Using Social Network Analysis to Highlight an Emerging Online Community of Practice

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Abstract: In this exploratory study, Cocciolo, Chae and Natriello investigate the extent to which the communicative processes exhibited within a large digital repository illustrate the emergence of an online community of practice (CoP). In order to make this claim, we present a method for identifying the emergence of an online CoP using Social Network Analysis (SNA) on communication data (i.e., uploads and downloads) and institutional role (i.e., expert/faculty vs. novice/student). The analysis reveals that the online repository provides opportunities for novices to perform the role of the expert knowledge facilitator. We posit that these conditions constitute a necessary element for the emergence of an online CoP.

Introduction

In September 2006, Teachers College, Columbia University launched PocketKnowledge (PK) (http://pocketknowledge.tc.columbia.edu/) a digital repository for archiving and publishing the "knowledge products" (e.g., publications, working papers, research data, audio, video) of faculty, students, staff, and alumni. Informed by the literature on communities of practice (Lave & Wenger, 1991; Wenger, 1998), PK was purposively developed to facilitate the sharing of intellectual materials and collaboration among various members of the Columbia University (CU) community. Specifically, features such as: 1) group pockets/portfolios, 2) community commenting, 3) distributed/non-authoritative taxonomic intersections, 4) Rich Site Summary (RSS), and 5) variegated item-level access permissions were incorporated into the design of the system in order to encourage collaboration.

In this exploratory study, we analyze PK utilization by different members of the CU community (e.g., faculty, students) in order draw attention to the possible emergence of an online community of practice (CoP). In the context of this initial study, an online CoP refers to a group of people separated by time and location who: 1) share a common interest in some topic, 2) engage in a process of social learning, and 3) provide opportunities for the novice to perform the expert role (Johnson, 2001; Lave & Wegner, 1991; Wenger, 1998). Using Social Network Analysis (SNA) (Wasserman & Faust, 1994) and cutpoint analysis techniques (Hanneman, 1997), we construct a method for identifying the emergence of an online CoP, and examine the (sub)networks and interactions that have emerged thus far in PK.

Literature Review

The literature on collaborative learning has called for greater research emphasis on the "communicative processes involved in successful (and unsuccessful) peer interactions rather than just learning outcomes" (Cho, Steganone, & Gay, 2002, p. 43). According to scholars such as Lave and Wenger (1991), this line of inquiry is critical because learning is fundamentally a socially situated process. One method for analyzing communicative processes is the investigation of structural locations within a system using social network analysis (SNA). SNA has been used to shed light on several Computer Supported Collaborative Learning (CSCL) contexts. For example, SNA has enabled researchers to identify central and peripheral actors in a CSCL course. Moreover, it has elucidated how the actors' positionalities mediate "learners' perceptions and behaviors related to community-based information sharing practice" (p. 49). Other researchers such as Reffay & Chanier (2003) have investigated the influence of group cohesion in Computer Supported Collaborative Distance-learning (CSCDL). Others have used SNA to clarify the impact of social structures on knowledge construction in an asynchronous learning environment (see, for e.g., Aviv, Erlich, Ravid, & Geva, 2003).

Despite the insights that SNA affords, there are a number of concerns regarding the scope, depth, and richness of network data (de Nooy, Mrvar, and Batagelj, 2005). To address this concern, Martínez, Dimitriadis,

Rubia, Gómez, Garachón, & Marcos (2002) augmented their SNA with qualitative research to gain a deeper understanding of a CSCL environment. Future iterations of this study will similarly employ qualitative methods to supplement the network analyses.

Methods

In the context of this mini-study, we used Systems Theory to define the uploading and downloading of materials as "communicative acts," PK users as "actors," and the cumulative communicative exchanges as "interactions" (Buckley, 1967). Although this is only one configuration for evaluating sociality (1), this particular systems arrangement is useful because it provides a readily available metric for assessing actors' interactions within a network.

PK usage data was gathered from September 6, 2006 to November 18, 2006. During this time, N=228 distinct users exchanged files either by uploading a file or by downloading a file. The analysis does not include downloads from users who were not logged in. The usage data was converted to a matrix and visualized as a network using NetDraw (Boragatti, 2002). Network attribute data, which indicated institutional role (e.g., masters-level student) and color, was added to indicate user/node role. Additional analyses were conducted with NetDraw, including segmenting the network into components and filtering out key actors using cutpoints analysis. Table 1 presents the distribution of individuals over the set of institutional roles.

Table 1: Role distribution of user population

Library	Doctoral Student	MA Student	Faculty/instructor	Staff	Other
2	66	106	17	11	25

Results

The network can be decomposed into several components as shown in Figure 1. These include: 1) isolated actors (users who only use the system to store their own work and choose not to share with others), 2) a large and varied community of actors and interactions, and 3) close-knit communicators who are isolated. Within the large community of actors and interactions, there are two clusters. These can be found by visual inspection or by computing eigenvetors. Cluster one illustrates interactions for a course offered by a doctoral student, and cluster two illustrates interactions around library-contributed materials (e.g., historical dissertations). These two clusters illustrate the importance of community members who are specifically responsible for communicating knowledge or content (in this case, an instructor and an academic library).

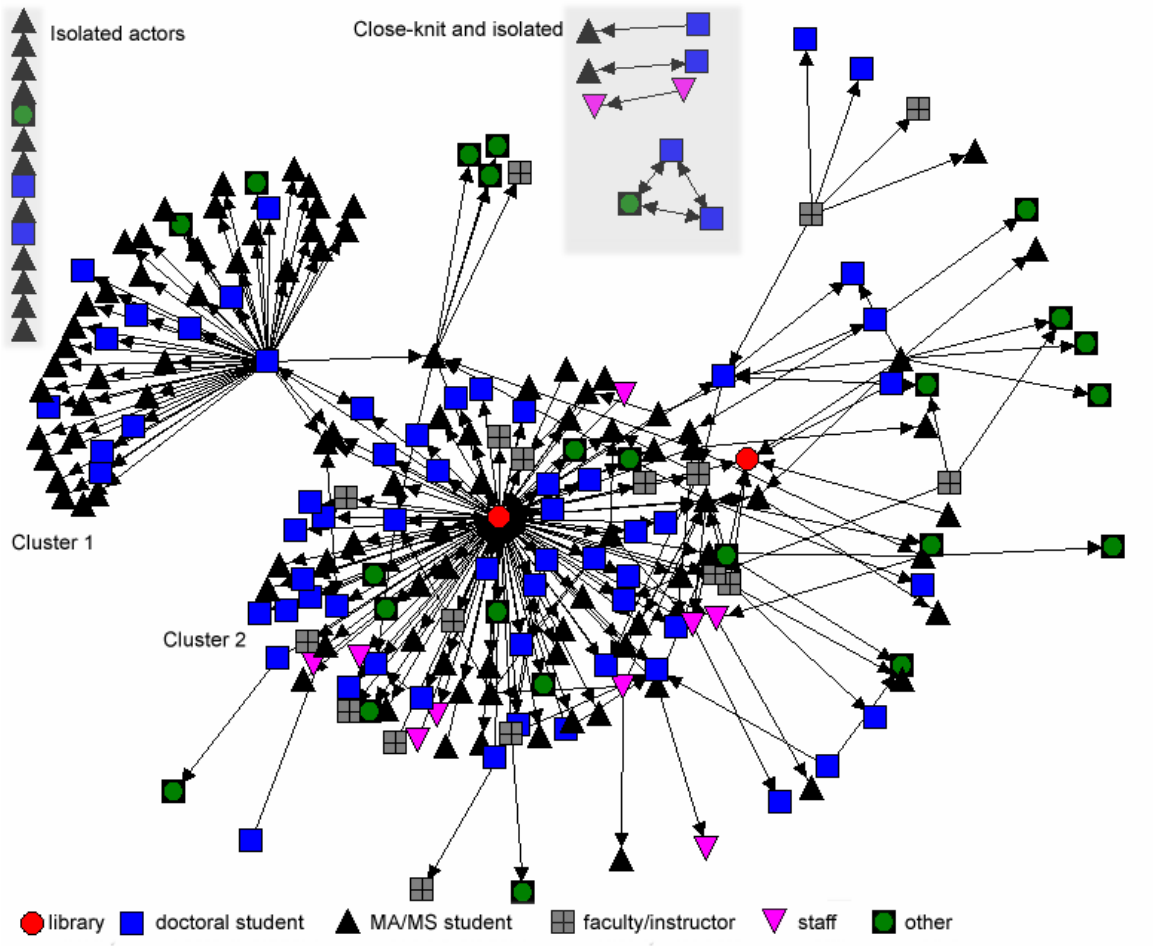

Figure 1. Components of community network visualization

Upon further analysis, there are many more critical community members than Figure 1 might suggest. A cutpoints analysis was conducted to reveal those key actors/nodes whose removal would leave the network divided into unconnected systems. As described by Hanneman (1997), "cutpoints may be particularly important actors -- who may act as brokers among otherwise disconnected groups." Figure 2, which shows the cutpoints or key facilitators, reveals that there are other actors—in addition to those highlighted in Figure 1—who play a significant role in knowledge sharing.

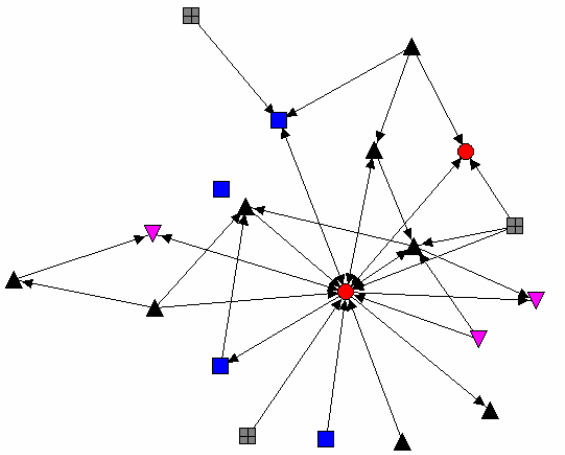

Figure 2. Cutpoints, or key facilitators of sharing

In the context of this study, cutpoints are actors who are facilitators of knowledge sharing. This analysis reveals that knowledge facilitators occur in proportion to their total numbers within the system. For example, ~11% of all cutpoints are faculty, and ~7% of all actors are faculty. Similarly, ~72% of all cutpoints are students, where ~75% of all actors are students (see Table 2). Our analysis also reveals that students (i.e., novice) play an equally important role in facilitating knowledge sharing as do faculty (i.e., experts). Moreover, the analysis indicates that novice learners (in a relative sense) are able to come to occupy the role of the expert facilitator, gradually "fashioning relations of identity as a full practitioner" (Lave & Wegner, 1991, p. 121). Much like a CoP, experts are not dispensed with, but rather novice learners are provided "with opportunities to make the culture of practice theirs" (p. 95).

Table 2: Cutpoints (or key actors) by role, % of all cutpoints, and % of all users

	Library	Doctoral Student	MA Student	Faculty/instructor	Staff	Other
Cutpoints	2	4	9	2	3	0
% of all cutpoints	11.1%	22.2%	50.0%	11.1%	5.6%	0%
% of all users	.9%	28.9%	46.5%	7.5%	4.8%	11.9%

Conclusion

This study used Social Network Analysis (SNA) to examine the communicative processes represented in an expansive repository for community-generated intellectual materials. This analysis reveled several phenomena, the most important of which is the extent to which novice learners have come to occupy central roles in terms of facilitating knowledge sharing. Additionally, by examining the extent to which novices are afforded opportunities to share the role of the expert performer, and analyzing the proportion of expert and novice actors who share the role of knowledge facilitator, the study presents a way for researchers to determine the emergence of an online CoP.

Endnotes

(1) Another measure of sociality could be community commenting on materials within PK

References

Aviv, R., Erlich, Z., Ravid, G., & Geva, A. (2003). Network Analysis of Knowledge Construction in Asynchronous Learning Networks. *Journal of Asynchronous Learning Networks, 7*(3), 1-23. Retrieved November 30, 2006, from http://www.aln.org/publications/jaln/v7n3/pdf/v7n3_aviv.pdf

Borgatti, S.P. (2002). *NetDraw: Graph visualization software*. Harvard: Analytic Technologies.

Buckley, W. (1967). *Sociology and modern system theory*. Englewood Cliffs, NJ: Prentice-Hall.

Cho, H., Stefanone, M., & Gay, G. (2002). Social information sharing in a CSCL Community. In G. Stahl (Ed.), *Computer support for collaborative learning: Foundations for a CSCL community* (pp. 43-50). Hillsdale, NJ: Lawrence Erlbaum.

De Nooy, W., Mrvar, A., & Batagelj, V. (2005). Exploratory social network analysis with Pajek. New York: Cambridge University Press.

Hanneman, R. A., & Riddle, M. (2005). *Introduction to social network methods*. Riverside, CA: University of California, Riverside. Retrieved November 30, 2006 from http://faculty.ucr.edu/~hanneman/

Lave, J. & Wenger, E. (1991). *Situated learning: Legitimate peripheral participation.* Cambridge: Cambridge UP.

Martínez, A., Dimitriadis, Y., Rubia, B., Gómez, E., Garachón, I., & Marcos, J.A. (2002). Studying social aspects of computer-supported collaboration with a mixed evaluation approach. In G. Stahl (Ed.), *Computer support for collaborative learning: Foundations for a CSCL community* (pp. 631-632). Hillsdale, NJ: Lawrence Erlbaum.

Reffay, C., & Chanier, T. (2002). Social network analysis used for modeling collaboration in distance-learning groups. In S.A. Cerri, G. Guardères, & F. Paraguaçu, (Eds.), *Proceedings of the 6th international conference on intelligent tutoring systems* (pp. 31-40). Biarritz, France.

Reffay, C., & Chanier, T. (2003). How social network analysis can help to measure cohesion in collaborative distance-learning. In B. Wasson, S. Ludvigsen, & U. Hoppe (Eds.), *Designing for change in networked learning environments. Proceedings of the international conference on computer support for collaborative learning 2003* (pp. 343–352). Dordrecht, Netherlands: Kluwer Academic Publishers.

Wasserman, S., & Faust, K. (1994). *Social network analysis: Methods and applications*. Cambridge: Cambridge University Press.

Wenger, E. (1998). *Communities of practice: Learning, meaning, and identity*. New York: Cambridge University.