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POTENTIAL POSSIBILITIES OF ENHANCING ONLINE COMMUNICATION OF EDUCATORS IN CONFERENCES

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Abstract

Communication using Twitter by educators who attended a conference of a centralized position was investigated to better understand the possibility to expand their Twitter communication in the backchannel of the conference. As a target, conferences for ICT educators organized by Ministry of Education, Thailand were selected. Data were collected through an application programming interface (API) by NodeXL, and a social-graph analysis was executed. Extensional investigation was continuously introduced to include personal tweets history of educators by tracing Twitter accounts, which appeared in their profiles as keys of data collection. Results were compared with the findings of preceding studies. The results showed rather inactive Twitter communication of participants during conference days. However, from the result of extensional investigation, integral bridge and hub users, who were expected to enlighten rural educators, were found. Finally, we present three feasible strategies using social group graph analysis that

challenged enhancement of awareness regarding the cutting-edge movement in ICT education of rural educators who could not attend a conference. Bridge users were able to forward messages from the conference organizer using deliberate modification of content to adapt their group culture.

Keywords

Twitter, Online Communication, Conference, Social Graph, Rural Education

1. Introduction

Decentralization has been an important phenomena to change local schools over the past 30 years (UNESCO, 2005). It has changed efficiency in management and governance of school education systems, and has improved rural education from slow and heavily centralized bureaucracy. Particularly, decentralization is used to improve capacity and quality of secondary and tertiary education in rural areas (Behrman, Deolalikar, & Soon, 2002).

Until the early 2000s, the school education system in Thailand was decentralized. However, many local schools were identified by the central ministry as having 'poor' student achievement (McGinn & Welsh, 1999). There was geographical difficulty for rural educators to become aware of and adopt new educational content and methods.

Then, the Ministry of Education in Thailand continuously provided centralized trainings of new and selected educational content for educators. Thailand Cyber University project (TCU) of the Ministry of Education implemented a large-scale, centralized, annual training conference for nationwide applicant educators (Figure 1 shows a TCU conference in 2016). This training conference has resulted in expected effects on participant educators; however, the conference could not cover unavoidable restrictions under a decentralized management system. For example, there is no cascade training system that can extend training effects to other educators in other regions.

Figure 1: *Centralized Conference in Bangkok*

As a measure, the TCU offered a derivative service of resources by using live-streaming video and online video archives of all session contents of the conference. Nevertheless, it was not easy to obtain sufficient access to cutting-edge movement in ICT by rural educators who could not attend the conference.

1.1 Using Social Network Systems to Communicate with Rural Educators

Today, Internet and mobile connections are disseminated even in rural areas of Thailand, and 96.1% of Internet users use Social Network Systems (SNSs) (Electronic Transactions Development Agency, 2016). A SNS has many advantages and is able to find people over large geographic distances by tracing already-formed connections in the cyberspace, and sometimes one message can reach a vast amount of people (Sinaga, M., 2015).

Personal e-mail, Twitter, Skype, and project mailing lists are the most popular applications used for communication in a SNS. While personal e-mail and Skype imply communication with known users, Twitter can address a public and open audience and is the only one service that can be used to disseminate effects to unknown users without an intermediary barrier. The motivation for publishing and sharing content by Twitter was identified as the higher rate of sharing knowledge, study, or work (Letierce, Passant, Breslin, & Decker, 2010). In addition, Twitter, one of microblogging services is extremely useful for fast exchanges of thought, ideas and information-sharing through a large volume of real-time messages. Regular weblogs (e.g. Facebook), in contrast, are mainly used for writing short essays, knowledge saving, coherent statements and discourse (Ebner & Schiefner, 2008). Twitter is also recognized as

beneficial for newcomers to become engaged with conference communities (Reinhardt, Ebner, Beham, & Costa, 2009). As Twitter has beneficial features that help to form connections, so we selected Twitter from various SNS services to use in our study.

On the other hand, the communication in a SNS have been investigated. When we observe users in a SNS, we can see many inactive users with a limited production of messages, but we can also see power users who produce a number of messages. From previous studies of SNSs, the relation between the number of users and the number of messages followed a heavy tailed distribution of a power law (Barabási, Albert, & Jeong, 1999). Therefore, communication in a SNS had a generative mechanism to form groups (Barabasi, 2009). These groups in the SNS arose importance to identify the integral users who can bridge groups.

Then, the purpose of our study is to find a feasible path and designing strategy to communicate with rural educators using the support of an intermediary user to forward messages from a conference organizer through Twitter.

1.2 Functions of Twitter

Twitter is mainly used by users to follow their favorite bloggers and news content. Also, in marketing, the potential of Twitter is recognized as a way to engage with users in real-time (Hannon, Bennett, & Smyth, 2010).

Twitter users can post a message no longer than 140 characters, which is known as a 'tweet'. In Twitter, some functional messages for distinctive communication are allowed.

The '#' symbol in the body of a tweet is called a hashtag and is used to mark a keyword or a topic. The TCU announced an official conference hashtag that had never been used before. This hashtag became the identifier to extract tweets from the public timeline of thousands of tweets per second. 'Replies to' are tweets through which a user can respond to a particular user. Some tweet responses are ushered into communication among participants by referencing a hashtag. 'Mentions' are tweets that contain another user's account in the body. Mentions become notifications and can be used to introduce an important person to users outside the conference.

The follow function in Twitter allows a user send a tweet automatically to their 'followers'. Usually, each user has compiled followers through their Twitter experience. Then, once an educator posts a tweet, the tweet will reach a timeline of followers' home tabs. From

another viewpoint, users need to follow others so that they can receive benefit from the tweets of these followees.

'Retweets' are tweets that start with 'RT'; these are used to forward and share interesting messages with followers. Both Twitter functions have influential power to notify others about what has happened in a conference to users in other groups. Retweeting makes it easier to find and form connections by reading content of tweets from un-connected users or from resources relevant to a user associated with certain Twitter accounts (Hannon, McCarthy, & Smyth, 2011).

2. Social Graph

In this study, social graph theory is used to analyze communication in Twitter. We apply the process of data-driven visual network analysis using a computer.

The 'social graph' in this context is made up of a 'node' and an 'edge' that connects nodes (see Figure 2). A node usually corresponds to an online user, and an edge usually means a message sent to another online user. The natural graph involves a 'hub' of nodes with aggregated edges, a 'bridge', which is a specific user who connects two separate groups, and a group that is a cohesive aggregation of edges more than the other parts of a network community. In this context, the group is called as a 'cluster'.

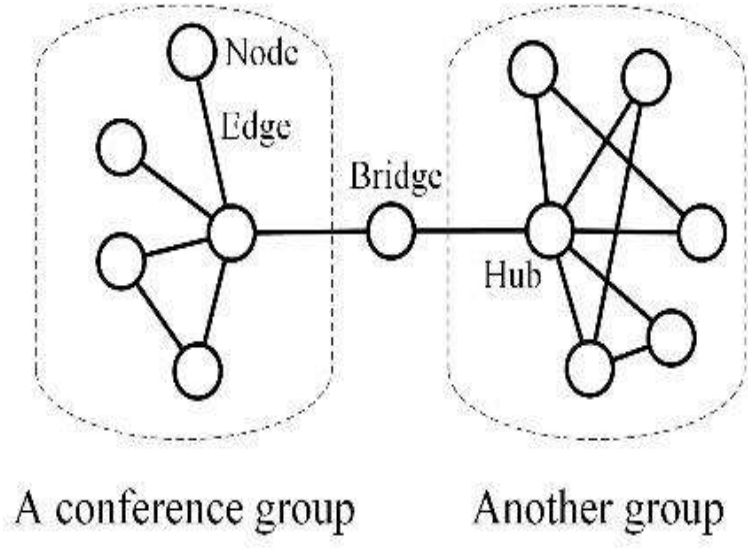

Figure 2: *Social Graph*

2.1 Bridges

The bridge identified in the social graph analysis clarifies possible flexibility to connect clusters through social interactions within a relationship structure. Generally, the bridge is located at an important position between clusters. The role of bridge is identified, and the following five types of bridges (see black circles in Figure 3) have been proposed (Lee & Sohn, 2016).

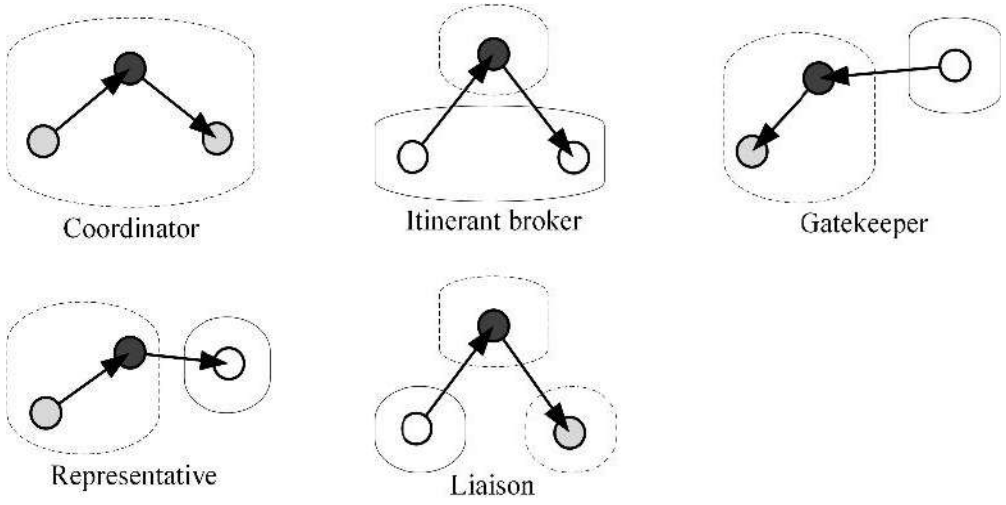

Figure 3: *Types of Bridges (Black Circles)*

A ‘coordinator’ is a mediating user within an identical cluster that receives a message from a member and transfers that message to another member. In many cases, a coordinator exists within a cluster and usually has high connectivity with other users as a hub. A ‘representative’ is a user that represents the entire cluster and receives messages from a user in the same cluster and transfers those edges to a user of another cluster. An ‘itinerant broker’ is located in a different cluster and connects users within the same cluster; they are often called a consultant. A ‘liaison’ connects users of different clusters, and receives messages and transfers the messages beyond its own cluster. A ‘gatekeeper’ is a user that is in a position to accept a message from another group and transfer that message to other members within its cluster.

From our preceding study of online communication, we observed different difficulties among different types of bridges (Yoshida & Thammetar, 2015a, 2015b). When a message came from a ‘coordinator’ of a hub, cluster members usually could accept the message. Similar receptivity was seen in the case of ‘gatekeeper’ if a message was modified to adapt the culture of

its cluster. When a message was edited or explained to be attractive or impressive for members in a target cluster, it was possible to be consumed as a message even if it came from a user of another cluster. Therefore, a 'liaison' would be possible.

When a message was transferred by a 'representative' of other cluster, some members of clusters began to doubt whether there was a hidden meaning behind the message. In this case, we need prepare a plausible reason to forward message to other clusters as well. When a message bridged by an 'itinerant broker' who is the member of other cluster, many of members began to doubt and showed difficulty to accept. This was because cluster members refuse to change their culture of the cluster by a user from other clusters.

3. Method

In this study, Twitter communication between educators was investigated.

3.1 Target Conference

A conference was held at BITEC Bangna, Bangkok, Thailand on 28-29 July, 2016 and six parallel session rooms and one main conference room were used.

All of the educators of the conference specialize in educational technologies, and all of the conference rooms had a wireless connection service available. Therefore, it seems very easy to use Twitter to communicate without any difficulty.

3.2 Collecting Data and Analysis

The software NodeXL Pro program was used for data collection and analysis. This is an add-in for Microsoft Excel that enables a user to access a SNS in order to collect data and introduce content analysis. The NodeXL can collect Twitter data by accessing an application programming interface (API), and this automated data collection is called 'crawling'. In addition, NodeXL has functions to calculate various social graph metrics of social network analysis and to draw a social graph.

3.3 Keys of Collecting Data

To begin, the conference organizer declared a conference hashtag, and announced it in a conference program and a conference badge to promote Twitter communication in order to promote backchannel activity for the conference.

As the first round of data collection, tweets of educators with the hashtag (hereinafter

hashtag educators) during the conference were collected on July 30th, 2016.

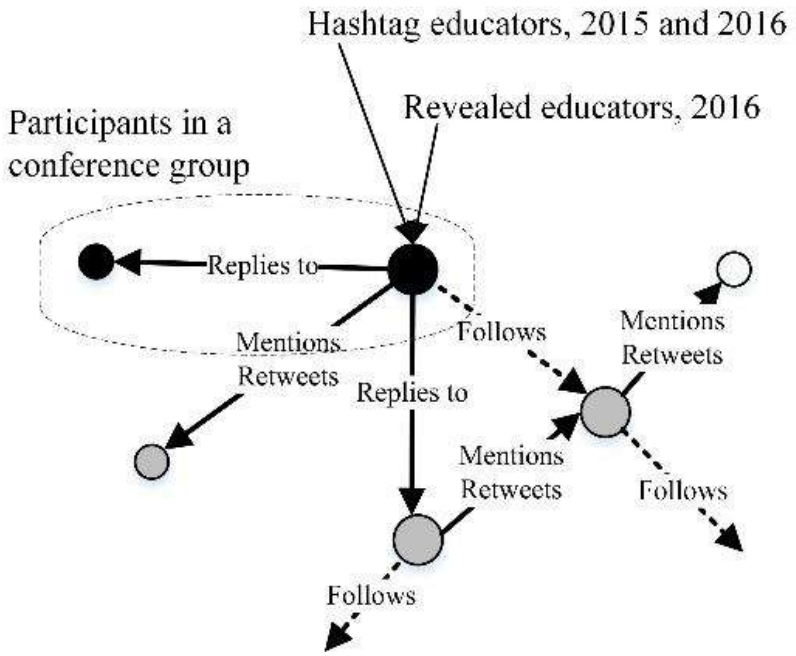

Figure 4: *Macrostructure of a Graph in Extensional Investigation*

The second round of data collection was an extensional investigation that included tweet history of 'replies to', 'mentions', 'retweets', 'isolated tweets', and 'follows'. Figure 4 shows the macrostructure of the methodology used to search data. We used 51 active Twitter accounts of educators (hereinafter revealed educators) shown in participants' profile of registration data of the conference as a key to trace. Crawling was done on August 1st, 2016.

4. Results

4.1 Effect of Announcement Method

Table 1 shows the result of the first round investigation. As reference, we put data of preceding study down with (Yoshida, 2016) for reference.

The result implied inactive tweets of educators during conference days in 2015 and 2016.

In fact, we collected a number of tweets with hashtags in a pilot session room in 2014 (Yoshida, 2015), and a hashtag announcement prompted a higher tweet rate (23 educators, 25%) than the tweet rates guided by the official announcement in documents (2% in 2015 and 1% in 2016). This was because a session room in 2014 had more sense of affinity to communicate in

Twitter with a lecturer or other participant educators in their front.

Table 1: *Comparison of Tweets during Conferences*

Conference Year	2014	2015	2016
Participants	93	751	833
Sessions involved	1	77	36
Keyword of Twitter crawling	A hashtag announced in a selected session room by a lecturer	A hashtag announced officially to all participants.	A hashtag announced officially to all participants. Twitter accounts filled in participants' profiles.
No. of hashtag educators	23	15	8
No. of tweets by hashtag educators	62	62	18
No. of revealed educators	-	-	51
No. of hashtag educators in revealed educators	-	-	1

4.2 Evaluation of Nature of Communication

The tweet rate of data in 2016 was calculated as 2.25. This was not an ample rate when we accounted for the reported average in a published work on tweets in conferences (4-8 tweets/node) (Wen, Parra, & Trattner, 2014), where the acceptable rate of 4.1 was seen in a conference in 2015.

Regarding this inactiveness, Nielson (2006) noted that most users in a SNS that rely on users to contribute content did not participate. He summarized this lack of user participation in blogs as the 95-5-0.1 rule, where 95% of users are lurkers, 5% of users contribute from time to time, and 0.1% of users participate a lot.

Then, it could be assumed that this conference with various sessions and workshops gave them the feeling of a vast environment, such as cyberspace.

4.3 Result of Extensional Investigation

Table 2 shows the results of the second round of data collection. Data were classified into tweet categories. In addition, the results of the first round were listed as reference. Figure 5 is a social graph of the extensional investigation using accounts of revealed educators. The edges include 'replies to', 'mentions', 'retweets', and 'follows'.

Table 2: *Result of Extensional Investigations*

Crawling target	Conference	Extensional
Crawling key	hashtag	Account
Nodes	8	16,457
Unique edges	6	20,987
Total edges	18	26,263
Maximum nodes in a connected component	5	16,364
Replies to	3	361
Mentions	1	570
Retweets	0	1,972
Isolated tweets	12	2,644
Follows	2	20,716

The major tweets were messages from their followees, and they occupy 79% of the total tweets. 'Replies to' of personalized communication is limited. Also, 'mentions', 'retweets', and 'isolated tweets' of users' spontaneous messaging were small numbers when we considered the size of the edges. However, while a recent study regarding the diffusion power of users (Wang et al., 2013) gave an average retweet rate of 0.11, our study found 0.095. This suggested that our field of study on the Twitter community was slightly inactive and had many lurkers of read-only users.

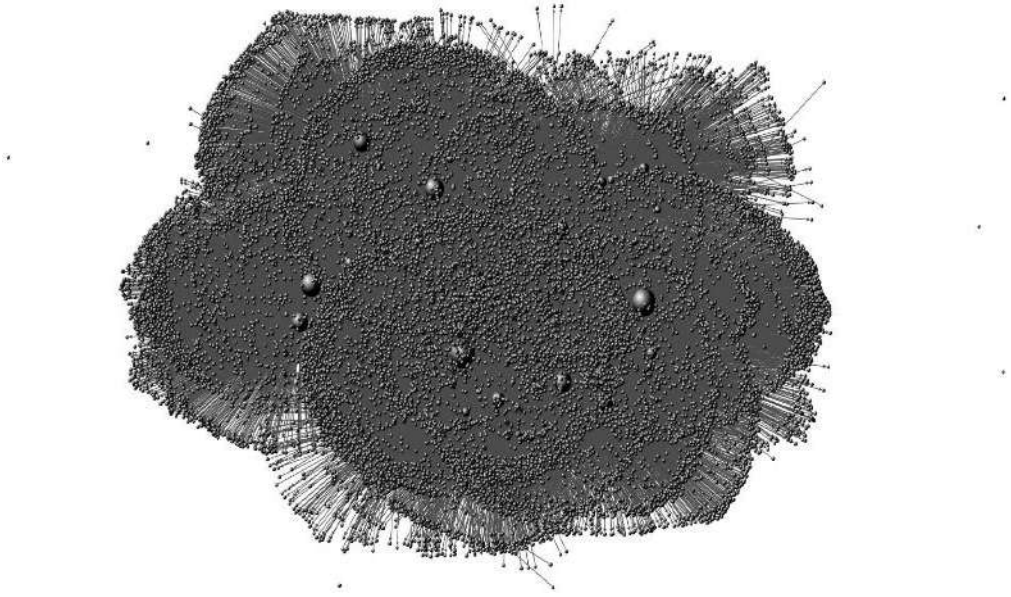

Figure 5: *Social Graph of Extensional Investigation. Node Size Proportional to PageRank Centrality Statistics. [Fruchteman-Reingold Algorithm (Fruchterman & Reingold, 1991)]*

'Retweets' and 'follows' forward tweets to followers. Target accounts are already registered in advance, and then these tweets have the possibility to introduce collaborative-based communication in which users expand their communication by adding followees. On the other hand, all tweet messages would be consumed based on users' interest and have possibility to introduce content-based communication. Therefore, both collaboration-based communication and content-based communication have the power to forward a message of the conference organizer to rural educators.

5. Discussion

The purpose of this study is to find a feasible strategy to connect with rural educators. The result of the second round of data collection was introduced into the further discussion.

5.1 Social Group Graph

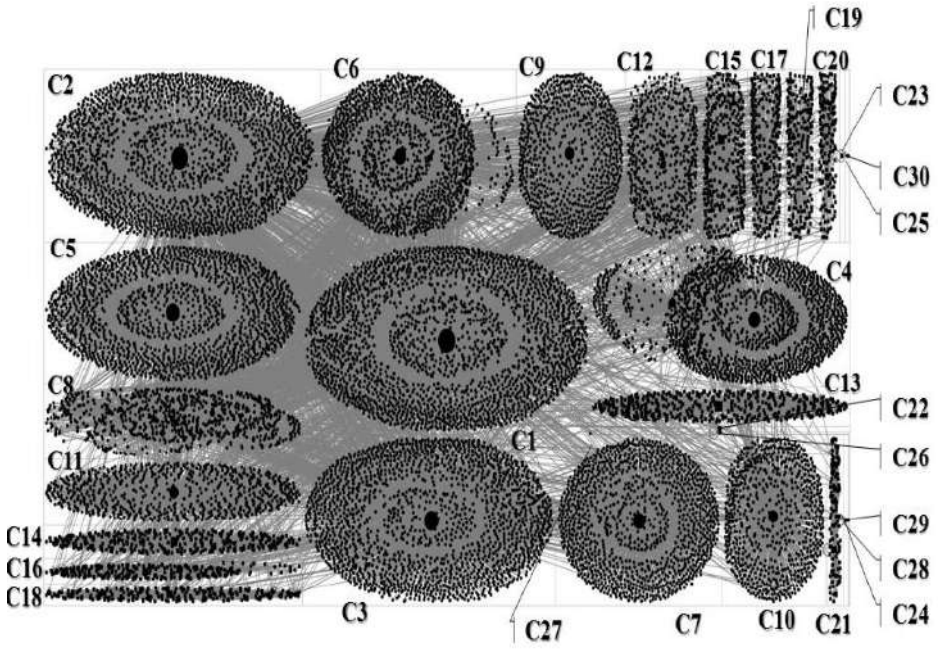

Figure 6: *Social Group Graph of an Extensional Investigation of Revealed Educators where Nodes are Arranged into 30 Clusters using Clauset-Newman-Moore Cluster Algorithm and Node Size Proportional to PageRank Centrality Statistics (All nodes are grouped into clusters and marked by cluster numbers.)*

NodeXL has functions to identify clusters by calculation, and it is also possible to draw clusters as an entire social group graph. Figure 6 shows a social group graph where all the graph

nodes are grouped into 30 clusters using the Clauset-Newman-Moore algorithm (Clauset, Newman, & Moore, 2004). This agglomerative algorithm is known to have a beneficial function to analyze very large networks and can detect community structures.

The size of nodes in Figure 6 represents PageRank centrality statistics, and larger nodes represent hubs. This PageRank method was also used to determine the order of the Web page that was found in the Internet search engine Google (Brin & Page, 1998). More important nodes receive connections from other important nodes, and the importance of a node depends on how many edges have been received from other important nodes.

There was no dominant size of a cluster in Figure 6 and this meant that various different interests and preferences were deployed among clusters. In addition, many edges to connect various pairs of clusters were seen.

5.2 Featuring Clusters

To better understand each cluster, we employed a content analysis using the Twitter analysis function of NodeXL; we also reviewed account profiles and messages. Unfortunately, some clusters were identified to be unrelated, because interests of members in those clusters were extremely different from educational events (i.e., communication of fan club of a musician, studying abroad, community in a hospital or community of male homosexuality) even if they involved educators. Finally 18 clusters were extracted.

5.3 Characteristics of Clusters

Table 3 shows summarized characteristics of each cluster along with the number of members. 31 revealed educators were identified to be involved in clusters, as seen in Table 3.

Table 3: *Selected Clusters*

Cluster	Hub Account	Number	Members
C1	Curator of ICT Education	2,098	Company Staffs, Students, Educators, Curators, Celebrities
C3	Professor	1,659	Company Staffs, Students, Governmental Staffs, Politician, Educators, Info. of UK
C5	Curator of Media Content Design	1,396	Artist, Company Staffs, Students, Educators, Professors
C7	Professor	1,093	Public Service Staffs, Health and Medical, Professors, Univ Students, Professors
C8	Some Professors (no strong hub)	745	Many Educators, Media Company, Univ Students
C12	Rural Educators (no strong hub)	493	Students, Educators, Music Fans, Entertainment Info.
C13	Educator (female) (no strong hub)	390	K-pop Fans, Entertainment Info., Educators, Students
C14	Educator in Bangkok (no strong hub)	330	Educational Technologists, Public Service Staffs, Media Workers, Professors, Educators, Students, Many Rural Staffs in Education
C15	Manager of Google Apps for Education (no strong hub)	311	Media Company, Students, Educators, Educational Technologist
C16	Rural Professor (no strong hub)	242	News Sites, Educators, Students, Engineers (Most are from North East Area)
C17	Educator (no strong hub)	239	Media Info., Educational Technologies, Educators, Professors, Univ Students (Nationwide)
C18	Rural Educator (no strong hub)	227	Rural Public Staffs, Personal-media Sites, Educators, Artists
G20	TCU Staff (no strong hub)	154	Educational Technologists, Educators, Professors
G22	Rural Educator (no strong hub)	52	Educational Technologists, News Sites, Professors
G26	Rural Educator (no strong hub)	10	Educators, Entertainment, Students
G27	Rural Educator (no strong hub)	6	Educators, Personal Friendship
G29	Educators (no strong hub)	4	Educators, Personal Friendship
G30	Educators (no strong hub)	3	Educators, Personal Friendship

Summarizing these clusters, it can be noted that the following categories were presented.

(1) Groups about central/new information: C1, C14, C20

(2) Groups operated by rural educators: G12, C16, C17, C18, C22, C26, C27

(3) Group which mainly discussing about foreign information: C3

(4) Groups about technical information: C5, G8, C15, C29, C30

(5) Groups about specific area of interest: C7, C13

If a message of the conference organizer is well designed to be attractive or impressive for members of clusters (1), (2), and (4), it will be acceptable by them. These clusters are useful for future content-based communication. On the other hand, we need to better understand the cultural details of (3) and (5), and this information needed in order to reconstruct official information to be consumed by these clusters.

5.4 Clusters of Educators

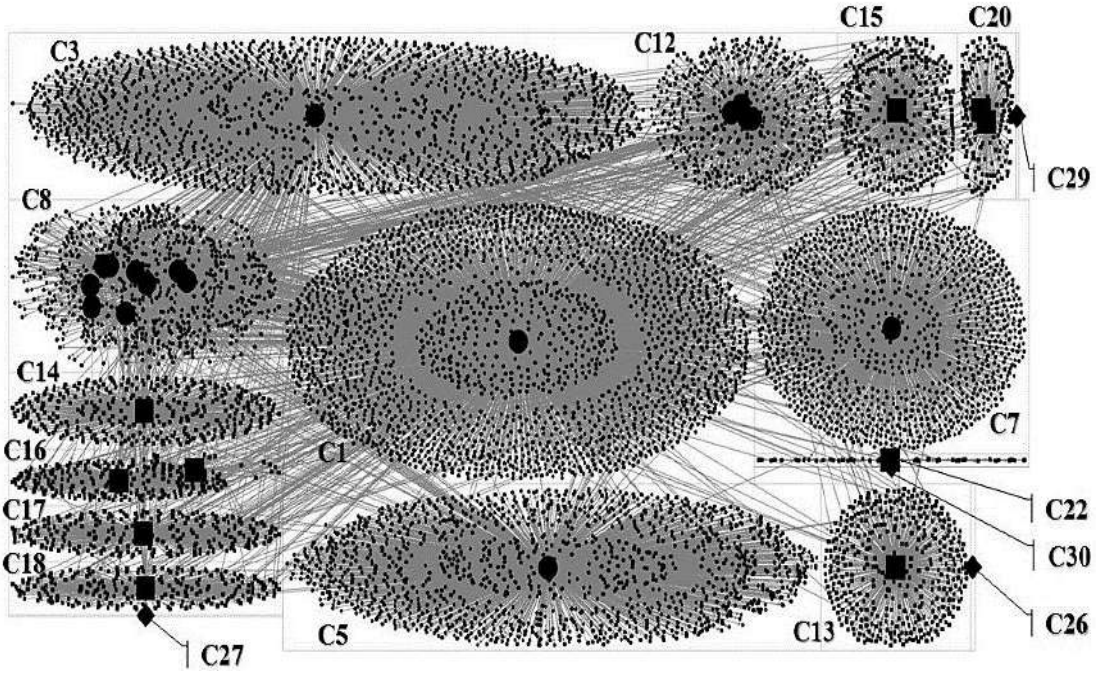

Figure 7: *Social Group Graph of Selected 18 Clusters. Nodes of Identified Revealed Educators are enlarged. Clauset-Newman-Moore Cluster Algorithm was used.*

To better understand the clusters of Table 3, a social group graph is depicted in Figure 7 where nodes of revealed educators are enlarged for identification. Note that many of the revealed educators are located in the hub positions.

The clusters can be classified into the following four categories.

- A cluster with a hub of no revealed educator: C1

- A cluster with a hub of a revealed educator: C3, C5, C7
- A cluster with unclear hub of no revealed educator: No
- A cluster with unclear hub of a revealed educator: C8 (some)*, C12 (some), C13, C14, C15, C16 (some), C17, C18, C20 (some), C22, C26, C29, C27, C30

*(some): Some accounts (including a hub account) of revealed educators are involved.

Hubs are extremely important, if a tweet of a hub can reach many followers immediately. Then, (2) should become an immediate target to process collaborative-based communication.

6. Conclusion

As our future challenge to formulate strategies to communicate with rural educators. Through the analysis of extensional investigation, the following three feasible strategies for forwarding information of the conference organizer were designed.

6.1 Enlightenment Communication

C20 is the special cluster that involved many users of TCU concerned, and they are on intimate terms. A hub is also a staff of TCU. They can influence to forward information and ideas. In this way, a hub is a 'coordinator' bridge.

Regarding representative users, Wu et al. (2011) investigated Twitter, and proposed the following four categories: celebrities (famous person), media (news), organization (companies), and blogs (bloggers). Also, they reported media (41.2%), and blogs (24.3%) had a higher engagement of users. This result implied that possible initial communication would be suitable around news and curators.

In our extensive investigation, many clusters of C1-C17 and C22 involved rich media news information. However, cluster C20 has limited media related tweets, and belongs to the blogs category. Therefore, it needs an assist of the conference organizer to a coordinator to circulate news tweets, and the following keywords are cues for designing tweet messages. In this cluster, the content-based communication can be expected.

Aim, Background, Concept, Emphasis, Expecting Effect, Possible Extension, Applied Examples, Links of Online Resource, Well-known Implementer, Theorist, Useful Sites, Way of Contribution, Info. Of Rural Education.

6.2 Awareness Building

The second strategy is also based on content-based communication, and clusters that involve rural educators at a higher rate were selected. It would be better to send tweets from C20 of the first strategy to revealed educators in other clusters. Receivers are gatekeeper bridges in their clusters.

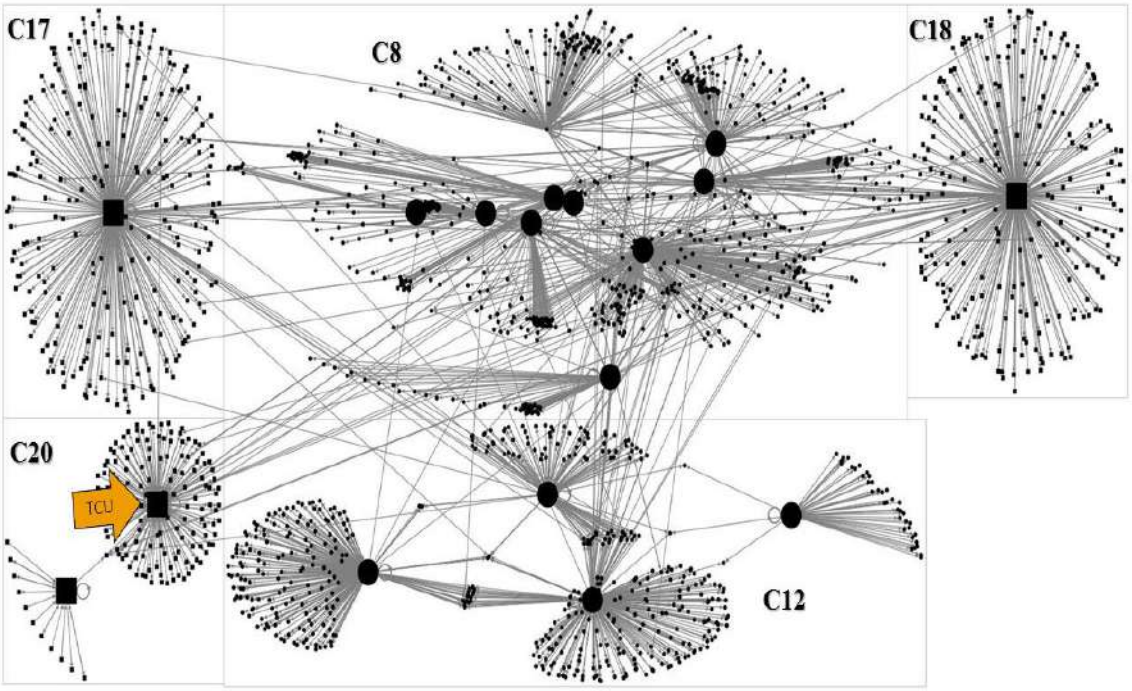

Figure 8: *A Social Group Graph of Selected Clust*ers that Have Many Rural Educators and a Hub of a Revealed Educator. *Nodes of Revealed Educators are enlarged. A Staff of TCU is marked by an Arrow in Cluster 20.* Visualized with the Harel-Koren Fast Multiscale Layout (Harel & Koren, 2000).

Figure 8 shows the relation between C20 and selected clusters. Fortunately, all selected cluster are regarded as suitable clusters for content-based communication in section 5.3. It would be reasonable to focus on C8, because many revealed educators exist and have experience communicating with C20. On the other hand, information from C20 should be designed to be attractive and impressive for members of C8. C8 is comprised of many educational technologists, and they appear to prefer information of technology. One of the most common techniques is collaborative filtering (Herlocker, Konstan, & Riedl, 2000) in which a message

organizer suggests recommendations of items, such as books or web sites, based on user preference similarity.

On the other hand, there are many edges that connect between C8 and other clusters of rural educators; then, the activity of gatekeepers in C8 have the possibility to reach other clusters by retweets or mentions as a ripple effect. In this case, gatekeepers will become liaison bridges.

6.3 Campaign to Promote Awareness

In addition to the content-based communication, it is possible to present the collaborative-based communication strategy, where influential users, which are hubs of larger clusters, are selected as targets. Fortunately, many hubs in larger clusters were revealed educators. To better understand their vigor in Twitter, a filtered social group graph that viewed users who exchanged more than 10,000 tweets are depicted in Figure 9. Revealed educators in C3 and C5 still appeared as active hubs. Fortunately, both clusters are listed as suitable clusters for collaborative-based communication in section 5.4.

The hub of C5 - an educational technologist in a rural school - had experience communicating with C20, and it is reasonable to select this as a target cluster. A hub of C5 is expected as a gatekeeper bridge in this strategy. The ripple effect from a hub of C5 is also expected, but C12 involves many music fans. Therefore, a hub of C5 will be a variant, and the hub will be a liaison bridge of C8.

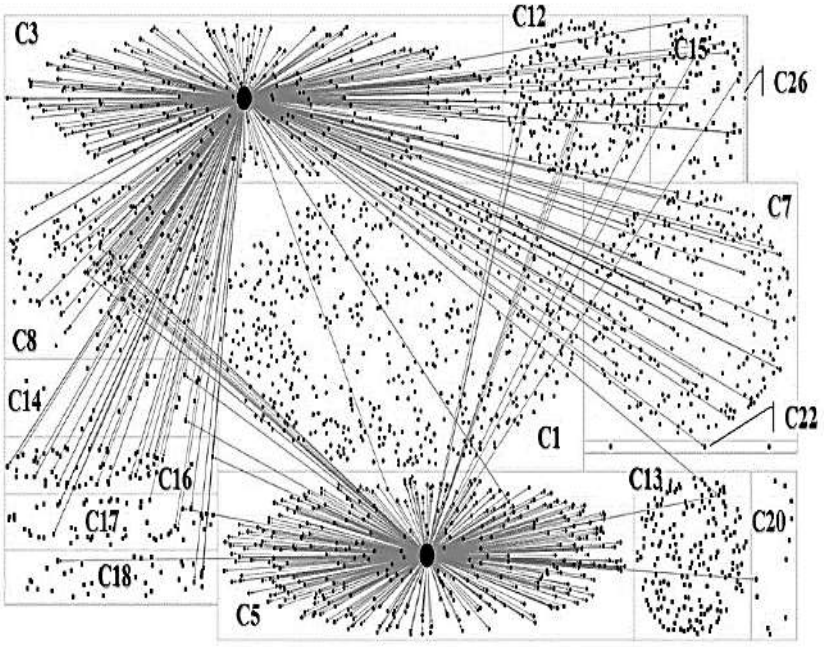

Figure 9: *A Filtered Social Group Graph of Figure 7. Communication of Twitter Users Who have More Than 10,000 Tweets Experience*

6.4 Future Studies

Investigational study in this article presented three feasible online enlightenment strategies to promote rural educators who could not attend a conference; however, it also implied the importance to design official information for specific interests of each cluster. Twitter is a particular SNS that enables easy dissemination of information to a vast amount of users; however, there is a limitation of letters involved in a tweet. Therefore, tweets needs to be selected deliberately, and an official account or link should be included to official pages in order to introduce continuous communication. At this moment, TCU has official home links to Facebook, Google plus, Pinterest, MOOCs, and YouTube as well as Twitter and its web page. Designing strategies of disseminating information in each of these services should be discussed in the next stage.

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