Scripting computer-supported collaboration by university students[1]

Anna Engel & Javier Onrubia

Departamento de Psicología Evolutiva y de la Educación.
Universidad de Barcelona
anna.engel@ub.edu, javier.onrubia@ub.edu

Summary

The present work studies the virtual collaborative elaboration of written documents in three groups of university students, and the influence of the assistance provided by the teacher on this elaboration. For the analysis a model of phases of collaborative construction of knowledge, adapted to the features of the studied tasks, is used. The results show that, although the students follow the instructions proposed by the teacher, they usually do not manage to reach the more advanced phases of collaborative construction of the model.

Keywords

Computer-supported collaborative learning; higher education; phases of collaborative construction of knowledge; collaborative scripts.

Introduction

The combination of the rapid development of the information and communication technologies (ICT) since the 1990s and the renewed interest for the social dimension of learning have, in a relatively short time, converted CSCL - *Computer-Supported Collaborative Learning*- in to a popular instructional

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[1] This article presents some of the results of a doctoral thesis in progress, titled "Construction of knowledge in virtual environments of teaching and learning. The interrelation between the processes of collaboration between students and the processes of help and guidance from the teacher." The thesis is carried out by the first author of this article, under the guidance of the second author at the Department of Developmental and Educational Psychology at the University of Barcelona.

approximation in several educational levels, especially in higher education. The shared interest of most research within the field of CSCL is how ICT facilitate the emergence and development of collaborative processes in teaching and learning situations, and how computer-supported collaborative learning environments can improve the interaction and group work and ultimately the results of the process of the participants' learning.

The most recent research that analyzes the collaboration between students in CSCL environments show a tendency to focus on the processes of joint construction of meaning, rather than on the individual contributions of the participants (the interpsychological processes rather than intrapsychological),elaborating descriptive models of these interpsychological processes. Some of these models worth highlighting are those of Garrison, Anderson & Archer (2001), Gunawardena, Lowe & Anderson, (1997), Harasim (2002) and Xin (2002), which have been revised and adapted by several authors in different research projects (Kanuka & Anderson, 1998; McLoughlin & Luca, 2000; de Laat & Lally, 2002, 2003, 2005; Schellens & Valcke, 2005; Schrire, 2006). Although these authors differ in their theoretical approach to these processes of joint construction of knowledge, and define a varying number of stages or phases in their production, essentially they all describe it as a socio-cognitive process characterized by "a logically sequenced developmental process" (Kanuka & Anderson, 1998): a process that moves from the divergence between the participants' ideas and contributions to the convergence of the meanings and the shared comprehension, and in which each stage or phase represents a higher level of cognitive complexity than the previous. The defined phases of the process represent an ideal logical sequence of development, although with a more complex nature in practice, (not linear and discontinuous), in which the group can demonstrate advances and declines between the phases. According to these works, this sequential process requires high levels of ongoing interaction and reciprocal communication between the participants in order to drive the processes of argumentation, negotiation, discussion and the joint construction of meanings.

The results of these studies prove the complexity and the difficulty of progress for the students from the initial levels to the more advanced phases of construction of knowledge. Usually the students share ideas and compare information – typical interventions for the earliest phases in the process of shared construction of knowledge-, but hardly debate ideas, concepts or statements, or negotiate meanings, and very rarely construct new ideas collaboratively – typical interventions for the more advanced phases of the process-. On the whole these works point out that, regardless of how sophisticated the electronic resources and devices are and how the environment technologically enables a certain expected social interaction in groups that work together in CSCL environments, there are no guaranties that this will occur (Wallace, 2003).

In studies of CSCL, establishing these difficulties have increased the interest in the role of the teacher as a guide and support in the students' process of collaborative construction of knowledge. In light of this, and in opposition to more traditional CSCL research, which mainly focuses on the interaction between students essentially isolated from the teacher's presence and impact on the processes of collaborative construction of knowledge in the analyzed activities, some of the more recent studies have begun to pay attention to the role of the teacher as a facilitator of the discourse, as the organizer and designer of the interactive processes, and as the expert that provides adjusted assistance to the students in their process of learning and promotes those types of interaction between students that

have higher constructive potential (De Laat & Lally; 2005; Garrison & Anderson, 2003; Lockhorst, 2004; Veldhuis-Diermanse, 2002).

The proposals of various authors to establish scripts for the process of collaborative construction also point out the importance of step-by-step description and direction of these processes for the facilitation of the development of optimal interaction from the point of view of collaborative construction of knowledge (Dillenbourg, 2002; Kollar & Fischer, 2004; Weinberger Fischer & Mandl, 2001). The scripts are defined as didactic scenarios that stipulate a certain number of activities of collaborative learning in a sequence of phases. Each phase of a script is concretized based on various attributes: the task that the students need to develop in the phase, the composition of the group – the size of the group, the criteria for the formation…-, the way in which the task is distributed in and between groups – subtasks, roles –, the mode of interaction – face to face, synchronous, asynchronous…- and the timing of the phase. The design of a script is based on the hypothesis that the promotion of certain interactive and communicative dynamics between students will activate specific interpsychological mechanisms that will facilitate the processes of negotiation and construction of meanings involved in learning and intellectual progress.

Following the description above, our study aims at an in depth comprehension of the processes of collaborative construction in CSCL environments and the role of the teacher in these processes. Therefore, adopting a constructivist and sociocultural conception of the processes of teaching and learning based on the CIT (Coll, 2001; Onrubia, 2005), we study the relations between students' collaborative construction of knowledge and the teacher's assistance to this construction in situations where the task of elaborating a written product is undertaken collaboratively. Earlier studies, which typically have focused on the analysis of the discussion forums, have paid little attention to the study of these situations. While acknowledging the relevance of this type of forums and their regular presence in CSCL environments, we assume that expanding the study to include other types of activities would be beneficial for theoretical as well practical reasons. Theoretical, because it can not be taken for granted that the investigative instruments and the obtained results, based on the analysis of one kind of activity, can be used or obtained in an identical manner in other activities, and practical, because the joint elaboration of written products also is a common type of task in CSCL environments. Consequently, and concretely, our work has two objectives. The first is to analyze the processes of collaborative construction of knowledge in three groups of students who have to resolve diverse tasks that require the joint elaboration of different written products. We are particularly interested in investigating if these processes can be described in terms of a sequence of phases similar to those established in earlier works, centred on the analysis of discussion forums. If this is the case, we would like to delimit the concrete indicators through which it is possible to identify these phases in tasks of collaborative elaboration of written products. Our second objective is to study some of the features of the assistance provided by the teacher to the students' collaborative construction of these tasks, with the intent of establishing some of the relations between those features and the phases of the attained collaborative construction. Methodologically, our work follows these objectives by way of an observational approach, without the intervention of the researchers in the studied phenomena, based on case studies.

Participants and situations of observation

Two didactic sequences have been registered and analyzed. Each of the registered sequences corresponds to one module of the course "Psychology of education", included in the plan of study of the degree of BA in psychopedagogy at the Open University of Catlunya (UOC). The UOC is a rather new university offering distance higher education through a virtual campus of their own design, which is based on tools for asynchronous written communication. The BA en Psychopedagogy has been part of their offer from the start of the university. The course "Psychology of education", with a duration of half a year and corresponds to 4,5 academic credits, is mandatory for some of the students who are aiming for the BA depending on their previous studies.

The data was gathered in one of the groups of the course, consisting of the teacher and 35 students. The students were organized in small heterogeneous groups with regard to four components. The analysis was centred on the data from three of these small groups. The selection was made in light of the objective to study groups with diverse levels of achievement and work dynamics, and was carried out based on the teacher's information with regard to these criteria.

The course was divided in to three modules. In each module the students were requested to carry out a set of different activities and tasks. The studied didactic sequences correspond to the modules 2 and 3 of the course. The duration of the didactic sequences was of, respectively, six and seven weeks. In each sequence, the students had to resolve one individual task and two tasks in the small groups. These tasks were subject to the teacher's evaluation. In the first didactic sequence the group tasks consisted of the analysis of diverse educational situations based on the theories presented in the module and the elaboration of a conceptual map of the main concepts of one of these theories. Both group tasks of the second didactic sequence revolved around the differences between the educational contexts (family, school, television and learning from adults). In the first task the small groups were requested to present a detailed description of these contexts based on a series of dimensions that characterize the educational practices developed in them, and in the second, a comparative reflection of the impact of the diverse contexts in the socialization of the individuals and the possible contradictions between them in relation to the promoted values and behaviours.

The virtual classroom of the course included several diverse spaces of communication: the *board*, a notice board where only the teacher could post notes; one general *forum* where both the teacher and the students could participate; *the group work space*, a private work space for the members of each group - the teacher could read the contributions and intervene if so desired – constituting of a board, a forum, a zone for storage and interchange of files; and the *space for continuous evaluation*, where the students send their written works to the teacher. The students could also use the electronic mailing system of the Virtual Campus, called *personal mailbox* for their communication concerning the course.

Procedures of data collection

The main body of gathered data corresponds to the register of the contributions and documents added by the teacher and the students from the three analyzed groups in the different available communication spaces throughout the duration of the two sequences. More specifically, registered

were all the messages to the board, the forum, the small group work spaces, the teacher's mail box, and all the interchanged documents between the students. The documents could contain individual proposals – preliminary or definitive, total or partial – in relation to the assigned tasks, comments or individual revisions of a document previously produced by any member of the group, or the final products presented as the result of the group work.

Additionally, information was collected from diverse sources with the purpose of providing contextual elements and facilitating the comprehension and interpretation of the messages in the registered messages and documents: initial and final interviews were carried out with the teacher, students filled out questionnaires at the beginning, during and at the end, and we also gathered the grades of each product in the different tasks given to each group by the teacher.

Procedures of data analysis

For the analysis of the process of collaborative construction of knowledge in small groups, in the first place, we selected messages and documents, of each member of each group, centred entirely or partially on the elaboration and resolution of the assigned tasks, separating them from those exclusively related to other questions, such as the individual study of the content, the organisation and management of the work in small groups or off-task questions. In the selected messages and documents corresponding to each task of the small groups, we identified the diverse ways in which the students discussed the contents, resolved the tasks and produced their final products; these diverse ways were categorized in terms of the phases of the process of the collaborative construction of knowledge in the group. The typology of phases that finally was used was the result of a repeated process of back and forth between theory and data. The starting point for the typology was the phases of collaborative construction proposed by Gunawardena et al. (1997) and Garrison, Anderson y Archer (2001). The final adapted typology distinguishes between four phases, which we call respectively, *phase of initiation, phase of exploration, phase of negotiation and phase of co-construction,* respectively. Ideally, these phases correspond to successive levels of shared elaboration of knowledge by the members of the small group, identifiable by four criteria: the continuity or discontinuity of the participation of each member of the group in the discussion; the level of reciprocity and contingency of the contribution; the level of critical acceptance of the ideas and the previous declarations of the participants; and the level of consensus regarding the delivered document as the final product of the task. Ideally, each phase provides the platform that allows the progress to the next. However, frequently, the groups' progress through the phases is interrupted so that they remain in one of the lower phases. Table 1 shows the operational criteria that enable the differentiation of the reached level by a group in a specific task.

I. INITIATION PHASE
The final product elaborated by the small group is a document based on the juxtaposition of the different individually produced parts by the members of the group, each of the parts without contributions from others.
II. EXPLORATION PHASE
The final product elaborated by the small group is: a) an initial document in which the group members have gradually made an accumulation of contributions (without modifications of the previous content) b) a document elaborated by one of the members of the group based on the juxtaposition of the different individually elaborated parts, which have been discussed and/or revised.
III. NEGOTIATION PHASE
The final product elaborated by the small group is: a) an initial document in which the members of the group have gradually made contributions to modify and revise previously contributed content, but without a final revision of the document that is handed in b) a document elaborated by one student on the basis of the joint discussion of the initial individual documents (total or partial) elaborated previously by the members of the group, but without a final revision of the document that is handed in.
IV. CO-CONSTRUCTION PHASE
The final product of the small group is a document corresponding to a phase III product which, in addition, has been subject to revision and explicit approval by the majority of the group members.

Table I. Operational criteria for the delimitation of the phases of the collaborative construction of knowledge

For the analysis of the teacher's assistance all the contributions (messages and documents) that involved some kind of support for the students' realization of the given task and the required products were identified. These contributions were described following three criteria. Firstly, the timing of the assistance offered was considered, distinguishing between the help *mechanisms "a priori"* – assistance offered by the teacher before the groups started the realization of the task and the elaboration of the corresponding products, for example while presenting the activity or the task-, *assistance mechanisms during the process* – help from the teacher parallel to the resolution of the tasks by the groups-, and assistance mechanisms "posterior"- assistance provided by the teacher after the resolution of the task by the groups, for instance through the correction of the final products and the delivery of the marks to the students. Secondly, aspects of the task for which assistance was offered were considered, distinguishing between assistance centred on the processes of planning, organizing and the functioning of the small groups, and assistance centred on the resolution of the task, the elaboration of the products and their content – a distinction inspired by some of the works on the roles of the teacher in online environments (Mason, 1991; Berge, 1995; Paulsen, 1998)-. The final consideration was if the assistance offered by the teacher was spontaneous or required by the students.

Results

We begin with the presentation of the results corresponding to the analysis of the phases of the collaborative elaboration of the tasks and the products by the small groups, and then move on to the results connected with the help offered by the teacher.

The process of collaborative elaboration of the tasks and the products

As mentioned earlier, the primary body of data for the analysis of the processes of collaborative construction of knowledge is constituted by all the interchanged messages and documents by the three groups of students with regard to the resolution of the task. Table 2 recapitulates the number of analyzed messages and documents, indicating the percentage that represents the sum total of the interchanged messages and the documents by the students and the teacher in the small group spaces throughout the analyzed sequences.

	Analyzed messages	% of total	Analyzed documents	% of total
Sequence 1	44	17,53%	56	80%
Sequence 2	83	21,45%	102	72,34%
Total	127	19,91%	158	74,98%

Table2. Number and percentage of analyzed messages and documents.

We have been able to adequately describe the process of elaboration of the required products in the different tasks, as reflected in the chosen messages and documents, in terms of our previously proposed phases. In the following, we begin by describing the general features of the identified phases and then the concrete phases reached by each of the three analyzed small groups in each of the four registered tasks.

During the *initiation phase*, the messages that the members of the groups interchanged are pertinent to the theme of the conversation but of independent nature: the participants contribute with their ideas and perspectives on the task through a brainstorm. The level of reciprocity and contingency between the participants' contributions is low and usually there are no explicit or implicit references to the previous contributions. Participants present and justify their own ideas, but do not question those presented by others. The typical way to proceed with the elaboration of the final product in the small groups that remain in this phase is the division of the task between the members of the group. Each student individually produces a document with the part of the task that he/she was assigned and presents it to the group. Theses documents are simply accepted without any questions or comments from the others. The compilation of these partial documents is presented as the final product of the task without any proposal of modification by the students, although there usually are general comments of approval from some or all of the students. The final product handed in by the students essentially corresponds to a strategy of "cut and paste" with contributions that can clearly be identified as having been written by the different members of the group.

In the *exploration phase* the level of reciprocity and contingency between the participants' contributions is higher than in the previous one, with continuous explicit and implicit references to

previous contributions. Even so, the majority of these references to previous contributions are acceptances of the presented information, without critique or questions, in such a way that the interchange typically takes the form of turns of presentation and acceptance where specific points of agreement are established, where as the disagreements are virtually non existent; when they appear, they are not taken up or discussed. Hence, in the groups which remain in this phase, the members share and jointly evaluate their ideas in the beginning of the resolution of the task, but the effort to understand the task as defined by the others does not extend beyond the initial moments. One example of this is found in the procedure of group 2 to resolve task 2.2. At the beginning of the task each group member contributes with an individually produced document describing the different educational contexts (family, communications media, school, education from adults). Following the guidelines given by the teacher, the group members revise the initial document produced by a group companion. The comments made by the students are basically positive, supportive and accepting valuations, although we do find additions to and comments of subtle distinctions in that written by others. However, these additions and distinctions do not elicit questions, answers or arguments within the group. One of the members of the group takes the responsibility of composing a final document based on the initial documents of all group members, and it is he alone who decides to consider or not, and in what way to consider, the different expressed comments. The final products produced in this phase correspond essentially, as in the case of the previous phase, to a strategy of "cut and paste", but in this case the fragments are not big parts, as in the previous phase, but rather phrases or short paragraphs, in a way that the document looks like a "puzzle" of contributions. Typically, the final product is handed in without a joint revision by the group members, although in some cases there may be messages from some group members displaying approval. However, such messages do not include any arguments or reasons for the approval of the text.

In the *negotiation phase* the interaction and the dialogue are produced continuously throughout the process of resolving the task. The interchanges reflect a high degree of connection and contingency, with continuous references to the previous contributions. There continue to be many turns of presentation and acceptance in this phase as well, but we also find complex sequences where the group members explain, clarify, verify, correct and confirm their contributions, as well as disagreements, although to a lesser extent. These sequences lead to several redefinitions of the product and joint decision making with regard to the meanings of the concepts and their interpretation in the context of the task, as reflected in the final document. One example of this process is found in how the members in group 1 set about the elaboration of task 1.1. In the beginning, each group member elaborates individually on one of the presented situations and writes a text explaining and illustrating the process of development in that situation from a particular theoretical perspective. Each student reviews the text of one other group companion inserting comments in the document. These revisions include valuations, confirmations, re-elaborations, reformulations, or rejections of the ideas and proposals made by the other participants. In the following we offer a couple of illustrating examples of this kind of comments (see table 3). In the first one, the reviewer, after having made a positive valuation of the companion's work, presents two proposals: the first is an extension of the presented ideas, justifying their pertinence and relevance, and the second is a proposal to modify the central focus of the explanation in the initial document. The second example corresponds to a revision of the description of the cognitive process of a child from the moment of her first encounter with a

jigsaw puzzle to the point of mastering the game. In this case, the reviewer questions some of the aspects of the companion's proposal.

DOCUMENT N45/24.10[2]	g1
N, congratulations on your work. I've made a small parenthesis in a couple of phrases. You make a very accurate description of all the concepts of Piaget, possibly I'd add the concept of "inequilibrium": According to Piaget, every progress of the child in his development comes from an "inequilibrium". Each rupture of the equilibrium brings a series of reaction which tend to restore the equilibrium. In the case of Laia the in equilibrium would takes place in the moment when she has to formulate a hypothesis in order to defend an idea in the argumentative text if she still is in the stage of concrete operations. The inequilibrium is according to Piaget a factor for the production of development. Possibly, and with the final work in mind, we shouldn't consider the extension, if that is the case, I would focus more on your explanation of the features of the stage where Laia is and not the general vision of the theory of Piaget. What do you recon? This, in the case of having to consider the extension. I've also corrected a couple of errors that I've	
DOCUMENT M41 24.10	G1
(…) The child has to have sufficient capacity to understand the meaning of the disorganized pieces that need to be organized in order for them to form a totality and therefore has to already master certain concepts, like for example the whole and the parts. According to Piaget in this stage the child isn't capable of simultaneously keeping in mind the whole and the parts, when the whole is distorted it is hard for him to establish the relation between the pieces with the whole. (…) As we said in the beginning of the explanation, that which will take Paula to the final resolution of the puzzle is the interactions that she achieves. It is possible that parents try to help her, but from Piaget's point of view, this will be something anecdotic, that at most will accelerate the process of learning a little bit. What will really be at stake is the capacity of assimilation and accommodation of the schemes that she has. It wouldn't be as much the schemes that she has, but rather in accordance with that differential of her experience with the object the accommodation of her schemes and the assimilation will take place (…)	

Table 3. Examples of comments to the contributions of the other participants, typical for the negotiation phase. The examples correspond to task 1.1 in group 1.

After revisions, the person responsible for the activity gathers the initial corrected documents in a new document and explicitly asks the group companions to examine the new document. All the group members contribute to the one document, along with comments concerning the made modifications.

The *co-construction phase* distinguishes itself from the previous in that, once the final document based on the negotiation between the different members is constructed, the group, or at least a large part of it, give the final document yet another "go", reviewing the content and/or explicitly showing general approval of it. Hence, a process of revision and/or explicit approval of the last version of the document by all the group members before the formal delivery to the teacher is added to the process of negotiation typical for the previous phase.

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[2] Original version in Catalan in appendix

In all the analyzed tasks, very rarely do the groups reach the higher phases of collaborative elaboration of tasks and products: only one group, in one single task, reaches the fourth and last phase of co-construction. In the majority of the tasks (8 of 12 analyzed tasks) the process is closed in the second phase of exploration, and in the three remaining tasks the process never moves beyond the initiation phase. Group 1 is the one that reaches the most advanced phase in one of the tasks, while group 3 is the one that to a large extent remains in the first phase of the process. The complete data are presented in figures 1, 2 and 3, which show the reached phases by each one of the groups in each one of the tasks of each one of the studied sequences.
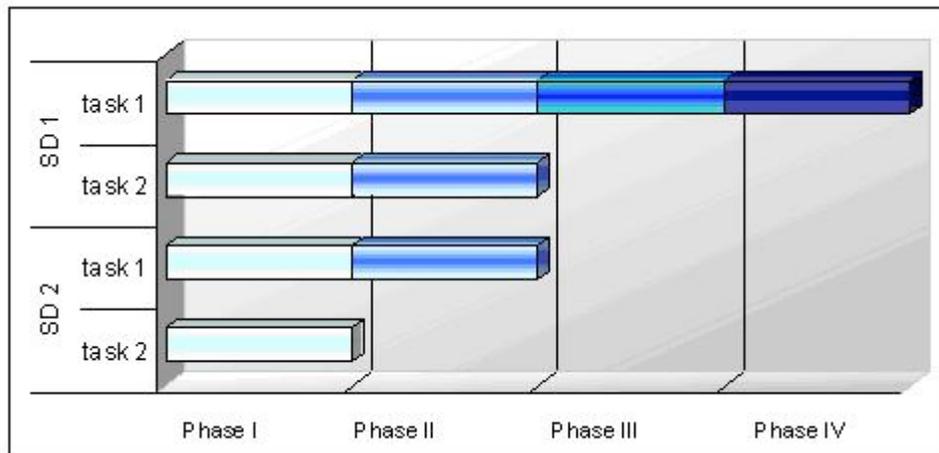

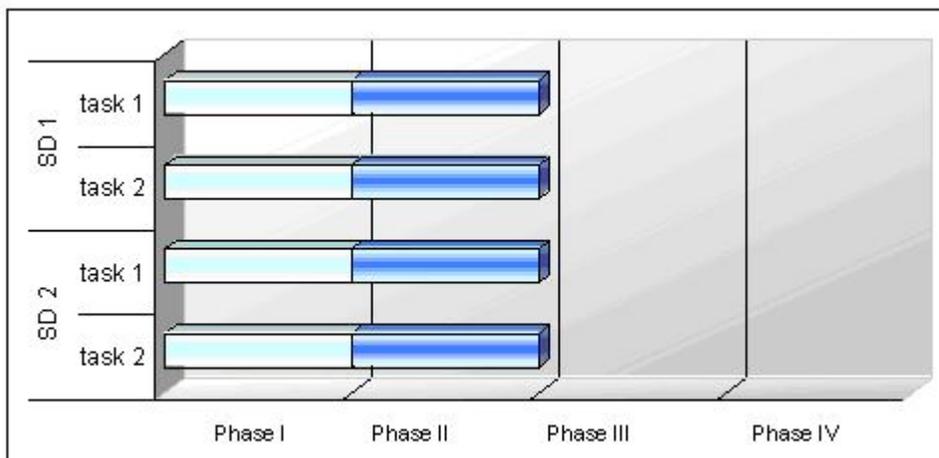**Figure 1.** Phases of collaborative elaboration reached by group 1 in the different analyzed tasks.

Figure 2. Phases of collaborative elaboration reached by group 2 in the different analyzed tasks.
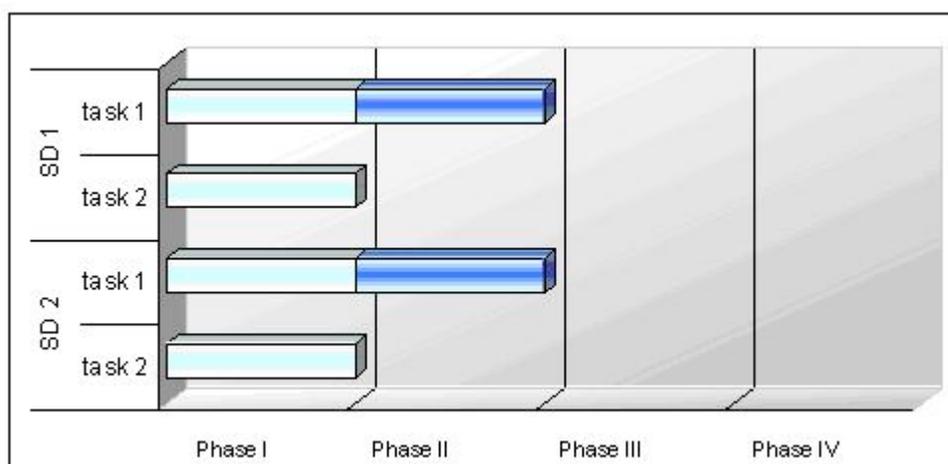
Figure 3. Phases of collaborative elaboration reached by group 3 in the different analyzed tasks.

Teacher's assistance in the elaboration of the tasks

The teacher gives detailed instructions of the different aspects of the dynamics of the groups, offering a high level of help "a priori". In the presentation of the course, the teacher indicates that for each task one student should assume the role of being responsible for regulating the process of task resolution and giving it a uniform format. Additionally, in the beginning of each didactic sequence, the teacher presents, amongst other documents, a chart with detailed description of the interactive dynamics of the group, thereby indicating for each of the tasks the sub-products that the group needs to elaborate and for each of them indicating who should be doing it, how the task should be done, the name of the product that should be sent to the shared space of files, the evaluation criteria and the final date of handing in. Table 4 recapitulates a fragment of the teacher's instructions for task 2.1, illustrating their features.

Task	Who does it	How it is done	Document to hand in	Evaluation criteria	Date of delivery
1. Complete in a rough copy the tables that appear in the presentation of the activity, by filling out all the boxes	Every one by himself	Each member of the group fills out the table corresponding to the analysis of each educational practice (family, communications media, school, permanent education), as well as the systems that characterize it.	Each one sends his/her task to the area of files of the group space: TEAM (nº)-(letter)-Task 1	Hand in the document by deadline. Identify the important information in order to characterize the educational practices based on the different dimensions and applied systems.	23.11
2. Gather the tables developed by the different group members in the previous part.	The responsible	The responsible develops two tables that integrate and at the same time synthesize the contributions from	A document to the area of files in the group space with developed tables. Identification: TEAM (nº)-TASK 2	Hand in the document before deadline. Collecting the answers.	25.11

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Task	Who does it	How it is done	Document to hand in	Evaluation criteria	Date of delivery
		the different group members. The rest of the companions sanction it.			
3. Write in a document, context to context, the way in which they are characterized, emphasizing the common elements and the differences.	Each one separately.	Each member of the group develops thoroughly the type of information that characterizes an educational practice and the systems that distinguishes it.	A document to the area of files in the group space. Identification: TEAM(nº)-(letter)-TASK 3	Hand in the document by deadline. Gather the most relevant information that enables the characterization of the educational practices and the systems that distinguish them.	28.11
4. Constructive comments to the work of a group companion.	Each one separately.	The companion in the couple adds suggestions for improvement or, when it is the case, approves it justifying why.	A document to the area of files in the group space. Attention, task 4 is the revised work of your companion in a different colour (which you were given in activity 1).	Hand in the document by deadline. Some comments with justifications, for improvements (additions or reductions) as well as acknowledgements (left just as it is).	30.11
5. Collection of all the tasks in only one document	Responsible	In order to make the revision easier for the responsible, enclose in only one document all the parts of the features and systems (with regard to the different educational practices) obtained in task 4.	A message to the area of files in the group space. Identification: TEAM (nº)-TASK 5	Hand in the document by deadline. Having gathered all the contributions and made an understandable presentation.	03.12
6. Reflection on the value for the development of the different contexts.	All at the same time.	The group members, while keeping in mind the features of the contexts, elaborate a reflection of the value of each one for the development of the persons.	Send one document to the area of files in the group space. Identification: TEAM (nº)-TASK 6	Contributions by deadline. Comments with justifications.	6.12

Table 4. The instructions provided by the teacher for the performance of task 2.1.[3]

With regard to the *assistance from the teacher during the process*, 19 of the teacher's interventions focused on the questions related to the process of planning, the organization and the operation of the work in the small groups. Of these 19 interventions, six are initiated by the teacher in order to remind the students of the instructions of the activity and when they are expected to hand in the sub-tasks, and 13 are responses to explicit requests from the different small groups, primarily related to the

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[3] Original version in Catalan in appendix

nature of the sub-task (group or individual) or with the formal aspects of the final document that will be handed in. The assistance during the process specifically related to the elaboration of the products and the content of the tasks occurs much less, in only five of the teacher's interventions, and four on teacher's own initiative. The five interventions refer to different themes, from specific theoretical concepts which cause misunderstandings, to the logic of the sequencing of the sub-tasks or the necessity to reach consensus about how to approach a task in the group.

Finally, we also find, although only occasionally, some teacher interventions, which we could be considered as assistance "*posterior"* to the students carrying out of the task. This assistance is related to the correction and the grading of the products: one week after the termination of each sequence the teacher returns the final documents of both tasks to each group, with diverse comments and valuations and the mark that the group is given. The teacher's comments basically are related to the students' use of the basic concepts and ideas that constitute the content of the module and occasionally include some general references or valuations with regard to the group process of carrying out the task. Table 5 recapitulates one of these valuations, where the first bullet is a general comment about the level of group elaboration of the document.

DOCUMENT P.234[4]	g1
In general you've done a good work where the following stands out: - You've done good team work, you've joined the criteria for carrying out and structuring the questions, which provides it with a lot of internal coherency, but in the first part, the comparison between the contexts is a little bit fragmented. (…) (…) - You've based the questions on the worked concepts in the course material corresponding to the module 3, but in some cases you haven't been able to use this knowledge in order to refer to the different contexts, for example, use the concept of "guided participation" for explaining the process of learning, not only in the family, but also in other contexts, as in the groups of equals, or for example, in the educational use of TV. These aspects, amongst others, which I have been commenting on through out the work process, make your mark in the PAC3 a B.	

Table 5. Teacher's valuation of the tasks 2.1. and 2.2. accomplished by group 1.

Discussion

Considering the process of collaborative construction of knowledge in small groups – the first objective of our investigation -, our results show that the development of these processes in the tasks of collaborative elaboration of written products can adequately be described, in the small studied groups, in terms of a sequence of phases similar to those established in previous works centred on the analysis of forums of discussion. The four identified phases (initiation, exploration, negotiation and co-construction) reflect levels of the small group members' successive shared elaboration of knowledge, and generally fit with the characterization of the process of collaborative elaboration as a process of progress towards higher convergence of meanings and more joined comprehension by the group

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[4] Original version in Catalan in appendix

members as suggested in the works of Kanuka & Anderson (1998), Gunawardena, Lowe & Anderson (1997) or Garrison, Anderson & Archer (2001).

Hence, in the initiation phase, the group members show each other their ideas, but there is hardly any joint elaboration of them, so that the joint activity acquires the features of "sum of monologues" rather than a dialogue. The members of the group hardly get involved in the explicit process of negotiation of meanings during the resolution of the task, so that the final document that is delivered to the teacher is more the result of a juxtaposition of elements carried out by the student that acts as the one responsible for the activity, rather than a joint and shared construction by the members of the group. The level of intersubjectivity assumed in the process of the construction of the product is, therefore, minimal: the only shared thing is, basically, the formal delivery of one sole product. In the second phase, that of exploration, we find a higher level of intersubjectivity: the members of the group consider the other group members as their conversation partners sharing some of the aspects of their contributions and constructing a somewhat shared body of knowledge and comprehension. However, this construction is of a rather accumulative nature, based on the acceptance of the others' contributions without much criticism. The third phase, that of negotiation, entails a new level of intersubjectivity, based on the explicit and continuous process of negotiation of meanings produced throughout the process of elaboration of the document. As a result, the products produced in this phase recapitulate jointly constructed ideas, based on a chain of elaborations and re-elaborations of the partial documents and the final document of the group, reflecting a high degree of shared comprehension and consolidation of the proposed solution to the task. Finally, the fourth phase adds yet another level to the process, based on the existence of a final systematic revision made by the different members of the group document to be presented. This explicit revision and approval of the last version of the final document underlines and strengthens the genuinely shared and unanimous nature of the produced group document.

At the same time, the phases that we have identified noticeably correspond to the type of task that was analyzed, the elaboration of written documents. Therefore, the concrete indicators that have enabled their establishment and the way in which the students collaborated are clearly different from those indicated by the works that have centred on the analysis of forums of conversation. In our case, the necessity to produce a final written product unquestionably characterizes the functioning and the interactive steps of the groups. Consequently, the students' contributions and the process of shared production is not done as much through the interchange of messages in the forum as the interchange of documents, and the production of consecutive versions of those documents converts itself in to a fundamental tool for the collaborative process of construction. The way in which the documents are combined in the joint document of the group, the way in which the proposals of change made by the different members of the group are incorporated in to the group document, or the way in which revision is made (or not) and how the approval is formalized with the final version of the group document, are key elements in the progression of the groups throughout the different phases that arise from the specific nature of the type of analyzed task, and which we do not find in the works that have analyzed forums of discussion. Accordingly, the identification of these aspects, and the concretion of the indicators of the different phases in the type of task that has been analyzed here, are specific contributions of our study, which complement the previous works which we have used as points of

reference, and which confirm the necessity, recently stated by some authors (Lockhorst, 2004), of investigations to consider different types of tasks.

In other respects, our results coincide with the previous studies in establishing that the students rarely reach the more advanced phases of collaborative development. Mostly, the groups that we have analyzed develop their products through the typical processes of the exploration phase, based on a type of interaction very similar to what Mercer (1997) calls "accumulative conversation", where the students use the language in order to put together their own contributions to those of others, with acritical acceptance and many affirmations, and where the joint knowledge is developed through a process of accumulation. The strategy of "cut and paste" and the "puzzle" format of the final document are typical for this kind of interaction.

From our point of view, it is possible to establish some relations between this type of collaborative production, mainly developed by the students, and the ways in which the teacher has provided assistance throughout the sequences- the second objective of our study - . Two of the features of the teacher's assistance, as manifested in our analysis, are in our opinion of particular relevance: the features of the instructions of how to carry out the tasks that the teacher presents at the beginning of each didactic sequence, and the limited availability of assistance during and after the tasks have been carried out.

The teacher's instructions end up being the main assistance available for the students' accomplishment of the tasks. According to the information from the interviews with the teacher, the objective of the instructions is to guide students to accomplish the tasks in a genuinely collaborative fashion, promoting the processes of co-construction of ideas and the mutual monitoring and control of the work. This objective is, no doubt, underlying several elements in the instructions: the specification of different roles in the group, and especially the role of the coordinator or the one responsible for each task; the requirement that all group members initially develop their own individual product in order to make sure that they all are involved from the beginning of the task; the insistence that all should read and revise the contributions of the others; the requirement that the final product be different to the initial individual products of each group member. However, when the indications in the instructions are examined in detail, it becomes clear that it is possible to follow them literally without really having to get involved in depth in the collaborative processes that are supposed to be promoted. If we take the instructions recapitulated in table 4 as example, it is possible to follow these instructions and that at the same time, for example, that the students give a mere formal approval to the contributions made by their companions, that the responsible person develops a final product of the task in a merely accumulative manner and through a strategy of "cut and paste" or that the final product is not up for revision by all the group members. For that reason, the behaviour of the students seems to indicate that they end up following the literal meaning of the instructions, rather than their underlying purpose, using them as a formal list of requirements that have to be fulfilled rather than an orientation of the type of collaborative processes in which they should get involved – something that also has been established in some studies of the use of *scripts* in CSCL environments (Weinberger, Fischer & Mandl, 2002; Weinberger, Ertl, Fischer & Mandl, 2005). The fact that the instructions include very detailed indications related to the organization and management of the work in groups, or with the formal features of the final product (name of the archive, space to which it should be sent, dates of expected

delivery) could have contributed to the students' literal use of the teacher's instructions as a list of requirements. It is definitely possible that the students' performance is at least partially the result of following the teacher's instructions, but in a very literal and formal way, attending in terms of Dillenbourg (2002) to the "syntax" of the instructions – the formal sequence of the phases and sub phases and the minimal expectations from each one-, but not to its "semantics"- the mechanisms of collaborative construction that the instructions intended to promote.

This kind of performance by the students may also have been favoured by details such as the fact that the instructions do not give any clues or explicit guidance regarding some of the key elements in the processes of negotiation and construction in the more advanced phases of a genuinely collaborative construction, i.e. the establishing of explicit relations between their own ideas and those of other members of the group, the justification and argumentation for their own perspective, the presentation of good explanations, or the posing of good questions to the other group members with regard to their contributions (Kobbe et al., 2007).

Finally, the scarce presence of assistance from the teacher during and after the processes of development of the tasks facilitates explaining why the students maintain this kind of use throughout the different tasks. As stated earlier, the assistance provided by the teacher throughout the sequences for the production of the products and the carrying out of the task is very scarce, as well as the references to the processes of production in the teacher's valuation at the end of each sequence. Once again, using a distinction proposed by Dillenbourg (2002), we could say that there are no acts of "regulation" by the teacher, which could compensate for the way in which the students seem to have interpreted the guidelines that were given when the activity was "structured" at the beginning. Instead, what we usually find during the process is assistance related to the management of the group work and the formal features of the tasks, mainly required by the students, which only confirms that these are essentially the aspects that preoccupy the students.

In summary, our results permit the confirmation as well as the extension of the previous studies of the students' processes of collaborative production, and indicate the relation between efficient assistance from the teacher and the features of such processes. At the same time, they show the difficulty in assisting students for the improvement of their processes of collaborative accomplishment of tasks that imply the production of written products, and underline the necessity to undertake new studies that consider this, which permit the identification, in different scenarios and under different circumstances, of the forms of teacher's assistance that can most efficiently improve these processes.

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Appendix

Original version of table 3 in Catalan. Examples of comments to the contributions of the other participants, typical for the negotiation phase. The examples correspond to task 1.1 in group 1

DOCUMENT N45/24.10	g1
N, felicitats per la feina realitzada. He fet un petit incís en un parell de frases. Fas una descripció molt correcta de tots els conceptes de Piaget, potser afegiria el concepte de desequilibri: Segons Piaget, cada progrés del nen/a en el seu desenvolupament prové d'un "desequilibri". Cada ruptura de l'equilibri comporta un seguit de reaccions que tendiesen a restaurar l'equilibri. En el cas de la Laia el desequilibri es produiria en el moment que ha de formular hipótesis per defensar una idea en el text argumentatiu si encara es troba en l'estadi de les operacions concretes. El desequilibir és, segons Piaget un factor per a produir el desenvolupament. Potser, i de cara al treball final, no sé si haurem de tenir en compte l'extensió, si fos així, ja hem centraria més en l'explicació que fas de les característiques pròpies de l'etapa en què es troba la Laia i no posar la visió general que dones de la Teoria de Piaget. Què et sembla? Això en el cas que s'hagi de tenir en compte l'extensió. També he corregit algunes faltes que he vist.	
Document M41 24.10	G1
(…) La nena ha de tenir prou capacitat com per entendre el sentit d'unes peces desordenades que cal organitzar per a que formin una totalitat i per tant ha de dominar ja certs conceptes, com ara el tot i les parts. Segons Piaget en aquest estadi el nen no és capaç de tenir present simultàniament el tot i les parts, quan el tot es descompon al nen li és difícil establir la relació de les peces amb el tot. (…) Com hem dit en l'inici de l'explicació el que durà a la Paula a la resolució final del trencaclosques serà les interaccions que hi realitzi. És possible que els pares provin d'ajudar-la, però des del punt de vista de Piaget, això serà quelcom anecdòtic, que com a molt accelerarà una mica el procés d'aprenentatge. El que realment estarà en joc serà la capacitat d'assimilació i acomodació d'esquemes que posseeixi la nena. No seria tant d'esquemes que posseeixi la nena sinó que en funció d'allò diferencial de la seva experiència amb l'objecte entrarà en joc l'acomodació dels seus esquemes i l'assimilació. (…)	

Original version of table 4 in Catalan. Instructions offered by the teacher for the execution of task 2.1.

TASCA	QUI LA FA	COM ES FA	DOCUMENT A LLIURAR	CRITERIS D'AVALUACIÓ	DATA LLIU-RAMENT
1. Completar en un esborrany les taules que apareixen a la presentació de l'activitat de manera que totes les caselles estiguin omplertes.	Cadascú per separat	Cada component de l'equip omple la taula responent a l'anàlisi de cada pràctica educativa (família, mitjans de comunicació, escola, educació permanent), així com els sistemes que la caracteritzen.	Cadascú envia la seva tasca a l'àrea de fitxers de l'espai de grup identificat com: EQUIP(núm)-(lletra)-TASCA 1	Lliurar el document en el termini establert. Identificar la informació pertinent per caracteritzar les pràctiques educatives a partir de les diferents dimensions i sistemes implicats.	23.11
2. Unificar taules elaborades pels diferents membres del grup a l'apartat anterior.	Respon-sable	El responsable elabora dues taules que integrin i alhora sintetitzin les aportacions dels diferents membres del grup. La resta de companys donen el vist i plau.	Un document a l'àrea de fitxers de l'espai de grup amb les taules elaborades. Identificació: EQUIP(núm)-TASCA 2	Lliurar el document en el termini establert. Recopilació de les respostes.	25.11
3. Redactar en un document, context a context, la manera en què es caracteritzen, emfasitzant els elements comuns i diferenciadors dels altres.	Cadascú per separat	Cada membre de l'equip elabora més a fons el tipus d'informació que caracteritza una pràctica educativa i els sistemes que la configuren.	Un document a l'àrea de fitxers de l'espai de grup Identificació: EQUIP(núm)-(lletra)-TASCA 3	Lliurar el document en el termini establert. Recollir la informació més rellevant que permet caracteritzar les pràctiques educatives i els sistemes que les configuren.	28.11
4. Comentar constructivament la tasca del company.	Cadascú per separat	El/la company-a de parella afegeix suggeriments de millora o, si és el cas, dóna el vist i plau argumentant el perquè.	Un document a l'àrea de fitxers de l'espai de grup. Atenció, la tasca 4 és la tasca del company revisada amb comentaris d'un color diferent (ja els vam assignar a l'act. 1). Identificació: EQUIP(núm)-(lletra)-TASCA 4	Lliurar el document en el termini establert. Alguns comentaris argumentats, tant si són de millora (s'amplia o es redueix) com si són de reafirmament (es deixa exactament com està).	30.11

TASCA	QUI LA FA	COM ES FA	DOCUMENT A LLIURAR	CRITERIS D'AVALUACIÓ	DATA LLIU-RAMENT
5. Recopilació de totes les tasques en un mateix document.	Respon-sable	Per tal de facilitar la revisió la responsable adjunta en un mateix document totes les parts de la caracterització i sistemes (referent a les diferents pràctiques educatives), obtingudes en la tasca 4.	Un missatge a l'àrea de fitxers de l'espai de grup. Identificació: EQUIP(núm.)-TASCA 5	Lliurar el document en el termini establert. Haver recollit totes les aportacions i fer una presentació de la informació comprensible.	03.12
6. Reflexió sobre el valor per al desenvolupament dels diferents contextos	Tothom a l'hora	Els membres del grup, tenint en compte la caracterització dels contextos, elaboren una reflexió sobre el valor de cadascun per al desenvolupament de les persones.	S'envia un document a l'àrea de fitxers de l'espai de grup. Identificació: EQUIP(núm)-TASCA 6	Aportacions dins el termini establert. Comentaris argumentats.	6.12

Original version of table 5 in Catalan. Teacher's valuation of the tasks 2.1. and 2.2. accomplished by group 1.

DOCUMENT P.234	g1

Heu realitzat, en general, un bon treball, del qual destaquen els següents punts:

- Heu fet un bon treball d'equip, heu unificat criteris de realització i d'estructuració de les preguntes, la qual cosa el dota de molta coherència interna, però en el primer apartat, la comparació entre contextos s'ha presentat d'una manera fragmentada.
(…)

- Heu fonamentat les respostes en els continguts treballats als materials de l'assignatura corresponents al mòdul 3, però en alguns casos no heu sabut utilitzar aquests coneixements per referir-vos als diferents contextos, per exemple, utilitzar el concepte de "participació guiada" per explicar el procés d'aprenentatge, no només a la família, sinó també a d'altres contextos, com el grup d'iguals, per exemple, o l'ús educatiu de la TV.

Aquests aspectes, i d'altres que us he anat comentant al llarg del treball fa que la vostra nota a la PAC3 sigui una B

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