

Collaboration in Virtual Environments: a study of interactions in a social network

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Abstract: This article describes a study that aims to understand the collaboration processes in a discussion forum of a social network created for the professional development of Portuguese speaking teachers. Murphy's (2004) conceptual framework was chosen to analyse the learning processes underlying online asynchronous interactions that occur following through six progressive stages from social presence and ending to the production of shared artefacts. The instrument used for the analysis has proved to be effective for recognising online collaboration. Results show that the social presence is essential to support a virtual community because it helps to remove the impersonality of such environments in which face-to-face contacts are almost non-existent. However, it has not been possible to check for high levels of collaboration as reported in the literature. Collaboration has still a long way to go and its promotion depends on the engagement of participants in the process of transcending individual perspectives and reaching collective knowledge construction.

Introduction

The study of asynchronous communication has gained increased interest as research shows its benefits and advantages to improve learning in online education in general and e-learning in particular (De Wever, Schellens, Valcke & Van Keer, 2006; Kian-Sam & Lee, 2008). According to Harasim (2012, p. 81), collaboration is the most important factor for learning to occur in online environments and it is the framework to guide learning in the Knowledge Age. According to the author, knowledge construction is evidenced when divergent ideas in online discussions move towards an embodied shared convergence of ideas inside the group. Although the literature reports several theoretical models to study asynchronous interactions it was Elizabeth Murphy (2004) who focused her model in the analysis of the progressive processes of online collaboration that begins with socialisation and ends with shared artefacts, an equivalent term to the convergence of ideas reported by Harasim (2012). This was the main reason for choosing Elizabeth Murphy's model of analysis in the present study, as its focus on the emergence of the progressive stages of collaboration in a forum of discussion within a community of practice of Portuguese speaking teachers named PROEDI (www.proedi.ning.com). On the other hand, to use a different model to study online collaboration in a forum of the same social network allowed the authors to have a different perspective on online collaborative processes while testing and validating a model of analysis that is not yet much reported in published literature.

The topic of discussion was "Wiki and Blog as educational tools", and the analysis of the messages was based upon the model developed by Murphy (2004), which detects the emergence of collaboration on asynchronous communication through six progressive stages that will be discussed in the literature review section. The research question that guided the study was formulated as follows: what are the levels of collaboration in the Proedi discussion forum "Wiki and Blog as educational tools"?

Literature Review

Murphy's model has as emerging context the online interactions, which are elements that lead to a favourable environment for a collaborative construction of knowledge. According to the author, these elements represent a continuous process that can be studied through six progressive stages: i) social presence; ii) articulating individual perspectives; iii) accommodating or reflecting the perspectives of others; iv) co-

constructing shared perspectives and meanings; v) construction of shared goals and purposes; and vi) producing shared artefacts.

The first stage, social presence, a term first coined by Garrison, Anderson and Archer (2000), is essential in online virtual communities, in order to establish a comfortable context for multiple interactions for collaboration to take place within the group (Garrison, Anderson & Archer, 2000). From this perspective the “participants may begin by introducing themselves, and then move on to articulating their individual perspectives. In this stage, participants are aware of the presence of others, but do not explicitly reference their perspectives or solicit feedback from them” (Murphy, 2004, 422). According to the author, at this stage, the members have not yet established dialogic dynamics, and may begin by introducing themselves, and then move on to articulating their individual perspectives.

In the second stage, the members begin to express their ideas. Despite being already aware of the presence of other members, the desire or perhaps the need to interact is not yet evident. The monologue is still predominant in this phase. Although there is no interaction at this stage, the author emphasises its importance as the starting point for what will happen in the next phase, accommodating or reflecting the perspectives of others. At this stage the process of reception and respect for others’ ideas also begins, as it will be necessary to change and reset of individual prospects to work together in the construction of meaning (Meirinhos, 2006).

The “co-constructing shared perspectives and meanings” stage follows, showing that interactions are more intensive and that the shared repertoire, - a term coined by Wenger (2000) to refer to routines, words, expressions that are used and identify a specific group - assumes a stronger configuration. By sharing information, people establish connections to prior knowledge and accommodate new information in their mental structures (Ausubel, Novak & Hanesian, 1980). It also shows that the group is more involved in the achievement of common goals, because, as stated by Murphy (2004, p. 423), “when individuals reach a stage at which they share goals, a sense of common purpose emerges. It is at this point that individuals work together and begin to move in unison towards a common direction”. From then on, knowledge building is possible; members share objectives and purposes aimed at the development and progress of the group, as specified in the next stage called “building shared goals and purposes”.

The apex of this model appears in the production of artefacts as a result of the joint collaboration. In fact, through collaboration and interaction, the members of a community create new concepts and new positions. According to Schrage (1995) the creation of artefacts is the reflex of collaboration and “can be measured by its results” (Schrage, 1995, p. 29).

This model was the starting point for Murphy to develop an instrument that allows researchers to identify and measure collaboration in online asynchronous discussion (OAD) and it is summarized in Figure 1 below presented.

Figure 1. The framework for the analysis of online collaboration (Murphy, 2004)

| General processes | Specific Indicators | Cod | Definition |
|-----------------------------------------------------------------------------------------|------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------|
| Social Presence (S) | Sharing personal information (P) | SP | Provide information about personal activities carried out |
| | Recognizing group presence (R) | SR | To be kind to the group and greet |
| | Complimenting/expressing appreciation towards other participants (S) | SC | Comment positively the participation of another member |
| | Expressing feelings and emotion (F); | SF | Use words that express emotions and feelings |
| | Stating goals or purposes related to participation (G); | SG | To show a clear interest in learning with the group |
| | Expressing motivation about project or participation (M) | SM | Expressions that manifest belief and confidence on the activities proposed |
| | Articulating Individual perspectives (I) | Statement of personal opinion or beliefs making no reference to perspectives of others (O) | IO |
| Summarizing or reporting on content without reference to the perspectives of others (S) | | IS | Personal summary or interpretation about the subject |
| Accommodating or reflecting the perspectives of others (P) | Directly disagreeing with/challenging statements made by another participant (D) | PD | Different opinions, questioning and proposing challenges |
| | Indirectly disagreeing with/challenging statements made by another participant (I) | PI | To praise the contribute of a another member, but also contribute to other interpretations and reflexions about a topic |
| | Introducing news perspectives (N) | PN | Attempt to redirect the focus to thematic objectives or propose other lines. |
| | Coordinating perspectives © | PC | Do an assessment of contributions |

| General processes | Specific Indicators | Cod | Definition |
|----------------------------------------------------|---------------------------------------------------------------------|-----|-----------------------------------------------------------------------------------|
| Co-constructing shared perspectives and meanings © | Sharing information and resources (I) | CI | Provide research sources |
| | Asking for clarification/elaboration (A) | CA | Request clarification, help, through inquiries made to the group |
| | Posing rhetorical questions (Q) | CQ | Before an assertive comment, to question its practical application |
| | Soliciting feedback (F) | CF | Request answers to possible questions |
| | Provoking though and discussion (P) | CP | Instigating the group to seek solutions to questions raised during the discussion |
| | Responding to questions © | CR | Contribute with ideas for the growth of the group |
| | Sharing advice (S) | CS | Join forces in pursuit of a goal |
| Building shared goals and purposes (B) | Proposing a shared a goal or purpose (P) | BP | Identify the need to establish goals and work towards the achievement of goals |
| | Working together towards a shared goal (W) | BW | Aggregate values by collaborating with the creation of new concepts. |
| Producing shared artifacts (A) | Document or artifact produced by group members working together (D) | AD | New concepts, knowledge, learning |

However, when compared to competing models that also study the processes of online collaboration, this model does not highlight the importance of a community leader – the e-moderator. In fact, if the e-moderator is the key element in the collaborative construction of knowledge inside a virtual community of learners in the Community of Inquiry Model of Garrison et al (2001) or the e-moderating model proposed by Salmon (2000), in Murphy’s model his role is not explicitly evidenced and this was an additional challenge to use in the present study.

Method

The empirical study consisted in the identification of the levels of collaboration in the forum of discussion "Wiki and Blog as educational tools", it was conducted in Portuguese and all the quotations presented later are translations of the original participants verbalizations.

The forum was created specifically for students who were attending the Curricular Unit ‘Educational Technology’ at their Master’s degree courses in Teaching (multiple subject areas) at the University of Minho. However, as the PROEDI social network is an open space, all other members of the online community could join the discussion and participate.

The blended learning Curricular Unit in Educational Technology lasts for a semester (15 weeks) with face-to-face and online sessions. The goal is to develop students' digital and teaching skills in order to become well-informed teachers who integrate the technologies in the classroom. At the beginning of the Curricular Unit students were offered some theoretical concepts – theories of communication, learning theories and instructional design – in order to understand that technologies are cognitive tools that enhance the learning process (Jonassen, 2007). In the hands-on activities, students, in small groups, used Web 2.0 tools to create digital resources for the classroom: a WebQuest was created using Google Sites software and a blog served as the digital portfolio where students posted the reflections on the subjects discussed in the classroom (Coutinho,

2012).

Simultaneously, as part of the online activities, and in order to improve the students' understanding of the Curricular Unit contents, a forum was created to discuss the topic "Wiki and Blog as educational tools". The Social Network PROEDI has been designed with the NING software and is part of a PhD project, whose main objective is to explore new approaches to ICT training and professional development of teachers that emerge from the context of the paradigm known as Web 2.0. The forum began on 28 May 2011, and was concluded 28 June when the Curricular Unit formally ended. Eighty-three contributions were posted on the forum, 70 from the class students and 13 from other members of the social network.

The empirical study was analytical, a form of non-experimental or descriptive studies (McMillan & Shumacher, 1997) as the research was based on the content analysis of the written text-based communication obtained from the discussion forum. Garrison, et al. Anderson and Archer (2000) coined this type of delayed communication as a lean medium emphasizing the advantages for knowledge construction for providing the learner with more time to reflect before participating in the online discussion. These same idea is defended by Buraphadeja & Kumar (2012, p. 29) when they argue that "The asynchronous nature of the medium extends wait times for learners to process information and reflect on learning materials, promoting deep learning and providing learner-centred instruction". Content analysis techniques allow researchers to infer meaning from written text (Buraphadeja & Kumar, 2012), and is being used widely for the research of the process of asynchronous communication in online environments, allowing the study of complex variables such as: critical thinking (Garrison et al. , Anderson and Archer 2001), knowledge construction (Gunawardena, Lowe & Anderson, 1997), social and teaching presence (Anderson, Rourke, Garrison, & Archer, 2001), problem solving (Hou, Chang & Sung, 2008) or even to measure the levels of collaboration (Murphy, 2004) as we do in the present article.

Data collection and analysis

For data collection two instruments were used. The first was a questionnaire attached to the social network site Ning, which, when completed, acted as a criterion for access. This was also used in order to characterise the sample. To analyse the level of collaboration between members who joined the discussion forum, we used the instrument for the identification and measurement of collaboration in online asynchronous discussions – OAD – designed by Murphy (2004), containing the six references mentioned above as well as their specific indicators. All contributions posted in the forum were considered for content analysis. As regards the nature of the written discourse, the codification process considered as a unit for the analysis the "semantic unit" (Bardin, 2008), which is similar in form to the "thematic unit" of Rourke, Anderson, Garrison and Archer (2001): a single idea that is conveyed by information extracted from the text. The frequency of the units of registry (evidence) was taken into account in order to measure the level of incidence of each reference and its specific indicators. In order to assure the validity of the categorisation process, the principles of homogeneity, mutual exclusion and pertinence were considered by the researchers as suggested by Bardin (2008). A total of 83 contributions to the forum (messages) composed the corpus. In order to determine the reliability of the coding process the inter-rater reliability coefficient, Cohen's Kappa (k), was chosen. A random sample of 25% of the transcripts was selected and the authors, who both had prior experience in coding asynchronous communication, independently rated each message according to the model categories and indicators specified, to experience any challenges with the forum transcript. When the codes were compared, Cohen's kappa was calculated at 0.46, but after discussion and negotiation, it was 0.83, a value considered to be an acceptable level of reliability for text-based asynchronous communication (Rourke et al., 2001). Subsequently, both authors codified the remaining messages independently. In total, 247 thematic units of registry were counted. Considering the number and extension of the messages, we used the WebQDA software, which is a qualitative data analysis programme that was developed at the University of Aveiro, Portugal (Souza, Costa & Moreira, 2011).

Participants

Our sample was made up of students belonging to the Master's degree in Teaching from multiple subject areas: five from English and Spanish; seven from Portuguese and Classical Languages; 12 from Biology and Geology; and eight from Mathematics. There were 32 students plus the instructor, who worked as the e-moderator of the community, besides the participation of 11 members of the social network; in total, 44 members (32 from Portugal and 12 from Brazil). In terms of gender, 19 were male and 25 were female. The vast majority, i.e. 20 members, belonged to the 20-25 years age range, six to the 26-30 years, six to the 31-35

years, four to the 41-50 years, three to the 36-40 years, two to the 56-60 years, one to the 51-55 years and two did not answer.

With respect to training in ICT, of the 38 who answered, 18 said they had basic knowledge, 13 had average knowledge and seven had no training in this area. When asked if they participated in other social networks, 20 said they participated, 10 reported that they did not participate and 14 did not answer. The networks that were featured were: Ning, Facebook, Orkut and Twitter. Finally, when asked if they were members of any virtual community, two responded that they participated, 18 responded that they were not members of any virtual community and 24 did not answer.

Results

In the first phase, called Social Presence, we counted 82 examples of indicators distributed among the following Specific Indicators: P - Sharing personal information (9); R - Recognising group presence (35); C - Complimenting/expressing appreciation towards other participants (18); F-Expressing feelings and emotions (4); M - Expressing motivation about project or participation (16).

In the next stage, Articulating Individual perspectives, it was possible to detect 46 indicators distributed among the following Specific Indicators: O - Statement of personal opinion or beliefs making no reference to perspectives of others (27); S - Summarising or reporting on content without reference to the perspectives of others (19). Table 1 summarises the results obtained.

Table 1. Results from the forum analysis

| Social Presence (S) | Articulating Individual perspectives (I) | Accommodating or reflecting the perspectives of others (P) | Co-constructing shared perspectives and meanings (C) | Building shared goals and purposes (B) | Producing shared artefacts (A) |
|----------------------------|-------------------------------------------------|-------------------------------------------------------------------|-------------------------------------------------------------|-----------------------------------------------|---------------------------------------|
| P 09 | O 27 | | I 11 | P 14 | D 09 |
| R 35 | S 19 | | Q 01 | W 17 | |
| C 18 | | D 04 | P 02 | | |
| F 04 | | I 16 | R 21 | | |
| M 16 | | N 20 | S 04 | | |
| TOTAL 82 | 46 | 40 | 39 | 31 | 09 |

In the phase Accommodating or reflecting the perspectives of others, we found 40 indicators distributed among the following Specific Indicators: D-Directly disagreeing with/challenging statements made by another participant (4); I-Indirectly disagreeing with/challenging statements made by another participant (16); N-Introducing new perspectives (20).

Continuing the analysis of table 1, we see that in the fourth stage entitled Co-constructing shared perspectives and meanings (C) we counted 39 indicators distributed among the following Specific Indicators: (I) Sharing information and resources (11); Q - Posing rhetorical questions (1); P - Provoking thought and discussion (2); R -Responding to questions (21) and S - Sharing advice (4). And in the penultimate stage, Building shared goals and purposes, we noted 31 indicators: P - Proposing a shared goal or purpose (14) and W - Working together towards a shared goal (17). Finally, in the phase Producing shared artefacts, we counted only nine indicators in our study.

In interpreting the results, it was possible to verify that the initial phase (social presence) constitutes the primacy of relationships in an asynchronous discussion environment. It was possible to perceive the involvement of members, leaving them freedom to express their ideas, personal opinions, and mainly to present themselves as motivated and interested in the issues discussed in the forum, as can be seen in some of the evidence described below:

I work with VET's and blogs have been a good approach because it motivates the student to participate in educational activities (SP).

Regards to all and wish good reflections to all of you (SR).

Very well done, Joel, you did a very good reflection. Actually there are many Internet sites, such as blogs and Wikis that can not be trusted. (SC)

Testimonials like these motivate us to pursue our journey (SF).

I can confirm that these technologies are consistently present in my teaching career! (SM)

However, it has not been possible to identify in members' statements evidence that shows interest in establishing objectives related to participation, i.e. a clear interest in learning inside the group. We believe that this is perfectly acceptable, since the group was still getting acquainted with a new environment. Furthermore, we believe that this phase constitutes the basic principle in asynchronous discussion, because it serves to establish an ambiance, in which the members begin to develop a sense of ownership and empowerment that triggers successful asynchronous online discussion, and the evidence obtained in our study strengthens this idea.

In the next phase, "Articulating Individual perspectives - I", it was possible to observe that initially the members were more concerned with exposing their individual opinions on the subject, i.e. they were more focused on synthesising their first impressions than on sharing opinions. But this is completely acceptable, because, according to Murphy, the monologue during this phase is important as it enables members to have a first impression about colleagues, and about the topic discussed, thus assimilating some concepts and then sharing opinions, as can be observed in some of the evidence:

Ever since I was little, I have been an apologist of the motto "one for all and all for one!" which can easily be associated with learning through tools like Wiki and Blogs (IO);

In summary, I think that blogs and Wikis are an indispensable medium for collaborative learning to occur, when well applied and used! (S)

As regards the stage "Accommodating or reflecting the perspectives of others (P)", we noticed a slight decrease in evidence. This can be justified given the level of preparation of students to reflect critically on the contributions of colleagues, because it requires a greater capacity of understanding and reasoning. To illustrate we present some of the evidence obtained:

However, there are also downsides, one example focuses on the fact that not all information available on the Internet is reliable, the web is free and anyone can write whatever they want without being checked (PD).

I agree with what you have written, however, it is important to stress that the advantage of the Wiki is the power to edit what has already been published and correct any misconceptions that the student, or other contributor member, might have written (PI).

Blogs, Wiki and even the Webquest allow students from various schools to exchange and share information in a cooperative way (PN).

Interestingly, at the stage "Co-constructing shared perspectives and meanings-C", there is a decrease in evidence if compared with the previous stages. We are also fully convinced that much of the evidence presented during this phase is mainly due to the presence of the e-moderator as an element which often took control of discussions, urging members to participate and also to make their contributions throughout the discussion. However, it was not possible to evidence the presence of important indicators such as "Asking for clarification/elaboration (A)" and "Soliciting feedback (F)". This was a point to be considered because it showed that although the group was motivated, it was not perceived in the analysis a particular interest in supporting each other for clarification of possible questions arising in the discussion.

In the last two stages, there is evidence of a greater level of involvement and engagement in learning collaboratively. Results show that, even if not too expressive, the group expressed interest in sharing common goals, to build knowledge collaboratively. This supports what was verified by Murphy (2004) in her analysis. As an example, we cite evidence from this penultimate stage named "Building shared goals and purposes (B)".

It is up to us, future teachers, to help other colleagues in this field so that teaching does not stagnate, jeopardising pupils' learning (BP).

What caught my attention was when you said "the collaboration between peers, when properly directed, is more productive and effective, as it allows you to develop strategies for the resolution of problems through interaction and communication", because I believe that this is the greatest challenge: I believe the great challenge is for teachers to make students work collaboratively (BW).

Finally, we have the last phase, "Producing shared artefacts", which Murphy (2004) considers as the apogee of the process. In the specific case of this forum, evidence shows that participants appropriate new knowledge, as perceived in participants' words:

It was important to raise awareness in the educational community to use these two easy interactive tools such as Wiki and Blog, that allow collaborative writing and contribute to our learning while developing technological skills (AD).

There is a greater openness to the level of acceptance of opinions and knowledge sharing. This type of learning can undoubtedly encompass the Wiki and Blogs as tools for sharing and disseminating information, something that provides critical and mental development of the students, helping to avoid the feeling of

loneliness and fear of criticism on the part of others (AD).

We believe that these two examples reveal that, in fact, the group was able to draw conclusions about what was being discussed. Moreover, interest was evidenced in applying the acquired knowledge in other contexts of their professional lives (Lisboa & Coutinho, 2011).

Discussion

Results reveal that, that the social presence is the main support in an online community because it helps to eliminate the cold and impersonal environment when face-to-face contacts do not exist. In addition, it tends to bring more members to the community thereby promoting engagement and causing members to develop their sense of belonging. This is the necessary requirement for them to see the space as their own, and thus motivate and engage not only their learning but also over an entire network of learners. Together they can seek the solution of a problem or even the achievement of a common goal.

However, when we analyse and interpret the phases that normally could better denote the involvement and commitment of the group to achieve higher levels of collaboration, we realise that this goal is still a challenge in the Proedi community. In fact, as referred by Buraphadeja and Kumar (2012), participation does not ensure collaboration, it is necessary to go further, questioning and motivating the group to become involved in the discussions as well as to give feedback.

These attitudes were more noticeable in the contributions of the e-moderator to the discussion forum. In fact, besides contributing to the discussion, the e-moderator did not lose his focus, and also helped with other sources of information, in order to enrich it further. Our study has shown that the e-moderator is the element that gives life to the community, encouraging members to develop their autonomy by managing their own contributions to the collaborative construction of knowledge. However, the analysis undertaken shows that Murphy's model does not highlight the role of the moderator inside a virtual community. From this point of view the Community of Inquiry model of Garrison et al (2001) is more complete as it values the teaching presence, embodied in the e-moderator role, as the element who not only guarantees a favourable environment but also the construction of collaborative knowledge, what for Murphy was named the production of shared artefacts.

Conclusions

The instrument used for the analysis has proved to be effective for the evaluation of the collaboration in the context of asynchronous computer-mediated communication. Our study also shows that online collaboration has still a long way to go and its promotion depends on the engagement of participants in the process of transcending individual perspectives to reach collective knowledge construction. In this process the e-moderator is the key element that maintains the members engaged in the focus of the discussion enhancing convergent thinking as suggested by Harasim (2012).

More research is needed in the field, as well as the disclosure of the pedagogical potential of social networks and, most importantly, its complete acceptance in formal educational institutions. We believe that it is important that educators begin to have a more positive attitude and to raise awareness of the importance of interaction and collaboration among peers in the learning process as well as to see social networking as informal spaces for lifelong learning.

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