

Interaction in virtual learning environments: an analysis of two discussion forums

DOI: 10.3395/reciis.v3i2.219en



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Abstract

The role of interaction in constructing knowledge in discussion forums in virtual learning environments (VLE) is often supported by students' reports regarding their experiences in such forums. This paper aims to describe the interaction and knowledge construction patterns in an online forum, based on the social network theory and on cognitive levels of increasing complexity. The classification of cognitive levels (SOLO taxonomy) was used as a theoretical framework when analyzing the data. We noticed that the number of messages posted, sent and received varied among the forums, which resulted in variations in centrality measures of those forums. The tutor participated actively in forum I. He interacted with the students throughout the activity. Such activity was restricted in forum II, where the tutor was limited to posting the initial and closing messages of the forum. This has not resulted in significant changes in student's interaction, unlike scientific literature which associates greater participation by the tutor with greater interaction between participants.

Keywords

virtual learning environment; distance learning; interaction; asynchronous communication; taxonomy

Education mediated by the internet refers to the educational process in which participants are separated geographically and/or temporally and use technologies available on the Web in order to exchange information. Support to this education consists of a series of integrated and distributed systems with client/server applications

which use the internet protocol standards. The tools present in these systems allow their users to interact synchronously and asynchronously. This allows more flexibility and efficiency in learning.

The interaction we will deal with in this article is asynchronous. In virtual learning environments it usually

takes place in limited spaces - discussion forums, and Primo (2005) classifies it as mutual due to its features of problematization, negotiation and reciprocal modifications by the interagents during the interaction process (recursion). Recuero (2005) adds that the negotiation which happens in this public space has “interdependent actions [which] generate interpretations and a dynamic flow.” The aim of this article is to present the results obtained in the project approved by the Program to Encourage Research and Technological Development - PIPDT 2007-2008 of the Institute for Communication and Scientific and Technological Information on Health (Icict) of the Oswaldo Cruz Foundation (Fiocruz). The purpose is to analyze how social actors in healthcare services use the information and communication technologies in virtual learning environments. The subject of our study was a Distance Learning (DL) course offered by the National School of Public Health-Fiocruz, in which the discussion forums were included as part of the assessment of students’ performance.

Despite the widespread use of discussion forums as one of the pedagogical strategies in virtual learning environments (VLE) and the importance given to interaction in the construction of knowledge, the analysis of students’ participation in the forums is largely based on counting the number of messages posted or on criteria defined by the tutor. Analyzing the forum messages when compared to the other messages shows the degree of connection and orientation of forum messages, as well as the reciprocity of communication between participants. Using methods arising from the social network theory and from taxonomies to classify the messages offers tools which help assess students’ participation in online discussion forums, as well as the level of critical thinking students have achieved.

We attempted to describe the interaction patterns of participants of two online forums, in addition to the levels of messages posted by using methods of social network analysis and classification according to the levels of complexity of SOLO taxonomy (Structure of Observed Learning Outcomes). We used discussion forums from the same class of a graduate course in health. We selected the first unit because it was the students’ first contact with the communication tools, the pedagogical guidelines and their colleagues and tutor (forum I). The third unit was also selected, when students were more familiar with the experience of asynchronous communication (forum III). The forums had 29 and 31 participants, respectively. Their names were listed alphabetically and numbered in a sequence for identification purposes. The following criteria were used to identify interactions between the participants: a) reference, in the body of the message, to one or more participants’ names; b) reference to topics, keywords or phrases in the subject line or body of the messages posted previously, with attention to place, date and time of the messages. The interactions between the participants were stored in an adjacency matrix in order to calculate the measures of density, centralization and centrality.

We have used as a theoretical framework the classification of cognitive levels through taxonomy (SOLO)

in order to analyze the data (Box 1). The messages were considered to be targeted (sender-receiver). The messages were classified according to SOLO taxonomy by three independent codifiers. The reliability of the codification was calculated by using Krippendorff’s alpha coefficient (HAYES et al., 2007). The correlation between the number of words and the classification in cognitive levels was estimated through the polyserial correlation coefficient. The density and centrality estimates and the sociograms used in examining the interaction data in interactions were calculated using the Ucinet application (BORGATTI et al., 2002). In connection with sociograms, the size of the node relates directly to the degree of betweenness centrality. The actors in the upper left-hand corner correspond to the participants who did not interact with the rest of the members in their respective forums.

Box 1 - Levels of complexity and range of the SOLO Taxonomy

Level of complexity	Range of level	Grade
Pre-structural	Hybrid	1
Uni-structural	States, makes notes, acknowledges	2
Multi-structural	Describe, interpreta, lista, resolve	3
Relational	Describes, interprets, lists, solves	4
Extended Abstract	Creates, debates, hypothesizes, predicts, validates	5

Source: BIGGS, J.B.; COLLIS, K.F. *Evaluating the quality of learning: the solo taxonomy (structure of the observed learning outcome)*, New York: Academic Press, 1982.

The result of this study shows that 51.1% of its participants were male, aged between 25 and 58 (average: 42.3 ± 7.9), and 67.7% had completed courses in the field of systems analysis. The reliability measures of the messages’ codification, 0.68 (forum I) and 0.76 (forum III), were considered acceptable for the abovementioned coefficient. The polyserial correlation between the number of words and the cognitive levels was greater in forum III ($\rho = 0.90$) when compared to forum I ($\rho = 0.75$). This correlation was statistically significant for both forums ($p < 0.01$). The average number of messages posted, sent and received in the forums varied between 2.9 and 3.8. The interaction measures are shown in Table 1.

Table 1 - Interaction measures of the actors in two online discussion forums

Estimate (%)	Forum I	Forum III
Density	10.3	10.7
Reciprocity	23.2	16.7
Centralization	5.4	12.1
Degree centrality (out/in-degree)	8.4/12.2	5.4/5.8
Betweenness centrality	17.6	8.9
Flow centrality	28.5	7.3

Source: author

The density of interactions, measured by the degree of dyadic connection, has shown low figures in both forums, with an average of 1.2 (forum I) and 1.5 (forum III) messages posted between two random pairs. The reciprocity of the communication, measured by the percentage of people who interacted, was also low - 23% (forum I) and 17% (forum III). Some participants stood out as influent actors in the forums by the number of messages sent and/or received in forum I (22,15,11) and forum III (22,11,19), but this has not resulted in clustering in small groups or network centralization (Figures 1 and 2).

The degree of centrality and power varied between the participants and the forums according to the strong and weak connections of the actors. The betweenness centrality average in the forums was low, concentrating on the tutor (5) and three participants (11, 4 and 22) in forum I. In forum III, the average of betweenness centrality was even lower, concentrating on actors 16, 11, 14 e 22. Students 27, 24, 21, 20, 18, 12, 9 and 7 had limited participation and intermediation in exchanges between students. The flow centrality measures were relatively low in forums I and III, whose participants 15 and 1 and 16 and 19, respectively, were the actors with greater control and power intermediating the discussion (Figures 1 and 2).

The analysis of students' interaction assumed that there would be great participation in the forums since they were relatively homogeneous groups who worked in the field of information in healthcare - which was the subject matter of the discussion in both forums. Additionally, because the forum was an asynchronous communication space, it allowed access according to the users' convenience, which would expand the possibilities of participation. However, with the exception of some influent actors, the forums have displayed low density and reciprocity. The limited volume of messages exchanged between forum members may be attributed to lack of interest in the means of communication and/or in the questions posed in the forums. It would not be possible to claim lack of time to participate, since these forums had an average duration of three weeks.

The forums' low degree of centralization and centrality has shown a more equitable feature of participation in the discussions. The fact that the indegree centralization index is greater in forum I than the outdegree centralization index is due to the fact that the answers come from a group of members (those who send the replies) greater than the group which receives the messages.

As to the tutor's participation in the forums, we observed that it was active in forum I, in which he interacted with students throughout the activity, and limited in forum III, in which he only posted the initial and closing messages in the forum. The change of attitude by the tutor has not caused significant changes in the pattern of interaction in the forums because of the performance of some participants in forum I and forum III. They took on the role of animators/mediators of the discussion (Figures 1 and 2). The low betweenness

centrality occurred because a greater number of actors joined the mediation of the discussion in forum III, despite the lower number of participants.

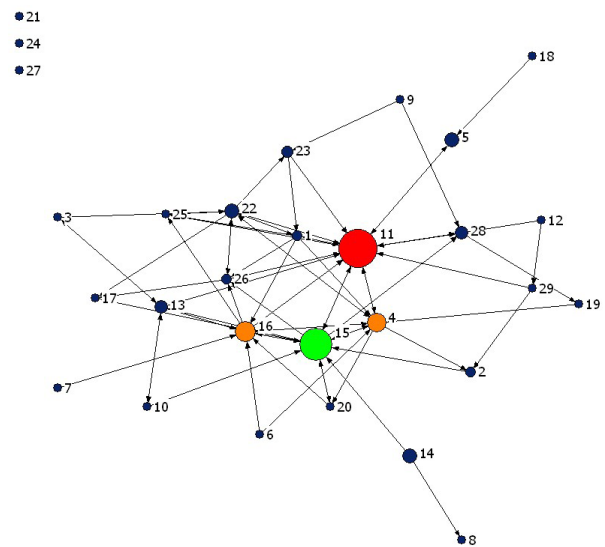


Figure 1 - Sociogram of forum I.

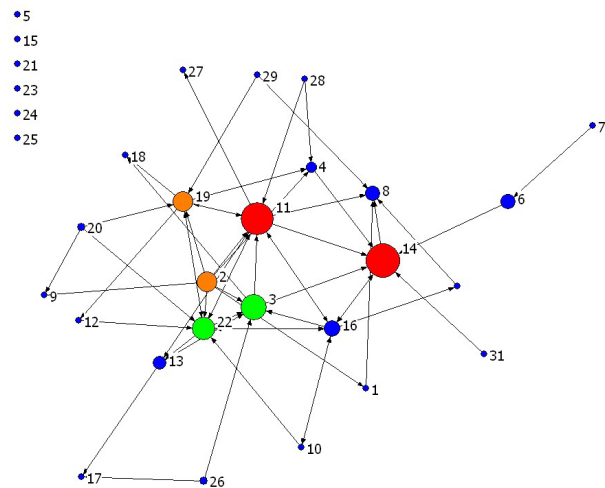


Figure 2 - Sociogram of forum III.

The variation of the reliability coefficients resulted from the codifiers' greater skill in using the taxonomy. The fact that forums were included as part of the assessment of students' performance stimulated them to post messages, but such participation did not result in messages which were guided by critical thinking. In the allocation according to cognitive levels, 59.8% (forum I) and 45.6% (forum III) of the messages were classified as level 2, in which contents were limited to noticing or reaffirming observations made by other participants. The reason for such findings is the classification we used, in which the higher cognitive levels are associated with the more elaborate discussions, with a detailed presentation of arguments, which is incompatible with succinct or reaffirming messages.

One can conclude that using the methods of social network theories and communication taxonomies opens a possibility to prevent that the assessment of communication dynamics of online discussion forums be limited to simply counting the number of messages posted, combined or not with variable tutor criteria. As to mediation in those forums, one may infer that it can either be made by the tutor as well as by other members. This encourages less centralized communication. The posting of messages of higher cognitive levels in forum III may have been influenced by the colleagues' familiarity with the communication tool, the posting of provocative messages supported by personal experience, as well as active participation of some members of the forum.

This project's continuity aims to analyze the respective forums in another class of the same course. We chose this class based on the tutor's performance. He participated actively in both forums. Thus, we will be able to establish a comparison between the interaction patterns according to the tutor's performance, combining such findings with the analysis of interviews of tutors and students regarding the role of forums in online learning. We hope that, by making this study's findings public, we may be able to offer information to help reformulate guidelines for professional education in this kind of environment. Such information will hopefully promote greater interaction between participants and critical thinking on the contents of discussion forums.

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Josué Laguardia has a degree in Medicine from Universidade Federal de Juiz de Fora (1989), a master's degree in Collective Health from Universidade do Estado do Rio de Janeiro (1995) and a Ph.D. degree in Public Health from Escola Nacional de Saúde Pública - ENSP/Fiocruz (2007). He is currently a researcher of the Institute of Scientific and Technological Information & Communication in Health (Icict) of Fundação Oswaldo Cruz. He has experience in the Public Health area, with focus on Epidemiological Surveillance, acting primarily in the following subjects: information system, tuberculosis, epidemiological surveillance, race and mandatory notification diseases. He currently develops researches in the remote education areas and assessment of virtual learning environments.

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