are many words, such as "thanks," "happy," "welcome," "congratulations," "friend," and "love," that are personal language, revealing the engagement approach of these libraries. Other words, such as "photo," "collection," "manuscript," and "image" are likely related to posts about their collections, indicating that the library is promoting their information resources. However, in Fig. 6, interesting significant unigrams for posts with low engagement include "retweeted," "access," "research," "please," "unavailable," "maintenance," "closed," "due," and "inconvenience." Facebook users interacted less with this content, as it appears to relate primarily to administrative maintenance or closure announcements by the library.

Fig. 7 shows the relative prevalence of bigrams (two-word sequences) in the dataset of Facebook posts with high engagement. The most frequent bigrams included "USC digital," "Whittington photography," and "Dick Whittington." This demonstrates that the libraries frequently used words associated with institutional ID/loyalty. This is evident also from the analysis of trigram for posts with high engagement (Fig. 9), whose results also demonstrate that these posts contain words associated with institutional loyalty (e.g., "the USC digital," "USC digital library," "in the USC," "Dick Whittington photography," etc.). Other bigrams are associated with photographs and other types of collections such as historical, digital, and special and rare collections. The low engagement bigrams in Fig. 8 included "will be," "latest news,"

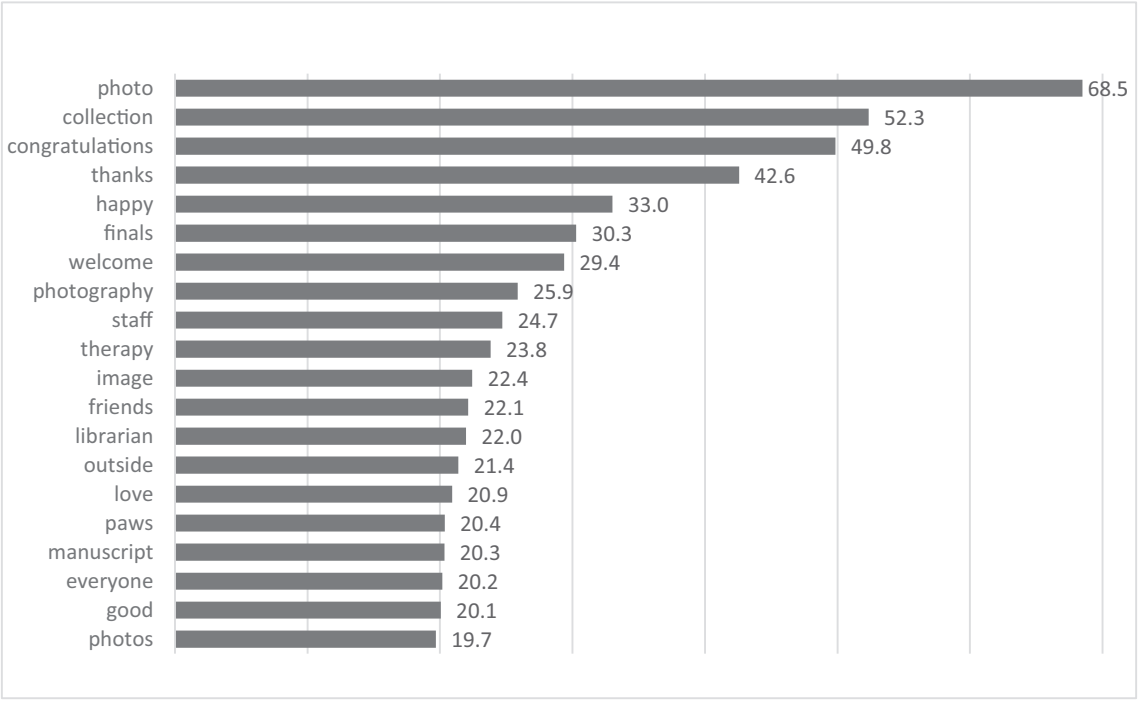

Fig. 5. Distribution of unigrams in posts with HIGH engagement.

"ISE research," and "be unavailable." These also appear to relate to routine announcements.

Fig. 10 displays similar significant trigrams for posts with low engagement: viz., "will be unavailable," "for the inconvenience," "there will be," "for any inconvenience," "we apologize for," "will be open," "are working to," "during this time," "library will close," "we apologies for," and "due to maintenance."

Semantic content analysis

We investigated the semantics content of the Facebook posts'. Fig. 11 shows that libraries across all four countries tend to use similar semantic categories, with remarkably similar prevalence, as demonstrated by the overlapping lines. The prevalent semantic categories are so-called EnlOth words (defined by the Harvard General Inquirer as "total enlightenment" and "other enlightenment" words, respectively; indicating enlightenment), time, place, temporal and spatial words, active words, communication words, and so forth. The term "enlightenment" here refers to "knowledge, insight, or information pertaining to personal and cultural relations".

Moreover, the results indicate that US libraries used fewer "state verb" (SV) words as categorized by the Harvard General Inquirer. The

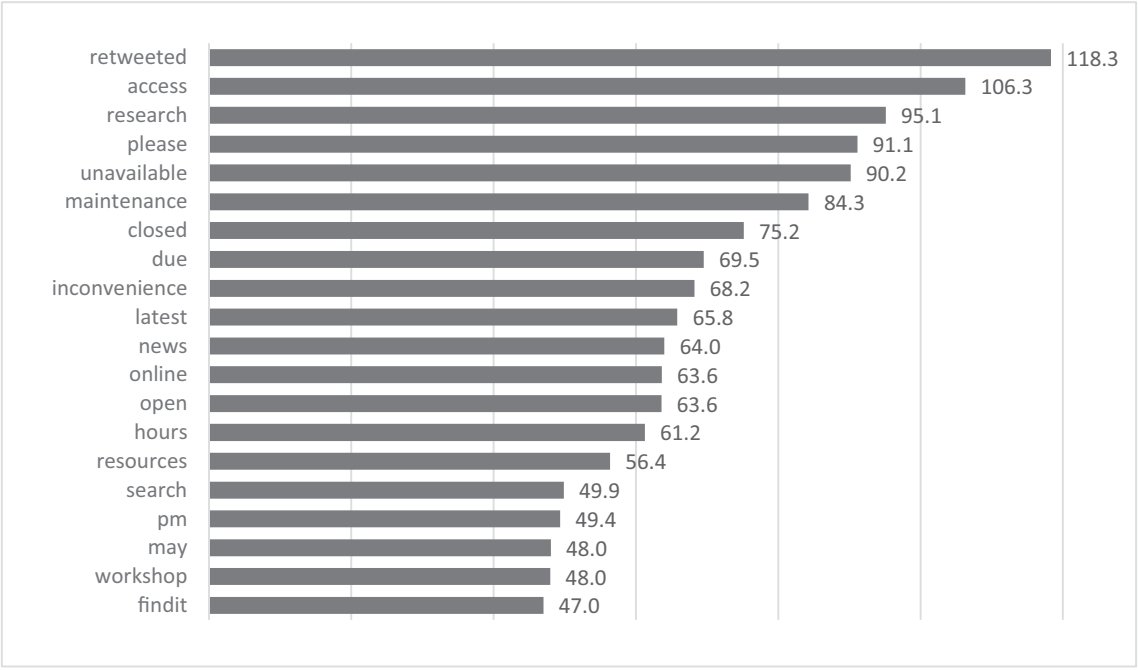

Fig. 6. Distribution of unigrams in posts with LOW engagement.

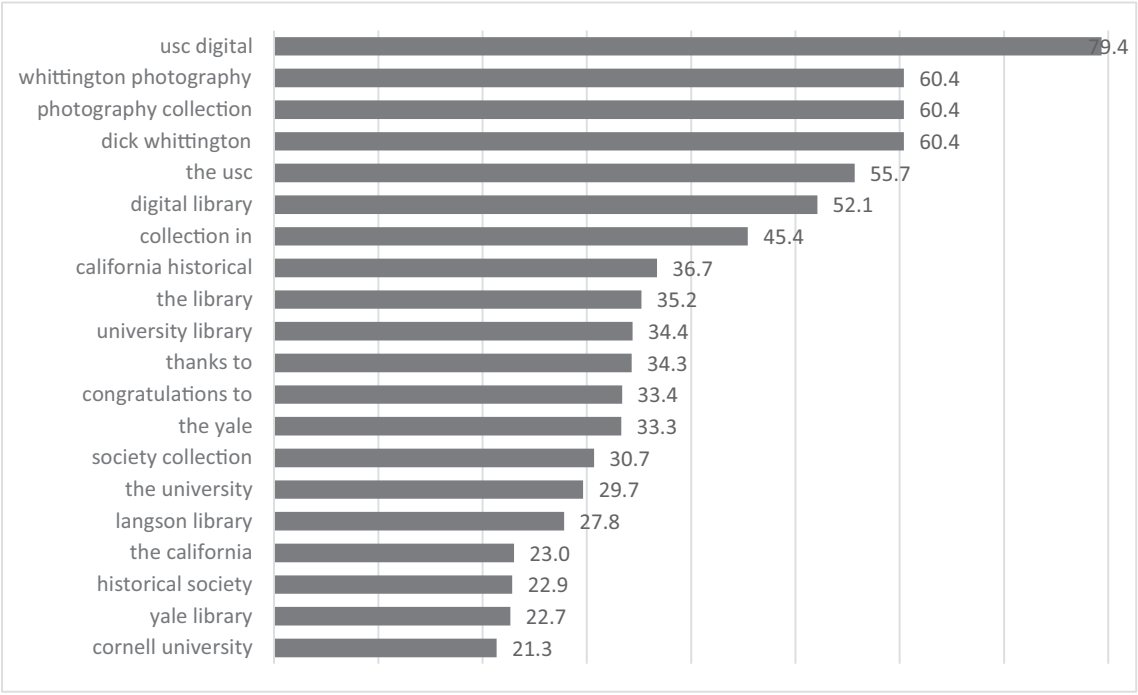

Fig. 7. Distribution of bigrams in posts with HIGH engagement.

SV category comprises 102 verbs describing mental or emotional states that are usually detached from specific observable events (e.g., "love," "trust," and "abhor.") US libraries also used fewer "you" words; the "you" category contains nine pronouns indicating that another person is being addressed directly. Finally, US libraries used slightly more "role" words than libraries in other countries. The "role" category comprises 569 words that refer to identifiable and standardized individual human behavior patterns, as used by sociologists.

Fig. 12 shows the semantic differences between posts with high engagement and those with low engagement. Although the differences are small in absolute numbers, they are often very significant by proportion. Posts with high engagement tend to have words classified as Ovrst (Overstatement), Place, Social, Quan(tity), and Space words. Posts with low engagement mention more active words, communication words, abstract concepts, time-consciousness words, and interpretative verbs. In particular, the "you" category is strongly associated with high post engagement.

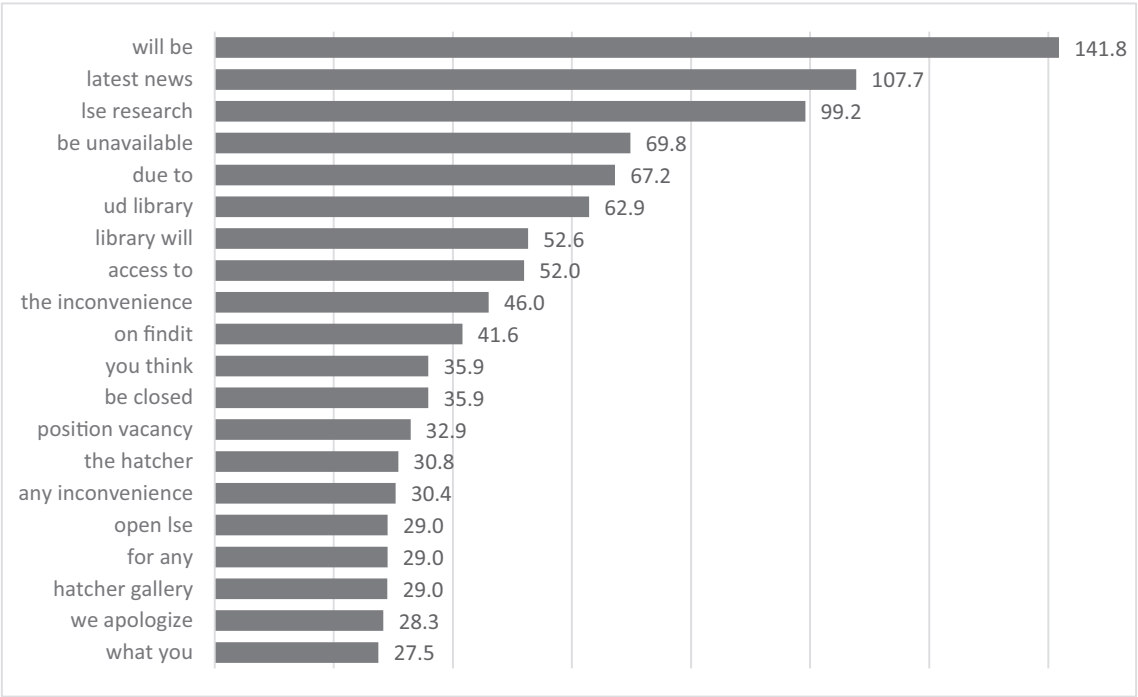

Fig. 8. Distribution of bigrams posts with LOW engagement.

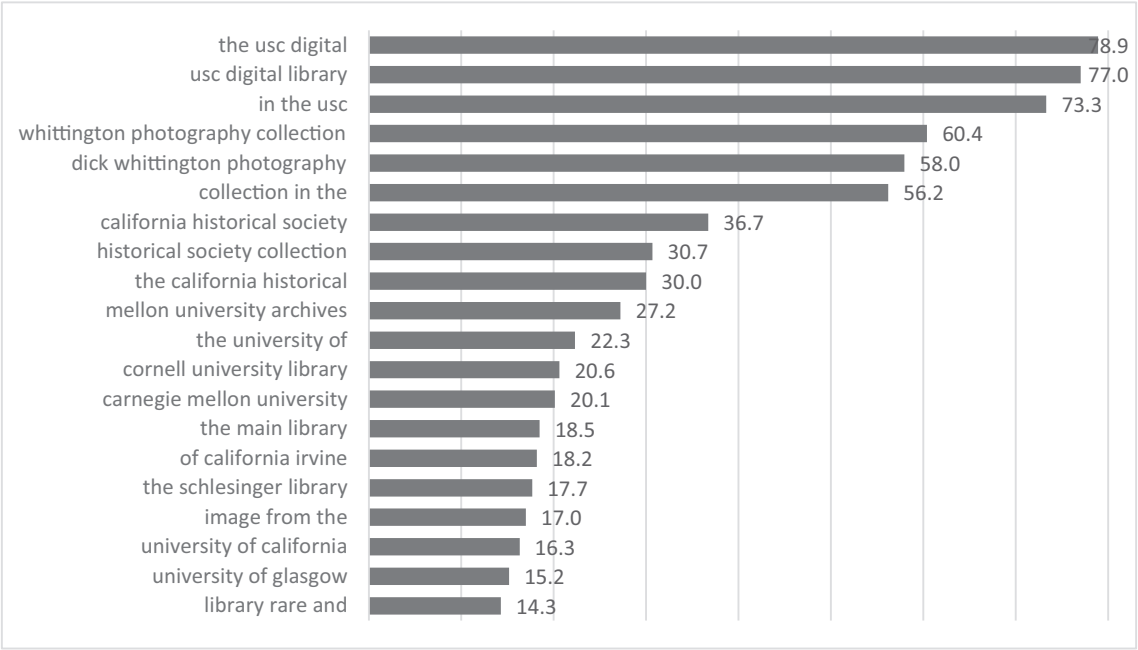

Fig. 9. Distribution of trigrams in posts with HIGH engagement.

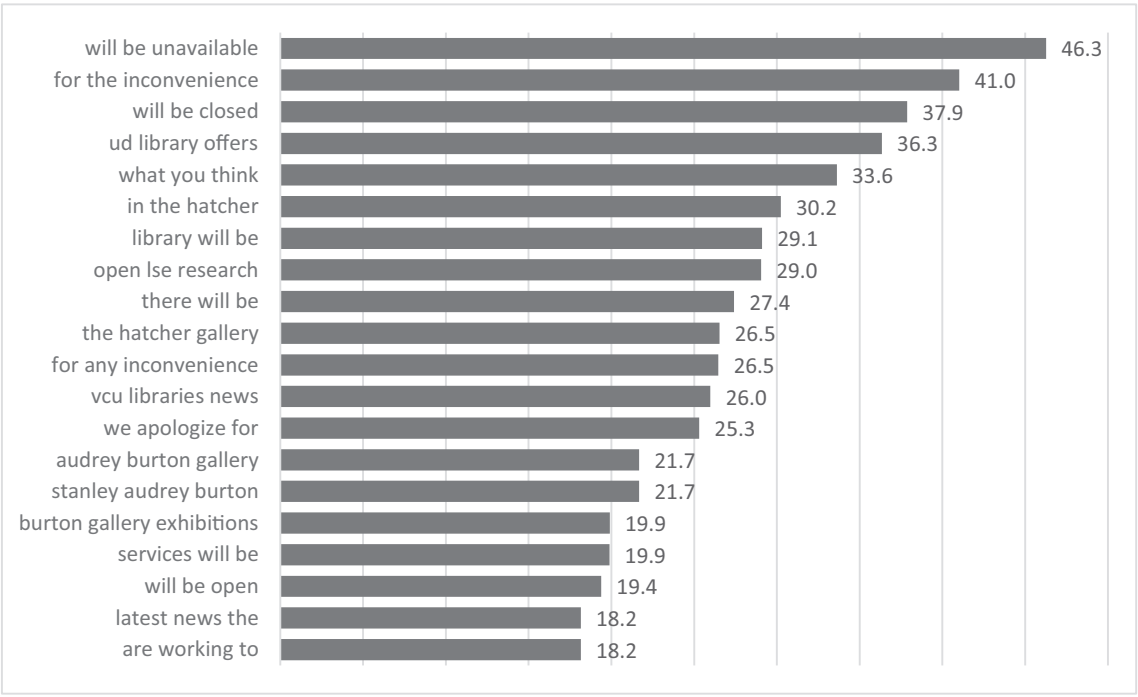

Fig. 10. Distribution of trigrams in posts with LOW engagement.

Discussion

The research employed text and data analytics for knowledge discovery of patterns in a dataset collected from academic libraries Facebook pages of the top 100 universities, as listed in the 2014 Shanghai World University Rankings. The research findings are based on analysis of 18,333 posts, 113,621 likes, and 3401 comments over a two-year period. Our data analysis identified differences among academic libraries in Facebook usage. These differences were conspicuous even among academic libraries in the same country, as previously noted by Ayu and Abrizah (2011) in Malaysia, and by Winn et al. (2017) in Canada. In the current study, there were differences in the average frequency of posts, and the number of page likes, post likes, and comments. These differences were expected, as these libraries are located in different cultures and different higher institutions, each with different library resources.

Analysis of the most frequently occurring terms provided two contexts for the significant unigrams in posts with high engagement. The first context is content type, such as a photo. This is also evident from the results of the top ten most liked posts as most of these posts were pictures. This is an indication that people tend to “like” or be more favorable to posts that contain pictures, in particular pictures of animals and local scenes (especially weather-related). Houk and Thornhill (2013) found that user engagement increased when photos were

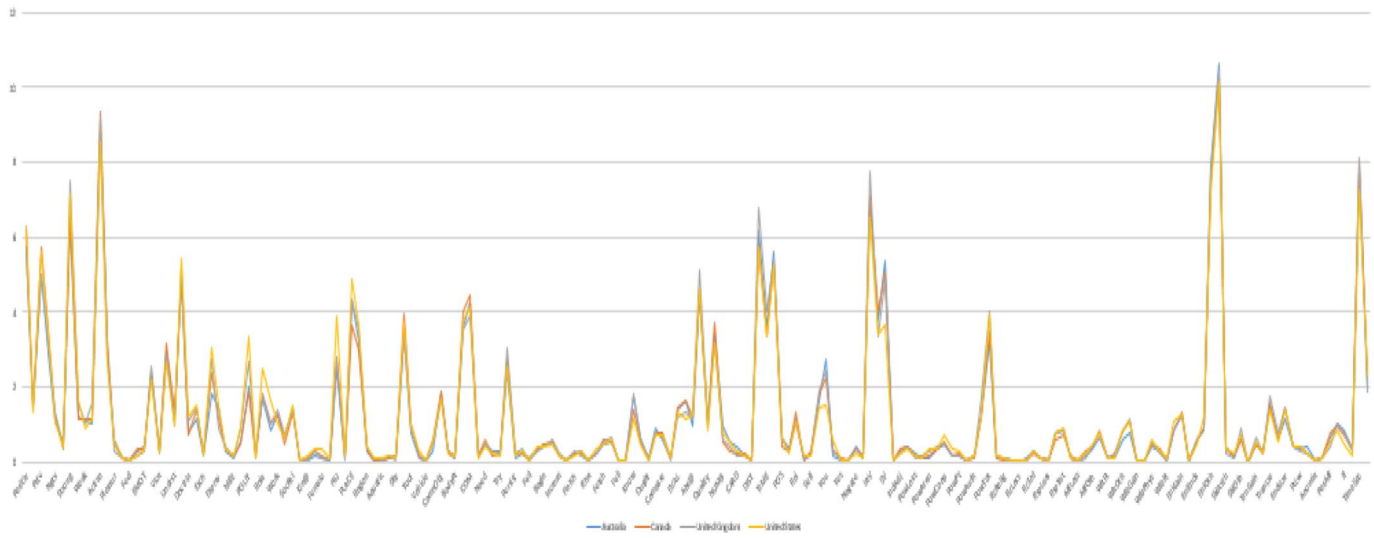

Fig. 11. Prevalent semantic categories in Facebook posts by country.

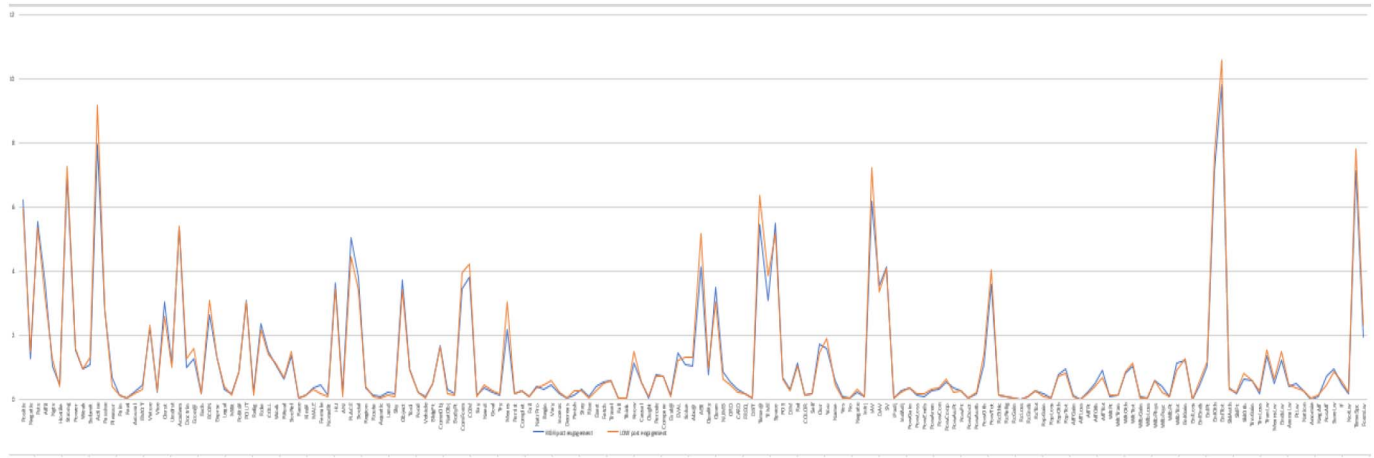

Fig. 12. Semantic analysis of Facebook posts with high vs. low engagement.

posted. The second context is the use of personal terms such as "congratulations" and "thanks." This confirms results from other studies that found academic libraries use personal language (e.g., Ayu & Abrizah, 2011; Phillips, 2011; Tan et al., 2012). This might be because these libraries engagement strategies included the use of contests, and reference to important student events such as graduation. Indeed, Chatten and Roughley (2016) recommended the use of such language. Our results also found that the category Overstatement was the top semantic category for libraries' Facebook content, followed by Place and Social, which confirms that the focus of the academic libraries on Facebook is engagement and visibility. Usually, these semantic categories are associated with collaborative community activities or events. However, it seems that academic libraries attract little attention when connecting their Twitter accounts to their Facebook accounts, insofar as the term "retweeted" is associated with low engagement. It seems that people does not interact with much of the non-original content.

The top frequently occurring significant bigrams in posts with high engagement were for terms such as "USC digital," "Whittington photography," "Dick Whittington," etc., demonstrating that libraries frequently use words associated with institutional ID/loyalty. This supports the conclusion of Akporhonor and Olise (2015) that social media can play a role for libraries in building their image and brand loyalty. This is evident also from the analysis of trigrams in posts with high engagement—for example, "the USC digital," "USC digital library," "in the USC," and so on. Again, semantic analysis of posts with high engagement supports this result. As discussed above, academic libraries use more overstatement terms. Other bigrams and trigrams in posts with high engagement are associated with pictures. Academic libraries use posts associated with pictures to build their image and generate engagement. The analysis of the top 50 most liked posts in the current study show that these include pictures. This result is supported by others such as Parvin (2017). Other bigrams and trigrams are associated with other types of posts such as those related to local animals, collections (e.g., historical, digital, special and rare collections), library winning awards/grants, weather, and contests.

The most frequent unigram terms in posts whose content attracts low engagement are terms such as "unavailable," "maintenance," and "closed." These are likely to be related to announcements and news content. Other studies, such as Aharony (2012), Chen et al. (2012), and Al-Daihani and AlAwadhi (2015), conclude that announcements are also the most frequent content type posted by academic libraries on Twitter. Other studies such as Harrison, Burress, Velasquez, & Schreiner found announcements about events within the library such as book fairs/sales, game nights, poetry readings, and speakers. However, the results of our study do not support the conclusion reached by Parvin (2017), who stated that announcements are used by academic libraries to increase user engagement. Indeed, content related to announcements was clearly in the most frequently occurring trigrams for posts with low engagement. These terms include "will be unavailable," "for the inconvenience," "there will be," "for any inconvenience," "we apologize

for," "will be open," "are working to," and so on. While these announcements provide utility to library users (e.g. helping users avoid futile trips when the library is closed), these announcements do not attract active liking or commenting. The semantic content analysis for posts with low engagement demonstrated that this content had an active tone. Active words were typically used to describe unilateral action by the library, rather than mutual or social activity, and thus attracted low engagement.

Among all the libraries in our dataset, the most frequently occurring semantic categories for the content of libraries' posts were related to the Enlightenment category. The results of this study are consistent with the findings of Al-Daihani and Abrahams (2016) from their analysis of a tweets dataset from academic libraries. This suggests there are few differences in academic libraries' content on Facebook and Twitter. Semantic analysis also shows that only about 18% of the words in the libraries' Facebook posts are not found in the General Inquirer dictionary, compared to about 30% for Twitter posts in the study by Al-Daihani and Abrahams (2016). This is likely to be due to fewer abbreviations in Facebook posts compared with tweets. Overall, the semantic analysis reveals a small number of differences in the content of Facebook posts between academic libraries in different countries. The differences in content might be related to cultural differences, as evident, for example, in US academic libraries' use of words related to the Role semantic category. This indicates that more interpersonal content is used by US libraries compared with other libraries. It seems that non-US libraries use more direct factual explanations than libraries in other countries.

Conclusion

This research conducted text and data analysis of the content of 100 academic libraries' Facebook posts. This paper contributes to analytic literature about academic libraries' use of social media. The results will be useful to academic libraries that wish to understand patterns of content in their engagement with users. The results can also be used as a basis for developing or updating social media strategies.

Future research could usefully apply a similar analysis to the comments of users of academic libraries on Facebook. This is could give more in-depth insight into the patterns of these comments. Another avenue of research would be to apply our research to non-English-language libraries—for example, Arabic academic libraries—for cross-language comparisons.

References

Aharony, N. (2012). Facebook use in libraries: An exploratory analysis. *ASLIB proceedings: New information perspectives. vol. 64(4). ASLIB proceedings: New information perspectives* (pp. 358–372).

Akporhonor, B. A., & Olise, F. N. (2015). Information and knowledge management librarians' use of social media for promoting library and information resources and services in university libraries in south–south Nigeria. *Information and Knowledge Management, 5*(6), 1–8.

Al-Daihani, S. M., & Abrahams, A. (2016). A text mining analysis of academic libraries' tweets. *The Journal of Academic Librarianship, 42*(2), 135–143.

Al-Daihani, S. M., & AlAwadhi, S. A. (2015). Exploring academic libraries' use of twitter: A content analysis. *The Electronic Library, 33*(6), 1002–1015.

Ayu, A. R. R., & Abrizah, A. (2011). Do you Facebook? Usage and applications of Facebook page among academic libraries in Malaysia. *International Information and Library Review, 43*(4), 239–249.

Chatten, Z., & Roughley, S. (2016). Developing social media to engage and connect at the university of Liverpool library. *New Review of Academic Librarianship, 22*(2–3), 249–256.

Chen, D. Y.-T., Chu, S. K.-W., & Xu, S.-Q. (2012). How do libraries use social networking sites to interact with users. *Proceedings of the American Society for Information Science and Technology, 49*(1), 1–10.

Delen, D., & Crossland, M. D. (2008). Seeding the survey and analysis of research literature with text mining. *Expert Systems with Applications, 34*(3), 1707–1720.

Fan, W., Gordon, M. D., & Pathak, P. (2005). Effective profiling of consumer information retrieval needs: A unified framework and empirical comparison. *Decision Support Systems, 40*(2), 213–233.

Gao, W., & Wallace, L. (2017). Data mining visualizing and analyzing faculty thematic relationships. In D. Mueller (Ed.). *At the helm: Leading transformation*Baltimore, Maryland: Association of College and Research Libraries Conference (22–25 March 2017).

Gerolimos, M. (2011). Academic libraries on Facebook: An analysis of users' comments. *D-Lib Magazine. 17.* (11/12), Available at: http://www.dlib.org/dlib/november11/gerolimos/11gerolimos.html, Accessed date: 28 November 2017.

Glazer, H. (2012). "Likes" are lovely, but do they lead to more logins?: Developing metrics for academic libraries' Facebook pages. *College & Research Libraries News, 73*(1), 18–21.

Han, J., Kamber, M., & Pei, J. (2012). *Data mining: Concepts and techniques.* Amsterdam: Morgan Kaufmann.

Harrison, A., Burress, R., Velasquez, S., & Schreiner, L. (2017). Social media use in academic libraries: A phenomenological study. *The Journal of Academic Librarianship, 43*(3), 248–256.

Houk, K. M., & Thornhill, K. (2013). Using Facebook page insights data to determine posting best practices in an academic health sciences library. *Journal of Web Librarianship, 7*(4), 372–388.

Lone, T., & Khan, R. (2014). Data mining: Competitive tool to digital library. *Journal of Library & Information Technology, 34*(5), 401–406.

Luarn, P., Lin, Y. F., & Chiu, Y. P. (2015). Influence of Facebook brand-page posts on online engagement. *Online Information Review, 39*(4), 505–519.

Nagarkar, S. P., & Kumbhar, R. (2015). Text mining: An analysis of research published under the subject category 'information science library science' in web of science database during 1999–2013. *Library Review, 64*(3), 248–262.

Nielsen, F.Å. (2011). A new anew: Evaluation of a word list for sentiment analysis in microblogs. *Proceedings of the ESWC2011 workshop on 'making sense of microposts': Big things come in small packages, Heraklion, Greece, 29 May–2 June 2011* (pp. 93–98). . Available at http://arxiv.org/abs/1103.2903, Accessed date: 28 November 2017.

Okerson, A. (2013). Text & data mining - A librarian overview. At: IFLA world library and information congress, 17–23 August 2013, Singapore. Available at: http://library.ifla.org/252/1/165-okerson-en.pdf, Accessed date: 28 November 2017.

Olajide, A., & Alao, A. (2016). Analysis of social media use among academic libraries. *Journal of Balkan Libraries Union, 4*(1), 20–26.

Parvin, S. (2017). Facebook as a communication tool for an academic library. East west university library, Bangladesh perspective. *International Information & Library Review, 49*(3), 237–247.

Phillips, N. K. (2011). Academic library use of Facebook: Building relationships with students. *Journal of Academic Librarianship, 3*(6), 512–522.

Renaud, J., Britton, S., Wang, D., & Ogihara, M. (2015). Mining library and university data to understand library use patterns. *The Electronic Library, 33*(3), 355–372.

Shanghai (2014). Academic ranking of world universities. Available at: http://www.shanghairanking.com/ARWU2014.html, Accessed date: 28 November 2017.

Siguenza-Guzman, L., Saquicela, V., Avila-Ordóñez, E., et al. (2015). Literature review of data mining applications in academic libraries. *The Journal of Academic Librarianship, 41*(4), 499–510.

Singh, P. K. (2016). Significance of data mining for library personnel. *International Journal of Information Dissemination and Technology, 6*(3), 159–160.

Stone, P. J., Dunphy, D. C., & Smith, M. S. (1966). *The general inquirer: A computer approach to content analysis.* Oxford, England: M.I.T. Press.

Stone, S. (2014). Breaking the ice: Facebook friending and reference interactions. *Reference & User Services Quarterly, 54*(1), 44–49.

Tan, C., Hedren, S. W. Y., Kiat, F. S. E., & Somasundram, V. (2012). Asia-Pacific libraries on Facebook: Content analysis on posts and interactions. *Singapore Journal of Library & Information Management, 41*, 51–68.

Wan, G. (2011). How academic libraries reach users on Facebook. *College and Undergraduate Libraries, 18*(4), 307–318.

Winn, D., Rivosecchi, M., Bjerke, J., et al. (2017). MTL 2.0: A report on the social media usage and user engagement of the "big four" academic libraries in Montréal. *Journal of Academic Librarianship, 43*(4), 297–304.

Witte, G. G. (2014). Content generation and social network interaction within academic library Facebook pages. *Journal of Electronic Resources Librarianship, 26*(2), 89–100.

Zhang, Y., & Gu, H. (2011). Text mining with application to academic libraries. In Y. Yu, Z. Yu, & J. Zhao (Vol. Eds.), *Computer science for environmental engineering and ecoinformatics: communications in computer and information science. vol. 158. Computer science for environmental engineering and ecoinformatics: communications in computer and information science* (pp. 200–205).