SOCIAL NETWORK ANALYSIS (SNA): A STUDY OF A SOCIAL NETWORK IN THE FORUM PROEDI

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Abstract

The study that we present in this article deals with the analysis of the interactions of the social network forum PROEDI, titled Educational Podcasting. The Social network analysis (SNA), through matrix data, allows you to create a list of nodes (node - every element of the network elements) and connections (established relations between the nodes), and create a graph of links which, in our case, we call "interactions". By analyzing the graphic and the various indicators (centrality, density, intermediation and closeness) we understand the position of the members of the network, identify whether the group is cohesive or not and also identify which members have greater influence in the group. The results obtained in the analysis of this forum show that the network has a density level that reveals a large involvement and engagement in the discussion group, thus allowing a flow of information fairly equal among the members. However, and although the data obtained indicate the great commitment of the group to interact, there are elements that assume control of communication, whether in sending or receiving the information. This is a new data, because in previous studies, conducted by researchers in the social network PROEDI, this role was taken over entirely by the e-moderator of the network, which did not happen in this case and that can be justified, in the perspective of the authors, by thematic debate that somehow stimulated and urged members to participate more actively and committed.

Keywords: interaction, social network analysis, density, cohesion, communication.

1   INTRODUCTION

In this article we present the results of an analytical study that analyzed the interactions established in a discussion forum among the members of a social network site called PROEDI for the professional development of teachers of Portuguese language. It is a fully oriented informal social network, created in January 2011 as part of a PhD project of one of the authors with the aim of investigating if it is possible, through interaction and social and cognitive mediation established between community members of PROEDI, to build a shared and collaborative knowledge ([1], [2], [3], [4]). The Forum examined was entitled Educational Podcasting and involved a group of 16 people from Brazil and Portugal. As the purpose of the review was to describe the position that members play in the discussion, we opted for Social network analysis (SNA) for we believe that it is a model of effective analysis and that provides us with sufficient data to analyze a few indicators that we consider important when we want to understand the dynamics of a network by allowing to see the network as a whole.

Therefore, this article is structured into 04 sections, which succeed to this Introduction. In section 2, we do a brief approach to the SNA; in section 03 we will feature the study implemented specifying the methodology used as well as the instruments employed. On section 04, we present and discuss the data obtained when the analysis and on the last topic (05), and present a few final thoughts.

2   SOCIAL NETWORK ANALYSIS

In the literature there is a panoply of instruments to analyze the interactions within a social network. In the specific case of our study we will focus our attention on the analysis of social networks (SAN), because, according to some theorists who address the subject, such as [5], the SNA is a reliable way to understand the dynamics of a given social network. The SNA is an ancient technique that has its roots in sociology, anthropology and also in social psychology and is used specifically to analyze the operation of a given system that has the connections and interactions as support. Roughly speaking, it is concerned with understanding how each element behaves having as a premise the connections that the members have between them ([6], [7]).

Its aim is to understand the relationship between different actors, seeking to ensure that the position they occupy can influence access to information, knowledge and influence the very construction of knowledge [8]. For this purpose it is accomplished a mapping and analysis of the relationships between the nodes (individuals, institutions, groups) and links (arrows - existing relationships) which can be directional or bi-directional [9]. By means of matrix data that are entered in a spreadsheet, which specify the existing relationships between specific nodes (actors), to which we assign "1" the existence of interaction and "0" the non-existence of interaction [10], these data are translated into a specific computer program allowing us a much easier approach, through the following indicators: i) density; ii) centrality; iii) centralization; iv) intermediation and v) closeness [11]. To facilitate the reader's understanding, the description of these indicators will resume later in this article in the topic where we present and discuss the data, at which time we will do a brief conceptual explanation of each one of them before they are applied to the data.

3   STUDY

The study presented here follows a preferred line of qualitative nature, whereas his main goals will be to analyze the existing interactions between the actors of the networks, their behaviors and positions that each Member occupies. For this, we use a number of techniques related to Social Network Analysis (SNA) that will allow us to represent the interactions and relationships between the actors not only by means of graphic representation, but also by means of some indicators which will provide inputs to explain the operation of the network [12]. In general terms, the SNA aims to describe and represent the interactions of the elements of the network, helping the researcher to understand the behavior and attitudes of the actors when participating in the discussion forum because, as referred by [13], the SNA is a very effective method to understand the oganization and available to members in a social network, that in the specific case of our study was the social network PROEDI (Teachers in the Digital Age).

The study focused on the social network forum PROEDI (teachers in the Digital Age- www.preodi.ning.com) titled "Podcast on Education", which was created on February 12, 2011, in honor of Valentine's day which in Portugal is celebrated on February 12. To this end, we create a podcast, titled "Valentine's day Poem" for the members to listen and somehow stimulate their participation in the Forum. Totally informal in character, with the participation of 16 members, with a total of 42 contributions. However, to our analysis we only counted on 41 contributions, whereas one of the contributions not answered the specificities and objectives of our analysis.

The PROEDI was created on Ning social software tool, online since January 2011, and is part of a wider project at doctoral level, whose central objective is to explore new approaches to training and professional development of teachers that emerge from the context of the paradigm known as Web 2.0 [14]. It is used in various contexts, i.e., both as informal learning environment and as a complement to face-to-face training actions.

3.1   Sample Characterization

As mentioned above, we had the participation of 16 members, all of them teachers. From these, 08 are male and 08 are female. With respect to age, 05 belong to age group 31-35 years; 03 belong to the age group 20-25 years; 03 belong to the age group 26-40 years; 02 belong to age group 26-30 years; 01 (41-50); 01 (56-60) and 01 is above 60 years of age. With respect to the country, the majority (09) is from Brazil and the rest are from Portugal. With regard to marital status, 06 are married, 05 are single, 02 divorced, 02 marked the option "other" and 01 did not answer. With regard to training in ICT, 06 replied that have basic training, 04 have average formation and 04 have advanced training and 02 have not answered.

3.2   Data Collection Instrument

For the structural analysis of the network we used direct observation, since, according to several authors [15], it is the most widely used technique for studying the links between the members of a small group, which, in the specific case of our study, is perfectly adequate. For the analysis of indicators (density, degree of centrality, index of centrality, intermediation and closeness), software Ucinet was used, and for the graphical representation of the interactions we use the Netdraw [16].

4   DISCUSSION OF THE DATA

In this study we will present the results of the sociometric analysis of the interactions seen in the discussion forum titled "Podcast on Education" with reference to the density, degree of centrality, index of centralization, degree of intermediation and degree of closeness, always weaving some comments that might enrich our study so that we can understand the role played by some of the participating members. However it is important to note that any analysis had as its starting point the spreadsheet (see figure 1) below that contains the existing relationships between the nodes, which were properly interpreted in software Ucinet and which we will discuss in the topics that follow.

UCINET Spreadsheet - C:\Users\eslisboa\Desktop\BACKUP PEN DRIVE 25.04.12\DOUTORAMENTO\ANEXOS\FORUNS\FORUM VII- POD CAST NA EDUCAÇÃO\ANALISE SOCIOMETRICA\rede_d eint

File   Edit   Transform   Fill   Labels   Options   Help

	A01	A02	A03	A04	A05	A06	A07	A08	A09	A10	A11	A12	A13	A14	A15	A16
A01	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
A02	1	0	1	1	1	1	1	0	0	1	1	0	0	1	0	1
A03	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
A04	1	1	0	0	1	0	1	0	0	0	0	1	0	0	0	0
A05	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
A06	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0
A07	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1
A08	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1
A09	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1
A10	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
A11	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
A12	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0
A13	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1
A14	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1
A15	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1
A16	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0

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Figure 1: Worksheet of interaction between the "nodes" or the participants of the discussion forum "Podcast on Education"

a) Network density

One of the essential features when studying a network is to realize first hand, the density of the network because it allows us to realize the level of cohesion among the members, and the established connections, which for us is an indicator of increased importance to understand the level of cooperation among the members in the construction of knowledge. To calculate the density of the network, we have first to know the number of existing relations and possible relationships. In the case of our forum we have 116 relations established between members of 240 possible, and applying the formula we can calculate the density of the network (see graphic 1)
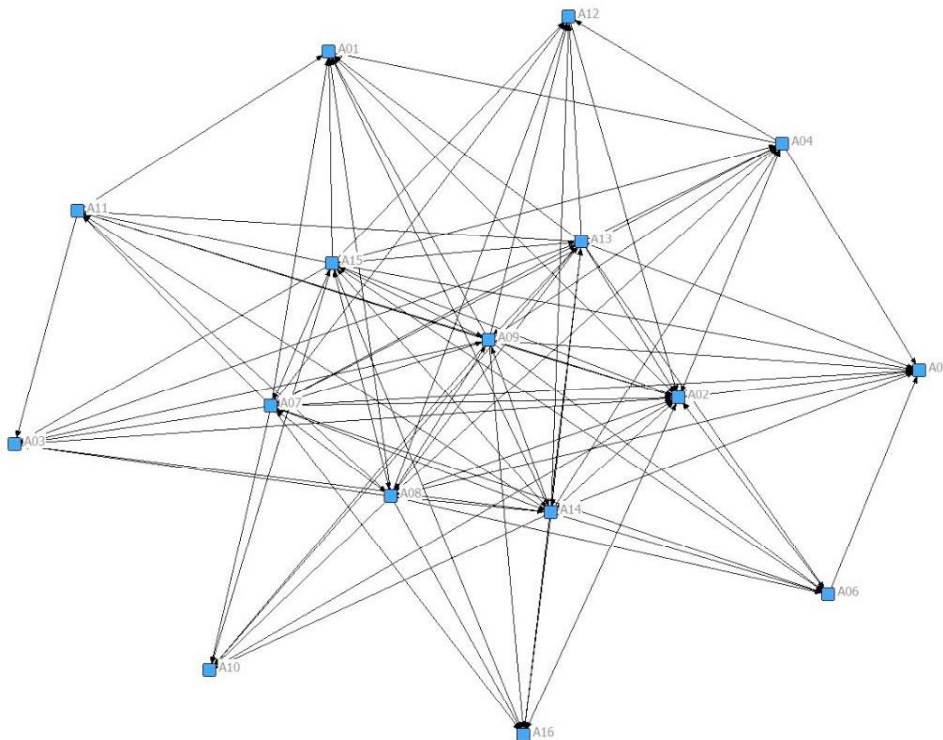
Graphic 1: Interactions between the participant members of the Forum "Podcast on Education"

Looking carefully at the graphic we can see that we have a network as intermediate density, which for us is a point to consider. The fact of the Forum is informal oriented, was attractive and we realized the group's engagement in the discussions, having as objective the construction of knowledge. In percentage terms, 48 of density, 33% that was good for us, because of a total of 240 possible relations, we had 116 links. This is because according to the theory that deals with the subject, to calculate the number of possible relations we simply have to know the number of participants, which we also called "nodes" (N), that in the specific case of Forum analyzed was 16. According to [15], we calculate the number of possible relations, by multiplying the total number of nodes (NTN) by the total number of nodes minus 1 (NTN-1), like this: [RP = NTN x (NTN -1)], i.e. RP = 16 x (16-1) = 16 x 15 = 240.

Based on this we can calculate the density given by the following expression: [D = RE/RP x 100], i.e. D = (116/240) x 100 = 48, 33%. Faced with this result we can say that the ties tend mostly to be stronger, converging on a greater engagement of the Group [17] and [18].

b) Degree of Centrality

According to [11], the Degree of Centrality is an important indicator because it enables us to realize the actors occupying more lucrative positions, in order to have greater access to information and finally have a greater degree of independence in the network, because it surfaces the importance of each actor in the network. Looking carefully at figure 2 we can realize that the actors A09, A14, A07, A08, A13, A15 feature the same OutDegree of 50%, revealing that these actors are influential people because they are responsible for the distribution and dissemination of information on the network. In relation to the InDegree we realized that the actors who receive more information and are therefore considered the most prestigious actors in the network are the A02 with 50%, followed by A01 and A05 with 30% and A03 with 26, 66%. This result shows us the motivator because despite the e-moderator (A02) be considered of greater prestige in the network, it does not assume control of communication, that is, it is not the only actor responsible for the sending of information although still dominant, it carries with it the most influential status among members [10] and [8].

	OutDegree	InDegree	NrmOutDeg	NrmInDeg
A09	15.000	5.000	50.000	16.667
A14	15.000	6.000	50.000	20.000
A07	15.000	7.000	50.000	23.333
A08	15.000	5.000	50.000	16.667
A13	15.000	5.000	50.000	16.667
A15	15.000	5.000	50.000	16.667
A02	10.000	15.000	33.333	50.000
A04	5.000	7.000	16.667	23.333
A11	2.000	7.000	6.667	23.333
A06	2.000	7.000	6.667	23.333
A12	2.000	7.000	6.667	23.333
A01	1.000	9.000	3.333	30.000
A05	1.000	9.000	3.333	30.000
A10	1.000	7.000	3.333	23.333
A03	1.000	8.000	3.333	26.667
A16	1.000	7.000	3.333	23.333

Figure 2: Degree of Centrality

Another conclusion that we can draw when we see the picture above, is that all members established connections, since they all feature an indegree and an outdegree. This is the positive aspect for the growth and development of a network.

c) Centralization Index

The Centralization Index is the indicator that determines whether or not an actor is the central element of a network, that is, if he and halt the flow of communication is also the link between the other members of the network [10]. Generally, we perceive that the network does not have a high centralization, as confirms the data presented by the software, i.e. the network in its entirety has an Outdegree of 29, 52% and an Indegree of 29.52%. This is a positive result because it confirms what

was said earlier, namely, that the network is gradually developing greater autonomy, thus allowing more horizontal relations [19].

d) Degree of Intermediation

The degree of intermediation is an indicator that allows the investigator to identify the position that the actors are on the network. To some theorists such as [5], [20] and [10], among others, the greater the degree of intermediation, the greater will be the probability of the individual having access to information and consequently will have more control of communication compared to members who have a peripheral, marginal or even participation (see figure 3) that are isolated (loose nodes).

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        Betweenness  nBetweenness
        ------------  ------------
A02       112.000        53.333
A07        27.667        13.175
A14        20.667         9.841
A01         6.500         3.095
A03         6.500         3.095
A04         2.667         1.270
A05         0.000         0.000
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Figure 3: Degree of Intermediation

According to the data we see that the actor who has a higher degree of financial intermediation is A02 with 112, and this number expresses the number of pairs with which the actor can connect and this percentage represents a total of 53, 33% (degree of normalized intermediation). Then we have the A07 with 13.17% and can connect to 27.66 actors, followed by the A14 with 9.84%, showing a likelihood of establishing connections to more or less 20.6 members and in an extreme position we have the A05 who has no degree of intermediation, i.e. without any likelihood of establishing connection with any actor on the network.

e) Degree of Intermediation

The Degree of Closeness lies in the "ability of a node on connecting to all the actors of a network" [10]. Is the indicator that specifies the degree of closeness of an author in relation to others on the network. According to [21] "The geodesic distance — that is, the shortest route – between pairs of actors is one of the most widely used measures of closeness". When we analyze a network and verify that a given node has a high degree of closeness, this means that it excels the rest by the ability to connect to other actors in the network (see figure 4).

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        inFarness  outFarness  inCloseness  outCloseness
        ---------  ----------  -----------  ------------
A02       16.000      20.000      93.750        75.000
A01       21.000      34.000      71.429        44.118
A03       22.000      34.000      68.182        44.118
A05       22.000      34.000      68.182        44.118
A11       23.000      45.000      65.217        33.333
A04       24.000      25.000      62.500        60.000
A06       24.000      33.000      62.500        45.455
A16       24.000      34.000      62.500        44.118
A07       24.000      15.000      62.500       100.000
A10       24.000      34.000      62.500        44.118
A14       25.000      15.000      60.000       100.000
A12       31.000      33.000      48.387        45.455
A09       34.000      15.000      44.118       100.000
A13       34.000      15.000      44.118       100.000
A15       34.000      15.000      44.118       100.000
A08       34.000      15.000      44.118       100.000
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Figure 4: Result of the degree of closeness of "network interactions" per node.

The table shows us two kinds of closeness: incloseness and outcloseness. In addition, it enables us to realize also the degree of infarness and outfarness of each member in the network. To do so, in our

analysis, we will take as reference only the incloseness and outcloseness. So, we can see that the A02 have a greater degree of closeness with a value of 93,750, followed soon after the "node" A01 which takes a value of 71.429. And in an extreme position the actor A08 has a lesser degree of closeness assuming a value of 44.118.

Generally, and supported in the literature that deals with the subject [22], we realize that the actors A02 and A01 have a greater power of influence and impose their views while interfering directly on other elements. On the other hand, the node that has the lowest incloseness is A08 and therefore it has the greatest degree of outcloseness. This means that in theory those actors are more autonomous with respect to their choices and behaviors [6].

5   FINAL CONSIDERATIONS

The study came to prove that in fact the SNA is an effective methodology for analysing the existing interactions between people within a specific group, namely the networks and virtual communities.

The data presented here allow us to deduce that the indicators used in our analysis are a great value for us to understand and intervene in the dynamics of operation of the network, proposing improvements in its structure. In the specific case of our study, factors such as degree of proximity, degree of centrality and degree of intermediation are indicators that deserve attention, as indicators of a greater engagement of members and influence among others. These indicators have enabled us to realize that although some members still have control of the communication, the Group was able to interact and establish connections, which for us was a great advance, whereas the Forum was fully informal oriented it lacked the rigor and the requirement for participation. Although we observed a 29 centralization index, 54%, we noticed that two actors have an influence over the others, one of which was the-moderator. We do not want to say that the-moderator is not an important element. On the contrary, it is of paramount importance to the achievement of receptive environment and also responsible for encouraging members to participate and interact, however its leadership should be shared, so that we can achieve the ideal virtual community or network, characterized in the literature as being heterarquic relations [23].

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