CONVERSATIONAL FUNCTIONS FOR KNOWLEDGE BUILDING: A STUDY OF AN ONLINE COURSE AT UNIVERSITY

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Interactions in online courses have been studied by analyzing Conversational Functions used by participants. Cacciamani, Perrucci Khanlari (2016) developed a coding scheme, named CF4KB, consisting of four Global Conversational Functions (GCF), each articulated in two Specific Conversational Functions (SCF). The aims of the present study were to explore: 1) What are the more frequently SCF used by the participants, both at the beginning and at the end of an online course, and if there are differences between the beginning and the end of the course in terms of SCF used; 2) If there is any specific pattern of SCF used at the beginning and at the end of the course and if there are any persistences in using the same SCF. For these aims, 152 messages posted in Knowledge Forum online environment by 24 university students (19 F and 5 M) were considered. The messages have been segmented into units of meaning and the 1451 resulting segments have been coded by two independent judges who applied

the CF4KB. The analysis of frequencies evidenced the more frequently used SCF, at the beginning and the end of the course. Comparing SCF frequencies between the beginning and the end of the course, differences were detected. Results showed also different patterns in the use of the SCF at the beginning and at the end of the course. In addition, the persistence of one SCF was found. Implication of these results for the analysis of the interactions in online courses are discussed.

1 Introduction

The aim of Computer Supported Collaborative Learning (CSCL) is to embrace technology to facilitate collective activity and collaborative learning. The general belief about CSCL is that sharing knowledge between contributors as well as constructing individual's own knowing are primarily achieved through situated discourse processes (Stahl, 2003). Therefore, it is required for CSCL researchers to investigate the discourse processes, in order to understand substantial, complex, and interactive process of joint activities between the participants (Lipponen, Hakkarainen, & Paavola, 2004). These beliefs have encouraged CSCL community to focus on studying and analyzing discourses in CSCL environments. Of particular interest in this field are studies on Conversational Functions (CF) in collaborative learning environment. As described by Wise, Saghafian and Padmanabhan (2012), Hare (1994) has defined functions as particular rights or duties assigned to roles which guide role takers to interact with other community members and contribute to the conversation. Each role may have one or more functions that need to be fulfilled by the role taker in order to support a productive conversation. Building on this definition, Wise and colleagues defined CF as a

> "specific kind of activity performed in a discussion that is expected to support productive interaction"(Wise *et al*., 2012, p. 57).

In their study, the authors analyzed students' online interactions to understand what kinds of CF are performed by the participants during the joint activities and identified the following seven common CF performed by students: motivate others to contribute, give direction to the conversation, provide new ideas, use theory to ground the discussion, bring in (relevant external) sources, respond to previous comments, and summarize existing contributions**.**

Building on this work, Cacciamani, Perrucci and Khanlari (2016) have recently developed a coding scheme, called "Conversational Functions for Knowledge Building" (CF4KB). Knowledge Building (KB) is defined by Scardamalia and Bereiter (2003a) as the production and continual improvement of ideas of value to a community through social interactions. KB holds an even stronger belief in the role of discourse in learning:

"the state of public knowledge in a community only exists in the discourse of that community, and the progress of knowledge just is the progress of knowledge-building discourse" (Scardamalia & Bereiter, 2006, p. 12).

As Bereiter and colleagues (1997) assert, students who fail to master knowledge-building discourse, have failed to master science.

Scardamalia and Bereiter (2006) described 12 principles for KB, including Real Ideas and Authentic Problems, Improvable Ideas, Rise Above, Epistemic Agency, Community Knowledge, Collective Responsibility, Constructive Uses of Authoritative Sources, Knowledge Building Discourse, and Concurrent, Embedded, and Transformative Assessment. These 12 principles frame KB as an idea-centered pedagogy with students as epistemic agents, creating knowledge through engaging in complex socio-cognitive interactions. Although CSCL environments and KB Environments are usually considered as synonym, Scardamalia and Bereiter (2003b) have articulated several features of KB environments which distinguish these two types of collaborative environments:

1. KB environments are self-organized, self-directed environments and support for advanced knowledge processes that contributors need;
2. in KB environments, collective knowledge advances built from the contributions of community members are represented in shared, user-configured design spaces;
3. in KB environments, contributions to the evolution of ideas are evident, as students cite and reference one another's work;
4. in KB environments, students represent higher-order organizations of ideas and show the rising status for improved ideas;
5. in KB environments, students consider different ways for the same idea to be worked with in varied and multiple contexts and to appear in different higher-order organizations of knowledge;
6. in KB environments, students provide feedback to enhance self-and group-monitoring of ongoing processes and to tap idea potential.

These are the essence of the 12 KB principles which describe Knowledge Building as a pedagogy which has the potential to "increase the likelihood that what the community accomplishes will be greater than the sum of individual contributions and part of broader cultural efforts" (Scardamalia & Bereiter, 2003a).

The implementation of the KB in an online course at University could help students to move from a model of work with knowledge centered on "acquisition of knowledge", towards a model centered on the "creation of knowledge" (Paavola & Hakkarainen, 2005).The first model assumes that

knowledge is a property of an individual mind. This approach is easily connected to a 'folk theory' of mind according to which the mind of learners is a container of knowledge, and learning is a process that fills the container, implanting knowledge there by the teacher (Bereiter, 2002). The second model, assumes that knowledge is actively constructed by the learner collaborating whithin a community, and implies an active position for the students in the work with knowledge. Scardamalia and Bereiter (2006) describe this position in terms of Epistemic Agency.

The work of Cacciamani and colleagues (2016) focused on cognitive aspects of the knowledge building process, considering these characteristics of a genuine KB environment, in order to detect CF in online activities in Knowledge Forum (KF)®. KF is the most widely used KB environment to support collaborative knowledge creation. CF4KB scheme identifies four Global Conversational Functions (GCF) articulated in eight Specific Conversational Functions (SCF):

- The GCF of *Exploring* which is mapped to the "Real Ideas, Authentic Problems" and "Epistemic Agency" principles of KB model includes the following two SCF: A) *Question or problem of inquiry*, by which students propose questions or problem of inquiry concerning the course content, *B) Hypothesis and ideas,* by which students formulate possible explanations about a question or problem of inquiry emerging during online discussion.
- The GCF of *Providing information* which is mapped to the "Constructive use of Authoritative Recourses" KB principle includes the following two SCF*: C) Applicative examples*, by which participants provide examples according to their personal experience, *D) Information from authoritative sources*, by which the participants provide theoretical information that is explicitly referred to a source.
- The GCF *of Re-elaborating,* which is mapped to the Rise Above KB principle, includes the following SCF: *E) Repetition/Quotation others' idea*: formulating explicit reference to an idea of another member of the community, and *F) Synthesis*: formulating a synthesis using ideas of different participants.
- The GCF *of Evaluation* is mapped to the "Concurrent, Embedded and Transformative Assessment" and includes the following SCF: *G) Comment*: providing content evaluation, including judgments of agreement or disagreement, positive or negative on a content expressed by another participant, *H) Metacognitive reflection and Metacommunication*: providing evaluation or reflections on the strategies of work of the online course or metacommunication about the activity.

The current study employs this coding scheme to explore:

- What are the more frequently SCF performed by the participants in the activity of knowledge building, both at the beginning and at the end of an online course, and if there are differences between the beginning and the end of the course in terms of SCF used.
- If there is any specific pattern for using SCF at the beginning and at the end of the online course and if there are any persistence in using the same SFC from the beginning to the end of the online course.

2 Method

2.1 Participants and course background

The dataset used for this study is comprised of students' discourse in the online course of Educational Psychology, as archived in Knowledge Forum® (KF), an environment built specifically to support production and refinement of the community's knowledge. The course was held in 2006-2007 academic year at the University of Valle d'Aosta and was organized in four modules. The participants included 26 (21 F and 5 M) undergraduate students of Primary Education, as well as undergraduate students of Educational Sciences, in addition to the teacher and tutor.

For research purposes, 152 messages posted by 24 students (19 F and 5 M), who wrote in both Module 1 (= 83 notes) and Module 4 (= 69 notes) were considered[1].

2.2 Procedure

The procedure, inspired by Strijbos and colleagues (2006), included the following steps: 1. develop the segmentation procedure according to the unit of analysis; 2. apply the coding scheme categories; 3. determine the agreement of the codification; 4. resolve the controversial cases. The 152 messages have been segmented into units of meaning, identified by punctuation (i.e. full stops, suspension dots, exclamations, and question marks), used by the author of the message, (cf. Strijbos *et al*., 2006). The 1451 resulting segments have been coded by two independent judges who applied the CF4KB coding scheme at SCF level. The overall inter-agreement amounted to 77.3%, with a K of Cohen = 0.66, considered good in the literature (Landis & Koch, 1977). Controversial cases were discussed until the complete agreement by the same two judges.

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[1] Two students that had not posted neither in Module 1 nor in Module 4 were not considered.

2.3 Data Analysis

In order to answer the first research question, the percentage of each SCF was separately computed for both Module 1 and Module 4. Then, employing Wilcoxon Test, Module 1 and Module 4 were compared, in terms of the frequencies of each SCF.

In order to explore the second research question, for each SCF, correlations between the frequencies were conducted, by means of Spearman's statistic, both within each Module and between Module 1 and Module 4.

3 Results

3.1 Research Question 1

In Table 1, for each SCF used in Module 1 and Module 4, frequencies and percentages of the total of segments are reported.

Table 1
FREQUENCIES (F) AND PERCENTAGES (%) OF THE PERFORMED SCF
IN MODULE 1 AND MODULE 4

SCF	Module 1 f (%)	Module 4 f (%)
A. Question or problem of inquiry	7 (0.78)	12 (2.19)
B. Hypothesis and ideas	246 (27.27)	243 (44.26)
C. Applicative Examples	13 (1.44)	66(12.02)
D. Information from authoritative sources	547 (60.64)	165 (30.05)
E. Repetition/Quotation others' idea	6 (0.67)	0 (0)
F. Synthesis	4 (0.44)	1 (0.18)
G. Comment	12 (1.33)	9 (1.64)
H. Metacognitive reflection and Metacommunication	12 (1.33)	19 (3.46)
I. Other	55 (6.10)	34 (6.19)
TOTAL	902 (100)	549 (100)

As Table 1 shows, the more frequently used SCF in both Module 1 and Module 4 are *Hypothesis and ideas* (B) and *Information from authoritative sources* (D), while the less frequently used SCF are *Synthesis* (F) and *Repetition/Quotation others' idea* (E), which is completely absent in the last module. Nevertheless, from Table 1 it is evident that the *Information from authoritative sources* (D) is more frequent in Module 1 than in Module 4. From Wilcoxon Test this difference results significative ($Z = -2.68$, $p < .01$). Moreover, Wilcoxon test results evidence a significant difference ($Z = -3.22$, $p < .01$) between frequencies of *Applicative examples* (C); in Module 4 students

used more *Applicative examples* compared with Module 1 (see Table 1).

3.2 Research Question 2

In Table 2, correlation between the SCF are separately shown for both Module 1 and Module 4.

Table 2

CORRELATIONS (RHO) BETWEEN THE SCF IN MODULE 1 AND MODULE 4

SCF	A	B	C	D	E	F	G	H	I
A		.041	-.254	-.141	-.257	-.093	-.308	-.050	-.286
B	-.037		.564 **	-.184	-.307	.091	.269	.320	.431 *
C	-.208	.048		.174	.082	.278	.638 **	.378	.586 **
D	-.334	-.061	.041		-.028	.076	.149	.157	.093
E	-	-	-	-		-.120	.333	-.082	.043
F	.456 *	.349	-.247	.181	-		.217	.377	.203
G	-.050	.209	.027	-.071	-	.436 *		.257	.449 *
H	.144	.408 *	.082	.048	-	.394	.199		.390
I	.050	.227	.034	.263	-	.359	.196	.787 **	

Module 4 · Module 1

* $p < .05$; ** $p < .01$

As shown, in Module 1, the SCF of *Applicative examples* (C) significantly correlates with *Hypothesis and ideas* (B) (Rho = .564, $p < .01$), *Comment* (G) (Rho = .638, $p < .01$) and *Other* (I) (Rho = .586, $p < .01$). Although the correlation between *Hypothesis and ideas* (B) and *Comment* (G) is not significant, all the correlations between *Other* (I) and *Hypothesis and ideas* (B), *Applicative example* (C), *Comment* (G) are significant (Rho = .431, $p < .05$; Rho = .586, $p < .01$; Rho = .449, $p < .05$, respectively).

In Module 4, the SCF of *Synthesis* (F), significantly correlates with both *Question or problem of inquiry* (A) (Rho = .456, $p < .05$) and *Comment* (G) (Rho = .436, $p < .05$). Moreover, the correlation betweeen *Hypothesis and ideas* (B) and *Metacognitive reflection and Metacommunication* (H) appears as significant (Rho = .408, $p < .05$).

Frequencies correlations between Module 1 and Module 4 run for each SCF, show a statistical significance only for *Hypothesis and ideas* (B) (Rho = .58, $p < .01$).

Conclusion

The present study was focused on two questions of inquiry. The first one was oriented to identify the more frequently SCF performed in the activity of knowledge building by the participants, at the beginning and at the end of the online course. We explored also the differences in SCF performed in the first and last part of the course, if there is any. The second question of inquiry was oriented to analyze if there is any specific pattern of using SCF at the beginning and at the end of the online course. In addition, we explored if there are any persistences in using the same SFC from the beginning to the end of the online course.

Concerning the first question of inquiry, results showed that both in the first and in the last module of the online course, the more frequently SCF used are *Information from authoritative sources* and *Hypothesis and ideas,* respectively. Moreover, the less SCF used are *Synthesis* and *Repetition/Quotation others' idea.* It can indicate that the students use the online environment as a place to share their explorative activity (corresponding to the GCF of *Exploring*) focused on building hypotheses and ideas about the problems discussed and on providing information from authoritative sources. In this work, the use of the others' ideas of the and also the synthesis of ideas developed in the online discussion (corresponding to the GCF of *Re-elaboration*) are not so frequent. These results are consistent with a study conducted by Pena-Shaff and Nicholls (2004), showing that in the online interactions analyzed in a bulletin board system used by university students, few messages provided a summary of the ideas presented in a discussion thread; therefore, most discussion seemed to be left unfinished. This result can indicate that the students are not aware of the possibility to improve the common knowledge using other's ideas in combination with their own ideas and the sources of information. They also seem not to perceive the relevance to create a synthesis helping the common systematization of the knowledge advancement developed.

Comparing the first and the last module, we have seen also a decrease in the use of *Information from authoritative sources* concomitant with an increase of *Applicative examples*. This result can indicate the progressive abandonment of the working model, centered on "acquisition of knowledge", towards the model centered on the "creation of knowledge" (Paavola & Hakkarainen, 2005). The students seemed to assume the first model in the first part of the course, organizing their online activity essentially in terms of writing in their notes the information derived from the handbook. In the last part of the course, students seemed to adopt the second model, assuming an Epistemic Agency expressed by the reduced impact in the online activity of the information derived from the handbook (comparing the number of segments of this SCF in the first and

last module). Students connect, indeed, actively theoretical concepts derived from handbook with examples from their own experience and used them to create or elaborate ideas.

With reference to the second question of inquiry results showed two patterns in the use of the SCF emerging at the beginning of the course. These patterns are indicated by the correlation between *Hypothesis and ideas* and *Applicative Example,* as well as correlation between *Applicative Example* and *Comment,* in Module 1. The first pattern can be considered from one hand as having an argumentative purpose: students who proposed hypotheses or ideas, also provided examples from their experiences to support them. From the other hand, it can be also interpreted as having a reflective purpose; students who described examples from their experience, can reflect on them and create hypotheses and ideas. Also, in the second pattern we can see argumentative or reflective purposes: some students produced comments on the note contents of other members and provided examples to support their own comments. Otherwise, students described in the online activity personal experiences and reflecting on them, identified ideas to make comments on the notes contents of the other community members. In the patterns of the first module, also the SCF of *Other* is present, through a statistical significant correlation with *Hypothesis and ideas*, *Applicative examples*, and *Comment*. This can indicate that students involved in these patterns, also performed SCF not necessarily focusing on knowledge building activity.

Three different patterns emerged in Module 4. The correlation between *Question or problem* of inquiry with *Synthesis*, seems to indicate from one hand that being more active in posing questions is associated with summarizing the ideas emerged in the online discussion. From the other hand, it can also indicate that the synthesis can be the starting point for new questions, showing that students are deepening their understanding. In addition, the correlation between *Hypothesis and ideas* and *Metacognitive reflection and Metacommunication* (corresponding to the two GCF of *Exploring* and *Evaluating*) can indicate that, at the same time, the community members are paying attention to the exploration and evaluation activity. From one hand, in fact, to seek explanations about the problems and questions of inquiry can lead to reflect on the strategy of work used in the knowledge building activity. From the other hand, this kind of reflection can stimulate students agency toward the creation of new hypotheses and ideas about the problems discussed. This seems to indicate that students are more aware that they are working towards the collective goal of building common knowledge. Finally, the correlation between *Synthesis* and *Comment* shows that the need to understand what the advancements of community knowledge are -expressed in making a synthesis- is associated with the interaction with the ideas contained in the messages of the other community

members. This correlation shows that the expression of comments on the others' ideas can stimulate producing a synthesis, probably perceived as a "tool" to trace the common effort to build knowledge, expressed in reciprocal comments. It is interesting to note that, unlike Module 1, there is no correlation between the SCF of these patterns and the category *Other*: students involved in the patterns of Module 4 tend to not to use SCF not implied in knowledge building activity.

These three patterns can help to understand how the online interaction between students works and to describe in which ways they are assuming Epistemic Agency about the work with knowledge in the online course (Scardamalia & Bereiter, 2006).

With reference to the correlation between Module 1 and Module 4, we have found that introducing hypotheses and ideas in Module 1 is associated with the use of the same SCF in Module 4. This can indicate that there are some students who are more capable or available to work with hypotheses and ideas, compared to other students. Combining the present result with the previous ones, these students in the first part of the course connect the activity of *building hypotheses and ideas* with *providing examples*, as well as with SCF of *Others*, which is not oriented toward knowledge building activity. In the last part of the course, *building hypotheses and ideas* is associated with the *metacognitive reflection/communication*. We can interpret this result in terms of an "emerging role" (Strijbos & Weinberger, 2010). This construct highlights that the group work members develop spontaneously during their collaborative learning activity roles that helps the group to work effectively. In this respect, the presence of students who tended to introduce hypothesis and ideas in Module 1 and Module 4 can be considered in terms of an "emerging role", helping other students to work on creating new ideas and improving them. This role seems to be associated with two different patterns: it moves from a personal argumentative or reflective purpose in the first module towards a more collective purpose focused on combining cognitive elaboration and strategies to be used in the community for knowledge building activities. This role can favor the students' transition from the "acquisition model" to the "construction model" in the work with knowledge.

In terms of limitations, all the participants were from a specific context (the same university) and it may limit the ability to generalize the results. Therefore, the development of this research needs to overcome this limitation, by other experimental tests to give statistically more support to the results and estimate the extent to which they are generalizable (with different context, skill level of participants, topic, type of conversation, etc.).

Despite this limitation, the present study can offer a relevant contribution in terms of both knowledge advancements for the research in the field and new direction of inquiry.

In terms of new contribution for knowledge advancement, the results showed, using the SCF analysis, that students involved in an online course where KB has been implemented, moved really from an "acquisition model" toward a "construction model" in the work with knowledge. The analysis through the CF4KB coding scheme allowed to identify this change of model analysing, in particular, how students performed the SFC, how their use changed during the online course, which kind of patterns in the SCF use and which role emerged in the online activity.

New directions of the inquiry could be, then, focusing, in the design of online courses at University, on the study of the conditions that can favor the change of the students' model of work with knowledge, using the CF4KB coding scheme to detect this change. First of all it is possible to study the relationships between the change in the use of SCF, during the online activity, with reference to the aspects of the course (kinds of tasks, features of online environment, tutor's or teacher's strategy, etc.). In addition, it is possible to identify other patterns or "emerging roles", with reference to these contextual aspects. It is also possible to adopt a "scripted roles" perspective, which focuses on how the collaborative learning process can be facilitated by structuring and prescribing role by the teachers to learners (Cesareni, Cacciamani & Fujita, 2016). Emerging and scripted roles can be analyzed in terms of SCF to study their development during all the online course. It would be interesting to study the impact of these roles, through the social network analysis (Mazzoni & Bertolasi, 2012), on the students participation. It is possible to use the Weighted Indegrees (number of ties that a member of the group receive from other students) as indicator of "social attractivennes" and Weighted Outdegrees (number of ties that a member of the group outcome toward other members) as indicator of "social influence" exercised through these roles towards other course members (Weimann, 1994; Cacciamani, 2017). These parameters can allow to analyze what contribution each student, assuming an emerging or a scripted role, can offer in the collaborative knowledge building activity and which level of social influence and attractivennes he or she has on the community.

Finally, CF4KB coding scheme can be used in order to create a user profile for the participants, according to the CF they perform. In fact, although collaborative online environments have been extensively studied as communities (Chen & Caropreso, 2004), there has been a growing interest to analyze individual differences in collaborative environments. Such a study will help to understand individual's differences in terms of the different kinds of CF performed.

Acknowledgments

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