Beyond sociograms inspection: What social network analysis (SNA) has to offer to measure cohesion in CSCL

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Abstract: Social network analysis (SNA) has emerged as a widely used approach to study structural aspects of collaboration. However, its techniques have not been fully exploited yet in CSCL. This paper presents the main results of a survey that focused on identifying the existing approaches for the study of cohesion in CSCL using SNA techniques. It also points out some challenges and future research lines in this area.

Introduction

Social network analysis (SNA) has been recognized as one of the relevant methods within the multiple analytic voices in CSCL (Suthers et al., 2011). The number of papers dealing with SNA presented in recent CSCL conferences reflects this interest (Reffay & Martínez-Monés, 2011).

SNA provides indicators and visualizations to gain insight into the structural properties of interaction, as well as into the ways these properties affect the individuals. However, despite its apparently simple and intuitive techniques, SNA is also a broad and complex research field in its own right. Researchers need to be aware of the rules and conventions of SNA when applying it to their work.

This work aims to shed light on how SNA has been used to measure cohesion based on empirical data from educational settings and guide future research in the area.

Method

We reviewed the literature on the use of SNA to analyze interaction in computer-supported educational settings. The first finding was that researchers had paid relatively less attention to the study of cohesion than to other network properties, such as centrality and position.

Cohesion is considered in collaborative learning as an important factor for motivation and effectiveness. Dense and cohesive networks have the potential to facilitate fluid flow of information, ideas and resources among participants, which in principle is conducive to collaboration. However, it is unclear whether and how this is being studied in CSCL and to what extent these potential benefits apply to CSCL. In order to delve into these issues, we focused this study in the following questions:

- Which SNA methods have been proposed to measure cohesion in CSCL?
- What are their main findings in terms of the influence of group cohesion in learning?

Results and findings

Once the focus and dimensions of this survey were set, we reviewed 143 papers to identify those dealing with cohesion. A total of 41 papers were selected. These were classified according to the data source(s) employed to build the network and to the technique used to measure cohesion. The detailed categorization of these selected papers is available as an online appendix (1). Table 1 shows a summary of the number of papers found in each category.

We distinguished four main approaches to measure cohesion in SNA: (1) sociogram inspection to analyze the network structure and groupings; (2) indexes such as cohesion index and network density and centralization; (3) identification of cliques and clusters; and (4) cut-point analysis and identification of bridges. The reviewed works posed research questions related to the relationship between group cohesiveness and the quality of knowledge construction, as well as more specific questions, such as the existence of an homophily effect, that assumes that similar people tend to join together. The research approaches varied from hypothesis testing to more descriptive mixed-method studies, where SNA was used to complement other data sources.

The data sources used to build the networks were predominantly asynchronous forum discussions and collaborative knowledge building discourse. Many current tools used to conduct automatic SNA use forum data as their input. Other data sources, especially those that characterize interaction in Web2.0 are rare. We also found that there is a tendency to not specify sufficiently how the networks are built from the data sources. Many studies take the meaning of the links almost for granted. Others, like Goggins (2010), show that many subtleties exist and need to be made explicit, as they have an impact on the interpretation of the analysis.

Table 1: Number of papers found for each group of cohesion techniques and data source. Some papers count more than once, if they apply more than one technique or/and deal with different data sources.

Data source \ Techniques (Total of distinct papers = 41)	Sociogram inspection for cohesion (16)	Numerical indexes: Density Cohesion and centralization (24)	Groupings: Components, Cliques, Clusters (19)	Cut point analysis, bridges (4)
Discussion Forum (21)	6	11	12	2
Document sharing (8)	5	4	2	2
Wiki (1)	1	0	0	1
Blog / shared profiles (3)	2	1	2	1
CSILE or KF (7)	3	5	2	0
Chat (1)	0	1	0	0
e-mail (2)	1	1	2	0
Twitter (2)	1	2	0	0
Integrated data (2)	1	0	0	1

Conclusions

SNA is becoming an accepted analytic approach in CSCL to measure structural properties of collaboration in learning settings. This dimension is becoming even more prominent now, with the rising popularity of MOOCs (Massive Open Online Courses) and other community-wide learning events. The first finding of our literature review is that the vast majority of the reviewed papers deal with centrality and positions of individuals in the network. Less than a third of them were studying cohesion.

In terms of the interpretation of the results, we have found little consensus in the relevant literature on the implications of cohesion for learning in general. Although it is regarded as a desirable characteristic of a group, some of the reviewed works found out that cohesion indexes where negatively related to knowledge construction variables, while other obtained positive results. This does not mean that SNA is inadequate for studying these structural aspects of learning and collaboration, but that its findings need to be interpreted in the contexts they were generated. It seems to us that there is room in this direction for research to better identify the impact of cohesion on learning in its various contexts.

This is related to another conclusion of our work: more care should be taken in considering the implications of each particular network model on the interpretation of the results. Accordingly, we implore researchers using SNA methods to pay special attention to describing the network models they are applying and how they are built from the raw data. Despite the wide range of possible and emerging data sources (social media, blogs, tweets, etc.), asynchronous discussion forums remain the most commonly studied ones. Furthermore, even if different sources are considered in a number of works, they are mostly considered separately. One specific aspect that has been neglected so far in the studies is how to combine them and use multiplexity to gauge the strength of ties between people according the variety of relationships rather than merely the quantity of interactions in a particular medium. Many CSCL interaction studies employ different mediating tools, and this provides an excellent opportunity to study multiplexity as an index of the collaboration in educational settings.

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Endnotes

(1) http://gsic.uva.es/docs/CSCL2013/MartinezReffayTeplovs_Appendix_CSCL2013.pdf

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