Computers & Education 57 (2011) 1348–1357

Contents lists available at ScienceDirect

Computers & Education

journal homepage: www.elsevier.com/locate/compedu

Online group work patterns: How to promote a successful collaboration

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ARTICLE INFO

Article history:
Received 6 October 2010
Received in revised form
14 January 2011
Accepted 21 January 2011

Keywords:
Computer-mediated communication
Cooperative/collaborative learning
Interactive learning environments
Learning communities
Post-secondary education

ABSTRACT

Participation is a complex process, engaging the whole person, implying cognitive, emotional and relational aspects. In online open and distant learning, group work is a commonly used strategy, given its collaborative nature and constructivist framework (Bates & Poole, 2003; Garrison & Anderson, 2003; Jonassen, 2005). In this context, collaborative learning processes are highly dependent on the shared written information and the interactions that are established among the participants. The types of interactions that occur within such groups can influence their knowledge convergence processes, and are often decisive for its success.

In this paper we aim to study the different types of collaborative practices in online Courses based on the analysis of the online interactions on the discussion forums, the works produced by the students (both individually and in small groups), and answers to questionnaires applied in the different stages of the investigation. In this particular case we are interested in exploring questions related to the process of knowledge convergence during online group work in Open and Distance Learning.

Data analysis involved iterative analysis and revision of the coding scheme. Two of the researchers derived the initial coding key from the online discussion forums used during the group project phase of the Curricular Unit. Some of the codes were quantified in order to foster a more meaningful comparison of the data by allowing patterns to be identified and further explored (McConnell, 2006).

In this study, it became clear that the more and less successful groups, in terms of their outcome or product, clearly revealed distinctive patterns of work, characterized by negotiation, research, conception and production. Moreover, particular patterns of work make decisive contributions for the participants' shared knowledge and knowledge convergence.

1. Collaborative learning

The notion that peer interaction stimulates knowledge production and produces cognitive gains (Dillenbourg, 1999; McConnell, 2006; Perret-Clermont, Perret, & Bell, 1991) explains many pedagogical decisions. Virtual worlds and learning environments provide participants with the possibility to appropriate knowledge and develop competencies through exploration, research and experimentation, putting them in contexts, groups and situations that offer diverse learning settings. This is particularly important in the case of online group work given the Internet and web capabilities to "provide a virtual environment for learners to work together, share resources and collaborate" (McConnell, 2006, p.31). According to this author, these types of virtual communities provide participants with the opportunity to take ownership over the content and direction of their learning; be responsible for managing their learning and cooperate; and to "focus on their own learning and development from a critical, reflective perspective, combined with an understanding of relevant academic ideas and concepts" (p.31).

This way, we argue for the endorsement of collaborative learning contexts that stride for the quality of learning through the understanding of the relationships between participants, tools/artifacts, and social groups. The instructor should act mainly as a facilitator to the learning process, directing his participation towards the orientation of the community/group work in a productive direction while supervising the peripheral participants (Wenger, 1998), to whom tools may be provided to self-regulate their interactions (Dillenbourg, 1999).

On any given situation, participants produce and create the contexts of their community of practice (Wenger, 1998), supporting themselves on the cognitive, social, and physical aspects of the environment that they consider relevant. In this sense in order for the

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doi:10.1016/j.compedu.2011.01.017

collaboration to take place there must be a motive and space for negotiation. Collaboration in a community is characterized by participants who share a common goal, are at a similar level and can perform the same actions while working together; the interactions defined as collaborative have the possibility to influence the peers cognitive processes, to be negotiable and may produce misunderstandings, that are a significant part in the "collaborative learning dynamics model" (Dillenbourg, 1999, p.10).

Moreover, Rovai (2004) considers that collaborative learning is successful when the group agrees on a product that translates the contribution of each member. This way, we argue that group work can contribute to the development of a collaborative and participative learning environment. Research (McConnell, 2006; Swan et al., 2000) has shown that this type of work may lead to more polarized decisions and heated discussions. In these situations, the instructor's role becomes extremely important, and requires him to supervise and regulate the group work. Also, in Open and Distance Learning (ODL) elearning environments, usually, older students are characterized by their high motivation to learn, fueled by their realization that learning will help them to better perform in their professional settings. What is more, according to Rovai (2004), their life experiences constitute a very good resource for collaborative learning.

2. Group work and knowledge convergence

McConnell (2006), in his description of online group collaboration, describes the process of group work as being defined by such attributes as "the students ability to have an in-depth discussion, raise points, contribute to discussions (…) and generally participate as fully and openly as possible." (p. 62). This author refers to three approaches to the analysis of group collaboration in online environments: the process of group work; social presence; and the outcomes and products of group work. The process of group work is related with the participants' abilities to develop in-depth discussions, to question and contribute to the group work. Social presence is related to the degree of "openness" between the group participants and is particularly important for the group's well-being. The outcomes and products refer to the results of the participants' productions and may include course assignments, projects, the construction of an artifact, and the ideas expressed in the online debates.

Concerning the processes of group work, McConnell (2006) goes one step further and describes a series of patterns experienced by the participants. This author distinguishes between the patterns of work of "harmonious" and cohesive groups, and "anxious" or less cohesive groups. In the case of "harmonious" and cohesive groups there are patterns of work characterized by a negotiation process, discussion, agreement, work and research, and production. For the "anxious" and less cohesive groups emerge patterns of work described by constant changing of minds and direction, leadership struggles, learning conflict and argumentation, and changing of focus of the project.

Barron (2003), in a face-to-face setting, was able to distinguish that some patterns of interactions are more productive than others for establishing a working joint problem-space that allows the group to capitalize on the resources available to solve problems and to learn from one another. This author concludes that successful groups have a greater tendency to discuss its member's proposals and to link them with their prior conversations. On the other hand, less successful groups are more likely to reject or ignore its partner's contributions without weaving them with their prior conversations.

The attention given to the patterns of interaction is particularly important because of its close relationship with the process of knowledge convergence. Jeong and Chi (2007) define knowledge convergence as "the process by which two or more people share mutual understanding through social interaction, and is believed to reflect the fundamentally social nature of the knowledge construction process" (p.287). According to Weinberger, Stegman, and Fischer (2007), knowledge convergence/divergence can be analyzed from a variety of levels. Moreover, the concept of knowledge equivalence refers to the degree of similitude between the participants learning. In this way, during the development of group work, the participants can progress to stages of higher knowledge equivalence and shared knowledge, as a result of a successful collaboration; or diverge and produce a small amount of knowledge equivalence and little shared knowledge. In this context, knowledge convergence can be reflected in the quality of learning and in the groups' collaboration and final products. Also, given the presented framework collaborative learning research suggests the need to give greater emphasis to interactional practices in order to render them more productive (Matusov, Bell, & Rogoff, 2003).

In this paper we aim to discuss how more and less successful groups, in terms of the product of group work (McConnell, 2006) – a project related with the participants professional practice requiring the creation of a learning situation mediated by technological tools – have been influenced throughout their work process by online collaborative interactions. This is supported by Barron (2003) when she says that the "quality of interaction had implications for learning" (p.307). Moreover, our own teaching experience taught us that all students do not equally benefit from collaborative work. Therefore, we are particularly interested in distinguishing the patterns of work that characterize more and less successful groups.

The proposed research questions are part of a bigger research project where different types of collaborative practices in online Courses were investigated, based on the analysis of the online interactions on the discussion forums, the works produced by the students (both individually and in small groups), and answers to questionnaires applied in the different stages of the investigation. In this particular case we are interested in exploring questions related to the process of knowledge convergence duringonline group work in ODL. Two main research questions were asked: What are the patterns that identify successful groups? What types of constraints prevent some groups from fully developing a successful collaboration?

3. The context

Based on the recent developments in ODL, the Universidade Aberta has assumed a student centered pedagogical model (Pereira, Mendes, Morgado, Amante, & Bidarra, 2007) founded on flexibility – where asynchronous technology is preferred and students and instructors can participate on the Courses from wherever they are located – and supported on three types of interaction: student-content; student-instructor; and student–student. Moreover, on the principle of digital inclusion, giving access to a higher education institution to an adult population that had no previous competences on instructional and communication technologies (ICT).

This study was conducted in the context of a Curricular Unit called *Using ICT for Learning and Teaching* that is part of the degree plan for the Master in Elearning Pedagogies and the Master in Educational and Multimedia Communication at the Universidade Aberta. Based on the University Pedagogical model (Pereira et al., 2007), the adopted methodology was structured around completely asynchronous and

Table 1
Using ICT for Learning and Teaching Course organization.

Task	Discussion of the learning contract	Participation in an online game	Reading and production of reflection to be debated in an online seminar	Production of Technologically enhanced learning paths	Final paper
Themes	Learning Contract (negotiation of the course organization)	Learning metaphors	Cognitive and socio-cultural perspectives	Blogs, wikis, PBL and GBL as tools for TEL	Student choice
Modes of organization	Whole group online discussion	Individual contribution to the game's wikiWhole group online discussion	Individual readings and reflectionsWhole group online discussion	Small group project workWhole group online discussion	Individual work with tutorial help from the instructor
Duration	1 week	2 weeks	4 weeks	6 (4 + 2) weeks	5 weeks

complementary work strategies (see Table 1). In accordance with this model, the course was based in the negotiation of a proposed Learning Contract (Pereira, Tinoca, & Oliveira, 2010). Firstly, it promoted the participants' independent study and reflections of the presented documents. It required participants to read critically, to identify the main thesis defended by the authors, and elaborate their own opinion. Secondly, it required that the participants work collaboratively with their peers, participating in online forums where they debate and (re) construct collectively their knowledge. Thirdly, participants were expected to choose a theme, from within a set given by the Professors (blogs, problem-based learning, game-based learning), and work in small groups to find the best solutions for the problems and cases that they were confronted with (4 weeks to develop the group project, and 2 weeks to discuss it). And finally, to develop an individual final paper based on a literature review or on the report of a pedagogical experience. The role of the online teacher varied throughout the course, according to each phase objectives. During a first phase, when the participants are engaged in big group discussions, the teacher worked as a facilitator and a critical observer; during the group work stage the responsibility for the discussion leadership was entirely the responsibility of the participants, with the teacher being only a critical observer and interacting only when requested.

In this research, we have focused on the small group project work (see Table 1) where the students developed a project linked to their professional practice, while creatively using technological tools adapted to the learning environment. The assessment of the group project was divided in two: 1) the process of elaboration of the project (1/3 of the project grade); and 2) the final project product (2/3 of the project grade). The Instructors responsible for this Curricular Unit recognized that in this type of activity the participants often develop a large majority of their work outside of the Virtual Learning Environment (VLE) and use other tools (such as MSN® or Skype®), therefore, it was decided to attribute the responsibility of assessing this component to the participants. The Instructors, however, developed a set of criteria, negotiated through the Learning Contract (Tinoca, Oliveira, & Pereira, 2010), that the participants should use to guide their self-assessment and that of their peers. These criteria included:

- Commitment to the group project.
- Relevance/pertinence of the research made.
- Presentation of innovative elements to the project.
- Contribution to the group dynamic.

The assessment of the group's final product was performed by the instructors based on the following criteria, also negotiated through the Learning Contract:

- exploration of the chosen theme;
- critical reflection about the use of ICT in learning environments;
- synthesis;
- originality of the final product presentation media

4. The participants

The participants were 36 master students from the referred programs. From this sample, 19 were female and 17 male. All of the participants were employed professionals, including 5–12th grade teachers, professional development trainers, University instructors and a psychologist. Participants came from a variety of locations, from both continental Portugal and from the Madeira and Azores islands, and there was also one participant from another European country. The ages ranged from 30 to 55. The participants met for the first time during the pre-program socialization module that all first-time students are required to participate in, with the objective of familiarizing themselves with online communication modes and technologies. During this module participants are expected to start the development of an online learning community and are already required to engage in small group work.

The participants were divided, by the instructors into 8 groups (with 4–5 participants each) based on their individual choices from 4 themes presented by the instructors (blogs, game-based learning, problem-based learning and second life); after that, the groups were created by the instructors based on the participants individual grades on the first two activities of the course (see Table 1), in such a way that the participants with very good and only fair results were equitably distributed.

Each group was asked to develop a project that would later be presented to the whole class and discussed by all on a forum. The project that they had to complete was based on the creation of a learning situation mediated by technological tools. Ten of the thirty six participants had previous experience in Computer supported Collaborative Learning (CSCL) at different levels, ranging from those who had been learners in technologically enhanced environments to those who had already acted as instructors in formal learning scenarios resourcing to ICT.

5. Data collection and analysis

In this research we have tried to understand what differentiates the process of collaborative group work in the cases of groups that have been very successful in their final product from those that have been less successful. We aimed to study how the groups coordinated their actions, their decision making processes, how the group members interacted, and what was the role of any artifacts that the group researched or created. We were also interested in analyzing how collective cultural resources, both discursive and practical, were used by the participants, in the context of participating in a group project for their Master's program. For these reasons we used the "socio-cultural" discourse analysis (Mercer, Littleton, & Wegerif, 2009) qualitative method. This method is focused on three dimensions of activity: cognitive processing, social processing and language functions. It is particularly appropriate to scenarios such as the one studied where learning activities cannot be separated from the context in which they take place and from the constructed artifacts. For that, after the assessment and classification of all the groups' final products, based on the previously negotiated criteria, two representative groups were identified: Dali (very successful in their final product) and Matisse (less successful). Group Dali was composed by 3 professional development trainers and one psychologist with ages ranging from 30 to 45, two of them with previous experience in CSCL, and was very successful with their final product. Group Matisse was composed by 3 teachers and one professional development trainer with ages ranging from 30 to 45, one of them had previous experience in CSCL, and was not as successful with their final product.

After that, we went back and analyzed each group's processes of collaboration, with particular emphasis to the interaction between the participants during the four weeks of online group work, and the artifacts that were constructed, and reconstructed, by each group on the way to their final product. The group online forums interactions and the group's artifacts were coded and used as the base for the "socio-cultural" discourse analysis.

Moreover, all the participants were also requested to answer an online questionnaire about their experience throughout the course (Tinoca, Oliveira, & Pereira, 2007), targeted at their perceptions regards the assessment strategies being used, the Learning Contract tool, the online forum discussions, and the group wok project. The questionnaire was composed by seven open-ended questions, and was completed by 23 out of the 36 participants. Descriptive data concerning the participants' academic and professional backgrounds was also gathered through the online introductions forum.

The theoretical interpretation of the data emerged from its systematical analysis, implying a very close relationship between them (Strauss & Corbin, 1998). It is important to clarify that this interpretation of the theory is sustained by a set of well-defined categories (concepts or themes) that are systematically interrelated through statements of relationship originating a theoretical framework that explains the situation being studied.

In this study, the researchers are also online instructors, with experience in the conception and implementations of courses, and when this investigation was started had already a set of questions to guide their analysis. This way, the initial reading of the participants' interventions was guided by these initial questions, later emerging the themes (adapted from the work of McConnell, 2006) that were used as references. Afterwards, the analysis was refined around those themes. Finally, two representative groups (Dali and Matisse) were more carefully scrutinized to identify their similarities and differences when compared to the overall framework that had initially emerged.

6. Results

The two chosen groups (Dali and Matisse), presented very different final products, having group Dali receive an outstanding grade, and group Matisse only a fair one. Group Dali presented a learning scenario for adult lifelong learners, based on a creative use of blogs, with excellent theoretical underpinnings, demonstrating a thorough critical reflection about this tool, and choosing an original media for their product presentation – a blog where all the resources were embedded. As part of this scenario, e-tutors were asked to create a blog as a learning resource for their professional activity. In this blog the e-tutors had to describe tutoring profiles, learning roles in online environments, as well as make available resources and technological pedagogical tools such as bibliographical and web references. The course activities were to be implemented in both a VLE and a blog built to support it. Group Matisse developed a learning scenario for learners of Portuguese as a second language, based on a classical but not very exciting game, available in a public website, but poorly supported by the studied learning theories, and without critically reflecting about the game's potentialities and limitations taking into account the goals that they had set up. Their final product was presented only in a traditional paper format.

From the analysis of the interactions, of all the groups, emerged four main categories of work that we now present: negotiation, research, conception and production. These four categories are intended to clarify the main phases that groups go through when collaborating. Also, from the analysis of group Dali and Matisse interactions we identified the patterns of work (McConnell, 2006) emerging during the online collaboration. However, as a result of our analysis, we also added several new patterns of work that were not previously considered, including:

- Clarification of focus
- Making the goals explicit
- Establishing a structure
- Sharing information
- Creation of artifacts
- Defining section headings
- Drafts of sections
- Reflection over the produced sections
- Merging the produced sections
- Cooperation
- Different perceptions of expertise and experiences
- Establishing the final presentation format

Table 2
Patterns of group work.

Group category	Group Dali	Group Matisse
Negotiation	• *Clarification of focus* • Making the goals explicit • Establishing a structure • *Collaboration*	• Making the goals explicit • Establishing a structure • *Struggle*
Research	• Sharing information • *Creation of artifacts*	• Sharing information • *Changing minds and direction*
Conception	• *Collaboration* • *Defining section headings* • Drafts of sections • *Reflection over the produced sections*	• *Cooperation* • *Different perceptions of expertise and experiences* • Drafts of sections • *Anxiety*
Production	• Merging the produced sections • *Establishing the final presentation format* • Discussion • *Assurance concerning the assessment requirements* • *Revision* • Sharing the final product with the community	• Merging the produced sections • Discussion • Sharing the final product with the community

- Assurance concerning the assessment requirements
- Revision
- Sharing the final product with the community

Similarly to what was reported by McConnell (2006) some of the patterns of work identified were only present in one of the groups. In order to make this distinction more clearly they are presented in italic in Table 2.

The category of *Negotiation*, already referred by McConnell (2006, p. 154), "is characterized by considerable negotiation between the members of the group". Also in our case, this concept implies the effective involvement of all members with the goal of promoting an equitable collaborative learning environment. This concept includes the following patterns of work:

Clarifying the focus of the group project, as when in group Dali it is said "I leave here a proposal for our discussion. I'm waiting for reaction. What is exactly your idea? Can you give more practical examples for us to visualize something? We need to see, in order not to stray away from the proposal…" (Susana). It is frequent, particularly in successful groups to carefully identify and clarify what the focus of their project should be.

Making the goals for the project explicit between the members of the group, and with the instructor's help when necessary, as for example when Carla (group Matisse) says "Meanwhile I'll ask the instructors to clarify this task… I'm a little confused about what is wanted". In this pattern, the participants make an explicit effort to clearly establish all the project's goals and objectives.

Establishing the structure for the project, as when Pedro from group Dali says: "here goes a more pragmatic suggestion for the proposal I had theorized about, however, it needs a lot of critical reflection, and some pondering so we can collaboratively overcome this challenge. Learning scenarios. Objectives. Framing of the proposal based on learning theories". Also during the negotiation stage, it is common to observe this pattern where groups try to establish the structure for their project, with a variety of levels of development and success.

Collaboration is also very evident during this phase, particularly in group Dali as we can see in the following excerpt "Do you want to share some starting point or are we all going to propose some topics for the discussion to take shape between us? So far, I believe we are all still trying to do everything, next it will be the stage to harmonize it all between us, and in the end we will have "something" that was done by "someone"" (Maria). In group Matisse this was also the moment when some of the participants started to *struggle* between themselves for protagonism as we can see in Filipe's post about what their project's goals and objectives are "You must be delirious! Read the threads carefully, and make sure who is answering whom, reflect about what is written and don't react so disproportionately to the simple question I made you? Oh Edite, if you are not kidding, save me. Ok?" This quote illustrates the group's struggle to develop an effective collaboration, and successfully negotiate their project's development.

Another category that we have identified was the *Research* that all groups clearly engaged in, as a critical exploration of the available bibliography and tools (games for group Matisse and Blogs for group Dali) relevant for their projects. As Susana from group Dali says "I'm going to do some readings about blogs as learning tools and then will leave here a clearer picture". In this category we emphasize the *sharing of information* between the group members and the *creation of artifacts*, such as the blog created by group Dali where they shared comments and reflections, as an addition to the gathered information: "I'm going to put on the blog some of the papers that we found and I will also post there about what I think about the readings. This forum can be more for us to debate how the project is going to evolve" (Susana). Group Matisse did not share any artifacts, each of the groups' member posts resources for their project but without critically analyzing their suggestions or their colleague's contributions. They present during this period some indecision – *changing minds and direction* – about where to go with their project, with the members not being able to agree on a bearing and continuously proposing new ideas without stopping to discuss between them and without providing feedback to the ideas posted by their colleagues.

The category of *Conception* is characterized by the development of a learning situation mediated by technological tools. This category includes several patterns of work.

Similarly to what happened during the Negotiation, group Dali once again engages on a high level of *collaboration* that is clearly less visible in group Matisse. The next excerpt illustrates the collaborative learning setting in group Dali:

"By Susana – March 4th 2007, 23:11
Proposta_de_Intervencao_Pedagogica.doc
As promised I leave here something else in the development of our paper. Tomorrow I'll be back and intend to include some images and schemes for it not to be so heavy. Meanwhile I'll be waiting for new developments.
By Maria – March 5th 2007, 04:04

Proposta_de_Intervencao_Pedagogica.doc
Hi everyone I leave here an update."
This excerpt is part of a long thread with 49 replies, where group Dali collaboratively constructed their proposal, and illustrates one of the iterations where one of its members builds on a partner's initial proposal.

Characteristic from this pattern is also the *drafting of sections* for the final product, as well as the *definition of the section headings*, as is evidenced in the next post "As I had written in this morning's forum, I have put together some things that I wrote with the last ones that Pedro had suggested and so it come to the document that now goes as an attachment. When I was finishing this process Maria wrote here some new proposals about a new parameter and a different objective from the initially suggested…" (Victor, group Dali). In line with this there is also the *reflection over the produced sections* that translate into polishing their own work through questioning and commenting each other's contributions as when Pedro (group Dali) says "The main and specific objectives do not need to be about the blog construction. In fact, they may be any other objectives which fulfillment implies the use of the blog. What I mean is that it seems limited to me to have as learning goals the construction of a blog". These patterns of work are common during the Conception phase when the groups work to start developing their projects, by drafting and reviewing the participants proposals.

In group Matisse the Conception phase was developed in a less harmoniously manner. The pattern of *anxiety* is particularly prevalent, as can be seen when Edite proposes an idea to be developed by the group, but only 8 days later does she get feedback from one of her colleagues saying "That's an interesting idea! … but what scares me is that you say that you must know everything! … and know everything in such short time looks like a herculean task! (Artur), the remaining group members did not give her any feedback. In a similar way, other group members begun to share this state of anxiety without a set plan to advance their project. In that same day Carla advances with a new post saying "… since we have several different games, and have not reached a conclusion yet, how about defining the learning scenario that we want to work? Maybe this way it will be easier to choose a game…" Even more, two days later (one before the deadline) Miguel also reveals his anxiety by posting "it is evident that we are having serious difficulties to finish by the deadline… I suggest we request an extension, in order to organize all the shared information and properly argument our learning path. Do you agree?"

Also emerging from group Matisse was the pattern *different perceptions of expertise and experiences* revealing the participants lack of recognition for their colleagues contributions. This can be illustrated when Carla presents a proposal of an educational game to be used, but is rejected by Filipe saying "Carla, don't you think that the *hangman's game* can be symbolically cruel for the children? … I stopped telling the *little red riding hood* story because it isn't politically correct." However Carla does not accept this argument and answers "let me see if I understand you… do I think if the *hangman's game* can be symbolically cruel for the children? No more that Dragon Ball… (but you don't even consider the *hangman's game* a game) … anyway I agree with the choice of an "innocuous" game". Some of the participants have very strong viewpoints and are not willing to negotiate or review them. Nevertheless, there is some opening for a possible third alternative that may be considered more consensual and less controversial. During this phase group Matisse exhibits anxiety for not being able to reach an agreement about their learning scenario, and what kind of game to use. Moreover, it should be noticed that these discussions never include all the group's participants. This as a stage when the group felt the need to resource to the instructor to intervene given their divergences about the project.

The last category that emerged was the *Production* of the final product, related to the elaboration of the final project to be presented, and the format of its presentation. Included in this phase we identified several patterns. The *merging of the produced sections* as illustrated by Pedro (group Dali) when he says "after reading what we have so far done, let's add, tweak, and correct as necessary, but in different colors so we can understand each others' contributions", exemplifying the traditional process of putting together the final project version from a variety of sections that were developed by the participants. By the *definition of the format of the final product* as is shown when Susana (from group Dali) posted "If we are talking about blogs in Education, I believe it makes a lot of sense to construct our work in a blog, don't you think so?" This pattern was particularly prevalent in our study given the fact that the format of the final project product was specifically assessed. The *discussion* emerges here, especially in group Dali, as a moment of *revision*, to reformulate proposals and harmonize the final product and also promoting "*assurance concerning the assessment requirements* is sought" (Pereira, Tinoca, & Oliveira, 2010), as we can see in this post "Alexandre, can you take a look at the activity sequence and see if it is in agreement with what you had imagined? If not we can cut, remove, add, etc. In particular activity 5 needs to be completed; if we change the goal and replace it by Ana's proposal it doesn't even need to appear in activity 5…" Finally, the *sharing of the final product* with the community appears as the last step in the project that was reached by every group. As required, every project was then subject to a debate on a forum where all the class members participated. Here is how group Dali shared their work:

"Hi everyone, attached you can find a pdf version of the work developed by team Dali. To take a look at our project in a blog forma go to the webpage *Blogs e Aprendizagem Colaborativa*. Good Job, Team Dali"

In group Matisse, this category also includes the patterns *merging of the produced sections*, *discussion*, and *sharing of the final product*. However, these patterns are present in a much less developed form, with almost no negotiation between the participants, as can be illustrated by the fact that when Artur posted the final version of their product requesting comments from his colleagues no one answered him. Also during this phase the group felt the need to resource to the chat tool but without everyone's participation. It is also important to notice the absence of three other work patterns for this category that were not observed in this group: *definition of the format of the final product*, *revision*, and *assurance concerning the assessment requirements.*

Another aspect where these two groups greatly diverged was in the sequencing and time used in each of the presented patterns of group work (see Fig. 1). In the case of the successful group (Dali), a clear sequence is observable in the way they structured their work. They started almost immediately working in the negotiation process, and as that was finalized, the progressed to the research and conception phases. They invested more intensively in research at the beginning of the conception, but felt the need to come back to it two more times during the conception process to further develop their understanding of particular areas. Finally, as the conception stage approached its end, the participants redirected their effort towards the production phase, which lasted approximately one week, and were able to present their final product at the predetermined date.

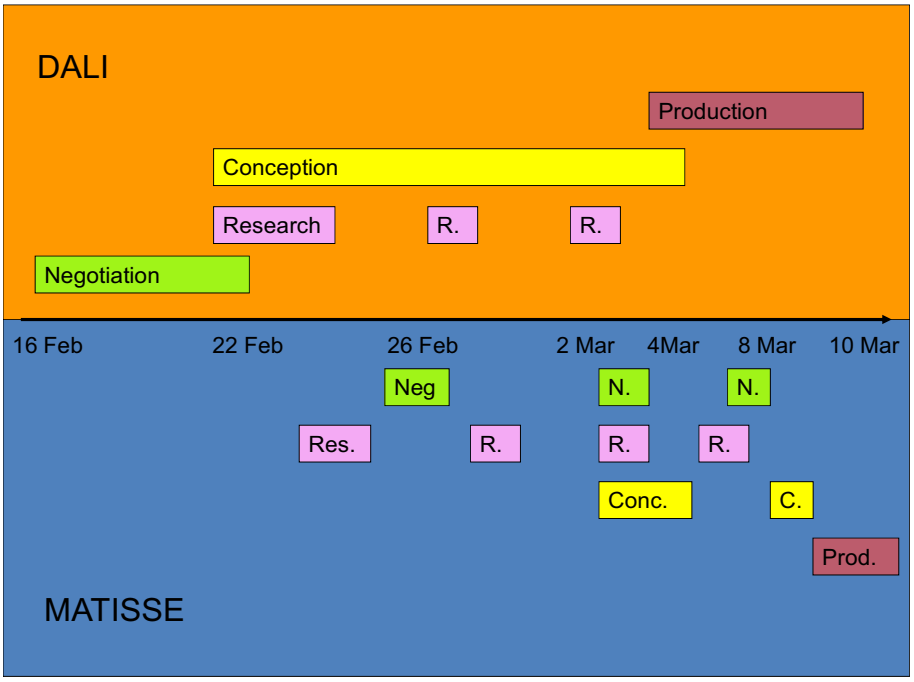

Fig. 1. Temporal dispersion and duration of both groups' patterns of work.

In the case of group Matisse we are faced with a very different scenario. The first relevant aspect that deserves noticing is the fact that this group took almost one week to begin their interaction, and when they finally initiated their work, they did not start by negotiating the focus of their project, but instead started by sharing between themselves the results of their random research efforts. After this initial research they initiated the negotiation process, but were unable to come to a consensus. This made both the negotiation and research phases to drag along intermittently until March 8th and, consequently, hindering the conception phase development and delaying their whole project. Because of that, this group was only able to reach the production phase at a very late time, resulting in their late final product submission.

These two groups also diverged significantly in the way that they developed their collaborative learning communication processes supported by the available technologies (see Table 3). In the case of the successful group (Dali), their communication was centered on two online discussion forum threads, in which all the participants contributed with feedback and elaborations, for a total average of 42.5 replies per thread, which was also complemented by one chat session where the participants brainstormed some of the ideas that they had during the negotiation phase. The participants were consistently careful to take into account everyone's contributions, sustaining them by the course readings, and providing constructive feedback to their peers in an effort to develop the groups' knowledge convergence.

Groups Matisse illustration is very different. For this group, there were 22 initiated threads by the groups' members on the online discussion forum. However, these initiatives were not supported by the other group colleagues, being only able to attain the very low average of 1.2 replies per thread. Moreover, this group also resourced considerably more to the chat tool, despite the fact that they were not able to use it in a productive way. There are many proposals that the participants made that were completely ignored by their colleagues, being clear that each member was not careful to develop his contribution sustained on his partners' postings and so contribute to the development of the groups' arguments and knowledge. The lack of negotiation for the development of their project was appalling.

7. Discussion

In this research we drove to study processes of collaboration during a small group project, developed in the context of a Curricular Unit from an online Master Program. All the groups were able to complete their projects and share them with their peers; however, various degrees of success were present. Here we discuss the contrast between two groups representative of this situation. This research was completed through the analysis of the participants' postings in the group work forums, their completion of an online questionnaire and the assessment of their final group projects.

Group Matisse spent most of its time researching material for their project without ever clearly defining the setting that they wanted to work on. They spent a lot of time manifesting their differences without resolving them. In spite of the large research they shared, they did not comment on it when they presented it. Moreover, they did not provide feedback to each other. Decisions were made by some members

Table 3
Communication Characteristics.

Groups	Dali	Matisse
Threads	2	22
Replies/thread	42.5	1.2
Chats	1	3

but the others did not comment on them. No agreement was formally reached in the asynchronous forums. They felt the need to resource more often to the chat tool, being apparent that during those sessions they were forced to move on with their work and assume the responsibility to make decisions about it. Unfortunately, this did not translate into improved sharing in the forums. From the participants posting in their online group work forums, it became clear that their achieved a low level of knowledge convergence (Jeong & Chi, 2007). Moreover, the amount of shared knowledge (Weinberger et al., 2007) between the participants was also low, hindering the development of the participants' knowledge equivalence. From the analysis of this group's interactions it is also clear that the group members do not know each other and have not developed strategies to promote that knowledge. According to Giddens (1997) this knowledge is necessary to provide the participants the ontological security that enables trust and a collective identity.

There was clearly a case of members with very strong views and that were not open to negotiate them. However, these struggles may derive into strong disputes within the group, but may also work as the catalyst to a more thorough exploration of an issue and have a very positive effect in the group's learning and dynamics. Nevertheless, this was not the case for group Matisse.

Group Dali worked in a very distinctive way. From the beginning they were careful to ensure that they negotiated an approach to their working process that assured the collaborative participation of all members. The whole process of negotiation intended to clarify what was the focus of their project and their goals to achieve it. They were also careful with scheduling of their activities in order to make sure that all deadlines were kept. They started by building together the understanding of what is a blog, and how it can be used as an educational resource, and went one step further and actually created one. This might be considered one of the milestones (McConnell, 2006) that helped to define groups' identity and energized them to complete their project. They were careful to relate their work to the studied learning theories, and when they shared the results of their individual readings they added to it their critical comments and benefited also from their colleagues input. There is an in-depth work of reflection to which all the members contributed, not only about the project itself, but also about their own learning, decisively contribute to the participants' knowledge convergence (Jeong & Chi, 2007) apparent in their collaborative online knowledge construction. As a result, the participants were able to develop a large amount of shared knowledge (Weinberger et al., 2007), contributing for the development of the participants' knowledge equivalence.

When we compare the two groups, even though they follow a very similar pattern of work, several differences are clear. In group Dali, from the beginning, there is a clear intent to harmonize and value everyone's participation and so contribute to the development of a learning community (Wenger, 1998). Furthermore, participants thoroughly negotiate, and discuss what they intend to accomplish with their project, and so contribute to their knowledge convergence (Jeong & Chi, 2007). On the other hand, in group Matisse the negotiation of the problem is not clearly done in the beginning and as a consequence extends almost until the end. Moreover, in this group the research pattern is also much longer due to this lack of definition of their focus. They did not establish a work plan and as a consequence, only the pressure of the deadlines forced them to move on. This is much more the case of a cooperative work rather than a collaborative one resulting in little shared knowledge (Weinberger et al., 2007).

Another clear difference is the way in which the groups share their individual readings. In group Matisse the members simply post the links or references to the readings that they have considered relevant. In group Dali, the members go one step further and make also available their critical reflections on the readings that they are sharing. This prompted their colleagues to give them feedback and so initiate a rich discussion about their research that is absent on the other group. This is also in agreement with Barron (2003) when she says that "the most successful group had high rates of affirming, agreeing, and accepting remarks. These kinds of responses served to prolong the discussion of ideas and led to higher levels of reasoning" (p. 313).

The lack of feedback in group Matisse's interaction may be hinting the lack of trust in their shared motivations, and considered essential for their sense of community (Wenger, 1998). Even more, as Giddens (1997) told us "attitudes of trust in relation to situations, persons or specific systems, and at a more general level, are directly related to the psychological *security* of the individuals and the groups" (pp. 19 italicized in the original). This seems clearly to have been one of the issues hindering the performance of group Matisse, originating from their lack of trust between themselves. Moreover, group Matisse's lack of creativity in terms of their final product, and in their choice of format, may be interpreted based on Giddens (1997) view: "Creativity, which represents the ability to act or think originally with regard to pre-established modes of activity, is intimately connected to trust" (p.38).

An interesting characteristic from group Matisse's discussions is the large number of threads (22) but with a very small number of replies per thread (1.2). Conversely, on group Dali when the members post their participations they immediately invite their partners to comment on them resulting on a much smaller number of threads (2) but with a much bigger number of replies per thread (42.5). Group Dali spent the large majority of its time in the asynchronous forums (re)working on their proposal and sharing their ideas about it and its organization. In contrast, group Matisse feels a much stronger necessity to also recur to the chat tool to enable its project to advance. As McConnell (2006) already pointed out, also in our case, we have noticed that the group with more collaborative difficulties is the one who feels a stronger need to use the chat tool. Even more, the lack of collaborative knowledge construction in group Matisse is also revealing of their low shared knowledge (Weinberger et al., 2007). Group work revealed to be a powerful tool to develop collaborative learning. However, giving the students the opportunity to engage in online group work is clearly not sufficient to assure that they will work collaboratively, as was the case with group Matisse.

In our study, it became clear that the more and less successful groups, in terms of their outcome or product, clearly revealed different group processes – patterns of work, and diverging types of social presence (McConnell, 2006). Considering the observed patterns of work, even though several patterns were common to both groups, there were also several patterns distinguishing them. In the case of the successful group, we observed distinctive patterns of work, including: clarification of focus, collaboration, creation of artifacts, defining section headings, reflection over the produced sections, establishing the final presentation format, assurance concerning the assessment requirements, and revision. These patterns illustrate the collaborative nature of this group's work, and their continuous effort to develop a product that was representative of all the participants' contribution. Furthermore, these emerging patterns of group work seem to contribute to the development of a fruitful environment for shared knowledge and knowledge equivalence (Weinberger et al., 2007).

Conversely, the less successful group revealed patterns of work such as: struggle, changing of minds and direction, cooperation, different perceptions of expertise and experiences, and anxiety. These patterns illustrate this group's difficulties to develop a harmonious collaboration and hint into the lack of trust between the group's members. The participants denote their lack rapport evident by the shortage of

feedback of their peers, and by the proliferation of unsupported post, and new proposals that do not take into account previous contributions. In this group there were even occurrences of struggles amongst group members that did not recognize each other's expertise, and that were never fully resolved. It should also be noted the lack of contribution from the other group members to the resolution of these episodes. According to Giddens (1997) aspects related to ontological security and trust, as well as social identity, are cornerstone to understand how the groups coordinate their actions in order to develop their work and collaborate effectively. This is a feature that should be more thoroughly considered and researched during the development group work.

This study was conducted with the goal of characterizing the interaction patterns during online group work and relating them to the participants' knowledge construction and success in their project work. However, there are several limitations to our approach that should be considered, namely, the adopted methodology did not take into account the participants' individual prior knowledge related to the project developed during the group work.

On the other hand, the conduction of individual interviews, which were not contemplated in this study, could also have contributed to the clarification of this issue, as well as of the participants understanding of their previous experiences with CSCL, and to a better interpretation of the observed work patterns.

Finally, relational aspects clearly came up very strongly as extremely important to fostering a positive work environment. This in turn leads to a healthier relationship between the group members, and consequentially to improved learning and knowledge construction. For this reason, during the development of group projects, it is particularly important for the online teacher to take on the role of a social relationships facilitator, especially in situations where it becomes necessary to deal with conflict and different opinions, such as in the case of group Matisse.

8. Implications

A first implication that we must point out, is that, whenever possible, special care should be given to the construction of the groups. This should be done taking into account not only cognitive aspects where a balance is commonly intended, but also, the participants' interpersonal skills. It is necessary to consider how the relational contexts as well as social and cognitive aspects interfere in the development of collaborative processes. Research suggests that action coordination towards a shared task has a clear effect in the participants' negotiated identities (Giddens, 1997; Wenger, 1998).

The instructor's presence can heavily influence the types of interactions observed during group work, particularly during the earlier stages, due to its supportive, facilitator role, guiding the groups towards the patterns of work identified as more productive. Truly, the instructor's presence is especially important in groups with work patterns that may indicate difficulties hindering their development of a successful knowledge convergence process.

Also, considering the collaborative learning framework under which we are working, and recognizing the potentialities of group work to foster knowledge convergence, it is exceedingly important to align the instructional design with this perspective. In fact, it is fundamental to consider what is the best strategy to integrate group work in one's instructional design, in order to capitalize on its ability to nurture knowledge convergence. For example, in our case, at the end of the project only the final product resulting from the group work was assessed by the instructor, and not the individual contributions, even though peer assessment was also used within each group and reported to the instructor (Tinoca et al., 2007).

In conclusion, as curriculum designers for online courses we must think about the consequences that this study has for our practice. What do we envision as consequences in order to foster an environment nurturing to the production of collaborative work? An obvious one is that we must rethink the role of tutor/instructor. What should his role be for each group? In particular, in the case of less successful groups, what strategies can be used to promote a more collaborative setting? Moreover, it is necessary to explore other methodological approaches to research group work's impact on knowledge convergence. What other indicators should be considered when trying to assess the quality of learning in small groups? How can this research be expanded into a larger scale? What consequences are there for individual learning, and how can they be measured? And finally, what factors should be considered in order to promote the participants' trust and engagement in group work?

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