“MedEd” on Twitter: A Social Network Analysis

Shazia Iqbal¹,²*, Shahzad Ahmad¹,², Mohd Ali Samsudin¹, Saood Khan Lodhi³, Salima Naveed Manji³

Abstract

Background. In the current era, Twitter is an increasingly popular tool for the dissemination of information as a social media voice. Social media is a valid, but underutilized, education tool at medical education institutions. Social media technologies provide opportunities for the presentation of information in alternative and multiple formats to enhance engagement, content creation, and motivation for individual and collaborative learning.

Objective. This study examined the type of social structure and sub-clusters do exist regarding “MedEd” on the Twitter network. Additionally, it determined the top opinion leaders in these networks and which type of topics generates users’ interest regarding “MedEd”.

Methods. This study applied NodeXL to analyze the results and retrieved Twitter data on November 1, 2022 by using the keywords “MedEd”. The data were saved and interpreted in the “vertices” and “edges” on the NodeXL worksheets.

Results. We found that the top opinion leader (vertex) “Cryptovitas” had the highest in-betweenness and out-degree centrality. “Innov_medicine” had the in-degree centrality for networks. “In-Degree” and “Out-Degree” are the count of Tweets an opinion leader gets and forwards messages out, correspondingly. The study found that although “Cryptovitas” had the highest in-betweenness centrality, “taylorswift13” had the maximum number of followers (91,523,045) with in-betweenness centrality of 0.0. This indicates that the vertex having maximum influence with the largest number of in-betweenness centrality has not linked with several followers.

Conclusions. Twitter embodies a potential prospect to engage the medical education community. The content of top networks’ tweets was around the number of “MedEd” innovations with the potential to significantly improve medical education delivery and innovative technologies in healthcare services. There is no link between the number of followers and in-betweenness centrality to influence the strength of social media voice. Although clinical and social tweets were there, not much was discussed regarding the curriculum reforms, continued professional development, technical issues in MedEd, and assessments. This triggers the insistence for rapid and innovative adaptations to the new learning environments and remarkable revolutions in medical education, including the encouragement of evidence-based education. The Twitter discussions promoted a research network circulating a wide range of informative innovations and collaborations.

Keywords

MedEd; Twitter; Social Network Analysis; Medical Education

¹Universiti Sains Malaysia, Malaysia
²Vision College, Riyadh, Kingdom of Saudi Arabia
³FMH College of Medicine & Dentistry, Lahore, Pakistan

*Corresponding author: iqbalian2002@hotmail.com

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Introduction

In the current era, Twitter is an increasingly popular tool for the dissemination of information as a social media voice. Social media is a valid, but underutilized, education tool at medical education institutions [1]. Social media technologies provide opportunities for the presentation of information in alternative and multiple formats to enhance engagement, content creation, and motivation for individual and collaborative learning. Twitter is the most prominent platform for medical education, commonly named “MedEd” on social media. Medical education does not occur in an ivory tower, that’s why social media assists in the overall engagement of the medical education community, especially the enhancement of communication among
medical educators, postgraduate residents, and medical students. The postgraduate trainees most often operate social media to keep up to date with clinical guidelines, research collaborations, and discussions on different aspects of medical education [2].

Cutting-edge technology has confronted the way medical educators stem and present an opportunity for modernization in an educational context. Medical students, novices, and health professionals’ academic faculties lay out new curricula and utilize new learning modalities using social media platforms. Medical schools offer myriad teaching strategies and ideas for medical education [3]. Social networks have been considered an appropriate variable in the interaction with theories, such as commitment, satisfaction, dedication, career development, and innovation. Social media using Twitter allows for easy and quick communication between students, professors, and healthcare professionals [4]. This can be used to discuss and share information about medical topics, ask questions, and collaborate on projects.

Moreover, Twitter can be used to share articles, research papers, and other relevant resources related to medical education. This can help students stay up to date on current practices and new research [5, 6]. It can be used to set up discussions and debates on health-related topics. This can encourage medical students to participate and engage with the material, leading to a deeper understanding of the subject matter [7]. Overall, social media analysis, specifically Twitter, can be a powerful tool for enhancing engagement and learning in medical education [8, 9]. By facilitating communication, sharing resources, encouraging participation, networking, and tracking trends, educators can help students stay engaged and up to date on the latest trends and research in the field [10].

The use of social network analysis (SNA) for social support evaluation has proven to be useful at the organizational level. Such as Twitter can be used to network with other healthcare professionals and organizations [11, 12]. This can help students connect with potential mentors and search for new job opportunities. Social media is an essential method of communication for a substantial advantage of our digitally associated society [13]. Although our patients have raced to join social media sites and networks very quickly, medical professionals are lagging in joining social media. This reluctance is slowly changing as physicians begin to see the increasing utility of social media in medicine [14].

Furthermore, medical education has altered substantively by expanding the professionalization of inquiry and scholarship [15]. Social media analysis can be valuable to track trending topics and hashtags related to medical education. The “MedEd” collaborative efforts increase exposure to medical education research opportunities. There is an increasing number of medical students and apprentices seeking to chase an academic medical education career [16]. Social network engagement through Twitter supports other trainee research collaborators that explore education research in their specialties. SNA revealed powerful publication relationships among the association affiliates as well as beyond the medical institutions. There is a remarkable growth in social network connections and density over time in the medical education community [17].

Presently, social network statistics and big data analysis are popular to analyze and depict ongoing situations in any field of life because traditional charts and tables can no longer express the internal structure of a social network [18, 19]. Graph visualization technology can explain the bigger picture of current issues more explicitly [20]. This method can visually reveal the logical organization of the diagram two-dimensionally and by studying the visual patterns of the graphs, scientists can obtain profound conclusions to feed insights for further research [21]. We can obtain useful information regarding how people perceive issues and understand social phenomena [22]. Therefore, the use of social media offers a prospect to obtain information that may be helpful to the healthcare system quickly and inexpensively [23].

The importance of community participation and connection is strongly encouraged in health professional education. Currently, there is a huge research gap to analyze the utility of social media and the role of Twitter use in medical education at various levels.

Hence, this study will investigate the type of social structure and sub-clusters do exist regarding “MedEd” on the Twitter network. In addition, it will establish the top opinion leaders in these networks and analyze which type of topics generates users’ interest regarding “MedEd”. Previous research has been done using SNA and natural language processing in “MedEd” research [17, 24]. Our study is a new theoretical impact and recommends important complementary insights into knowledge sharing and the correlation between sentiments and tweeting behaviors.

Materials and Methods

Twitter is one of the most accepted social media in the Web 2.0 era. Twitter is a corpus for sentiment analysis and opinion mining. This study retrieved Twitter data on November 1, 2022 by using the keywords “MedEd”. The data were certainly saved in the “vertices” and “edges” on the NodeXL worksheets. To achieve the objectives, this study applied NodeXL to analyze the results. NodeXL is an add-in for Microsoft Excel and offers a user-friendly tool for novices and non-programmers. It upholds various visual network layouts, vigorous filtering, clustering, mapping of vertex and edge, and customizable visual properties and tags [25]. It aids researchers to commence SNA through content scrutiny and data visualization after determining network metrics such as centrality, degree, and clustering [26]. As NodeXL relies on data from social media platforms, collecting these data can be challenging due to issues such as privacy concerns, access restrictions, and the sheer volume of data available.

The data were processed on NodeXL to extract knowledge about the networks, and the Semitic thematic analysis was done to extract three main themes. This study considered the graph metrics to recognize the size, connectivity, and characteristics of the network, based on betweenness centrality, and in-degree and out-degree centrality [27].
Vertices (also known as nodes or entities) refer to an individual, event, physical or virtual locality, comfort, or social structure, e.g., organization, country, institution, or team. An edge means a link or connection, which appears when two vertices work in partnership or exchange information. In-degree centrality is employed to determine the significance of individuals in the network diagram and can be utilized to explore the information trends of the whole social network graph and the likelihood of individuals influencing resources. It intends to discover valuable entities in the set of connections. [28].

Using NodeXL, the thematic analysis is called Text mining or Semantic analysis, and data results are autogenerate by this software depending upon the number and frequency of top tweets and retweet content. Once data were collected, they were sorted, cleaned, and organized to prepare them for thematic analysis. At this stage, this was a time-consuming and complex process, as social media data were messy and unstructured. After performing data visualization, the graph was built using the Harel-Koren Fast Multiscale blueprint system. This approach facilitates multiscale graph representation and the appropriate design to show the results. It is used for visualizing mesh graphs and can promptly establish directed and large graphs in numerous dimensions with tremendous navigational capability. Out of 10, 599 tweets, more than 200 tweets were read in detail and analyzed by 3 independent researchers to establish the types of topics that generate users’ interests and top content analysis for their tweets.

**Results**

We found that the top opinion leader (vertex) “Cryptovitas” had the highest in-betweenness and out-degree centrality. “Innov_medicine” had the in-degree centrality for networks as shown in Fig. 1, 2, and 3. “In-Degree” and “Out-Degree” are the sum of Tweets an opinion leader gets and sends out, correspondingly. The study found that although “Cryptovitas” had the highest in-betweenness centrality, “taylor swift13” had the maximum number of followers (91, 523, 045) with in-betweenness centrality of 0.0. This indicates that the vertex having maximum influence with the largest number of in-betweenness centrality has not linked with several followers. Table 1 shows the overall metrics of this study data and Table 2 explains the content of the tweet for the user who got: (i) High Betweenness Centrality; (ii) High In-Degree Centrality; (iii) High Out-Degree Centrality.

### Thematic Analysis - Semantic Analysis

Recently, the advancement of artificial intelligence (AI), machine wisdom, and natural language processing have transformed all the ways of big data analysis [29]. Expanding algorithms, progressively powerful computers, and data-based training have rendered machine-driven semantic analysis a tangible thing with numerous real-world applications [30, 31]. The structure of the semantic analysis is a human analysis to evaluate the context of conversation using the surrounding words, phrases, objects, scenarios, etc. Such machine-driven semantic analysis can uncover the meaning of colloquial speech in online posts, find the answers to a question without having to ask a human, and extract relevant information.

<table>
<thead>
<tr>
<th>No</th>
<th>Vertex</th>
<th>Betweenness Centrality Value</th>
<th>Vertex</th>
<th>In-Degree Value</th>
<th>Vertex</th>
<th>Out-Degree Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>“Cryptovitas”</td>
<td>38629765</td>
<td>“Innov_medicine”</td>
<td>2334</td>
<td>“Cryptovitas”</td>
<td>794</td>
</tr>
<tr>
<td>2</td>
<td>“Innov_medicine”</td>
<td>30000814</td>
<td>“Brownhospmed”</td>
<td>2190</td>
<td>“Antibioticsbot”</td>
<td>115</td>
</tr>
<tr>
<td>3</td>
<td>“Brownhospmed”</td>
<td>25078095</td>
<td>“Inverse”</td>
<td>1006</td>
<td>“Nataliacoin990”</td>
<td>111</td>
</tr>
<tr>
<td>4</td>
<td>“Inmedverse”</td>
<td>10339955</td>
<td>“Advreproduction”</td>
<td>901</td>
<td>“Inverse”</td>
<td>74</td>
</tr>
<tr>
<td>5</td>
<td>“Advreproduction”</td>
<td>9040190</td>
<td>“Grep” MedEd”</td>
<td>723</td>
<td>“Gastrorts”</td>
<td>74</td>
</tr>
</tbody>
</table>
Figure 1. “Cryptovitas” showing the highest betweenness centrality of the study.
Figure 2. "Innovative Medicine" showing the highest "in-degree" of the study.
Figure 3. "Cryptovitas" showing the highest "out-degree" of the study.
Theme 1 - Explanation of Tweet Content
In semantic networks, vertices are words or models that are bonded by co-occurrence within pre-defined social media content (Tweets, Facebook posts, news articles, etc.). Semantic networks map interactions between ideas and permit us to extract sense from text based on the conjunction of notions [32]. The structure of thematic analysis mainly focuses on the high in-degree centrality, high betweenness centrality, and high out-degree centrality. A total of 10,599 tweets were obtained on the NodeXL data sheet when the “MedEd” keyword was searched.

“Cryptovitas”, “Innov Medicine”, and “Brownhospmed” were at three positions with maximum in-betweenness centrality of 38628764.746, 30000813.502, and 25078095.095 respectively. Meded @cryptovitas is a page on Twitter by a doctor (@KrittanawongMD) to support the Med Twitter communities. The content analysis of their conversation highlights the future of becoming doctors and outstanding physician-scientist programs will hugely depend upon the new cutting-edge technologies in medical education and creating an immersive learning environment. Meded @cryptovitas quoted, “Are You Missing Out on the Metaverse? Here is why You Absolutely Must Invest In The Metaverse!! @elonmusk”. “Innov medicine” tweets mention mainly the sharing and reuse of “MedEd”-related data for research purposes and highlight policy and implementation guidelines regarding ethical issues related to medical education research. “Innov medicine” quoted, “The Innovation, a Cell Press partner journal, is a new broad-scope, open-access journal publishing basic and applied research that has an impact for the benefit of society. https://cell.com/the-innovation/home”. Innovative approaches to treat different medical and surgical conditions are highlighted in tweets and retweets.

Theme 2 - Examples of Top Networks Tweet Content
The original dataset links Twitter users to other Twitter users and NodeXL navigates to the word worksheet to examine its contents. The word worksheet is concentrated on each word used in the text and is linked with the network. It accounts for the count of each word, its salience, and whether the word exists on any of the three sentiment word lists. Table 3 shows the group metrics of the study data and Table 4 shows the top word count analysis of the study. This study result shows that the most top used words were #MedEd, #medtwitter, #medicine, #health, #healthcare, #tipsfornewdocs, #MedEd, #medicine, and #medical. Fig. 4 shows the top pair-word count groups analysis of the study.

In word networks, clusters depict sub-groups of words that exist jointly in social media communications, for instance, posts and tweets more than they occur with other words. This approach navigates to the group worksheet to examine the various sub-conversations. Eventually, it provides a magnitude of the size of the group digging into the actual themes. The highest degree words in a group (“MedEd”) suggest the words that show up with a high range of other words and hence have pervasive significance in the network.

Theme 3 - Relationship Between the Result of Semantic Analysis with Theme 1 and Theme 2
Word networks allow for the exploration of huge datasets founded on words, themes, or concepts that tend to occur together. It evaluates network clusters and conveniently analyzes metrics to begin the analysis [33]. It generates data that are useful and feasible for visualizing the dataset. This method relies solely on who is linked to whom (a word is connected to another word). Several different network “clustering” (also known as “community detection”)
Wakita-Tsurumi, and Girvan-Newman with the growing reputation of Twitter chats, online journal previous work that more frequent posting is associated with the largest number of in-betweenness centrality has not linked with several followers. Therefore, there is no link between the number of followers and in-betweenness centrality to influence the strength of social media voice. Our results established that sentiment valency did not correlate with the sum of favorites or retweets [39].

The types of topics generating users’ interests were different: #MedEd, #medtwitter, #medicine, #health, #healthcare, #tipsfornewdocs, #medicine, #clinicalpearl. “Cryptovitas” had the maximum betweenness of centrality and his tweets mentioned mostly “#MedEd” in the context of engaging medical educators and students in the learning process through sharing clinical scenarios with visuals and animations. These tweets and retweets highlight that medical education around the world is moving towards interaction and learning experiences by actively engaging in-person activities by switching to online learning and teaching activities. The Twitter discussions promoted a research network circulating an extensive scale of educational revolutions and collaborations [17].

**Discussion**

Social media is progressively utilized in medical education with the growing reputation of Twitter chats, online journal clubs, and conference live-tweeting. Twitter has materialized as a novel approach for medical educators to reveal ideas and support for policy change in health professional education [37]. The study results are consistent with previous work that more frequent posting is associated with more followers on Twitter [24]. Interestingly, a higher number of “MedEd”-related tweets were not associated with an increased number of followers. Although clinical and social tweets were there, not much was discussed regarding the curriculum reforms, continuing professional development, technical issues in MedEd, and assessments. This provokes the insistence on quick and narrative adaptations to new situations and astonishing inventions in medical education, including the promotion of more evidence-based education [38].

In terms of the content of a tweet, the inclusion of pictures, links, GIFs or videos, and tagging other users are associated with a higher number of followers. This study indicates that the vertex having maximum influence with the largest number of in-betweenness centrality has not linked with several followers. Therefore, there is no link between the number of followers and in-betweenness centrality to influence the strength of social media voice. Our results established that sentiment valency did not correlate with the sum of favorites or retweets [39].

The results are consistent with a finding of Goh et al., which mentioned that the whole process of research and grant can be reinforced and improved by the universal accessibility of a wide range of diverse digital technologies such as social media and multimedia [40]. However, medical educators must be pledged to open discussion, iterative, and provoke reflective developments during their learning journey on social media. Our study results are consistent with the results of Katz et al., that the users may be more involved in the clinical and social dimensions of Twitter than the “#MedEd” pedagogical aspects. Hence, clinicians and organizations must progress to adopt the use of social media programs for medical education. Healthcare professionals can handle social media encounters on the same moral grounds that they would with patients in person. However, healthcare organizations eventually must allow medical professionals to promote this by redefining realistic social media policies and privacy issues [8].

As the world is becoming more digitally oriented, medical educators are increasingly visualizing social media as an important channel for discussion on different aspects of medical education promotion [5]. Social media, especially Twitter, is a form of communication that has shown to be very successful. Therefore, inculcation of the use of social media and noticeable consideration of the right balance between digital and traditional medical education tools is important for health professional educators. Undoubtedly, wide research gaps prevail about advancing the tactical use of social media based on audience segmentation, appraising the influence of social media in health professional education interventions, understanding the impact of social media on medical education development, and privacy concerns [41].

Our study strongly endorses that encouraging academic accomplishments through social media usage and Twitter use embodies a potential prospect to largely connect the medical education community [42].

**Study Limitation**

The limitation of this study is that this method of research assisted to collect data in a limited timeframe on a very hot topic discussion on social media. As Twitter data were collected on November 1, 2022, it is too limited timeline to implement the results of the research. Further studies are required to form a certain opinion about these results.
in medical education. One of the biggest challenges for researchers is interpreting the results of social network analyses because using NodeXL is tricky. Medical researchers need to be familiar with concepts such as centrality, clustering, and community detection to understand the insights provided by the tool. Additionally, they need to be able to explain these concepts in a clear and accessible way to non-expert audiences.

**Conclusions**

Our study concludes that cutting-edge technology can enable medical education available anytime and anywhere to enhance learning environments among health professional educators. Social media communications through Twitter could be the best practice and innovation in providing access for distance learners, especially in low- and middle-income countries. Twitter can enable learners to maximize their learning by creating inclusive online learning environments that respond to their diversity in age, gender, background culture, religion, disability, sexual orientation, education, and national origin. Our study strongly endorses that to promote academic achievements, using Twitter embodies a potential prospect to involve the medical education community.

The content of top networks’ tweets was around the number of “MedEd” innovations with the potential to significantly improve medical education delivery and innovative technologies in healthcare services. A higher number of “MedEd”-related tweets were not associated with an increased number of followers. Although clinical and social tweets were there, not much was discussed regarding the curriculum reforms, continuing professional development, technical issues in MedEd, and assessments. This provokes the urgency for rapid and novel adaptations to the new circumstances and remarkable innovations in medical education, including the promotion of more evidence-based education. The Twitter discussions promoted a scholarship network circulating a broad range of educational innovations and collaborations.

Further studies are needed to better understand how medical education professionals can use social media platforms as educational tools most effectively. Eventually, social media is here to stay over time, influencing public knowledge and trainees’ education. Institutions should engage clinicians with robust social media capability in leadership roles to lead cultural changes in the educational environment.

The limitation of this study is that this method of research supports gathering data in a constrained timeframe on social media. The amount of data depends on the keyword and hot top for discussion in that limited time. Moreover, as social networks grow in size, analyzing data with NodeXL becomes more challenging. Processing large datasets can be slow, and researchers may need to use more powerful computing resources to handle large-scale analyses.

**Ethical Statement & Informed Consent**

Not applicable in this study design.
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