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Research Article

Analyzing e-government agencies' Twitter/X engagement: A case study of Nevada

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ABSTRACT

This research aims to investigate the dynamics of interactivity between Nevada's e-government and its citizens through the utilization of social media, with a specific focus on Twitter. Employing a mixed-methods approach, the study analyzed how Nevada state agencies engage with the public on Twitter, while concurrently assessing citizens' responses through qualitative empirical research. These responses were categorized into content features, encompassing subjective opinions and sentiments (positive/negative), and structural features, comprising objective elements like special characteristics and multimedia components. Content analysis was employed to explore these features, leading to the identification of seven themes within a hypothesized two-dimensional framework, encompassing both the reflection of interactivity and the transmission of interactivity.

Quantitative methods, specifically ANOVA and multiple regression analysis, were utilized to test the hypothesis. The findings revealed that Nevada e-government agencies predominantly used Twitter for one-way information dissemination, with limited two-way communication with citizens. To enhance interactivity, it is suggested that e-government posts incorporate multimedia elements and external links to facilitate information dissemination. Public administrators in the State of Nevada should focus on providing valuable and beneficial government posts, encouraging citizens to respond and express their opinions. Continuous training for public administrators is recommended, given the rapid advancements in technology and social media platforms.

Furthermore, adopting best practices from domestic and international social media companies is advised to stay innovative. Public administration should transition from merely governing individuals and information to becoming facilitators and moderators of discourse on social media platforms. State e-government can strengthen citizen interaction by consistently delivering valuable information on social media, thereby obtaining immediate feedback, and influencing public opinion.

Keywords: e-government in Nevada state, social media platforms, Twitter/X, interactivity, public administration, citizens

INTRODUCTION

Social media platforms have become an integral part of citizens' lives, and all levels of government use these channels to interact with constituents (Haro-de-Rosario et al., 2018). Among these platforms, Twitter plays a significant role in e-government by opening channels for citizens to provide feedback and engage with their government (Stone & Can, 2021). While various social media platforms have many active users, Twitter stands out due to its unique open communication capabilities. It allows users to create free accounts and communicate through concise messages of up to 280 characters, fostering thoughtful and precise communication. Twitter's community demonstrates strong loyalty, and despite its similarities to Facebook, Twitter's impact on e-government services its distinct (Bonsón et al., 2019). The literature on Twitter in the public sector, especially at the municipal level, is limited and often focuses on its role as an election campaign tool.

There are several compelling reasons to investigate state e-government agencies' use of Twitter. Frist, Twitter's popularity as a microblogging platform provides simple, low-cost methods for government agencies to engage with citizens on various issues (Stone & Can, 2021). Second, Twitter effectively engages large numbers of citizens, facilitating conversations that can offer new insights and innovations for the public sector (Bonsón et al., 2019; Haro-de-Rosario et al., 2018). For instance, the city of Las Vegas uses Twitter to communicate directly with followers and track their engagement and interests.

Despite these advantages, there remains a lack of empirical studies on social media's role in improving interactivity between governments and the public (Song, 2017), this study aims to fill this gap by examining the interactivity specifically through Twitter in the context of Nevada's e-government. The research questions guiding this study are:

1. How can interactivity be measured?
2. What factors influence interactivity?
3. How can interactivity between agencies and citizens be facilitated via social media?

By addressing these questions, this study seeks to provide valuable insights into the role of Twitter in enhancing government-citizen interactions and contribute to the broader understanding of e-government practices.

LITERATURE REVIEW

Digital Synergy: Social Media and E-Government

E-government: Legislation, adoption, and integration

Enacted in 2002, the U.S. e-Government Act stands as a pivotal legislative cornerstone that guides the continual evolution of federal information technology management practices. Its principal aim is to propel endeavors aimed at augmenting the accessibility of government information and services through online platforms (Misran et al., 2021; Moreno et al., 2018; Song & Lee, 2016). E-government, as facilitated by this legislative framework, extends to citizens round-the-clock access to a spectrum of resources, including information, forms, and streamlined government-citizen transaction processing. This encompasses a range of tasks, from the renewal of automobile registration to filing taxes.

Empirical research underscores the transformative impact of investing in e-government initiatives. Such investments not only enhance the delivery of services but also result in substantial cost reductions (Abu-Shanab, 2021; Criado & Gil-Garcia, 2019). The widespread adoption of e-government is conspicuous across public agencies, transcending government hierarchies. This prevalence is attributed to the proliferation of internet-based public services and the assimilation of intelligent technologies across diverse policy domains and governmental operations (Criado & Gil-Garcia, 2019; Manoharan, 2013). The multifaceted influence of the U.S. e-Government Act underscores its role as a catalyst in reshaping the landscape of government-citizen interactions.

E-government has evolved in synchrony with modern technologies, particularly social media, aiming to reinforce the foundational principles of e-participation, facilitate streamlined information dissemination, and

empower citizens to actively engage in governance processes. These pivotal roles encapsulate the core objectives driving the inception of e-government initiatives.

Within the realm of social media, various applications offer web-based services endowed with diverse functionalities and features. These tools actively support user connections, enabling the construction of profiles, and facilitating the seamless sharing of content within the system. The synergy between e-government and social media platforms enhances communication efficiency and the delivery of government services. Moreover, this integration fosters a transparent environment, aligning with the overarching goal of establishing accessible and participatory governance mechanisms.

Social media and government communication

In the realm of contemporary communication, prominent social media platforms – Facebook, Twitter (X), YouTube, and Instagram – are wielded extensively as conduits for government engagement. President Obama's (2009) pivotal 'transparency and open government' memo delineates a strategic framework encompassing three pillars: the imperative for executive departments and agencies to augment participation, foster collaboration, and enhance transparency. Implicit in this mandate is the Open Government Initiative, which advocates for the adept utilization of 'new technologies' by executive entities to fulfill these objectives. Chief among these technologies are social media tools, serving as dynamic facilitators of two-way communication channels between governments and their citizenry.

The integration of social media into governmental practices has significantly enhanced transparency, as evidenced by agency postings that openly address issues and disseminate information to the public (DePaula et al., 2018; Misran et al., 2021; Song, 2017). This utilization of social media technologies by government entities represents a natural extension of contemporary digitization efforts within e-government services. Within the public sector, the incorporation of social media platforms can be aptly characterized as the adoption of information and communication technology (ICT) in government operations (DePaula et al., 2018).

The advent of ICTs has not only created opportunities for heightened government efficiency and effectiveness but has also posed challenges to established standard operating procedures and norms (Criado & Gil-Garcia, 2019; Moreno et al., 2018). This transformative shift underscores the dynamic impact of technology on governance, prompting a reevaluation of traditional practices in favor of more agile and responsive approaches.

The United States government has exhibited a discernible trend in the increased incorporation of social media platforms as tools for disseminating information to both governmental agencies and citizens. This strategic shift finds its origins in the implementation of a Memorandum on Transparency and Open Government during the tenure of former president Barack Obama. This memorandum mandates executive departments and agencies to undertake specific actions geared toward the realization of a more transparent government (Born et al., 2019; Ganapati & Reddick, 2012). A case in point is the city of Las Vegas in Nevada, which in adherence to this memorandum, has strategically employed Twitter as a direct communication channel with a growing base of followers, predominantly citizens (Davies, 2018; Munks, 2016).

Despite the palpable momentum toward social media integration in governmental communication, a comprehensive review of the existing literature underscores a noteworthy gap in scholarship. Specifically, there is a scarcity of research that delves into the dynamics of interactivity between Nevada state governments and their constituents via social media. This scholarly void warrants further exploration to illuminate the nuances and implications of these evolving communication channels within the governmental context.

Social media: Evolving communication paradigms

In contrast to traditional one-way interactions facilitated by e-government applications, social media introduces a crucial differentiating facet – the ability to foster two-way communication with various constituents (Fretwell, 2016; Misran et al., 2021). Initially designed to educate and inform the public, e-government applications, particularly government websites, operated as portals following agency logic. This conventional approach often resulted in one-way communication, where citizens could email agencies, but instant responses were rare and response times prolonged (Lovari & Valentini, 2020; Mergel, 2013).

Social media platforms, on the other hand, go beyond the informative role, enabling discussions around disseminated information. They enable agencies to initiate dialogues, promoting the exchange of information, reminiscent of the traditional approach embraced by governmental agencies. Results from general polls on social media platforms contribute tangible value for government operations, providing innovative ideas for cost-cutting and policy changes that can inform future decision-making (Lovari & Valentini, 2020; Mergel, 2012).

The utilization of social media within the framework of e-government stands as a pivotal development, signifying a paradigm shift in how governments interact with citizens. Social media platforms, including but not limited to Facebook and Twitter, have become integral tools for public administration.

The importance of social media for e-government: Opportunities and challenges

In recent years, there has been a growing global emphasis on reforming the public sector through the strategic application of ICTs to enhance the delivery of services to citizens and various stakeholders (Khan et al., 2020). Government entities have adopted social media platforms as crucial instruments to improve service quality and foster more efficient engagement with the public (Khan et al., 2020; Park et al., 2015). Social media presents an opportunity for government organizations to enhance accessibility, responsiveness, and efficiency, while concurrently enabling the public to articulate their perspectives on government policies and the quality of public services.

One of the key opportunities afforded by the incorporation of social media in e-government is the potential to significantly enhance citizen engagement. These platforms offer a direct line of communication between government agencies and the public, providing a space for real-time interaction and feedback. Through the immediacy of social media, governments can disseminate information swiftly, while citizens gain a platform to express their views and concerns, fostering a more participatory and inclusive governance model (Ly & Ly, 2023).

Accessibility represents another noteworthy advantage stemming from the integration of social media into e-government initiatives. Accessible to government agencies and citizens with internet connectivity, these platforms establish communities, networks, and interactive capabilities at minimal costs (Hrdinová et al., 2010; Khan et al., 2020; Park et al., 2015). This increased accessibility not only facilitates the dissemination of government services but also empowers citizens by providing them with easier access to information, thereby promoting transparency and accountability.

Amidst the plethora of opportunities associated with the incorporation of social media into e-government initiatives, challenges emerge that warrant careful consideration. A salient concern centers on the realm of data security and privacy (Logas et al., 2022). The extensive volume of information disseminated on social media platforms prompts inquiries into safeguarding sensitive government data and preserving the privacy of citizens. To effectively contend with these challenges, an imperative arises to develop comprehensive policies and frameworks. These instruments are indispensable for ensuring the secure and ethically sound utilization of information within the digital domain of governance (Choenni et al., 2022).

By understanding the opportunities and challenges posed by social media in e-government, policymakers, researchers, and practitioners can collaboratively work towards harnessing the benefits while mitigating potential risks, thereby shaping a more efficient and responsive government-citizen interface.

THE INFLUENCE OF SOCIAL MEDIA ON HABERMAS CRITICAL THEORY

Critical theory emerges as a pertinent framework for understanding the dynamic landscape of communication tools between the government and the public. Rooted in a commitment to critique and transform societal structure, as articulated by Turner (2013), critical theory offers both descriptive and normative foundations for social inquiry. Its objectives encompass diminishing societal domination and fostering increased freedom across diverse domains (Turner, 2013). Through the elucidation of explicit norms for criticism and the identification of achievable goals for societal transformation, critical theory provides a robust lens for examining the evolving dynamics of communication between the government and the public. In this context, the significance of public opinion emerges as a crucial force, playing a pivotal role in upholding the foundations of a democratic society.

Renowned critical theorist Jurgen Habermas (1989) offers conceptual frameworks supporting this inquiry, particularly through this work, "Structural transformation of the public sphere". Turner's (2013) interpretation emphasized that the public sphere is a space for societal discussions, where individuals deliberate without recourse to custom, dogma, or force, resolving differences through rational argument. According to Habermas (1989), the public sphere necessitates the supportive spirit of cultural traditions, patterns of socialization, and a populace accustomed to freedom, surpassing the institutional assurances of the legitimate state (Habermas, 1992).

In contemporary contexts, social media platforms can be seen as a manifestation of the public sphere, enabling new forms of public interaction through communicative action. Habermas (1984) defines communicative action as coordinated actions achieving mutual understanding. The impact of social media, particularly in recent U.S. electoral campaigns, is evident in its powering effects on online discussion and fundraising. For public administrators navigating the political realm of social media, a legitimacy dilemma arises. Administrators are expected to be open to public involvement while maintaining a non-political stance (Knox, 2016; Nedeljakova, 2023). Leveraging social media through communicative action allows administrators to address controversial issues and justify their service to citizens.

Critical to the principles of the public sphere is the open discussion of general societal concerns. In the public sector, the use of social media plays a pivotal role in policymaking for marginalized and powerless populations. The public sphere facilitated by social media significantly enhances public participation, fostering debates on key issues and advancing the cause of participatory democracy (Dommett & Verovšek, 2021; Kellner, 2014).

A critical concern to comprehend and consider revolves around the transfer of elements perceived as public, defined as spaces for sharing and engaging in debates, which now extends beyond traditional public squares or conventional media communications (Ruano, 2019). This confluence of structure and cultural shifts is frequently denoted as a transition from a mass-mediated public sphere to a networked public sphere (Kersey, 2011; Ruano, 2019).

In the contemporary digital landscape, social media applications have emerged as powerful tools, offering the public significant opportunities to comprehend e-government services. This extensive array of platforms enhances interactivity, providing users with dynamic channels to engage with and understand e-government initiatives. Notably, social media's interactive features facilitate communication with citizens and contribute to the enhancement of transparency, participation, and cooperation (Brainard & McNutt, 2010; Hao et al., 2016; Ly & Ly, 2023; Mergel, 2012, 2013). This multifaceted engagement serves as a bridge between e-government entities and the public, fostering a more collaborative and informed civic environment.

The analysis of metrics from social media platforms provides invaluable empirical insights for shaping public policy. Research into the impact of social media on e-government holds substantial potential for informing policies that prioritize accountability, transparency, and service delivery. A nuanced understanding of social media interactions equips policymakers with the knowledge needed to formulate strategies for enhancing citizen engagement, ensuring compliance with initiatives like the Open Government initiative and optimizing the overall effectiveness of e-government services.

The literature review underscores the transformative role of social media in cultivating interactivity between e-government entities and the public. Through an exploration of various dimensions of online interaction, ranging from two-way communication to feedback mechanisms, empirical studies and analyses contribute to the ongoing discourse on the intricate interplay between e-government and social media. This body of research aims to enrich our understanding of how these platforms can be harnessed to advance the goals of modern government.

ANALYTICAL FRAMEWORK

The study employs Habermas's critical theory as a framework to analyze interactivity within the context of government-citizen communication through Twitter. Effective interaction between government entities and citizens is often best exemplified through online communication. In this process, a government agency

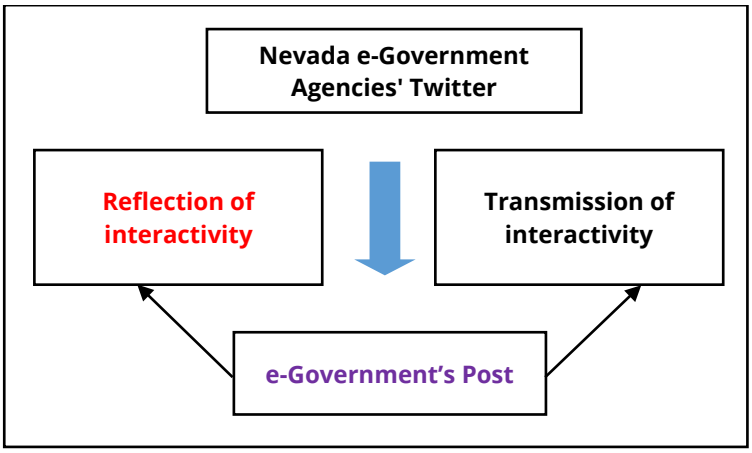

Figure 1. Analytical framework (Source: Song, 2017)

initiates communication by posting a message via Twitter to the public, after which the public responds by engaging through posts, likes, and reposts.

This study is guided by two dependent variables:

(1) the reflection of interactivity and

(2) the transmission of interactivity.

The dimension of interactivity, termed "transmission," is quantified by the number of individuals who share posts, reflecting the extent to which posts are shared or forwarded within their online social networks. Conversely, the dimension of interactivity referred to as "reflection" is assessed by the number of posts and likes received by government agencies' posts. These metrics signify the feedback and responses generated by the government's online communications (refer to **Figure 1**).

Nevada E-Government Agencies' Twitter Accounts

These are the official Twitter accounts maintained by various government agencies within the state of Nevada. Each agency uses its Twitter account to interact with the public, provide information, and promote government services.

E-Government's Posts

These are the posts and messages shared by Nevada e-government agencies on their Twitter accounts. These posts serve as a means of communication with the public and contain valuable information about government services, policies, and initiatives.

Reflection of Interactivity

This component involves the analysis and examination of interactions within e-government's posts. It seeks to assess how citizens engage with the government's Twitter content, particularly through replies, likes, and other forms of feedback.

Transmission of Interactivity

This part deals with the strategies employed to make e-government posts and the resulting interactions more widely accessible. Transmission can include sharing, reposting, and using hashtags to reach a broader audience.

In this framework, Nevada e-government agencies use their Twitter accounts to share information, engage with citizens, and promote government initiatives. The degree of interactivity within these posts is examined, and strategies are employed to ensure that the interactions are disseminated to a wider audience. This holistic approach aims to enhance transparency, accessibility, and engagement between the government and the public through Twitter.

Table 1. The features of Twitter

Structural features	Examples
Special characters	@: mention
	#: hashtag, URL
Multimedia components	Picture, video, audio
Like	Favorite posts by user
Post-length status	Post-length
Timestamp	Post publication time & date
Content features	**Examples**
Tags/key phases	Topic tags; high-frequency words
Opinions & sentiments	Score-based approach; sentiment lexicons
Topics	Topics of posts
Affects subjectivity	Affective degree of posts
	Whether the language of the text is objective or subjective

Note. Adapted from Hao et al. (2016)

METHODOLOGY

Social media applications have become widely accepted sources of information and communication channels in the United States. The Obama Administration recognized government information as a public asset that must be shared with citizens. Consequently, executive departments and agencies provide links to social media platforms on their main websites. In the public sector, social media use includes online social networking services and sharing sites to support organizational missions, deliver services, and manage issues and relationships with citizens (Bretschneider & Mergel, 2011; Lovari & Valentini, 2020; Mergel, 2010, 2011). Therefore, social media plays a crucial role in enhancing the credibility, transparency, and participation of the government (Bonsón et al., 2019; DePaula et al., 2018).

The degree of citizens' responses was divided into two categories: content features and structural features. These features represent the dichotomous nature of certain independent variables in this study. Content features involve the content of social media, while structure features include objective attributes. Structural features include multimedia elements, hashtags, mentions, and external links. Content features involve originality, agency-relevance, and subject matter. Multimedia elements, hashtags, mentions, external links, and originality are continuous variables. The agency-relevance variable is dichotomous, and the subject variable is categorical, classifying posts into seven sections:

1) GA (general announcement),
2) PSA (public service announcement),
3) PR (press release),
4) SP (agency self-promotion),
5) SE (solicitation & exhortation),
6) TC (Twitter conversation), and
7) AP (agency publication).

The list of social media features is presented in **Table 1**.

Hypotheses

The analytical framework underpinning this study identifies two dependent variables, namely the "reflection of interactivity" and the "transmission of interactivity." These variables are influenced by seven independent variables categorized into structural and content features. The structural features encompass multimedia elements, hashtags, mentions, and external links, each treated as continuous variables. On the other hand, content features include original posts(continuous), agency-relevance (dichotomous), and subject (categorical). This section outlines ten hypotheses that anticipate empirical outcomes based on this analytical framework.

Structural Features

Multimedia elements

The examination of text within the context of online communication unveils its objective features, encompassing structural elements such as comments release time, visual content like pictures and videos, as well as the geographical locations of new events. These structural components function as carriers of information, exerting a notable influence on readers' reflections and sharing behaviors. In the context of this study, four distinct variables – multimedia elements, hashtags, mentions, and external links – are identified as independent factors, each representing crucial structural features.

Multimedia elements, which encompass images, graphic interchange format (GIF), and videos, play a pivotal role in enriching the content of government posts. However, their incorporation introduces a potential concern regarding information overload, a phenomenon that has been acknowledged in previous research (Hao et al., 2016). Notably, the platform formerly known as Twitter, now rebranded as 'X,' has introduced a groundbreaking update. This enhancement allows creators and brands to upload up to four images, videos, and/or GIFs within a single tweet (Neves, 2023). This innovative feature enables users to maintain flexibility by either using all four media elements in the same format or mixing and matching them based on their preferences. In the light of this transformative update, two hypotheses are formulated.

H1: There will be a positive correlation between the presence of multimedia elements and citizens' engagement with interactivity.

H2: There will be a positive correlation between the presence of multimedia elements and citizens' active participation in interactivity transmission.

These hypotheses lay the groundwork for empirical investigation, seeking to unravel the intricate relationship between multimedia elements and citizens' engagement and participation in the context of online interactions with government communications.

Hashtags

The strategic incorporation of hashtags within posts serves as a dynamic mechanism for accentuating specific keywords, enabling effective categorization, and enhancing the visibility of posts across the expansive landscape of Twitter. This widespread practice, recognized as a universal approach, empowers users to seamlessly categorize their content, rendering it more accessible and relevant to a diverse audience. The inherent advantage of hashtags lies in their role as searchable terms, offering users a convenient means to explore and contribute to discussions on a myriad of topics.

In essence, hashtags serve as digital gateways, allowing users to access a wealth of information related to their areas of interest without the necessity of following every account utilizing the same hashtag. This functionality facilitates periodic revisits to stay abreast of ongoing discussions, positioning hashtags as indispensable tools for content curation and information dissemination. Operating under the assumption that citizens leverage hashtags as a strategic means to curate content aligned with their individual interests, the ensuring hypotheses underscore the potential impact of hashtags on citizens' engagement with government posts.

H3: There will be a positive correlation between the use of hashtags and citizens' reflective engagement with interactivity.

H4: There will be a positive correlation between the use of hashtags and citizens' active participation in interactivity transmission.

These hypotheses provide a framework for empirical investigation, aiming to elucidate the role of hashtags in shaping citizens' reflective and active participation within the context of online interactivity with government communications.

Mentions

Within the dynamic realm of Twitter interactions, mentions emerge as a potent tool, infusing a personalized dimension into the platform's communicative fabric. Defined as posts containing another user's username within their body, mentions establish a direct channel of communication and engagement. The

notifications tab serves as a centralized repository, not only capturing mentions but also encompassing all subsequent replies. This design choice creates a streamlined avenue for users to effortlessly stay informed and engaged in ongoing conversations directly involving them.

The feature allowing the inclusion of multiple usernames within a single post introduces a layer of complexity, suggesting a mechanism for amplifying message visibility and potentially fostering collaborative discussion. The design aspect aligns with Twitter's commitment to providing users with versatile tools for dynamic and multifaceted communication.

A noteworthy design choice by Twitter is the omission of posts mentioning a user when visiting their profile page, underscoring the platform's real-time, notification-centric approach to interactions. This feature encourages users to engage with the immediacy of notifications rather than relying on profile-based visibility. However, the platform allows users to proactively seek out discussions involving them through the search functionality, fostering a balance between real-time engagement and retrospective exploration. In light of these nuanced functionalities, hypothesis **H5** and hypothesis **H6** suggest correlations between mentions and citizens' engagement with government posts.

H5: There will be a positive correlation between mentions and citizens' reflective engagement with interactivity.

H6: There will be a positive correlation between mentions and citizens' active participation in interactivity transmission.

These hypotheses provide a conceptual foundation for empirical investigation, aiming to unravel the intricate dynamic between mentions and citizens' reflective and active participation within the context of online interactions with government communications on Twitter.

External Links

The integration of external links within online content plays a pivotal role in enriching available resources and providing additional information for more in-depth exploration. This practice is anticipated to yield positive correlations with increased replies and reposts, thereby influencing citizens' engagement and participation on digital platforms. Two hypotheses are formulated to guide the investigation into the relationship between the inclusion of external links and citizens' interactive engagement.

H7: A positive correlation exists between the incorporation of external links and citizens' reflective engagement with interactivity.

H8: A positive correlation is anticipated between the inclusion of external links and citizens' active participation in interactive transmission.

These hypotheses set the stage for empirical investigation, aiming to discern the impact of external links on citizens' reflective engagement and active participation within the realm of online interactivity.

Content Features

In the exploration of governmental posts, attention shifts to the realm of content features, where the focus is placed on the inherent attributes of the textual content. This encompasses elements such as the comment count, originality, agency-relevance, and subject matter. As a key determinant of user engagement, the comment count of posts serves as a quantitative measure of the level of interaction elicited by the content.

Among the content features, the concept of original posts is operationalized by distinguishing between original posts and reposts. Original posts are motivated by the fact that replies and quotes frequently lack accompanying text from the respondent and these responses tend to be shorter or less informative than desired (Hosseini et al., 2020). A significant proportion of governmental social media posts comprises reposts, serving as a conduit for administrative messages to reach the wider (Hao et al., 2016). However, if an original governmental post adopts a peer-to-peer communication style, fostering a more conversational dialogue, users engaged in such interactions may be inclined to provide more replies and likes than in the case of traditional one-way communication. In alignment with these considerations, hypothesis **H9** and hypothesis **H10** posit positive correlations between original posts and citizens' engagement with government posts.

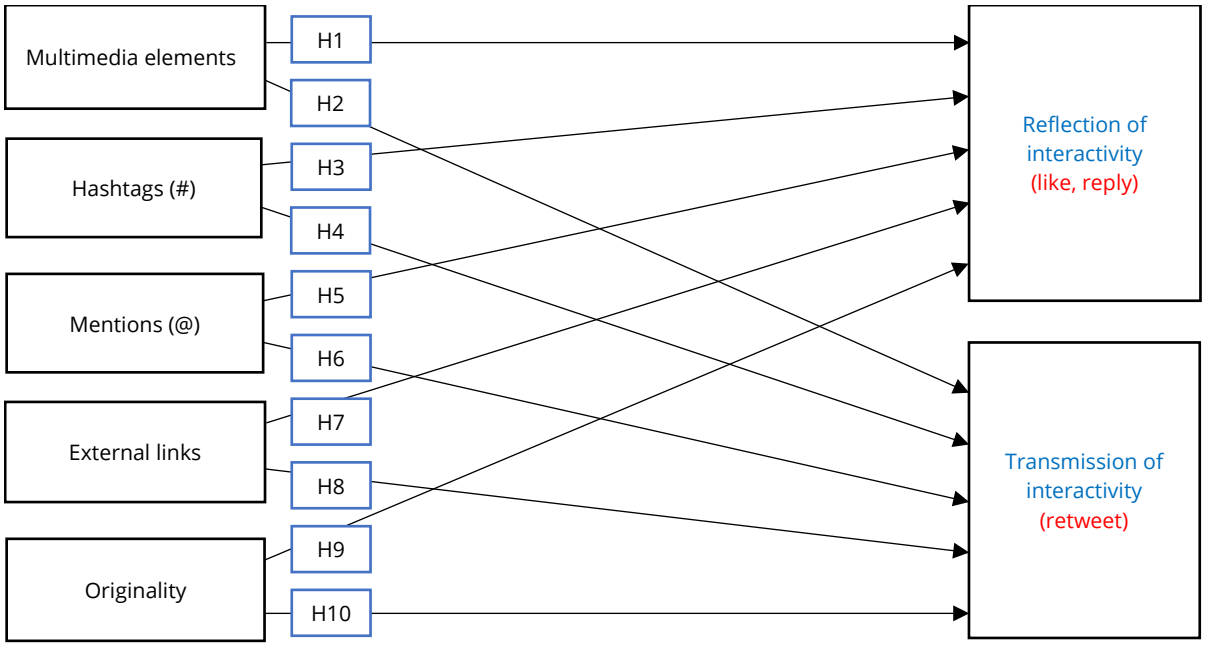

Figure 2. Research model (Source: Song, 2017)

H9: A positive correlation is anticipated between the degree of original posts in governmental posts and the extent of citizens' reflective engagement with interactivity.

H10: A positive correlation is expected between the level of original posts in governmental posts and citizens' active transmission of interactivity.

Within the realm of content features, the assessment of agency-relevance becomes a focal point, hinging on whether a given post is directly linked to the functions of the agency. This dimension is expected to wield a significant influence on the average daily ratio of replies and likes. The rationale behind this expectation lies in the notion that citizens may actively engage with and express their approval through replies and likes when content is closely tied to the agency's core functions. This impact may not extend to the average daily ratio of reports, as citizens might be more selective in sharing content, preferring to disseminate information aligned with their specific interests.

Based on the formulation of ten hypotheses, a research model is presented, and **Figure 2** visually depicts the outlined research model.

The categorical variable of subject further diversifies the content landscape, dividing it into seven distinct themes: GA, PSA, PR, SE, TC, SP, and AP. These diverse themes are anticipated to elicit varying levels of engagement, as citizens may exhibit preferences for specific topics based on their individual interests.

Underlying this assumption is the expectation that the number of comments and likes across these seven different topic categories will exhibit significant differences. Citizens, driven by their distinct interests, are likely to engage more actively with content that resonates with their preferences. However, this diversity in topics may not necessarily translate into significant variations in the transmission of interactivity, as citizens might selectively share content based on their specific interests, thereby limiting the impact of subject on the overall transmission of interactivity.

Data Collection

The data for this study was collected over a two-week period from October 15 to 31, 2017. During this period, posts from all Nevada state agencies were systematically collected based on the following criteria:

1. The Twitter account must have posted at least one tweet within the preceding two weeks.
2. Each Twitter account should have received a minimum of one reply or one retweet during the specified two-week period.

Table 2. Description of dependent variables

Dependent variables	Definition	Operationalization	Data type
Transmission of interactivity (retweet)	Diffusion of posts from government to the public	The ratio of average number of daily reposts divided by the average daily total posts accounted for the proportion of daily total number of posts	Continuous variable (CON)
Reflect on interactivity (tweet)	Response of posts from the public to government	The ratio of average number of daily likes and comments accounted for the proportion of daily total number of posts	CON

Note. Adapted from Hao et al. (2016)

The collected data encompassed key metrics such as the Twitter handle's name, the count of likes, reposts, replies, followers, following, timestamp, and multimedia features, including the presence of pictures, videos, external links, mentions, hashtags, and emoticons.

Rationale for Data Collection Period

The rationale for selecting the two-week period was to capture a representative snapshot of typical interactions between Nevada state agencies and citizens on Twitter. This period was strategically chosen to avoid major holidays or events that could skew the data, ensuring that it reflects regular engagement patterns. Additionally, a two-week timeframe was considered sufficient to gather a substantial amount of data for analysis while remaining manageable in scope. Furthermore, this period was just before the presidential election day, a time when many people were actively using Twitter to express their concerns and preferences regarding the candidates and parties. This heightened activity provided a rich context for analyzing government-citizen interactions on social media.

Ethical Considerations

Although the data collected from Twitter is publicly available, this study adheres to ethical standards to ensure the privacy and confidentiality of social media users. The privacy of individuals was maintained by anonymizing user handles and not collecting sensitive information.

This research did not require institutional review board (IRB) approval as it does not involve human subjects as defined by federal regulations. According to the IRB review, the study is considered "research" designed to contribute to generalizable knowledge but does not fit the definition of "human subjects" research. Specifically, it does not involve obtaining data through intervention or interaction with individuals or identifiable private information. Consequently, the study was excluded from the IRB review process.

Data Analysis

The investigation of Twitter accounts in Nevada state agencies was conducted through a three-step process:

(1) content analysis,

(2) one-way analysis of variance (ANOVA), and

(3) multiple regression analysis.

Content analysis

For the content analysis, feature words (see **Table 1**) were extracted from each government post on Nevada state agencies' Twitter accounts using NVIVO software. Posts were labeled based on structural and content features. The content features were classified into two categories: agency-irrelevance and agency-relevance. Within the agency-relevance category, content features were further divided into seven themes based on Lutkoski (2011): GAs, PSAs, PRs, SPs, SEs, TCs, and APs.

Statistical analysis

This study assessed the statistical contribution of content and structural features to two dependent variables: reflection of interactivity and transmission of interactivity. **Table 2** presents the definitions and operationalization of these dependent variables, as adapted from Hao et al. (2016).

Table 3. Description of independent variables

Independent variables	Definition	Operationalization	Data type	Hypotheses: Predicted coefficient	
				Y_1: Reflection	Y_2: Transmission
Structural features					
Multimedia elements	Whether a post includes pictures, or emotions, or videos	The ratio of posts that include multimedia elements accounted for the proportion of total number of posts	CON	Negative	Positive
Hashtags	Whether a post includes label "#"	The ratio of posts that include hashtag accounted for the proportion of total number of posts	CON	Positive	Negative
Mentions	Whether a post includes label "@"	The ratio of posts that include mentions accounted for the proportion of total number of posts	CON	Positive	Positive
External links	Whether a post includes external links	The ratio of posts that include external links accounted for the proportion of total number of posts	CON	Positive	Positive
Content features					
Originality	Whether a post is original tweet or retweet?	The percentage of the original tweet	CON	Positive	Positive
Agency-relevance	Whether a post is related to agency function or not?	Yes (1) & No (0)	Dichotomous	ANOVA	ANOVA
Subject	The main topics of the post	GA, PSA, PR, SP, SE, TC, &AP	Categorical	ANOVA	ANOVA

Note. Adapted from Hao et al. (2016)

Multiple regression analysis

Multiple regression analysis was employed using SPSS software to investigate the predictive relationship between the five independent variables (multimedia elements, hashtags, mentions, external links, and originality) and the dependent variables. **Table 3** describes the definitions and operationalization of independent variables from Hao et al.'s (2016) study.

One-way ANOVA

One-way ANOVA was utilized to examine the influence of agency-relevance (a dichotomous variable) and subject (a categorial variable) on both the reflection of interactivity (dependent variable) and the transmission of interactivity (dependent variable). The average daily ratio of reposts, replies, and likes across various categories, treating agency-relevance and agency-irrelevance as dichotomous independent variables, and subject categories (**Appendix A**) (GA, PSA, PR, SP, SE, TC, and AP) as categorical variables.

Coding

Agency-irrelevance was coded as "0" and agency-relevance and "1" general announcements were coded as "GA," public service announcements as "PSA," press releases as "PR," agency self-promotions as "SP," solicitations and exhortations as "SE," Twitter conversations as "TC", and agency publications as "AP".

Two codes conducted the coding process to ensure inter-coder reliability. In instances where coders categorized subjects differently, the primary investigator resolved inconsistencies through consultation with the second coder. Coders were permitted to assign more than one subject category to a single tweet when

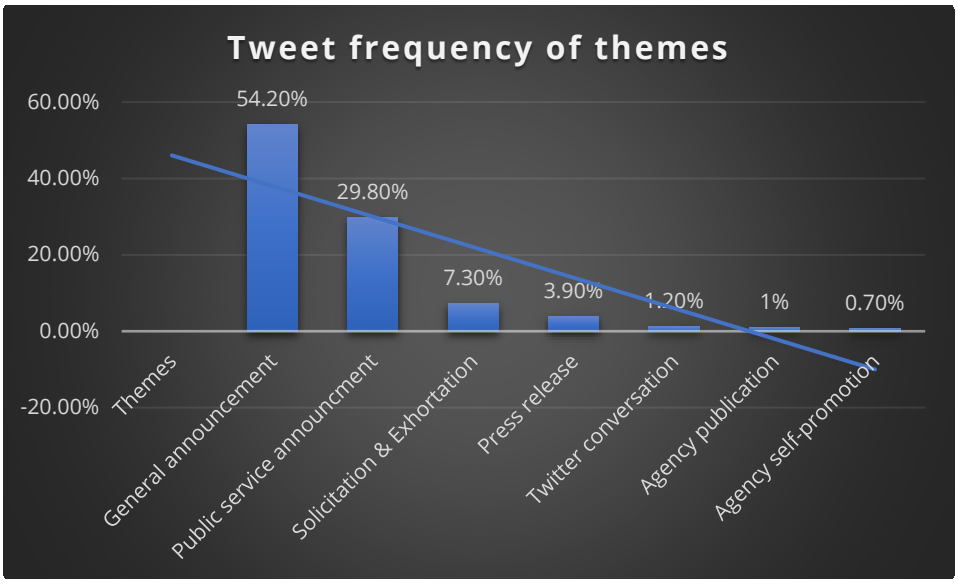

Figure 3. Tweet frequency of themes (Source: Song, 2017)

appropriate. Approximately 10% of posts were coded with more than one subject category, but these multi-subject posts typically represented a partial match, which decreased inter-coder reliability.

RESULTS

Content Analysis

The study focused on the social media presence of Nevada's state agencies, with a review of 35 Twitter accounts out of a total of 101 agencies. Notably, 33.7% of agencies had no social media accounts, while others exclusively used Facebook or Twitter accounts that were not functioning properly. Additionally, some agencies had Twitter accounts, but during the data collection period, there were no posts.

The analysis of 727 posts revealed two main categories: agency-relevant (97.4%) and agency-irrelevant (2.3%). The predominant theme, constituting 54.2% of total Twitter content, was GAs, conveying simple statements about facts or occurrences. PSAs, accounting for 29.8% of posts, were the second most common theme, addressing issues of immediate public concern, such as safety, weather, housing, health, travel, voting, and employment. The Department of Transportation, particularly handling "traffic safety," led in PSAs, contributing 65.7% of total cases.

PRs, making up 3.9% of posts, were distinguished from GAs based on coders' decisions often guided by context provided by URLs. Agencies like the Department of Education were more inclined toward PRs, constituting six out of 11 cases.

SEs, forming 7.3% of posts, invited readers to engage in events or activities. This theme was prominent during the October 2016 presidential debate, especially among colleges and universities, as exemplified by the University of Nevada, Las Vegas (UNLV).

APs were rarely tweeted about (1%), linking to newsletters, magazines, and publications from state agencies. SP, boasting achievements or promoting the organization, accounted for 0.7% of posts. These posts differed from TCs, representing 1.2% of the total, often directed at specific users.

In summary, the analysis offers insights into the diverse themes and patterns observed in Nevada state agencies' Twitter activity, providing a comprehensive understanding of their social media communication strategies. The tweet frequency of themes is shown in **Figure 3**.

Analysis of Variance

The investigation revealed statistically significant differences between Group 1 (agency-relevance) and Group 0 (agency-irrelevance) in terms of the daily ratio of reposts, as well as in the daily ratio of replies and likes. These findings underscore the distinct patterns of engagement and interaction exhibited by the two

Table 4. Results of content analysis (ANOVA)

Differences	SS	df	MS	F	p-value
Average of daily ratio of reposts (group with "1" & "0")					
Between groups	.788	1	.788	73.931	.000
Within groups	.341	32	.011		
Total	1.129	33			
Average of daily ratio of posts and likes (group with "1" & "0")					
Between groups	1.967	1	1.967	66.223	.000
Within groups	.951	32	.030		
Total	2918	33			
Average of daily ratio of reposts (group with "GA," "PSA," "PR," "SP," "SE," "TC", & "AP")					
Between groups	.762	6	.127	49.719	.000
Within groups	.286	112	.003		
Total	1.048	118			
Average of daily ratio of posts and likes (group with "GA," "PSA," "PR," "SP," "SE," "TC", & "AP")					
Between groups	2.972	6	.495	41.249	.000
Within groups	1.345	112	.012		
Total	4.316	118			

Note. *Significant level = 0.05

groups, suggesting that variations in content or audience dynamics may contribute to the observed disparities.

When exploring the daily ratio of reposts, statistical significance was identified among the various thematic groups – GA, PSA, PR, SP, SE, TC, and AP. This suggests that the nature of content, categorized into these thematic groups, has a discernible impact on the frequency of reposts. A similar pattern emerged when examining the average number of replies and likes, with statistical significance noted among the thematic groups GA, PSA, PR, SP, SE, TC, and AP. These results emphasize the significance of content categorization in influencing user engagement, as reflected in both replies and likes.

The statistical analyses were conducted using the one-way ANOVA method, as detailed in **Table 4**. This analytical approach allows for a comprehensive examination of the observed differences among the groups, providing a robust foundation for understanding the nuanced dynamics of user engagement and interaction across distinct thematic categories. The utilization of one-way ANOVA adds quantitative rigor to the study, enhancing reliability of identified statistical significance and supporting the validity of the reported findings.

Agency-relevance posts and likes

A one-way ANOVA was conducted to examine the effect of agency relevance on the ratio of posts and likes on Twitter. The results indicated a significant difference between agency-irrelevant and agency-relevant posts, with $F (1, 32) = 66.223$, $p < 0.001$. This suggests that agency relevance significantly impacts the level of interaction, measured by the ratio of posts and likes.

Descriptive statistics showed that agency-relevant posts (mean [M] = 0.5710, standard deviation [SD] = 0.08080) had a significantly higher mean ratio of posts and likes compared to agency-irrelevant posts (M = 0.0900, SD = 0.22997). The confidence interval for agency-relevant posts (95% CI [-0.0283, 0.2082]), further supports the significant difference.

Levene's test for homogeneity of variances was not significant ($p = 0.110$), indicating that the assumption of equal variances was met.

Agency-relevance reposts

The ANOVA results for the ratio reposts also indicated a significant difference between agency-relevant and agency-irrelevant posts, with $F (1, 32) = 73.937$, $p < 0.001$. This highlights that agency relevance substantially influences the number of forwards.

Descriptive statistics revealed that agency-relevant posts (M = 0.3517, SD = 0.06470) had a higher mean ratio of reposts than agency-irrelevant posts (M = 0.0472, SD = 0.13088). The confidence interval for agency-relevant posts (95% CI [0.3184, 0.3849]) was distinct from that of agency-irrelevant posts (95% CI [-0.0201, 0.1145]).

Table 5. ANOVA results for agency-relevance and content themes

Analysis	Groups/factors	M	SD	F	p	95% CI	Significant different (Tukey HSD)
Posts & likes	Group 0	0.0900	0.22997	66.223	< 0.001	[-0.0283, 0.2082]	Group 1 > group 0
	Group 1	0.5710	0.08080			[0.5295, 0.6126]	
Reposts	Group 0	0.0472	0.13088	73.931	< 0.001	[-0.0201, 0.1145]	Group 1 > group 0
	Group 1	0.3517	0.06470			[0.3184, 0.3749]	
Posts & likes	GA	0.4676	0.28012	41.249	< 0.001	[0.3236, 0.6116]	GA > PSA, PR, SP, SE, TC, & AP
	PSA	0.0861	0.05511			[0.0577, 0.1144]	
	PR	0.0118	0.02838			[-0.0028, 0.0264]	
	SP	0.0053	0.02094			[-0.0055, 0.0161]	
	SE	0.0237	0.03108			[0.0077, 0.0397]	
	TC	0.0017	0.00335			[0.0000, 0.0034]	
	AP	0.0076	0.01795			[-0.0016, 0.0168]	

Note. (1) Confidence intervals (CIs) for the means of agency-relevant groups (posts, likes, & reposts) do not overlap with those of agency-irrelevant groups, indicating differences; (2) Levene's test indicated that the assumption of homogeneity of variances was met for the agency-relevance analyses but not for the content themes analysis; & (3) Significant differences in the content themes were identified through Tukey HSD post hoc analysis, indicating that GA had significantly higher engagement compared to other themes.

Levene's test for homogeneity of variances was not significant ($p = 0.375$), indicating equal variances across groups.

Seven themes of posts and likes

An ANOVA was conducted to explore the effect of seven different content themes on the ratio of comments and likes. The themes included GA, PSA, PR, SP, SE, TC, and AP. The results showed a significant effect of theme on the ratio of comments and likes, with $F(6, 112) = 41.249$, $p < 0.001$.

Post hoc comparison using the Tukey HSD test indicated that GA had a significantly higher mean ratio of comments and likes compared to all other themes. For instance, the mean difference between GA and PSA was 0.38154 ($p < 0.001$), and between GA and PR was 0.45585 ($p < 0.001$). These results demonstrate that GAs are more engaging compared to other content themes.

However, Levene's test indicated significant differences in variances among the themes ($p < 0.001$), suggesting that the assumption of homogeneity of variances was violated. This should be considered when interpreting the ANOVA results. **Table 5** provides a summary of the ANOVA results.

Multiple Regression Analysis

The findings from the multiple regression analysis provide comprehensive insights into the factors influencing the transmission and reflection of interactivity in e-government communication via Twitter. The analysis elucidates how various structural features contribute to these two dimensions of interactivity.

Transmission of interactivity

The regression model used to examine the transmission of interactivity explained a modest portion of the variance ($R^2 = .474$, adjusted $R^2 = .234$). This indicates that while some independent variables influenced the dependent variable a significant amount of variability remains unexplained.

Among the independent variables, the ratio of mentions emerged as a significant predictor, demonstrating a positive effect on the transmission of interactivity ($\beta = 2.345$, $p = .014$). This suggests that posts including mentions are more likely to be retweeted, thereby enhancing engagement and information dissemination within the e-government context. In contrast, other variables, such as the ratios of multimedia elements, hashtags, external links, and originality, did not show significant contributions to the transmission of interactivity, as evidenced by their non-significant p-values (all $p > .05$).

Table 6 presents the detailed results of the multiple regression analysis for the transmission of interactivity.

Table 6. Results of multiple regression for transmission of interactivity

Structural independent variables	Coefficient	Standard error	t-statistic	p-value
Dependent variable: Transmission of interactivity				
Constant	.277	.043	6.465	.000*
Ratio of multimedia	-1.268	1.048	-1.210	.252
Ratio of mention function	2.345	.808	2.901	.014*
Ratio of hashtag feature	-.105	1.125	-.094	.927
Ratio of external links	-.630	1.824	-.345	.736
Ratio of originality	1.695	1.745	.972	.352

Note. *Significant level = 0.05; R^2 = .474; & Adjusted R^2 = .234

Reflection of interactivity

The model examining the reflection of interactivity provided a stronger explanatory power, accounting for a larger portion of the variance (R^2 = .614, adjust R^2 = .439). This suggests a more substantial fit for the reflection model compared to the transmission model.

Interestingly, the ratio of mentions had a significant negative impact on the reflection of interactivity (β = -2.262, p = .024). This finding indicates that while mentions may increase retweets, they do not foster the same level of direct replies or likes, implying a different dynamic in user engagement. Like the transmission model, the ratios of multimedia elements, hashtags, external links, and originality did not show significant effects on the reflection of interactivity (all p > .05).

Table 7 provides the detailed results of the multiple regression analysis for the reflection of interactivity.

Table 7. Results of multiple regression for reflection of interactivity

Structural independent variables	Coefficient	Standard error	t-statistic	p-value
Dependent variable: Reflection of interactivity				
Constant	.721	.046	15.762	000*
Ratio of multimedia	.700	1.120	.625	.545
Ratio of mention function	-2.262	.864	-2.619	.024*
Ratio of hashtag feature	.224	1.203	.186	.856
Ratio of external links	.234	1.949	.120	.906
Ratio of originality	-2.394	1.864	-1.284	.226

Note. *Significant level = 0.05; R^2 = .614; & Adjusted R^2 = .439

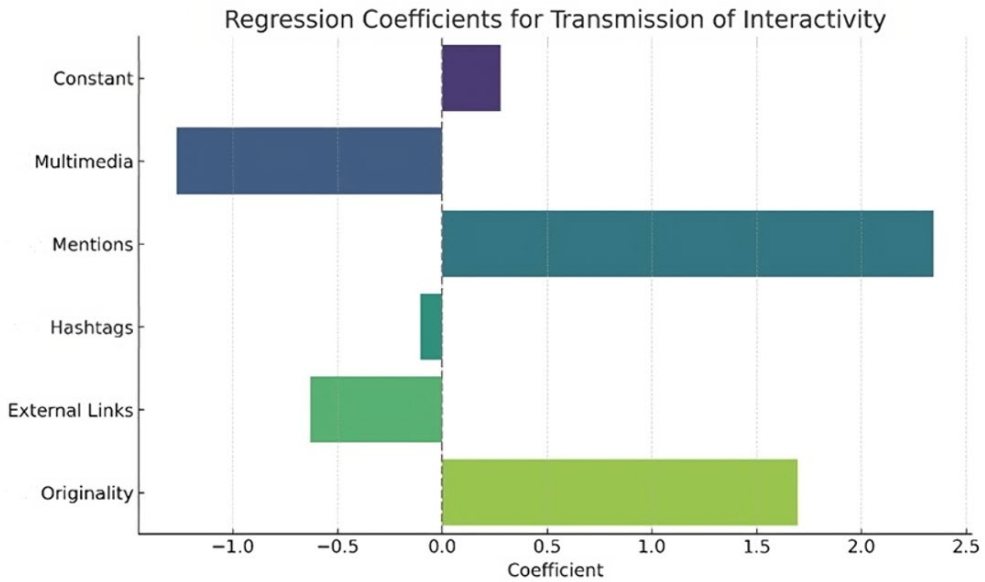

Figure 4. Regression coefficients for transmission of interactivity (Source: J. V. Song)

Figure 4 illustrates the impact of various independent variables on the transmission of interactivity (measured by retweets). The coefficient for the ratio of mentions (2.345) is significantly positive, indicating

that mentions strongly enhance the likelihood of tweets being retweeted. Other variables, such as multimedia elements, hashtags, external links, and originality, show no significant impact, as their coefficients are close to zero and their p-values are greater than 0.05. This suggests that these factors do not contribute significantly to the transmission of interactivity.

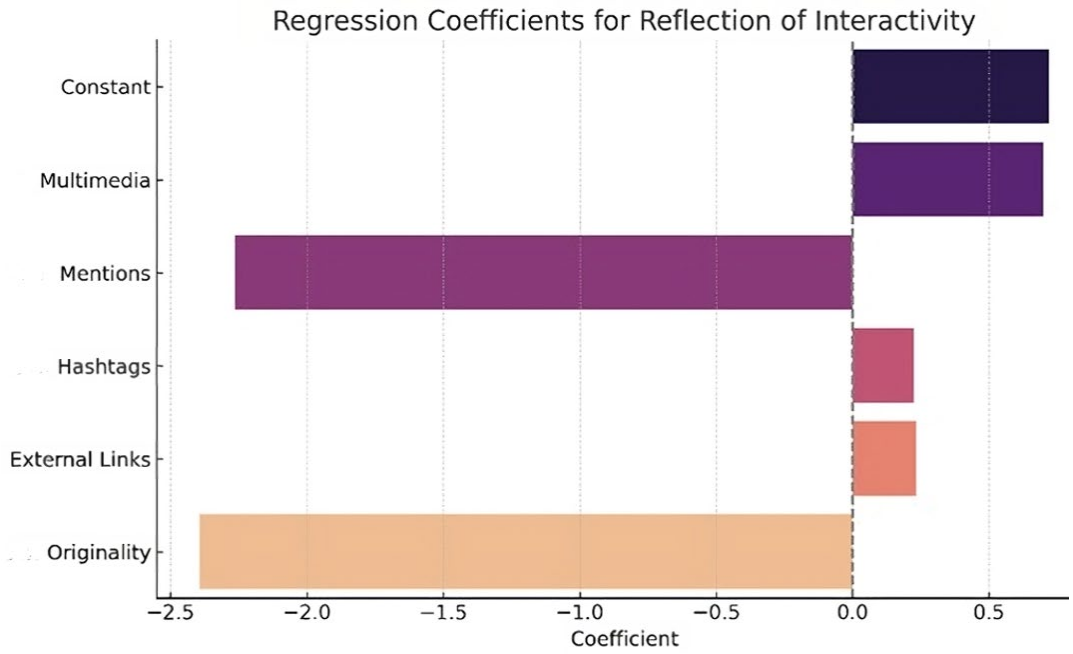

Figure 5. Regression coefficients for reflection of interactivity (Source: J. V. Song)

Figure 5 shows the influence of independent variables on the reflection of interactivity (measured by replies and likes). The coefficient for the ratio of mentions (- 2.262) is significantly negative, indicating that while mentions increase retweets, they may reduce direct engagement such as replies and likes. Other variables, including multimedia elements, hashtags, external links, and originality, do not show significant effects on reflection, as indicated by their non-significant p-values.

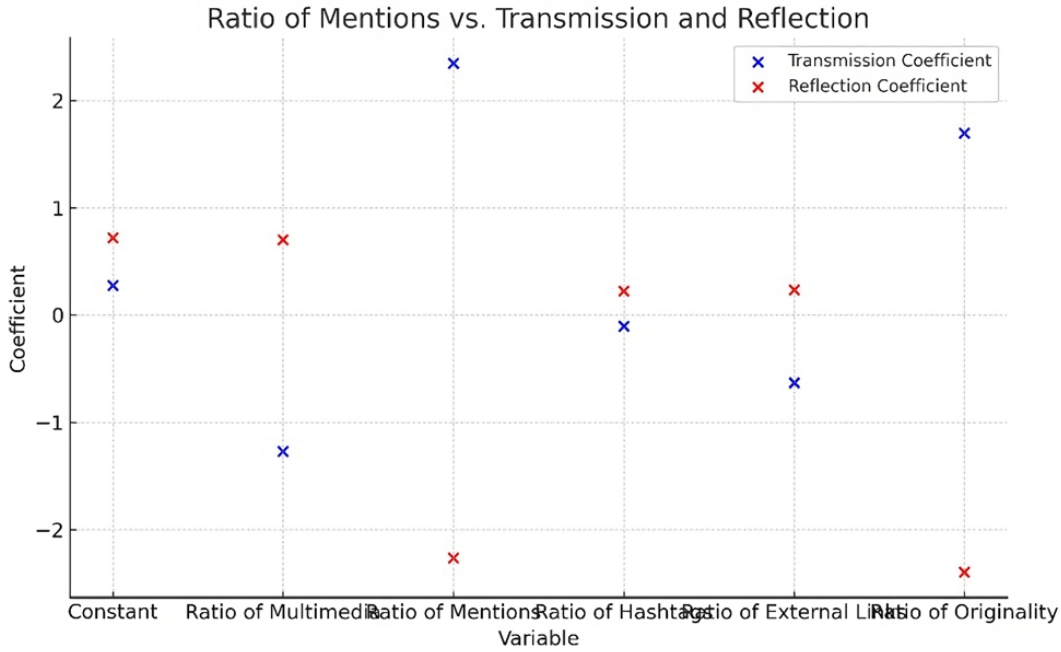

Figure 6. Scatter plot for ratio of mentions vs. transmission and reflection (Source: J. V. Song)

Figure 6 compares the coefficients of the ratio of mentions for both transmission and reflection of interactivity. The positive coefficient for transmission (2.345) underscores the role of mentions in enhancing retweets, whereas the negative coefficient for reflection (- 2.262) suggests a decrease in replies and likes when mentions are used. This dual effect highlights the complex role of mentions in social media engagement, positively influencing information dissemination while potentially reducing direct interaction.

These explanations provide a concise understanding of the visual data, elucidating the significant impact of mentions on e-government communication dynamics and varying effects of other structural features.

DISCUSSION

The content analysis of Nevada state agencies' Twitter activity provides a nuanced understanding of social media communication strategies within the framework of e-government. This study aimed to address three primary research questions:

1. How is interactivity measured?
2. What factors influence interactivity?
3. How can the interactivity of social media between Nevada e-government agencies and citizens be facilitated?

The discussion is structured around these research questions and the corresponding hypotheses.

Research Question 1: How Is Interactivity Measured?

Interactivity was measured using ratios of posts, likes, and reposts on Twitter. The statistical analysis, including ANOVA and multiple regression, revealed significant insights into user engagement dynamics. The significant F-values and low p-values from ANOVA highlight the substantial impact of content relevance and type on public interaction with government levels compared to agency-irrelevant content, supporting the hypothesis that relevant content is crucial for fostering public interaction.

Research Question 2: What Factors Influence Interactivity?

The findings indicate that several factors influence interactivity on social media.

Content relevance

Agency-relevant posts received significantly more posts, likes, and reposts. This aligns with existing theories in communication studies, particularly those emphasizing the importance of content relevance in media interaction and public engagement.

Content themes

Among the different content themes, GA were the most engaging. This suggests that timely and informative content is highly valued by the public. PSA and other informative messages also played a critical role in public engagement, particularly in addressing immediate public concerns.

Structural features

The multiple regression analysis identified mentions as a significant factor positively impacting both the transmission and reflection of interactivity. The finding underscores the importance of direct engagement and dialogue between government and citizens, aligning with Habermas's critical theory on communicative action. In contrast, multimedia elements, hashtags, and external links, while not significantly impacting interaction transmission, positively influenced interaction reflection, suggesting their role in fostering responsive engagement.

Research Question 3: How Can the Interactivity of Social Media Between Nevada E-Government Agencies and Citizens Be Facilitated?

The results underscore the need for strategic content planning to optimize user engagement. Agencies should prioritize content that is relevant and directly engage with the public. The significant role of mentions

suggests that interactive and dialogic content can enhance public engagement. Additionally, while multimedia elements and hashtags do not significantly affect the transmission of interaction, they are valuable for reflection, indicating that visually engaging and well-tagged posts can foster responsiveness and interaction.

Comparison With Existing Studies

The findings of this study are consistent with similar studies in other contexts, which have also highlighted the importance of content relevance and direct engagement in enhancing public interaction on social media (Bonsón et al., 2019; DePaula et al., 2018; Haro-de-Rosario et al., 2018). For instance, studies on e-government Twitter engagement in other regions have similarly found that timely and relevant content drives higher public engagement (Born et al., 2019; Mergel, 2013; Zhang et al., 2008). This comparison highlights the generalizability of the findings and underscores the importance of tailored content strategies across different e-government contexts (Ellison et al., 2007; Manoharan, 2013; Stone & Can, 2021; Yoon et al., 2019).

Future Research Direction

Future research endeavors could explore the utilization of various social media platforms beyond Twitter/X by public administrators. This includes platforms such as Facebook, Instagram, and LinkedIn, as well as emerging platforms like TikTok and Clubhouse. Understanding the dynamics of engagement and communication strategies across different platforms can provide valuable insights into how governmental entities can effectively leverage social media for citizen engagement and outreach.

Additionally, advancements in social media technology, such as the integration of augmented reality (AR), virtual reality (VR), and artificial intelligence (AI), present exciting opportunities for enhancing e-government communication strategies. Future research could investigate the potential applications of these advanced technologies in facilitating more immersive and personalized interactions between government agencies and citizens.

Furthermore, exploring the impact of social media communication on citizen perceptions of government transparency and accountability remains a critical area for future inquiry. Understanding how various communication strategies and platforms shape citizen perceptions can provide policymakers with valuable insights into enhancing the transparency and responsiveness of e-government initiatives.

As social media continues to evolve and play an increasingly prominent role in public administration, understanding its implications for e-government is essential. By exploring the utilization of different social media platforms and embracing advancements in social media technology, policymakers can refine their communication strategies to better serve and engage with the public, ultimately advancing the principles of democratic governance.

CONCLUSION

This study advances our understanding of social media communication strategies in e-government, emphasizing the importance of relevant content and interactive engagement in nurturing robust citizen-government relationships. By leveraging these insights, government agencies can refine their social media strategies to better serve and engage with the public, thereby advancing the ethos of democratic governance.

Embracing Habermas's critical theory, which underscores the role of communication in fostering mutual understanding and transparency, is pivotal in this endeavor. By prioritizing substantive interaction and dialogue with citizens, government agencies can work towards building more inclusive and participatory governance structures, ultimately enhancing the legitimacy and effectiveness of democratic institutions.

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Data availability: Data generated or analyzed during this study are available from the first author on request.

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APPENDIX A: SUBJECT CATEGORIES

General Announcement

A statement includes simple statements about a fact or an occurrence, such as an appointment of a new administrator or a reminder about an upcoming event.

Public Service Announcements

A statement includes raising awareness of an issue or informing the public about matters of immediate concern, such as traffic safety, weather, housing, health, travel, voting, and employment.

Press Releases

A statement is official statements from the tweeting organization announcing or promoting newsworthy information or events. This tweet shows ### as official tweet or -30- at the end of an article.

Self-Promotion

A statement tweets that act as a booster or promotion of agencies to the tweeting organization.

Solicitations and Exhortations

A statement tweets that invite the reader to engage in an event or activity or to provide information. Solicitations and exhortations ask the reader to join a group at an event, vote in an online poll, or provide information or an opinion.

Twitter Conversations

A statement contains little information and is used as part of a Twitter conversation. Can be a reply message or seek to initiate a conversation (@ [username]).

Agency Publications

This theme is link to newsletters, magazines, and other publications produced by state agencies.

APPENDIX B: THE RESULTS OF MULTIPLE REGRESSION

Transmission of Interactivity

Table B1. Descriptive statistics

	Mean	Standard deviation	N
Transmission	.3517	.06470	17
RatioOfMulti	.0527	.02589	17
RatioOfMention	.0395	.02018	17
RatioOfHashtag	.0521	.02608	17
RatioOfExternalLink	.0489	.02899	17
RatioOfOriginality	.0504	.02663	17

Table B2. Correlations

		Transmission	RatioOfMulti	RatioOfMention	RatioOfHashtag	RatioOfExternalLink	RatioOfOriginality
Pearson correlation	Transmission	1.000	.001	.509	.043	.165	.215
	RatioOfMulti	.001	1.000	.469	.825	.654	.552
	RatioOfMention	.509	.469	1.000	.342	.207	.128
	RatioOfHashtag	.043	.825	.342	1.000	.761	.673
	RatioOfExternalLink	.165	.654	.207	.761	1.000	.947
	RatioOfOriginality	.215	.552	.128	.673	.947	1.000
Sig. (1-tailed)	Transmission	.	.499	.018	.434	.263	.204
	RatioOfMulti	.499	.	.029	.000	.002	.011
	RatioOfMention	.018	.029	.	.090	.213	.313
	RatioOfHashtag	.434	.000	.090	.	.000	.002
	RatioOfExternalLink	.263	.002	.213	.000	.	.000
	RatioOfOriginality	.204	.011	.313	.002	.000	.
N	Transmission	17	17	17	17	17	17
	RatioOfMulti	17	17	17	17	17	17
	RatioOfMention	17	17	17	17	17	17
	RatioOfHashtag	17	17	17	17	17	17
	RatioOfExternalLink	17	17	17	17	17	17
	RatioOfOriginality	17	17	17	17	17	17

Table B3. Variables entered/removed[a]

Model	Variables entered	Variables removed	Method
1	RatioOfOriginality, RatioOfMention, RatioOfMulti, RatioOfHashtag, RatioOfExternalLink[b]	.	Enter

[a]Dependent variable: Transmission

[b]All requested variables entered

Table B4. Model summary

Model	R	R square	Adjusted R square	Standard error of estimate
1	.688[a]	.474	.234	.05662

[a]Predictors: (constant), RatioOfOriginality, RatioOfMention, RatioOfMulti, RatioOfHashtag, RatioOfExternalLink

Table B5. ANOVA[a]

Model		Sum of squares	df	Mean square	F	Sig.
1	Regression	.032	5	.006	1.979	.160[b]
	Residual	.035	11	.003		
	Total	.067	16			

[a]Dependent variable: Transmission

[b]Predictors: (constant), RatioOfOriginality, RatioOfMention, RatioOfMulti, RatioOfHashtag, RatioOfExternalLink

Reflection of Interactivity

Table B6. Descriptive statistics

	Mean	Standard deviation	N
Transmission	.5710	.08080	17
RatioOfMulti	.0527	.02589	17
RatioOfMention	.0395	.02018	17
RatioOfHashtag	.0521	.02608	17
RatioOfExternalLink	.0489	.02899	17
RatioOfOriginality	.0504	.02663	17

Table B7. Coefficients[a]

Model		Unstandardized coefficients		Standardized coefficients	t	Sig.
		B	Standard error	Beta		
1	(Constant)	.277	.043		6.465	.000
	RatioOfMulti	-1.268	1.048	-.507	-1.210	.252
	RatioOfMention	2.345	.808	.731	2.901	.014
	RatioOfHashtag	-.105	1.125	-.042	-.094	.927
	RatioOfExternalLink	-.630	1.824	-.282	-.345	.736
	RatioOfOriginality	1.695	1.745	.698	.972	.352

[a]Dependent variable: Transmission

Table B8. Correlations

		Transmission	RatioOfMulti	RatioOfMention	RatioOfHashtag	RatioOfExternalLink	RatioOfOriginality
Pearson correlation	Transmission	1.000	-.361	-.518	-.403	-.578	-.609
	RatioOfMulti	-.361	1.000	.469	.825	.654	.552
	RatioOfMention	-.518	.469	1.000	.342	.207	.128
	RatioOfHashtag	-.403	.825	.342	1.000	.761	.673
	RatioOfExternalLink	-.578	.654	.207	.761	1.000	.947
	RatioOfOriginality	-.609	.552	.128	.673	.947	1.000
Sig. (1-tailed)	Transmission	.	.077	.017	.055	.008	.005
	RatioOfMulti	.077	.	.029	.000	.002	.011
	RatioOfMention	.017	.029	.	.090	.213	.313
	RatioOfHashtag	.055	.000	.090	.	.000	.002
	RatioOfExternalLink	.008	.002	.213	.000	.	.000
	RatioOfOriginality	.005	.011	.313	.002	.000	.
N	Transmission	17	17	17	17	17	17
	RatioOfMulti	17	17	17	17	17	17
	RatioOfMention	17	17	17	17	17	17
	RatioOfHashtag	17	17	17	17	17	17
	RatioOfExternalLink	17	17	17	17	17	17
	RatioOfOriginality	17	17	17	17	17	17

Table B9. Variables entered/removed[a]

Model	Variables entered	Variables removed	Method
1	RatioOfOriginality, RatioOfMention, RatioOfMulti, RatioOfHashtag, RatioOfExternalLink[b]	.	Enter

[a]Dependent variable: Reflection
[b]All requested variables entered

Table B10. Model summary

Model	R	R square	Adjusted R square	Standard error of estimate
1	.784[a]	.614	.439	.06051

[a]Predictors: (constant), RatioOfOriginality, RatioOfMention, RatioOfMulti, RatioOfHashtag, RatioOfExternalLink

Table B11. ANOVA[a]

Model		Sum of squares	df	Mean square	F	Sig.
1	Regression	.064	5	.013	3.506	.039[b]
	Residual	.040	11	.004		
	Total	.104	16			

[a]Dependent variable: Reflection
[b]Predictors: (constant), RatioOfOriginality, RatioOfMention, RatioOfMulti, RatioOfHashtag, RatioOfExternalLink

Table B12. Coefficients[a]

Model		Unstandardized coefficients		Standardized coefficients	t	Sig.
		B	Standard error	Beta		
1	(Constant)	.721	.046		15.762	.000
	RatioOfMulti	.700	1.120	.224	.625	.545
	RatioOfMention	-2.262	.864	-.565	-2.619	.024
	RatioOfHashtag	.224	1.203	.072	.186	.856
	RatioOfExternalLink	.234	1.949	.084	.120	.906
	RatioOfOriginality	-2.394	1.864	-.789	-1.284	.226

[a]Dependent variable: Reflection

APPENDIX C: THE RESULTS OF ANOVA

The Results of ANOVA for Agency-Relevance Posts and Likes

Table C1. Descriptives

	N	Mean	Standard deviation	Standard error	95% CI for mean		Minimum	Maximum
					Lower bound	Upper bound		
Group 0	17	.0900	.22997	.05578	-.0283	.2082	.00	.89
Group 1	17	.5710	.08080	.01960	.5295	.6126	.41	.75
Total	34	.3305	.29736	.05100	.2267	.4342	.00	.89

Table C2. Test of homogeneity of variances

Levene statistic	df1	df2	Sig.
2.695	1	32	.110

Table C3. ANOVA (Ratio)

	Sum of squares	df	Mean square	F	Sig.
Between groups	1.967	1	1.967	66.223	.000
Within groups	.951	32	.030		
Total	2.918	33			

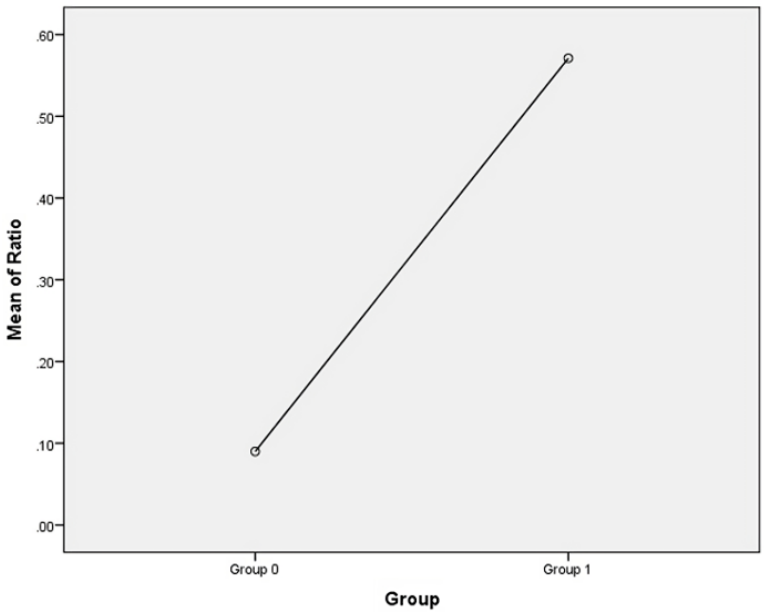

Figure C1. Mean of ratio vs. group (Source: Song, 2017)

The Results of ANOVA for Agency-Relevance Reposts

Table C4. Descriptives (Ratio of reposts)

	N	Mean	Standard deviation	Standard error	95% CI for mean		Minimum	Maximum
					Lower bound	Upper bound		
Group 0	17	.0472	.13088	.03174	-.0201	.1145	.00	.52
Group 1	17	.3517	.06470	.01569	.3184	.3849	.23	.47
Total	34	.1994	.18497	.03172	.1349	.2640	.00	.52

Table C5. Test of homogeneity of variances (RatioOfForward)

Levene statistic	df1	df2	Sig.
.810	1	32	.375

Table C6. ANOVA (Ratio of reposts)

	Sum of squares	df	Mean square	F	Sig.
Between groups	.788	1	.788	73.931	.000
Within groups	.341	32	.011		
Total	1.129	33			

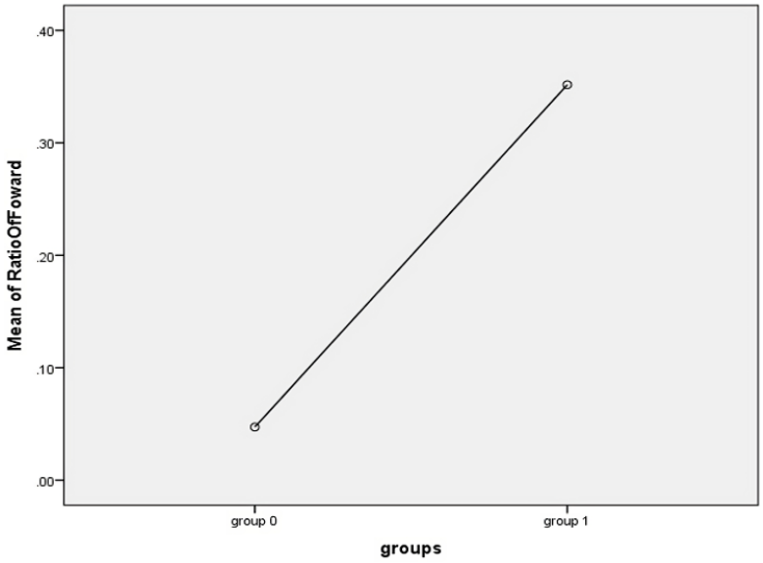

Figure C2. Mean of ratio of forward vs. groups (Source: Song, 2017)

The Results of ANOVA for Seven Themes of Posts and Likes

Table C7. Descriptives (Ratio)

	N	Mean	Standard deviation	Standard error	95% CI for mean		Minimum	Maximum
					Lower bound	Upper bound		
GA	17	.4676	.28012	.06794	.3236	.6116	.08	1.35
PSA	17	.0861	.05511	.01337	.0577	.1144	.01	.17
PR	17	.0118	.02838	.00688	-.0028	.0264	.00	.11
SP	17	.0053	.02094	.00508	-.0055	.0161	.00	.09
SE	17	.0237	.03108	.00754	.0077	.0397	.00	.10
TC	17	.0017	.00335	.00081	.0000	.0034	.00	.01
AP	17	.0076	.01795	.00435	-.0016	.0168	.00	.06
Total	119	.0863	.19126	.01753	.0515	.1210	.00	1.35

Table C8. Test of homogeneity of variances (Ratio)

Levene statistic	df1	df2	Sig.
8.736	6	112	.000

Table C9. ANOVA (Ratio)

	Sum of squares	df	Mean square	F	Sig.
Between groups	2.972	6	.495	41.249	.000
Within groups	1.345	112	.012		
Total	4.316	118			

Table C10. Multiple comparisons (Dependent variable: Ratio)

	(I) Themes	(J) Themes	Mean difference (I-J)	Standard error	Sig.	95% CI	
						Lower bound	Upper bound
Tukey HSD	GA	PSA	.38154*	.03758	.000	.2687	.4944
		PR	.45585*	.03758	.000	.3430	.5687
		SP	.46234*	.03758	.000	.3495	.5752
		SE	.44392*	.03758	.000	.3311	.5568
		TC	.46594*	.03758	.000	.3531	.5788
		AP	.46004*	.03758	.000	.3472	.5729

Table C10 (continued).

	(I) Themes	(J) Themes	Mean difference (I-J)	Standard error	Sig.	95% CI	
						Lower bound	Upper bound
	PSA	GA	-.38154*	.03758	.000	-.4944	-.2687
		PR	.07430	.03758	.435	-.0385	.1872
		SP	.08080	.03758	.331	-.0321	.1936
		SE	.06238	.03758	.644	-.0505	.1752
		TC	.08440	.03758	.280	-.0285	.1972
		AP	.07850	.03758	.367	-.0344	.1914
	PR	GA	-.45585*	.03758	.000	-.5687	-.3430
		PSA	-.07430	.03758	.435	-.1872	.0385
		SP	.00649	.03758	1.000	-.1064	.1193
		SE	-.01193	.03758	1.000	-.1248	.1009
		TC	.01009	.03758	1.000	-.1028	.1229
		AP	.00420	.03758	1.000	-.1087	.1170
	SP	GA	-.46234*	.03758	.000	-.5752	-.3495
		PSA	-.08080	.03758	.331	-.1936	.0321
		PR	-.00649	.03758	1.000	-.1193	.1064
		SE	-.01842	.03758	.999	-.1313	.0944
		TC	.00360	.03758	1.000	-.1093	.1164
		AP	-.00230	.03758	1.000	-.1151	.1106
	SE	GA	-.44392*	.03758	.000	-.5568	-.3311
		PSA	-.06238	.03758	.644	-.1752	.0505
		PR	.01193	.03758	1.000	-.1009	.1248
		SP	.01842	.03758	.999	-.0944	.1313
		TC	.02202	.03758	.997	-.0908	.1349
		AP	.01612	.03758	1.000	-.0967	.1290
	TC	GA	-.46594*	.03758	.000	-.5788	-.3531
		PSA	-.08440	.03758	.280	-.1972	.0285
		PR	-.01009	.03758	1.000	-.1229	.1028
		SP	-.00360	.03758	1.000	-.1164	.1093
		SE	-.02202	.03758	.997	-.1349	.0908
		AP	-.00590	.03758	1.000	-.1187	.1070
	AP	GA	-.46004*	.03758	.000	-.5729	-.3472
		PSA	-.07850	.03758	.367	-.1914	.0344
		PR	-.00420	.03758	1.000	-.1170	.1087
		SP	.00230	.03758	1.000	-.1106	.1151
		SE	-.01612	.03758	1.000	-.1290	.0967
		TC	.00590	.03758	1.000	-.1070	.1187
Dunnett T3	GA	PSA	.38154*	.06924	.001	.1402	.6228
		PR	.45585*	.06829	.000	.2160	.6957
		SP	.46234*	.06813	.000	.2228	.7019
		SE	.44392*	.06836	.000	.2040	.6838
		TC	.46594*	.06794	.000	.2266	.7052
		AP	.46004*	.06808	.000	.2205	.6995
	PSA	GA	-.38154*	.06924	.001	-.6228	-.1402
		PR	.07430*	.01504	.001	.0239	.1247
		SP	.08080*	.01430	.000	.0321	.1295
		SE	.06238*	.01535	.008	.0112	.1136
		TC	.08440*	.01339	.000	.0373	.1315
		AP	.07850*	.01406	.000	.0302	.1268
	PR	GA	-.45585*	.06829	.000	-.6957	-.2160
		PSA	-.07430*	.01504	.001	-.1247	-.0239
		SP	.00649	.00855	1.000	-.0217	.0346
		SE	-.01193	.01021	.994	-.0453	.0215
		TC	.01009	.00693	.934	-.0142	.0344
		AP	.00420	.00814	1.000	-.0228	.0312
	SP	GA	-.46234*	.06813	.000	-.7019	-.2228
		PSA	-.08080*	.01430	.000	-.1295	-.0321
		PR	-.00649	.00855	1.000	-.0346	.0217
		SE	-.01842	.00909	.609	-.0484	.0116
		TC	.00360	.00514	1.000	-.0144	.0216
		AP	-.00230	.00669	1.000	-.0242	.0196
	SE	GA	-.44392*	.06836	.000	-.6838	-.2040
		PSA	-.06238*	.01535	.008	-.1136	-.0112
		PR	.01193	.01021	.994	-.0215	.0453
		SP	.01842	.00909	.609	-.0116	.0484
		TC	.02202	.00758	.161	-.0046	.0486
		AP	.01612	.00870	.737	-.0129	.0451

Table C10 (continued).

	(I) Themes	(J) Themes	Mean difference (I-J)	Standard error	Sig.	95% CI	
						Lower bound	Upper bound
	TC	PSA	-.46594*	.06794	.000	-.7052	-.2266
		PR	-.08440*	.01339	.000	-.1315	-.0373
		SP	-.01009	.00693	.934	-.0344	.0142
		SE	-.00360	.00514	1.000	-.0216	.0144
		TC	-.02202	.00758	.161	-.0486	.0046
		AP	-.00590	.00443	.968	-.0213	.0096
	AP	PSA	-.46004*	.06808	.000	-.6995	-.2205
		PR	-.07850*	.01406	.000	-.1268	-.0302
		SP	-.00420	.00814	1.000	-.0312	.0228
		SE	.00230	.00669	1.000	-.0196	.0242
		TC	-.01612	.00870	.737	-.0451	.0129
		AP	.00590	.00443	.968	-.0096	.0213

*The mean difference is significant at the 0.05 level

Table C11. Ratio

	Themes	N	Subset for alpha = 0.05	
			1	2
Tukey HSD[a]	TC	17	.0017	
	SP	17	.0053	
	AP	17	.0076	
	PR	17	.0118	
	SE	17	.0237	
	PSA	17	.0861	
	GA	17		.4676
	Sig.		.280	1.000

Means for groups in homogeneous subsets are displayed
[a]Uses harmonic mean sample size = 17.000

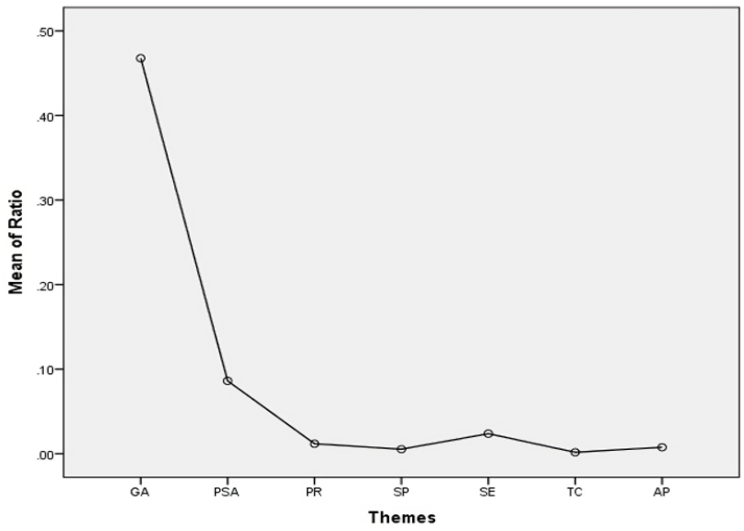

Figure C3. Mean of ratio vs. themes (Source: Song, 2017)

The Results of ANOVA for Seven Themes of Reposts

Table C12. Descriptives (Ratio)

	N	Mean	Standard deviation	Standard error	95% CI for mean		Minimum	Maximum
					Lower bound	Upper bound		
GA	17	.2306	.10767	.02611	.1752	.2860	.04	.43
PSA	17	.0992	.07370	.01787	.0613	.1371	.00	.27
PR	17	.0083	.01879	.00456	-.0014	.0180	.00	.06
SP	17	.0034	.01045	.00254	-.0020	.0087	.00	.04
SE	17	.0145	.01773	.00430	.0054	.0236	.00	.06
TC	17	.0009	.00163	.00040	.0000	.0017	.00	.01
AP	17	.0031	.00841	.00204	-.0012	.0074	.00	.03
Total	119	.0514	.09423	.00864	.0343	.0685	.00	.43

Table C13. Test of homogeneity of variances (Ratio)

Levene statistic	df1	df2	Sig.
21.821	6	112	.000

Table C14. ANOVA (Ratio)

	Sum of squares	df	Mean square	F	Sig.
Between groups	.762	6	.127	49.719	.000
Within groups	.286	112	.003		
Total	1.048	118			

Table C15. Multiple comparisons (Dependent variable: Ratio)

	(I) Themes	(J) Themes	Mean difference (I-J)	Standard error	Sig.	95% CI	
						Lower bound	Upper bound
Tukey HSD	GA	PSA	.13141*	.01733	.000	.0794	.1835
		PR	.22230*	.01733	.000	.1703	.2743
		SP	.22724*	.01733	.000	.1752	.2793
		SE	.21609*	.01733	.000	.1640	.2681
		TC	.22973*	.01733	.000	.1777	.2818
		AP	.22749*	.01733	.000	.1755	.2795
	PSA	GA	-.13141*	.01733	.000	-.1835	-.0794
		PR	.09090*	.01733	.000	.0389	.1429
		SP	.09583*	.01733	.000	.0438	.1479
		SE	.08468*	.01733	.000	.0326	.1367
		TC	.09832*	.01733	.000	.0463	.1504
		AP	.09609*	.01733	.000	.0440	.1481
	PR	GA	-.22230*	.01733	.000	-.2743	-.1703
		PSA	-.09090*	.01733	.000	-.1429	-.0389
		SP	.00493	.01733	1.000	-.0471	.0570
		SE	-.00622	.01733	1.000	-.0583	.0458
		TC	.00743	.01733	1.000	-.0446	.0595
		AP	.00519	.01733	1.000	-.0469	.0572
	SP	GA	-.22724*	.01733	.000	-.2793	-.1752
		PSA	-.09583*	.01733	.000	-.1479	-.0438
		PR	-.00493	.01733	1.000	-.0570	.0471
		SE	-.01115	.01733	.995	-.0632	.0409
		TC	.00250	.01733	1.000	-.0495	.0545
		AP	.00026	.01733	1.000	-.0518	.0523
	SE	GA	-.21609*	.01733	.000	-.2681	-.1640
		PSA	-.08468*	.01733	.000	-.1367	-.0326
		PR	.00622	.01733	1.000	-.0458	.0583
		SP	.01115	.01733	.995	-.0409	.0632
		TC	.01364	.01733	.986	-.0384	.0657
		AP	.01140	.01733	.995	-.0406	.0634
	TC	GA	-.22973*	.01733	.000	-.2818	-.1777
		PSA	-.09832*	.01733	.000	-.1504	-.0463
		PR	-.00743	.01733	1.000	-.0595	.0446
		SP	-.00250	.01733	1.000	-.0545	.0495
		SE	-.01364	.01733	.986	-.0657	.0384
		AP	-.00224	.01733	1.000	-.0543	.0498
	AP	GA	-.22749*	.01733	.000	-.2795	-.1755
		PSA	-.09609*	.01733	.000	-.1481	-.0440
		PR	-.00519	.01733	1.000	-.0572	.0469
		SP	-.00026	.01733	1.000	-.0523	.0518
		SE	-.01140	.01733	.995	-.0634	.0406
		TC	.00224	.01733	1.000	-.0498	.0543
Dunnett T3	GA	PSA	.13141*	.03165	.006	.0269	.2359
		PR	.22230*	.02651	.000	.1297	.3149
		SP	.22724*	.02624	.000	.1351	.3194
		SE	.21609*	.02647	.000	.1236	.3086
		TC	.22973*	.02612	.000	.1377	.3217
		AP	.22749*	.02619	.000	.1354	.3196
	PSA	GA	-.13141*	.03165	.006	-.2359	-.0269
		PR	.09090*	.01845	.002	.0270	.1548
		SP	.09583*	.01805	.001	.0326	.1591
		SE	.08468*	.01838	.004	.0209	.1484

Table C15 (continued).

	(I) Themes	(J) Themes	Mean difference (I-J)	Standard error	Sig.	95% CI	
						Lower bound	Upper bound
		TC	.09832*	.01788	.001	.0354	.1613
		AP	.09609*	.01799	.001	.0330	.1592
	PR	GA	-.22230*	.02651	.000	-.3149	-.1297
		PSA	-.09090*	.01845	.002	-.1548	-.0270
		SP	.00493	.00522	.999	-.0125	.0223
		SE	-.00622	.00627	.999	-.0267	.0143
		TC	.00743	.00457	.865	-.0086	.0235
		AP	.00519	.00499	.998	-.0117	.0221
	SP	GA	-.22724*	.02624	.000	-.3194	-.1351
		PSA	-.09583*	.01805	.001	-.1591	-.0326
		PR	-.00493	.00522	.999	-.0223	.0125
		SE	-.01115	.00499	.460	-.0278	.0055
		TC	.00250	.00257	.999	-.0065	.0115
		AP	.00026	.00325	1.000	-.0104	.0109
	SE	GA	-.21609*	.02647	.000	-.3086	-.1236
		PSA	-.08468*	.01838	.004	-.1484	-.0209
		PR	.00622	.00627	.999	-.0143	.0267
		SP	.01115	.00499	.460	-.0055	.0278
		TC	.01364	.00432	.100	-.0015	.0288
		AP	.01140	.00476	.359	-.0046	.0274
	TC	GA	-.22973*	.02612	.000	-.3217	-.1377
		PSA	-.09832*	.01788	.001	-.1613	-.0354
		PR	-.00743	.00457	.865	-.0235	.0086
		SP	-.00250	.00257	.999	-.0115	.0065
		SE	-.01364	.00432	.100	-.0288	.0015
		AP	-.00224	.00208	.996	-.0095	.0050
	AP	GA	-.22749*	.02619	.000	-.3196	-.1354
		PSA	-.09609*	.01799	.001	-.1592	-.0330
		PR	-.00519	.00499	.998	-.0221	.0117
		SP	-.00026	.00325	1.000	-.0109	.0104
		SE	-.01140	.00476	.359	-.0274	.0046
		TC	.00224	.00208	.996	-.0050	.0095

*The mean difference is significant at the 0.05 level

Table C16. Ratio

	Themes	N	Subset for alpha = 0.05		
			1	2	3
Tukey HSD[a]	TC	17	.0009		
	AP	17	.0031		
	SP	17	.0034		
	PR	17	.0083		
	SE	17	.0145		
	PSA	17		.0992	
	GA	17			.2306
	Sig.		.986	1.000	1.000

Means for groups in homogeneous subsets are displayed.
[a]Uses harmonic mean sample size = 17.000

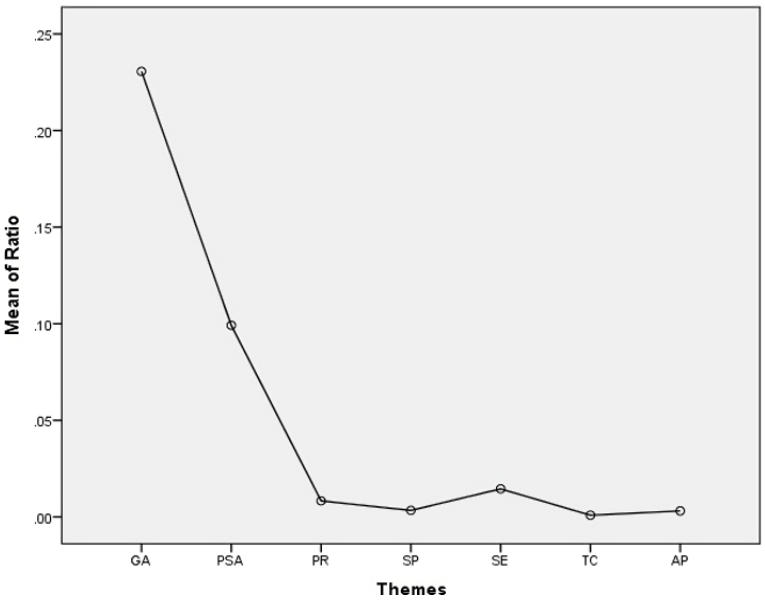

Figure C4. Mean of ratio vs. themes (Source: Song, 2017)