The role of scaffolding in CSCL in general and in specific environments

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Abstract:
This paper aims to analyse if virtual forums set up in an environment specifically designed to improve collaborative learning can effectively influence students' discourse quality and learning when compared with those forums set up in a general environment. Following a coding schema based upon the set of scaffolds offered in the Knowledge Forum environment, we have qualitatively analysed 60 forums and 1,370 students from different subjects. The results show that there are very few elaborated and shared deep discussions: the central axis in those superior contributions focuses on bringing new information to already written contributions. There are more new and contrasting opinions in forums set up in a specific virtual environment, while there is more reasoning and elaboration in those that were set up in a general one. We propose some explanations for this dissonance and we conclude that collaborative virtual environments are secondary aspects in accounting for deep exchanges of information. Therefore, there are many aspects that need to be taken into account to improve collaborative learning and knowledge building.

Keywords: CSCL, scaffolds, scripts, categorisation, collaborative learning

1.- Introduction

The most important aspect of virtual environments is the relation that is established among five basic elements which constitute a knowledge community: the students, the teachers, the environment, the educative contents and the communicative tools. Thus, we can find asynchronous and synchronous communicative tools and management tools as teaching resources, and there is a considerable variation in the number of resources used. Hence, it can be considered that the richer the knowledge environment is in tools and resources, the more it fosters collaborative and constructive knowledge (De Laat and Lally, 2004; Hakkarainen, 2004; Kester and Paas, 2005; Schellens and Valcke, 2005; De Wever et al, 2009).

One of the most important elements in virtual environments is the forums where students can exchange information with other students and teachers. Sometimes, however, this communication is not understandable or accurate and, consequently, the discursive thread is broken. This study thus attempts to investigate if students who use scaffolds in their contributions improve their learning processes and their discourse. Consequently, we have created a coding schema following the predetermined scaffolds in the Knowledge Forum collaborative environment.

We have based our research on 60 virtual forums done in virtual environments. One of them has been built for learning in a collaborative way and the second one is of a more general nature. The general environment is called Sakai (v2.7), a learning management system that our university has been implementing since 2004. Sakai presents separate sections to upload subject syllabus, contents, activities (one for projects and another one for quizzes) and several communication tools: private messages, forum, chat, schedule, advertisement board and a shared folder. The forum tool of this environment is characterised by its rigidity. Messages are organised in topics and, for instance, it is not possible to group several messages together to publish them under only one note. Besides, forums can only be created by professors. Students cannot start a forum: they can only answer a message or answer to an existing thread. When they contribute by answering a message, they can change the message topic and attach a file, but there is no specific space for using scaffolds - this being the main difference between general and specific environments in a virtual forum.

Regarding the environment specifically designed to promote collaborative knowledge building, we decided to use Knowledge Forum (v4.7.1) for its great impact and relevance following the pedagogical concept of "knowledge building", which originated with CSILE (Computer Supported Intentional Learning Environment). Scaffolds are one of the resources that the Knowledge Forum environment has and that general ones do not have. The scaffolds or labels are helpful elements by which students show their ideas to others. In this way, students can assign a category or categories to their own messages before publishing them. As a result, their speech becomes more accurate and precise.

According to Scardamalia (2004), this knowledge-building process requires every student to take responsibility for and control his or her own production during the process of knowledge building. Every student should understand that, while learning, they are incorporating new ideas and concepts by taking active roles. Besides, having a friendly and attractive environment available implies an opportunity to make use of a great tool to improve this knowledge-building process and also a social scaffold for the creation of new knowledge.

Aiming to investigate if participating in virtual learning environments fosters and improves critical thinking and more complex knowledge exchanges, we have analyzed 60 virtual forums set up using these two kinds of environments. We have also observed the differences in discourse quality between specific and general forums.

2.- Theoretical approach

2.1 Computer Supported Collaborative Learning (CSCL)

There are multiple studies on the issue of Computer Supported Collaborative Learning, or CSCL. Collaborative knowledge building implies both individual and collective work in a group. Besides, both of them require negotiating, sharing information, collaborating towards knowledge building and taking always into account

cohesion and the identity of the group (Black, 2002; De Laat & Lally, 2004; Scheffel-Dunand, 2006; Gairín & Muñoz, 2006; Dettori & Persico, 2008; De Smet, Van Keer & Valcke, 2008). Hence, the successful elements of CSCL are many and very different, ranging from personality and situational aspects (Addison and Hutcheson, 2001) to popularity roles among students and the knowledge building task in hand (Prinsen, Volman and Terwel, 2007).

Nonetheless, observing all the aspects that we should bear in mind, we consider that selecting the suitable kind of knowledge is very important, and the software allows teachers to build appropriate tools (Veermans and Cesareni, 2005).

After having revised several authors' work, we have concluded that using CSCL tools has a positive impact on learning processes. Not only do students that participate in collaborative processes improve their problem solving and critical thinking abilities (Neo, 2003; Schellens et al., 2009), but they also solidify their cognitive strategies (Salovaara, 2005). Discourse interaction is an oriented task and it reflects high levels in the knowledge building process (Schellens and Valcke, 2005). Thus, it allows us to observe the collaborative knowledge building process (Arvaja et al., 2007).

Moreover, several basic elements for improving knowledge have been identified. In the first place, Neo (2003) states that collaborative knowledge not only improves problem solving and critical thinking abilities, but also increases teamwork and autonomy. In the second place, having students building knowledge cannot be considered a conceptual artefact, but a specific and local task (Ludvigsen & Morch, 2003). In the third place, the scientific methodology used in CSCL is a successful aspect for the collaborative knowledge that Salovaara (2005) investigated, concluding that it increases the use of cognitive strategies. In the fourth place, Schellens & Valcke (2005) establish the emphasis on interaction, and they conclude that it should be a guided task and that it shows high levels of knowledge building. Finally, Arvaja et al. (2007) assert that both an analysis of communicative functions and contextual resources allow for an exploration of the collaborative knowledge building process.

However, we are keen on investigating how to improve interactions among students, so that their collaborative discourse is richer. In general, the results of several studies carried out about this topic are positive. For instance, Zurita & Nussbaum (2004) speak about the improvement of social interaction and collaboration among students, while Veermans and Cesareni (2005) state that, if long-lasting learning activities are well structured, they will increase students' and teachers' awareness of the principles of collaborative learning.

2.2 Scaffolds

The notion of scaffolding comes from the socio-constructivist model of learning (Vygotsky, 1978). In accordance with Vygotsky's zone of proximal development, the scaffold should provide just enough information for the learner to make progress on his or her own. Scaffolds are designed and made to structure students' discourse. These scaffolds help students focus on particular aspects of the knowledge-building process when exchanging information, working in ways similar to a scientific group. As asserted by Scardamalia (2004, p. 7), scaffolds give ideas as defined roles in such processes as theory refinement and constructive criticism. Besides, "optimizing the characteristics of autonomy support and scaffolding in CSCL environments to effectively accommodate differences in self-determination of learners may have a profound effect on delivery and quality of online learning" (Rienties, et al., 2012, p. 2).

Many researchers comment on the importance of designing virtual environments taking into account participation as the main objective. According to them, a well-

designed environment can foster and improve communication. Thus, one way to improve participation in virtual forums is to design specific environments with these characteristics. Specific environments, which foster CSCL, are those featuring a scaffold set (such as Knowledge Forum, which offers predetermined scaffolds) in order to help students categorise their contributions and, consequently, to improve their discourse (Scardamalia and Bereiter 1993, Scardamalia, 2004). CSCL processes improve when participants use scaffolds while they are collaboratively building new knowledge.

Most studies about scaffolds have been performed using the Knowledge Forum environment. Authors such as De Laat et al. (2000), Dillenbourg et al. (2001), Rahikainen et al. (2001), Kleine et al. (2002) Salovaara & Järvelä (2003), Russell & Perris (2003), Hakkarainen (2004), Salovaara (2005), Prinsen et al. (2007), Cacciamani & Ferrini (2007) have researched the usage of the Knowledge Forum environment.

Having looked into the research carried out about this topic, we conclude that there are not many comparative studies of virtual environments, neither comparing general and specific environments nor analysing the scaffolds and other helping tools employed. It is precisely here where we have focused our study, with the main aim of analysing the content of the messages. We would thus like to highlight that in this study we have used scaffolds instead of tags because they were designed to provide procedural participation for fostering expertise in writing.

3.- Methodology

The research question focuses on whether the fact of participating in collaborative virtual environments improves critical thinking and a significant assimilation of new knowledge. Thus, it was pretended to study the level and the quality of students' participation in virtual forums representing the two environments mentioned above. Thus, it was necessary to analyze students' participation and know the communicative processes in which students engage when contributing in virtual forums. Students of several majors did their contributions in virtual learning forums and, once they had finished, a set of forums was analysed in order to study the content of all messages. The data has been analyzed by applying qualitative content analysis. Every contribution has been coded taking into account that an entire note (message) could be composed of several ideas indicating diverse categories of knowledge (Rahikainen et al., 2001). We finally counted and calculated the mean, as Prinsen et al. (2007) did in their research.

3.1 Aim:

To investigate the possible existence of differences in the levels of participation and learning, and to measure their quality in an environment specifically designed for collaborative knowledge building as opposed to a generic environment.

3.2 Sample and situation of observation

The sample consists of 30 virtual forums from different subjects which have been developed in a generic environment and 30 virtual forums done in an environment specifically designed for collaborative knowledge. We wanted the sample to be highly representative of the real use of the Sakai and Knowledge Forum environments. For the selection of these forums, we took into account three criteria. Firstly, we considered important that these forums were of different nature in relation with their dynamics and

assessment. One of the targets was to observe and analyse a heterogeneous set of virtual forums featuring contributions by subjects studying different majors. Thus, among the virtual forums studied, some were heavily influenced by a set of learning and communication instructions, while others featured opener instructions, letting participants contribute in a more spontaneous way. Besides, in some forums, professors had a higher level of intervention than in others, where participants contributed more spontaneously. In relation with the evaluation of the forums, students were evaluated in their communication processes in some forums, while in others professors evaluated both processes and a final production (for example, a piece of work or a synthesis of reflections about the forum). Therefore, the sample of this research represents the variety of virtual forums used in our university.

Secondly, and taking into account this variety of forums and our goal of comparing virtual forums done in two different virtual environments, the total number of participants has been 1370. The data was collected over a period of two academic years. We randomly selected, on the one hand, 30 units of observation (forums) featuring the general environment of our university (Sakai) and assessed by the Support in Teaching Innovation and E-learning Area. On the other hand, we studied 30 further samples of virtual forums implemented in the specific environment (Knowledge Forum).

Finally, a requirement for every forum was established in order to guarantee a minimum of messages being analysed. That is, each forum had to contain, at least, 15 messages.

The kind of forum is considered the independent variable (for the selection process), and we intend to evaluate the effect that it has upon different aspects of the forum outcome (dependent variable).

3.3 Data collection

The data was collected over a period of two academic years. All forums are aimed at students of different courses in different fields in the University of Lleida. The content of the forum messages was collected in text files. First of all, all selected forums were analysed following quantitative parameters (number of participants, number of messages, and number of words per message). Secondly, these text files were analysed qualitatively using Nvivo software, allowing for the categorization of the content of the messages. The same applies for the discourse analysis, which was performed following the category system based on the scaffolds of Knowledge Forum environment.

3.4 Data analysis

In order to categorise the content of the students' contributions in virtual forums using the Nvivo software, messages were downloaded in plain text format. Nvivo allows the user to collect, organise and analyse content from interviews, focus group discussions, surveys, and so on. After this initial stage, it was necessary to use a unified categorizing system. In the context of our study, as the specific forum is provided with a scaffolding system, we have used the scaffolds given in Knowledge Forum environment, i.e. opinion and knowledge building. The categorisation has been done by pairing off, reaching a 95% degree of reliability. Therefore, first, every message of every forum has been analysed using the opinion scaffolds (see table 1) – *opinion, different opinion, reason, elaboration, evidence, example and formulation* – and the knowledge building scaffolds – *I need to understand, new information, this theory cannot be explained, new information for clarifying, a better theory, put our knowledge*

together, – given in Knowledge Forum (a more accurate explanation can be found in Verdú and Sanuy, 2012).

Knowledge Forum: knowledge building	Knowledge Forum: opinion	Explanations:
	Opinion (OP)	Students manifest their points of view, their personal opinion
I need to understand New information		Students ask for help. They need further information
This theory cannot be explained	Different opinion (DO)	Students explain different ideas
New information for clarifying	Reason (RE) Elaboration (EL) Evidence (EV) Example (EX)	Students elaborate explanations based on theory, examples and evidence to explain better their own ideas to other participants.
A better theory		Students propose solutions and other ideas to their classmates in order to reach a consensus.
Put our knowledge together	Formulation(CO)	Students reach formulations through the ideas exposed in forums

Table 1: Relationship between Opinion Scaffolds and Knowledge Forum scaffolds

In the Knowledge Forum environment, scaffolds are always available. Participants have the option of categorizing their messages using one or more scaffolds or not - it is not compulsory for students to categorise a message before publishing it. Thus, observing this and bearing in mind that sometimes the scaffolds are not in their correct place, we think that an internal analysis of the messages is necessary. Moreover, this internal analysis is very useful for the forums set up in a general environment, because they do not have predetermined scaffolds that participants can use.

Another aspect that had to be taken into account was the unit of analysis. After having revised different studies about this topic, we decided to consider the "idea" as the unit of analysis, following authors such as Salovaara (2005), Strijbos et al. (2006) and De Smet, Van Keer and Valcke (2008). The reason behind our choice is that, on the one hand, there can be several categories of analysis in every message and, on the other hand, an "idea" can be formulated in different sentences. Other possible units of analysis which have been applied and studied by other authors are "whole message" (Veermans and Cesareni, 2005, Bonnett et al., 2006, Valcke and Martens, 2006, Zemel et al., 2007 and Timmers et al., 2008), "topic" (De Wever et al., 2006) and "sentence limited by punctuation mark" (Cacciamani and Ferrini, 2007).

Therefore, in order to internally analyze all the content of the messages, both set of scaffolds from the Knowledge Forum environment have been tracked, with the idea as the unit of analysis. Nvivo lets built a thread of categories and, by sectioning the corresponding part of the content and choosing the suitable category, the corresponding link is established. Once the categorisation is finished, Nvivo is capable to organise the data in a table, which can be subsequently imported into a spreadsheet, thus allowing data to be presented in numerical reports.

4.- Results

Not all forums have a sufficient number of participants to consider that they have a normal distribution. Consequently, we have used a non-parametric strategy to

know the level of significance between general and specific forums according to the quantity and the kind of categorizations of the messages. We have used the non-parametric proof U of Mann-Whitney, because it allows us to compare samples from the two independent nominal groups (general vs. specific forums) in quantitative measuring parameters, using the XLSTAT program. We calculate the significance level through the probability of an alpha risk p.<0.05.

The mean **number of participants** is 20 in general forums and 26 in specific forums. This difference is not significant: specific and general forums (U=442, p.=0.9058). Differences between the kinds of forum in relation to the text length are not significant either. The mean in specific forums is 10,910 words, while in the general ones it is 7,789 (U=401, p=0.4688).

It can be considered that the quantity of words in a forum is related to the number of participants. The non parametric proof reveals that, although in the specific forums there is much more variation, this is not significant (U=414 p.=0.5946).

The mean of written notes in general forums is 39.87 messages, climbing to 73.73 in specific forums. This difference is a positive and a favourable aspect of specific forums, because it can mean that, although the extra amount of words in the specific forums is not significant, there are more interrelations among the contributions, as we have explained before. However, we can conclude that the differences are not statistically significant (U=337.5, p.=0.0963), probably because specific forums feature great differences in the amount of written notes.

To sum it up, samples from both general and specific forums can be matched in relation to parameters of size, number of participants and number of written notes. The use of the scaffolds and the discursive guides that specific forums facilitate do not affect the quantitative parameters. Next, we will examine if the categorization analysis supports this conclusion.

4.1 Categorization of the notes following the coding schema based on the Opinion Scaffold

Categorizing messages/notes following this coding schema facilitates a more detailed observation of the contributions: to give reasons (RE), to propose a more elaborated version (EL), to give evidence (EV) and to show examples (EX).

As we can observe in table 2, there are more notes with this categorization in specific forums (mean=91) than in general ones (mean=55). This implies that students who participated in specific forums wrote more messages than those who contributed in general ones, which is somewhat logical because, in principle, environments like Knowledge Forum are specifically designed to encourage and foster communication among participants.

	/KF/opinion /OP	/KF/opinion/ DO	/KF/opinion /RE	/KF/opinion / EL	KF opinion / EV	/KF/opinion/ EXE	/KF/opinion/ CO
Mean (general forums)	25,03	,83	12,77	4,30	5,03	6,87	,23
Mean (specific forums)	59,23	2,10	11,43	1,20	9,43	7,87	,07

Table 2: categories according forum types

The non-parametric analysis reveals that there are no significant differences between both forum types, due to the great variability between them (p=0.2457). However, there are different categories depending on the forum type, as it can be observed in table 3. Different categories have different usage levels, but all of them

have been used. This difference is explained by the fact that giving one's **opinion** is easy and, therefore, there is a significant difference between specific and general forums (mean=59.23 vs. 25.03; U: 223.50, p.:0.0008).

Nevertheless, stating a **different opinion** or point of view means contradicting others' contributions and also reasoning one's ideas with fundamentals so that they are solid enough. This explains why this category is less used (mean=0.83 vs. 2.10) and the difference between forums is significant (U=257.50, p.=0.0026).

Although barely used, the category for giving arguments (**reason**) is more present in general forums than in specific ones (mean=37 vs. 24, U=649.00, p.=0.0033). On occasions, students only write solid arguments and ideas with the aim of proving to the professor that they know about the forum topic, so they offer some reasoning to obtain a good result in the forum assessment instead of explaining new knowledge to another student.

The category **elaboration** (understood as the improvement of reasoning) is more used in general forums than in specific ones (mean=8 vs. 23, U=669.50 p.=0.0004). When somebody is doing an elaboration, he/she is explaining things in a more conscious and extended way, because in an elaboration there can be reasoning, evidence, examples, opinions for an argument and opinions against an argument. However, these differences can be caused by external factors, such as the way the forum has been set out. In fact, there are only 5 elaborations in general forums and 1 in a specific one.

Contributions with **evidence** are not significant (U=491.00, p.=0.545). There are very few notes categorised as evidence, both in general (5.03) and in specific forums (9.43). We consider this kind of contribution extremely complex, because a piece of evidence implies looking up information using authors' statements in order to give emphasis to one's own ideas, opinions or reasoning.

A different process to reinforce the argument is to share examples. An easier process, it is common in both kinds of forums (U=376.50, p.=0.2782; mean=6.87 in general forums and 7.87 in specific forums). The examples that can be observed in all the forums are varied: from other researchers' examples to examples of theoretical statements, including examples of one´s own experiences.

Finally, we should consider that the possibility of bringing and sharing **conclusions** is very complicated, because it implies summarizing and building a discourse with one's own ideas, others' ideas and a theoretical approach. Consequently, there are very few conclusions (mean=0.23 and 0.07 in general and specific forums, respectively), and the difference between forums is not significant (U=511.00, p.=0.129).

4.2 Categorization of the notes following the coding schema based on the Theory Building Scaffold

The categorization based on this coding schema facilitates setting out an argument or speech focusing on the main ideas (CNE), proposing more elaborated conceptualizations (BT) and approving synthesis proposals (OKT).

As the above-presented results show (see table 3), the most used category in here is **My theory** (explanation), making it clear that specific forums foster a more detailed definition of one's own point of view (U=190, p.=0.0001).

|	KF/theory building/MT	KF/theory building/INU	KF/theory building/NI	KF/theory building/CNE	KF/theory building/BT	KF/theory building/OKT
Mean (general forums)	20,90	1,97	3,07	0,00	0,00	,13
Mean (specific forums)	55,57	4,77	28,57	0,00	0,00	0,00

Table 3: basic parameters of the categorization system

Regarding the category **I need to understand**, which implies identifying and explaining one's own ideas, there are no significant differences between both types of forums. Furthermore, this category is barely used. This category requires cognitive and social effort because, on the one hand, students should identify their own limits and, on the other hand, they should expose them to the other colleagues (U=359.5, p.=0.165).

The **New information** category is more used in specific forums (mean=28.57) than in general ones (mean=3.07), and the difference is statistically significant (U=167.5, p.<0.0001). Thus, the Knowledge Forum environment is positively correlated with the number of students writing messages under categories such as **My theory** and **New Information**.

The rest of categories are barely perceptible. Thus, there are no contributions categorised as **This theory cannot be explained** and **Better theory**, and there are only three categories of **Putting our knowledge together** in the studied general forums.

In figure 1, we can see the usage of both Opinion and Knowledge Building Scaffolds.
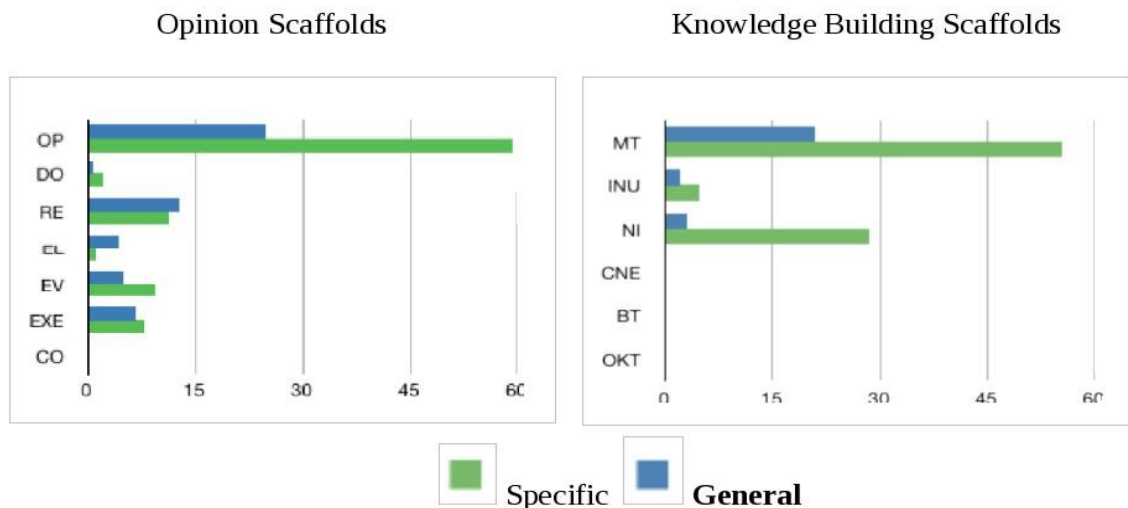
Figure 1: message categorizations

To sum up, the analysis of the Knowledge Forum categories confirms that there are very few elaborated and shared deep discussions: the central axis in those superior contributions in specific forums is bringing new information to already written contributions. Nevertheless, students who have participated in the Knowledge Forum have used more scaffolds than students who participated in the general one. Besides, the knowledge building set of scaffolds has been more applied in the specific environment.

5.- Discussion and conclusions

The purpose of this research was to study if virtual forums set up in an environment specifically designed to improve collaborative learning can have an influence in the participation and the quality of the contributions when compared with those forums featuring a more general environment. To be more specific, the study aimed, on the one hand, to analyse the categories resulting of the qualitative analysis of the discourse, and, on the other, to observe quantitative aspects such as the average number of entries, the number of words per message, the size of each contribution and the coherence of the message position within the overall forum (threads).

Virtual environments are key elements for virtual communication to take place. Yet, computer-mediated collaboration is not, in and by itself, a beneficial setting for learning, taking a secondary role in deep exchanges of information (Dehler et al., 2011).

First, the results from both kinds of environments do not show substantial differences in their size, in the number of participants and in the amount of written words.

Second, neither the content of the messages nor the interaction among participants can be considered of a high quality level. After having analysed the set of categories, we should bear in mind that what students do in virtual forums is mainly transmitting information. Almost all participants are transmitters, giving different points of view and personal opinions to the others, writing reasons and elaborations, and sometimes also pieces of evidence and examples.

Finally, there is certain a lack of content expressing doubts, problems, questions, suggestions, and well-argued disagreements. Our results are similar to those observed by Jorczak and Bart (2009), who already stated that the percentage of disagreement statements by students were very low (11.7%).

One possible explanation for these results is the lack of motivation and the lack of eagerness for reading and thinking about the ideas sent by other participants. We have to take into account that all those tools which foster student acquaintance with virtual environments are available to them. Furthermore, those tools must also facilitate the suitable application of all the strategies necessary to improve the group performance and their final outcome, as Black (2002) stated. The differences in academic motivation can influence both the kind of contributions elaborated by participants and the role every student plays in his/her learning community (Rienties et al., 2009). According to Häkkinen (2004), tools need to be based on teaching and learning models that consider the interrelation of different cognitive, social, emotional, motivational, and contextual variables in order to improve and foster collaborative learning.

Consequently, on many occasions, students participate in a virtual forum with the only aim of putting forward their contributions and giving their opinions. However, participation in a virtual forum implies more than this: from reading other colleagues' messages to pondering calmly their own messages and thinking about what to share. Students should write their own messages in a conscientious and metacognitive way and put the correct categories within the content they want to transmit. Once this is done, and before sending their contribution, students should think about where to place their message: if answering a colleague, the message should be tagged as an answer or, if their message contains a new idea, it should be tagged under a new thread. In our study we have confirmed that a high amount of messages are not placed in the correct place within the forum. This is a drawback because having an answer to a message many messages up or down from its correct place means the speech thread is lost. Marcelo and Perera (2006) also observed this disadvantage in their research. Conversation

breakage can imply several problems, not only in communication among students, but also when tutors analyse and assess message forums. Observing these results, we think that if students participated in a previous forum in order to become familiar with the methodology and with the virtual environment, this conversation breakage would be alleviated. The more previous training the students have in how to participate and interact in a virtual forum, the more accurate and logical the message structure will be.

Therefore, we consider that previous training in the use of scaffolds would enhance the level of discourse during the knowledge building process. Even though the answer is not clear, studies such as Argelagós and Pifarré (2011) and Gerjets et al. (2011) have confirmed that those students who were trained in the use of the scaffolds and were motivated to use them in their own messages had better results in knowledge building activities done afterwards and in this way, improving their learning. On the one hand, it is supposed that those forums set up in a Knowledge Forum environment feature more categories, as they provide scaffolds to participants. On the other hand, as we have already mentioned, although there is training on the scaffolds available to students, they often do not think thoroughly about the kind of message they have just written (Verdú, 2009). For instance, there is an imprecise use of scaffolds when categorizing their own messages, matching/equating *new information* and *elaboration* categories, when this is not really correct. Therefore, a student can write an elaboration without offering new information. This fact shows a lower profitable outcome than that expected from participation in a specific environment.

A set of differences about the way ideas can be categorised within every contribution has been shown. It is notorious that forums done in Knowledge Forum have more *explanations*/*opinions* (i.e. students building their own ideas) and also more *different opinions*. However, forums set up in a general environment show more clarifications/arguments/elaborations. This fact is paradoxical, because there are more complex categories in the general environment than in the specific one. In spite of these results, students have written these contributions with elaboration categories in the general environment, with the only goal of demonstrating that they know about the studied topic and worked in class. Thus, there is neither knowledge nor a communicative intention. It is more important to satisfy professors' instructions and demands than acquiring new knowledge (Onrubia et al., 2009). Groups that write longer contributions are groups that adopt a ''more is better'' strategy, which may be an indication that they devote too much time to put as much information as possible into their essays without considering the quality of this information and the quality of their writing (Janssen et al. 2010).

We wonder if these differences happen because, in specific environments, there are scaffolds that help students to categorise their messages before contributing and also due to the fact that the scripts have a decisive role. What is evident is that environments for computer-mediated collaboration need to trigger learning-productive interactions (Dehler et al., 2011).

Although in the present research we have not gone further in studying the variables that can have an incidence in contribution optimization, several key variables have been identified, according to Robinson (2010). For instance a) the context in which the virtual forum is done (Perit et al., 2009), b) the value of the forum towards the subject's final grading, c) the studies specialisation, d) the student's level, e) the students' and professors' roles – Strijbos and DeLaat (2010) provide a very helpful review of roles of learners in CSCL –, and f) the scripts. According to Morris et al. (2010), scripts consist of instructions regarding how group members should collaborate and complete tasks through their respective roles. Rummel et al. (2009) state that the scripted

interactions often lead to better results than unscripted ones, and Monteserin et al (2010) explain that their results show that conflicts always arise when a group of students try to solve a problem or exercises in CSCL. These authors consider that providing students with argumentation plans facilitates conflict resolution and does not make students think less or construct less knowledge while debating.

To sum up, in this research we have analysed the contributions in virtual forums taking place in both specific and general environments. The results obtained and the comparisons performed lead us to confirm that virtual environments are neither used to guarantee a significant and meaningful exchange of information among students and professors, nor they have a significant effect in the acquisition of new knowledge, although the shared information is wide and deep (Chou and Min, 2009). We also conclude that scaffolds are very important in order to help students think about the kind of contribution they want to share in the forum, just as Scardamalia (2004) and Järvelä et al. (2003) confirm. Finally, some challenges are yet unsolved, such as the fact that students need to be encouraged to communicate and exchange information among their peers. Besides, it is necessary to consider that there is not always a relationship between task cohesion and cognitive quality, as data from the research done by Wang and Hwang (2012) shows. It is necessary to foster different points of view, or disagreements, because the more different opinions there are, the richer the knowledge building is going to be. Jorczak and Bart (2009) found support for the assertion that discussion conflict is related to higher-order information processing, suggesting that tasks which increase conceptual conflicts are a promising means to improve the quality of CSCL discussions. Future work will concentrate on these points, including optimization aspects – a topic we will explore in further research.

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