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Social Network Analysis of Teacher's Role in Students' Online Discussion Community

Chih-Ming CHU
Department of Computer Science and Information Engineering, National Ilan University, Taiwan
cmchu@niu.edu.tw

Abstract: Because of the popularization of mobile devices and social media platforms, an increasing number of teachers have begun to adopt online student discussion groups as a method of teaching. Some teachers have asked students to add teachers to their discussion groups, while others have made no such request. The present study recruited college students and teachers for a "special project" course. The online discussion group without the teacher was defined as the control group, while the group with the participation of the teacher was defined as the experimental group. Without knowing that it was an experiment, the students were asked to use the online group for discussion for a period of three months. The messages and interactions of the two groups were then analyzed. The results showed that the number of messages of the control group was significantly higher than that of the experimental group, and the experimental group was relatively passive in leaving messages and less active in interactions. Additionally, the key figure of the community changed from being a student (group leader) in the control group to the teacher in the experimental group.

Keywords: social network analysis, online discussion, network learning community, degree centrality

1. Introduction

With the prevalence and rapid development of e-learning platforms, more educational institutions have begun to use e-learning platforms as a supporting tool for teaching (Sun & Gao, 2017; Swaggerty & Broemmel, 2017)). However, although learners may use the e-learning platforms out of curiosity in the beginning, they tend to gradually stop using the platform because of a lack of patience and external stimulation over time, which has been found to lead to a negative impact on learning performance (Wilfried, Jantina, Sanne, & Geert, 2011). For that reason, some studies have utilized emails to send regular reminders to learners to keep them motivated (Hodges, 2008; Hodges & Kim, 2010), or utilized short message service messages to send learning materials to learners on a regular basis (Hayati, Jalilifar, & Mashhadi, 2013). Nevertheless, the above methods still require learners to study on their own instead of encouraging them to interact with other learners. Such a learning strategy may result in learners developing feelings of loneliness and alienation and lead to high absenteeism (Liu, Magjuka, Bonk, & Lee, 2007; Rovai, 2001; Mayer & Moreno, 2003). Online discussion communities have been found to effectively establish an online learning environment and stimulate students' participation (Colachico, 2007; Conrad, 2005). In addition to improving learning performance, the interaction between community members may also reduce feelings of isolation (Rizzuto, 2017; Hramiak, 2010). Studies have pointed out that peers are very important in the learning process (Wei, Hung, Lee, & Chen, 2011). Bannan-Ritland's (2002) research showed that interaction is crucial for online learning, as it constitutes a part of the teaching goals; therefore, increasing interaction is conducive to the implementation of online courses. From the perspective of educational theory, having learning companions has been found helpful in the acquisition of knowledge as well as beneficial to learners' emotional states and degree of social interaction (Khlaif, Nadiruzzaman, & Kwon, 2017; Kim & Baylor, 2006). Exchanging information between peer learners may also facilitate learners' acquisition of more knowledge (Lan, Sung, & Chang, 2007). When an individual studies on his/her own, the learning process is easily interrupted because of factors such as frustration, while support from peer learners tends to facilitate the continuity of the learning process (Dean, Harden-Thew, & Thomas, 2017;

Dawson, 2010). Studies have revealed that peer interaction and discussion are conducive to problem-solving and knowledge absorption (Chen, Chang, & Wang, 2008). Seeking help from learner peers through online discussions is one way of solving problems (Guan, Tsai, & Hwang, 2006). Through participation in interactive peer learning, students can develop problem-solving skills and new knowledge acquisition abilities (Chou & Tsai, 2002). Additionally, online interaction can provide support and counseling to students with learning difficulties (Chen, Chang, & Wang, 2008). However, most research on the impact of online discussions on community learning appears to focus on the interaction during the communication process (Dominguez-Flores, & Wang, 2011; Liu, Magjuka, Bonk, & Lee, 2007). Few studies have investigated learners' roles in the community and the influence of teachers' involvement in online discussion. Therefore, the present study explored learners' roles in online discussion communities as well as the influence of teacher's participation on learners' performance in a discussion.

2. Literature Review

2.1 Online Learning Community

Communities that are formed around the core purpose of learning are defined as learning communities. This concept was first proposed by Alexander Meiklejohn (1932) and John Dewey (1933). They stated that a learning community allows learners to develop personal viewpoints and remain connected to the concurrent realities of the learning context; therefore, a learning community is an environment that allows a group of individuals to exchange necessary knowledge and information during learning processes and provides individualized learning (Kochtanek & Hein, 2000). An online learning community refers to a group of learners that expand and develop knowledge and abilities both as a unit and as individuals in an online interactive learning environment (Hanna, Glowacki-Dudka, & Conceicao-Runlee, 2000), which is similar to a virtual learning environment and includes information sharing, discussion, and file downloading functions (Barry & Asiedu, 2017; Gillespie, Boulton, Hramiak, & Williamson, 2007). Ke and Hoadley (2009) suggested that an online learning community is an organization that implements learning in a virtual and supportive environment. In sum, an online learning community can be defined as a group of individuals with common learning objectives who participate in learning activities and share knowledge in a virtual community, establish gradual trust during interaction, and thereby develop a close-knit community relationship.

2.2 Social Network and Social Network Analysis

The concept of social networks was first proposed by Barnes (1954) to demonstrate a group of real-life social relations and mainly to explore the relations between individuals and the impact of relational structure on those individuals. Schultz-Jones (2009) suggested that social networks refer to the links between an individual and other individuals, including close relationships, secondary relationships, and other relationships that facilitate the connection between individuals and other individuals, as well as events and objects. A social network contains three key factors: actors, relationships, and linkages (also known as ties) (Mitchell, 1971). Actors are considered by the nodes of a network; they refer to the people, events, and things that define the network, and therefore, they constitute the main body of a social network. An actor usually belongs to many different networks simultaneously and may play different roles in each network. Relationships include the "existence" of a relationship and the "type" of relationship. Actors interact with one another because of the existence of certain relations. Different types of relations and corresponding content lead to a multitude of network environments. Common relations include transaction relations, communication relations, instrumental relations, sentiment relations, authority/power relations, and kinship and descent relations. Next, when an actor intends to establish a relationship with other actors, he/she must build the relationship directly or indirectly through a given path. Such basic links between actors are known as "ties." Based on the closeness, ties can be divided into "strong" and "weak." By analyzing the strength of ties, subgroups and brokers within the network can be identified. Social network analysis is an analysis method developed based on social statisticians to study social structures, interpersonal relationships, organizational systems, and

group interactions (Apperson & Beckman, 1999). In social network analysis, nodes and links represent the relationships within a group; by considering nodes as group members and links as the relationships between members, one is able to clearly demonstrate the structure of the social network, the types of relationships between members, and how they influence one another. In the *Dictionary of Psychology*, Corsini (2002) defined *community roles* as a high-level concept of behavior that is composed of a series of behaviors exhibited by an individual (Corsini, 2002). However, within the academic field of social network analysis, there is a disagreement on the definition of "role." Some studies claim that the notion of *role* depends on the notion of *position*. *Position* refers to a collection of actors that have similar social behavior, links, and interactions (in relation to the interaction of other actors) within the same relational network (Wasserman, & Faust, 1994). Therefore, a *role* is not defined by an actor's own attributes but rather by the types of relations between actors and their positions within the network (Wasserman, & Faust, 1994). Other studies argue that *position* and *role* have an interdefining relationship. Position is generated by the interaction between actors. However, once a position is formed, it is able to shape the relationships between actors. Therefore, the role is the link between the actors and positions. The present study adopted the viewpoint of community role and determined learners' role in the community based on their interactions. The present researchers then utilized social network analysis to explore the relations and influence between community members throughout the entire network structure and adopted the concept of centrality to examine members' roles in the community. The center was used to measure an actor's influence or power (Wasserman, Faust, 1994). The greater the centrality of an actor, the more influential he/she was defined to be.

3. Research Method

The present study recruited six juniors (four male and two female) from the Department of Information Engineering from a university in Taiwan as research subjects. The course utilized for the experiment was dubbed a "special project design." Without being informed that the course was a research project, students were asked to use Facebook's Messenger function to form two discussion groups: a control group and an experimental group. The control group was composed of six students, while the experimental group was composed of six students and their teacher for the course. After three months, social network analysis software Ucinet 6.506 and Netdraw 2.138 were employed to examine the differences in the number of messages exchanged and interactions between members between the two groups.

4. Results and Discussion

The number of messages exchanged by the control and experimental groups are shown in Table 1. S1, S2, S5, and S6 referred to the male students, and S3 and S4 were the female students. S3 was the group leader, and S7 was their teacher. After a three-month discussion within the Facebook Messenger groups, members of the control group exchanged 1,029 valid messages, accounting for 63.3% of the total number of valid messages of the two groups. Meanwhile, the experimental group exchanged 597 valid messages, accounting for 36.7% of the total number of valid messages of the two groups. This finding shows that, compared to members in the group with teacher involvement, members in the group with no teacher involvement tended to be more active in discussion participation. This situation is similar to the situation of students who feel too inhibited to raise their hands in class and express their viewpoints publicly, and yet willingly exchange their opinions privately with other students. Additionally, the number of messages sent by each student, in the order from large to small, was S3 > S5 > S2 > S6 > S4 > S1 in the control group and S2 > S3 > S1 > S5 > S4 > S6 in the experimental group. It can be seen, based on the changes in the order, that S1 was notably active in the experimental group with the presence of the teacher, suggesting that S1 was driven by the teacher's presence to gain recognition. In terms of response rates, the order from high to low was S1 > S6 > S3 > S2 > S4 > S5 in the control group and S3 > S2 > S1 > S5 > S4 > S6 in the experimental group. Although S1's response rate was the highest in the control group (73.1%), he only sent 26 messages, much lower than the number of messages sent by S3 (377 messages). It is worth noting that the number of messages and the

response rate of S4 were relatively low in both groups, suggesting that S4 was not active in the participation of the discussion groups. Moreover, compared to the control group, S6's response rate in the experimental group decreased substantially, indicating that S6 was less active in the group with teacher involvement. In sum, S1, S4, and S6 appeared to require extra attention from other members and the teacher so as to improve the effectiveness of the group discussion.

Table 1: The number of messages exchanged by the control groups and experimental groups.

Student code	Gender	Number of times to be responsed		number of messages		response rate	
		control groups	experimental groups	control groups	experimental groups	control groups	experimental groups
S1	M	19	30	26	36	73.1 %	83.3 %
S2	M	69	34	193	40	35.8 %	85.0 %
S3	F	166	32	377	37	44.0 %	86.5 %
S4	F	25	4	81	7	30.9 %	57.1 %
S5	M	48	6	262	10	18.3 %	60.0 %
S6	M	41	2	90	4	45.6 %	50.0 %
S7	M		431		463		93.1 %
		368	539	1029	597	35.8 %	90.3 %

Figure 1 illustrates the interactions of the control group during the discussion. The lines represent the interactions between two members. The denser the lines were, the more were the messages exchanged between two members. It can be seen from Figure 1 that interaction was present between all members. Moreover, S3 appeared to have more interactions with other members and more frequent interaction with S5, showing that S3 played the central role in the community, which defined his identity as the team leader. A further comparison between Figure 1 and Table 1 revealed that although S1 sent the least messages in the group, his response rate was the highest and he interacted with all members. It is apparent that under the attention of group members, S1 was still able to maintain interaction with others rather than being marginalized. Figure 2 demonstrates the interactions of the experimental group during the discussion. It can be seen clearly that S7 (the teacher) was the central figure of the community; the messages sent by all members reduced significantly, forming an S7-centered discussion environment. With the exception of S4 and S6 (no interaction was found between them), the majority of the members (including the teacher) had interactions with all other members; however, the interactions between S7 and other members appeared to be more dominant. Further, S7 had more interaction with S3 (team leader). It was apparent that the discussion among the members of the experimental group mainly centered around the teacher; interactions between students were limited.

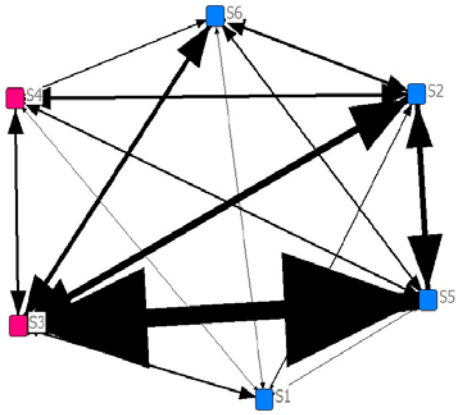

Figure 1. Social network analysis of the control group during the discussion

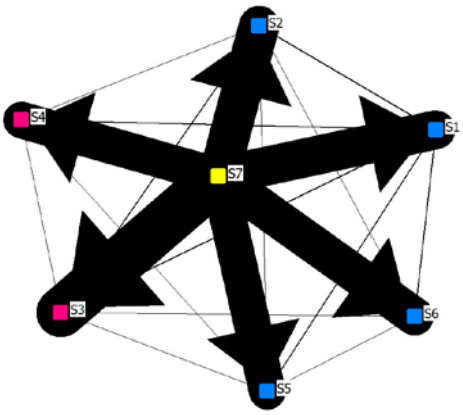

Figure 2. Social network analysis of the Experimental Group During the Discussion

5. Conclusions and Suggestions

Many teachers in the teaching will require students to group the way to set up community online discussion. Some teachers have asked students to add teachers to their discussion groups, while others have made no such request. The following conclusions and suggestions are given in this study. 1.If there is no teacher in the student's online discussion group. Although students can take the initiative to discuss and the number of messages are more. But the quality of discussion not grasp. There is no way for the teacher to discuss the process of the students. Only to see the final result presented. 2.If the teacher joins the online discussion group and plays an active role in leading the discussion topic. The performance of the students will be more passive and silent. 3.It is recommended that teachers should join the student's online discussion group, should more observation and less intervention. If necessary, make comments for students. Avoid intervening discussions and too many speeches.

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