

Role taking and knowledge building in a blended university course

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Abstract Role taking is an established technique for promoting social cognition. Playing a specific role within a group could lead students to exercise collective cognitive responsibility for collaborative knowledge building. Two studies explored the relationship of role taking to participation in a blended university course. Students participated in the same knowledge building activity over three consecutive, five-week modules and enacted four roles designed in alignment with knowledge building pedagogy (Scardamalia and Bereiter 2010). In Study 1, 59 students were distributed into groups with two conditions: students who took a role in Module 2 and students who did not take a role, using Module 1 and 3 as pre and post tests. Results show no differences in participation in Module 1, higher levels of writing and reading for role takers in Module 2, and this pattern sustained in Module 3. Students with the Synthesizer role was the most active in terms of writing and the second most active for reading; students with the Social Tutor role were the most active for reading. In Study 2, 143 students were divided into groups with two conditions: students who took a role in Module 1 and students who did not take a role. Content analysis reveals that role takers tended to vary their contributions more than non-role takers by proposing more problems, synthesizing the discourse, reflecting on the

Donatella Cesareni co-designed the research, was involved in data collection and analysis and in this article has written the sections “Method” and “Results”.

Stefano Cacciamani in the present study worked on the quantitative analysis of data for reading and writing activities and in this article has written the sections “Theoretical framework”, “Discussion” and “Conclusion”

Nobuko Fujita contributed to the “Introduction” and edited the English language of this article to clarify all sections

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process and organization of activity. They also assumed correct responsibilities for their role: 26
 the Skeptic prioritizes questioning of content, the Synthesizer emphasizes synthesizing of 27
 content, and the Social Tutor privileges maintaining of relationships. 28

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 Knowledge building · Pedagogical issues · Post-secondary education · Role taking · Teaching/ 30
 learning strategies 31
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Introduction 33

Over the past several years, a new generation of Internet technologies, called Web 2.0, has 34
 been developed, providing the opportunity to support new practices of teaching and learning in 35
 higher education. Web forums, wikis, chats, virtual worlds, and social networks represent a 36
 level of evolution of digital technology that is characterized by the expansion of opportunities 37
 for interaction among users (O’ Reilly 2005). To stress this idea, Selwyn (2012) defines these 38
 technologies as “social media” and identifies two main characteristics: 39

1. They are based on open and shared digital content that can be produced, criticized, and re- 40
 configured by a wide audience of users. Previously drawn distinctions between providers 41
 and users become blurred as participants can be both users and content producers, in turn. 42
2. All practices linked to social media are described in terms of socialization and participa- 43
 tion: they enable collective actions carried out by the network user groups online that are 44
 driven by the desire to build social relationships and oriented to participate in the activities 45
 that take place through these practices. 46

Some observers are beginning to recognize that the social nature of learning and knowledge 47
 using social media confounds education’s traditional focus on helping individual students 48
 master well-defined bodies of stable knowledge (Hickey et al. 2011). Digital social networks 49
 are continually shaped by shared control (where content and expertise are continually co- 50
 created by participants) and transformative interaction (where individual users and groups of 51
 users customize both the content and the format for their use) (Xenos and Foot 2008). 52

The use of Web 2.0 technologies in online courses in higher education has thus been 53
 conceptualized with reference to the idea of “community.” Black et al. (2008) highlight that, in 54
 the last 10 to 15 years, online learning researchers and instructional professionals have 55
 promoted the significance of community in online learning environments. Wallace (2003) 56
 states that community in online environments arises at the intersection of three contemporary 57
 topics in educational research: social learning theories, affordances of computers as commu- 58
 nication devices, and the increased utilization of learning theories in online course 59
 development. 60

Different models of communities inspired by a socio-constructivist perspective have 61
 recently been developed for online course contexts. For instance, the Community of Inquiry 62
 (COI; Garrison et al. 2000) model assumes that to promote deep and meaningful learning it is 63
 necessary to involve online course participants in a collaborative inquiry activity through the 64
 development of three interdependent elements: “cognitive presence,” “social presence,” and 65
 “teaching presence.” The Knowledge Building Community (KBC) model (Scardamalia and 66
 Bereiter 1999, 2006, 2010) suggests that we can re-conceptualize the classroom as a 67

collaborative community, in which members assume “collective cognitive responsibility” for the group’s knowledge building process and makes a commitment to investigate and discuss real ideas and authentic problems. The goals for this community thus become the progressive refinement of ideas and the building of increasingly coherent theories explaining the phenomena under investigation.

Both COI and KBC models stress the idea that the main goal of online courses in higher education is to build new knowledge in and for the community through a deep collaboration between students and teachers. Therefore, online courses supported by Web 2.0 technologies require, more strongly than in the past or compared to face-to-face instructional practices, the active participation of their students.

Student participation in online courses

Research in online learning defines “participation” as involving different forms of communication (e.g., content related, planning of task, and social support) and demanding different units of analysis (Hrastinski 2008). Participation may be detected by a quantitative approach, using numerical indicators such as the number of visits to the platform, the number of written messages or read messages, and the relationship between reading and writing. Participation can also be analyzed through a qualitative content analysis of the messages to identify their discursive functions (Cacciamani et al. 2012) or to evaluate the quality of the collaboration process through a group of indicators (Collazos et al. 2002). The main risk for student participation in an online course is represented by the phenomenon of “lurking”: this practice refers to students who limit their action in an online environment to reading messages without posting any messages (Morris and Ogan 1996). Lurkers in the online course discussion context are students who remain very passive during most or all of the collaborative process; their contributions often contain false promises or reflect some problems that they had in the past, aimed at apologizing for a lack of commitment to the group. Moreover, in most cases, lurkers have a vested interest in staying onboard with the group task but their participation is very minimal and consists more frequently of simple comments than contributions of new knowledge (Strijbos and De Laat 2010).

Nonnecke and Preece (2001) suggest that there are many reasons why people lurk. Some are unsociable or even selfish, but many are not. Lurking enables new members to learn community norms, see if their concerns are relevant, and obtain vicarious support without disclosing themselves. Depending on the perspective from which it is judged, lurking may or may not be a problematic behavior (Preece et al. 2004). Lurking might be considered a form of participation from a social constructivist approach, insofar as lurkers are often involved in the search for connections within the forum messages and the practice can be used to identify points of entry into the discussion (Nonnecke and Preece 2001; Hickey et al. 2011). If there are few or no messages being posted in an online community, however, the community cannot survive. Therefore, designers of online courses seek strategies to encourage all students to participate in posting messages and to sustain the online community, such as introducing roles.

Roles in CSCL

A “role” can be defined in terms of a system of functions that people can assume in a group to guide individual behaviors and regulate group interactions among the group members. Taking a role means being “associated with a position in a group with rights and duties toward one or more

other group members” (Hare 1994, p. 434). In an educational context, role taking can promote individual responsibility and group cohesion, as well as positive interdependence (Strijbos and Weinberger 2010). Furthermore, taking a role can facilitate a group member’s awareness of peer contributions and the group’s overall performance (Strijbos et al. 2004), with positive effects on knowledge construction (Schellens et al. 2007). For collaborative knowledge construction, the roles that individuals take in a group can be viewed as “multiple interpretive perspectives that conflict, stimulate, intertwine and be negotiated” in a community (Stahl 2006, p. 4).

In recent years, the concept of a “role” has been studied in the field of Computer-Supported Collaborative Learning (CSCL) as a factor supporting students’ collaborative learning activity. Two main perspectives characterize this field of study: the “emerging roles” perspective, which focuses on the roles that participants develop spontaneously during their collaborative learning activity; and the “scripted roles perspective,” which focuses on how the collaborative learning process can be facilitated by structuring and prescribing roles and activities to learners (Strijbos and Weinberger 2010). The first perspective emphasizes that the learners structure and self-regulate their online learning activity, thereby each developing different personal and collaborative learning preferences. This development then leads to a number of emerging roles that the students assume to facilitate the structuring and regulation of group work. The second perspective highlights the relevance of designed roles as instructional supports to improve both the processes and the outcomes of online collaborative learning. These “scripts” can specify, sequence and assign roles and activities so that students are expected to assume during a computer-supported collaboration (Weinberger et al. 2010). Since these scripts function to scaffold a collaborative learning activity, some authors prefer to use the expression “collaboration scripts” (Kollar et al. 2006).

Role taking and knowledge building

While previous CSCL research has examined the effect of scripting by assigning roles for knowledge construction (e.g., De Wever et al. 2010; Schellens et al. 2007), less is known about the relationship between role taking and knowledge building, defined as “the production and continual improvement of ideas of value to a community” (Scardamalia and Bereiter 2002, p. 1370). Knowledge building is distinguished from other educational settings by a combination of 12 socio-cognitive and technological principles that work together to move ideas to the center of classroom life (Scardamalia 2002). Key to understanding knowledge building is the principle of collective cognitive responsibility, in which the cognitive responsibility for high-level knowledge work does not rest with the instructor, but is shared by the collective comprised of the students and the instructor.

Knowledge building thus differs from role taking in three fundamental ways. First, role taking associates particular rights and duties with fixed roles for individual members in a group, whereas knowledge building does not. In knowledge building, the cognitive responsibility is distributed among the community members and each member has the flexibility to play multiple roles to ensure the success of the group (Scardamalia 2002). Second, instructors typically assign roles to students to distribute responsibility for online discussion across different group members (Dillenbourg 2002) and to shift the responsibility for online discussion from the instructor to peers (De Laat and Lally 2004). In contrast, the social configuration of the group members in knowledge building is opportunistic and emergent rather than fixed by the instructor (Zhang et al. 2009). Finally, role taking might be seen as students performing tasks or activities that can obscure the goal for the collective to build knowledge. Instead,

knowledge building pedagogy focuses on students sharing responsibility for engaging in high-level cognitive work with ideas.

However, bridging role taking and knowledge building can benefit CSCL if we consider role taking as a way to scaffold the development of the kind of cognitive responsibilities, or functions that members of an expert team flexibly adopt by encouraging students to play multiple scripted roles in online discussion forums and fading this scaffolding over time. In large enrollment online and blended courses in higher education, it is a challenge to engage students in online reading and writing activities for knowledge building. Without considerable direction from the instructor, online discussions show low levels of participation and lack continuity (Hewitt and Scardamalia 1998; Scardamalia 2002). Online instructors may be able to “e-moderate” and create a welcoming online course community (Palloff and Pratt 2007; Salmon 2000), but to foster the higher-level cognitive work of knowledge building, students need to accept responsibility for work that is usually associated with the instructor. Common practices that students follow in threaded discussion to process a large number of “notes” or messages may impede convergent processes or syntheses for knowledge building (Hewitt 2005). In larger online or blended courses, instructors may structure small group discussions to increase students’ participation in reading and writing activities. In groups, students can perform functions to that could, over time, become more emergent and self-organizing ones for knowledge building.

From the knowledge building perspective, scripted roles can be defined in terms of “conversational functions” or specific kind of activities performed in a discussion that is expected to support productive interaction (Wise et al. 2012). The conversational functions frequently included in the roles assigned to the students in online discussion are to: 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 (Wise et al. 2012). Defining roles as conversational functions that create positive interdependence among participants aligned with the common goal to advance the community knowledge places ideas at the center of the online classroom and avoids the risk of role taking as focusing on tasks and activities. From this perspective, roles become supports enacted by the students to sustain collaborative interactions oriented toward knowledge building.

Scripted roles can be content-oriented or process-oriented (Strijbos and Weinberger 2010). Knowledge building focuses on knowledge advancement such as the synthesizer/summarizer role that integrates the content or ideas in the discussion, and places less emphasis on the affective process such as the motivator that may only indirectly affect learning and knowledge construction. However, recent studies on group effectiveness provide strong evidence for group members’ ability to “read” the mental states of others predicting the effectiveness of a group in both face-to-face and online settings (Woolley et al. 2010; Engel et al. 2014). Thus, it may be useful to include roles that attend to the social dimension to support knowledge building, where students foster equal participation (Dubrovsky et al. 1991) in alignment with the “democratizing knowledge” (Scardamalia 2002) principle.

Role taking and knowledge building in blended university courses

Despite the large interest in roles, only a few empirical studies analyze the effect of role taking on students’ participation in blended online courses in an academic context. Spadaro et al. (2009) found that in-service teachers enrolled in a Master’s-level blended course reach the highest level of participation in terms of writing and reading when they can play two roles in the course: *Tutor*, acting to promote forum discussion, and *Editor*, supervising collaborative

writing tasks. Wise and Chiu (2011) introduced an approach to analyzing temporal pattern of knowledge construction (KC) in online discussion, including consequences of role assignment in a blended university course. Their results showed that assigning a summarizing role mid-discussion could aid group progress to more advanced phases in KC. In a study investigating online collaborative modules in a teacher preparation course based on a blended approach, Pozzi (2011) introduced a role playing activity. The scripted, not assigned, roles were: Coach, Bureaucrat, Defeatist, Wise, Techno-skeptical, Techno-loving, Efficiency-minded, School Principal and Rapporteur. Results showed that roles that students chose helped them to develop a certain awareness of the collaborative learning process.

The few studies that analyzed role taking in blended courses highlight that the assumption of a role guides the activity of individual students, provides them with a script with which to act, and regulates their interactions within the group. Additionally, playing a specific role within the group possibly leads students to exercise greater responsibility for the community's own knowledge building. To investigate the relationship of role taking to online reading and writing activities for knowledge building in a blended higher education course, we conducted two studies that took a wider perspective on role-taking that avoided over-scripting and linked roles to knowledge building principles to facilitate collaborative knowledge building.

Research questions

The current work focused on four main research questions:

1. Do role takers and non-role takers differ on level of participation in a blended course, and which types of roles foster a higher level of participation?
2. What characterizes student's knowledge building/conversational functions and how are they different between role takers and non-role takers?
3. What are the differences between roles in the conversational functions used by role takers?
4. How does role taking influence the dynamics of knowledge building discourse?

We conducted two separate studies to answer these questions. The first study examined research question 1, and the second study examined research questions 2, 3 and 4. In the following sections, we first describe the setting and the online environment, which was the same for both studies. Second, we present the different methods and results for Study 1 and Study 2 in separate sections. Finally, we discuss the overall findings in the general discussion section.

Setting and online environment

Throughout the second semester of a first-year undergraduate pedagogy course at the Sapienza University of Rome, students were asked to participate in a blended knowledge building activity in addition to attending lectures. Students voluntarily chose to take part in the blended activity, and their participation was assessed as part of the course. Participants were distributed into discussion groups of 10–12 students. In these groups they interacted both face-to-face in class and online, sharing their ideas and collaboratively building artifacts, for example, a concept map of the group's shared understanding, to present during the larger lecture hall sessions. Online activities took place during the same period of time as the lectures and were divided into three consecutive, five-week modules. In each module, students were asked to

analyze, discuss, and reflect on different themes connected to the course curriculum, and to build a concept map or a short power point presentation at the end of the activity. The group composition remained the same during the three modules. Students in the blended activity received a score from 6 to 12 points according to their participation in the group activity, assessed not in relation with the amount of written notes but on the quality of their contribution to collective knowledge building. At the end of the course, the students' knowledge was assessed with a final exam with a maximum score of 20 points, which was added to the participation score to compute a final grade.

One hundred and forty-three students (22 males, 121 females), aged 18–30 years, participated in the activity. In such large classes of university students who are accustomed to traditional pedagogy in lecture classes, it is very difficult to introduce knowledge building. In order to create conditions for knowledge building, it is crucial to organize and model student participation (Hmelo-Silver and Barrows 2008). Thus, the students were distributed into 14 groups of 10–12 students to encourage participation in discussion. Not having enough instructors or teaching assistants to moderate group discussion for all 14 groups, we chose to assign students to specific roles, in turns, that could suggest and model principal discourse moves or “conversational functions” that are particularly important for knowledge building. These particular roles were designed in order to support group discussion and to create, the conditions for the emergence of collective cognitive responsibility (Scardamalia 2002) toward advancement of the community knowledge. At the beginning of each module, the instructor randomly asked four students in each group to take on a role, giving the students some instructions but allowing them the freedom on how to enact the role.¹ Students could accept or decline a role, without being penalized for refusing it. At the end of the module, role takers stopped enacting a particular role and other students were asked to take over the role. Some students did not take on any roles in the activity.

Four roles were specially designed to help students put into practice the knowledge building: 1) “Social Tutor”; 2) “Synthesizer”; 3) “Concept Mapper”; and 4) “Skeptic.” These roles were designed to create socio-cognitive conditions to scaffold collective cognitive responsibility for knowledge building. While the roles are linked with particular knowledge building principles, the 12 knowledge-building principles are inseparable and work together as a whole in a community. The Social Tutor was tasked with promoting participation of all the members of the group, mainly aligned with the “democratizing knowledge” knowledge building principle, which states that is necessary to create the conditions in the socio-relational dimension to legitimate all participants to contribute to the shared goals of the community (Scardamalia and Bereiter 2010). The Synthesizer, particularly consistent with the knowledge building principles of “improvable ideas” and “rise above” (Scardamalia and Bereiter 2010), was to produce a synthesis of group discussions every week, bringing out the main questions and presenting them again to the group in a “rise-above” note. In knowledge building, all ideas are considered improvable and rise-above notes are used to subsume selected previous notes, synthesize ideas, create historical accounts and archives, reduce redundancy, and impose a higher-level organization on ideas (Scardamalia and Bereiter 2006). The Concept Mapper was responsible for installing a concept-mapping software on their laptop and for presenting the concept map graphically representing the knowledge created by his/her group to other groups during the face-to-face discussion session. The Concept Mapper thus

¹ For example students could receive an e-mail like this: “Dear... I propose you to take on the role of Social Tutor in your discussion group. Your task is to foster group participation, make sure that there are no discussions between only two or three people and / or someone is excluded from the activity. Let me know if you accept to take on this role.”

resonates with the idea that knowledge building is producing knowledge of value to others as in the “community knowledge” principle. Particularly consistent with the knowledge building principle of “idea diversity” (Scardamalia 2002; Scardamalia and Bereiter 2010), the Skeptic was asked to emphasize promising ideas and avoid commonplace ideas in the group discussion in order to generate “prolific doubts”. This last role remained unknown to other students, while the other roles were known to all participants in the group.

Students interacted online in a Moodle (Modular Object Oriented Dynamic Learning Environment) e-learning environment (<http://elearning.uniroma1.it>). Moodle is a flexible learning environment that provides traditional educational tools (course management, assessment tests, exercises, etc.), but also offers interactive tools like chat, forum, and wiki that are particularly interesting for promoting a constructivist educational approach. In addition, we chose Moodle both for its accessibility as free and open-source software and for its usability in enabling students to access it from any browser.

In Moodle there are three different categories of users: administrator, teacher, and student. Teachers can use the educational tools in the system to manage courses, prepare the learning environment, and to facilitate and monitor the learning activities. Students can use learning objects or any digital resources available in the Moodle environment and participate in interactive activities.

For the knowledge building activity in Moodle, the lecturer organized 14 different online course databases, one for each group, using interactive tools like a forum, the collaborative building of a glossary, and the sharing of documents and artifacts collaboratively produced by students. An important pedagogical method to avoid user disorientation in such an online learning environment is to let the environment “grow” in an emergent way with the group’s activities. At the beginning, the online learning environments presented to different groups offered few elements visible by students (Fig. 1). Modules and tools were gradually introduced to enrich the environment as new activities started.



Fig. 1 The online environment at the beginning of the activity

Study 1: Role taking and levels of participation 308**Study 1 method** 309*Study 1 participants* 310

From the 143 participants in the blended activity, we selected for this first study two particular groups of students (59 students, 7 males and 52 females): 311
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a) participants who took a role only in Module 2 (31 students) 313

b) participants who did not take a role over three different modules of the Moodle activity (28 students) 314
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Study 1 procedure 316

The first study investigated whether taking a role leads students to a higher level of participation and which specific role fosters a higher level of participation (1st research question). We compared the participation (in terms of both the number of messages posted and read in the knowledge building forums) in the three different modules of the Moodle activity (Module 1, Module 2, and Module 3) among two groups of students: 1) Role takers, and 2) Non-role takers. In Module 1, none of the students in either condition took a role in the group. In Module 2, role takers assumed the roles mentioned above in their group. In Module 3, again none of the students in the two groups held particular roles (see Table 1). So we can consider Module 1 as a pre-test, we introduce a design variable in Module 2 and measure its effects in Module 3. Role takers and non-role takers were extracted from the same 14 discussion groups. 317
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In addition, we compared the writing and reading activity of the 31 students of the group “with role”. As mentioned before the roles were “Social Tutor,” “Synthesizer,” “Concept Mapper,” and “Skeptic.” Role takers received an e-mail from the lecturer with instructions explaining what they were supposed to do for their roles. 329
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Study 1 measures and data analyses 333

The data corpus consists of the student discourse in the Moodle knowledge building forums. This activity was analyzed using a quantitative approach to evaluate students’ participation both in terms of the number of messages written and messages read in all discussions in the consecutive three modules. 334
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Table 1 Research design for the first study

	Module 1	Module 2	Module 3
Role takers ($n=31$)	No role	With role	No role
Non-role takers ($n=28$)	No role	No role	No role

To answer whether taking a role leads students to a higher level of participation we compared, as stated before, the participation between role takers and non-role takers across two different modules, using Module 1 as a pre-test and Module 3 as post-test. We analyzed differences using the Student t -test because it was not possible to use anova due to insufficient statistical conditions.

In order to investigate which roles foster a higher level of participation, we compared the quantitative indicators of writing and reading activity among students with the different roles.

Study 1 results

Research question 1a: Do role-takers and non-role takers differ on level of participation in a blended course? ?

Comparing the two groups, we can see that taking a role has a positive effect on the role takers' writing activity (Table 2). The two groups did not differ on writing activity in the pre-test or Module 1 ($t(59)=0.53$, $p=.59$), before the introduction of the roles. Significant differences emerged in the post-test or Module 3 ($t(59)=-2.68$, $p=.01$). The role takers wrote a higher number of messages in the forums.

A similar pattern is found in the reading activity (Table 3). Again, no differences are found between the two groups in the pre-test or Module 1 ($t(59)=-0.77$, $p=.44$). In the post-test or Module 3, the role takers read a higher number of messages compared to their counterparts ($t(59)=-2.43$, $p=.018$).

Research question 1b: Which types of role foster a higher level of participation?

To answer this question, we analyzed the participation of students in light of the particular kinds of roles they assumed (Tables 4 and 5).

As shown in Table 4, the students who held the role of Synthesizer (of the group discussion) were most active in writing, followed by the students in the Social Tutor role. Students in the Concept Mapper role were less involved in the discussion.

As seen in Table 5, the students who held the role of Social Tutor were the most active in the reading activities, followed by the Synthesizers. Similar to the findings for writing, the students in the Concept Mapper role were the less involved in reading messages.

Table 2 Messages written by role takers and non-role takers in module 1 and 3

	Role takers		Non-role takers	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Module 1	4.16	3.56	4.92	7.16
Module 3	8.48	6.87	3.75	6.63

Table 3 Messages read by role takers and non-role takers in modules 1 and 3

		Role takers		Non-role takers	
		<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
t3.4	Module 1	34.90	36.14	27.14	41.07
t3.5	Module 3	60.03	66.37	24.50	41.61

Study 2: Role taking and the content of online contributions

Study 2 method

Study 2 participants

The second study involved all 143 students (12 males, 121 females) divided into two conditions:

Condition 1: 53 role takers in Module 1

Condition 2: 90 non-role takers in Module 1

Study 2 procedure

In the second study we investigated if taking on a role results in differences in the content of messages that role takers posted compared with non-role takers, and if there are also differences between the different roles in the conversational functions of the content of the messages they posted (Research Questions 2 and 3). We also examined how role taking influences the dynamics of knowledge building discourse (Research Question 4). In order to answer the three research questions, we qualitatively analyzed the content of discussion messages written by the students in Module 1, comparing role takers and non-role takers. We chose to analyze discussions in Module 1 because students in all the groups discussed the same topic: “How can we depict a ‘good teacher’?” Role takers assumed the same roles (Social Tutor, Synthesizer, Concept Mapper, Skeptic) as presented in the first study.

Table 4 Messages written by students with different roles in module 2

Role	Module 2		
	<i>n</i>	<i>M</i>	<i>SD</i>
Synthesizer	9	10.24	5.09
Social Tutor	7	9.50	2.71
Skeptic	6	8.70	4.85
Concept Mapper	9	7.00	4.71

Differences in numbers among the four types of roles are due to the fact that we consider only students that acted a role *only* in Module 2. We had 14 groups, so 14 Synthesizers for each module, but we consider here only nine students who took the role of Synthesizers because the other five students (14 groups, 14 Synthesizers) also had a role in Module 1 or 3, and are not taken in consideration for this first study. The same applies for the other roles

Table 5 Messages read by students with different roles in module 2

Role	Module 2		
	<i>n</i>	<i>M</i>	<i>SD</i>
Synthesizer	9	73.94	63.17
Social Tutor	7	77.30	42.68
Skeptic	6	69.10	44.58
Concept Mapper	9	51.46	34.97

Study 2 measures and data analysis

We adapted a content analysis coding scheme from Cacciamani et al. (2012) to analyze students' contribution to the online discussion. The scheme is based on a synthesis of theoretical approaches that considers students as contributors to knowledge building: Pontecorvo's (1987) "discussing for reasoning" approach, Muukkonen et al.'s (2004) Progressive Inquiry Model, Wise et al.'s (2012) conversational functions approach to scripted roles, and Scardamalia and Bereiter's (2006)'s knowledge building. Hmelo-Silver and Barrows (2008) consider three kind of discourse moves that are especially important in knowledge building: questioning; making statements, which can be simple assertion or reformulation or elaboration of an idea; and making regulatory statements directed at collaboration and learning processes. They also underline the importance of metacognitive statements that can support group work.

Starting from these discourse moves and aligned with Scardamalia and Bereiter's (2006) knowledge building pedagogy, we considered four types of global conversational functions that can contribute to collaborative knowledge building. The first component in contributing to collaborative knowledge building is to introduce new ideas into group discourse, in the form of a problem or statements that introduces new content. Next, in order to increase collective knowledge and enhance interdependence, students' build on each other ideas, synthesizing what has already been said (by themselves or others) to reinforce, clarify, and improve existing knowledge. An important contribution to the group discourse is provided by metacognitive reflections and evaluations of ideas and/or process. In order to create collaboration and enhance collective responsibility for knowledge building, it is also important to foster social relationships within the group.

Therefore, the coding scheme we designed consists of four categories that we defined as "global conversational functions" and subcategories that we expound as "specific conversational functions" that characterizes all of the students' contributions to the forum, as shown in the Table 6 below.

The identified global conversational functions connect with the knowledge-building model in the following ways:

- 1) "To introduce new problems or contents" includes communicative actions that resemble the knowledge building principle of "idea diversity";
- 2) "To take up or revise previous information or theories" suggests communicative actions that promote the knowledge building principles of "improvable ideas" and "rise above";
- 3) "To evaluate or reflect" contains communicative actions oriented to the knowledge building principle of "concurrent, embedded and transformative assessment" and "epistemic agency";
- 4) "To foster and/or maintain relations" includes actions supporting, from a socio-emotive point of view related to the knowledge building principle of "democratizing knowledge" and "community knowledge".

Table 6 Coding scheme for content analysis

Categories	Subcategories and examples
A. To introduce new problems or contents	A1. Introducing a personal idea or theory: “The ideal teacher should be empathic, attentive to students’ requirements, flexible ...” A2. Introducing information obtained from reliable sources: “I read in the textbook that ...”; “Studies on expert teachers say ...” A3. Introducing examples drawn from experience: “This ability was totally absent in the teachers of the school I attended”; “Today I listened to a really shameful discussion...” A4. Introducing information obtained during lectures: “As professor said yesterday during the lecture ...” A5. Posing research questions or problems: “How much, in school achievement, depends on us and how much do we rely on the teacher?”
B. To take up or revise previous information or ideas	B1. Elaborating own ideas (i.e., to clarify or widen ideas or theories): “To clarify, I wanted to say that the teacher has to ...” B2. Elaborating others’ idea (To explicitly refer to another’s opinion in order to amplify contents): “I agree with Laura about the qualities of a good teacher, and in particular, I want to specify that this flexibility...” B3. Synthesizing: “I’m trying to make a list and add my contribution starting from qualities mentioned by the group: competent, fond of his work, a good observer ...” B4. Repeating others’ ideas (without elaborating): “For example, Elisabeth says that a good teacher ...” B5. Repeating own contribution: “I reaffirm that if a student, despite his teacher’s attempt to ...”
C. To evaluate or reflect	C1. Expressing metacognitive reflection (on a process carried out or organization of cognitive activity): “We are here to confront our point of view ...”; “If you agree, I propose to use this list for going on” C2. Expressing metacognitive reflection on content: “Some points of this statement let me reflect on ...” C3. Commenting, evaluating: “Perhaps it’s for this reason that it’s difficult to be a good teacher...”
D. To foster and/or maintain relations	D1. Expressing agreement (plain expressions of agreement, without any comment or new contents): “I agree with what all of you have said before” D2. Expressing disagreement (simple disagreement, without any justification): “I’m not too sure if I agree with ...” D3. Maintaining social relations (messages relating to social aspects of the community): “Marilena, don’t worry about your difficulties in connecting everyday. The most important thing is that you respond to us”; “How was your meeting yesterday?” D4. Introducing statements at the beginning or at the end of the message that aims to foster or maintain relations with the group: “Good morning to everyone”; “I’m waiting for your answer”; “I hope it was clear”

One contentious methodological issue in content analysis of online discussions is the choice of the unit of analysis (De Wever et al. 2006). Some researchers have employed a unit of analysis, such as a sentence, that may be segmented reliably within a message (Fahy 2001). Others have chosen a more qualitative approach by identifying a consistent “theme” or “idea” (unit of meaning) in a message (Henri 1992). Alternatively, a whole message that a student posts may serve as the unit of analysis and be coded, for example, to a certain “phase” of knowledge construction in the discussion (Gunawardena et al. 1997)

We applied the coding scheme to easily identifiable segments of the messages in the forums (Fahy 2001), considering this solution as a more reliable unit of analysis. In particular, this study analyzed sentence units that were identifiable through the end punctuation (i.e., full stops, suspension dots, exclamations, and question marks) inserted by the authors of the messages. A total of 442 messages and 2372 segments from the first discussion from each of the 14 groups were coded. Independent judges coded the segments from the discourse data, reaching an inter-coder agreement of 87 %, calculated at subcategory level.²

We analyzed differences in the distribution of categories between the groups (role takers and non-role takers) using a chi-square test. In order to analyze which category contributes to make differences statistically significant in the chi square, we calculated adjusted standardized residuals (that are distributed as z), comparing them with the value of critical z for $p < .05$ and $p < .01$.

We delved deeply into the qualitative content analysis for two different groups, one with a high level of participation and one with a low level of participation, analyzing differences in distribution of global conversational functions and patterns of contributions to knowledge building given by students with different roles. In the following four excerpts, students’ messages have been abridged to highlight the representative conversation functions for each role. The student names have been changed to pseudonyms to ensure privacy.

Study 2 results

Research question 2: What characterizes student’s knowledge building/conversational functions and how are they different between role takers and non-role takers?

The qualitative analysis of the student discourse shows that role takers, besides writing more messages, tended to distribute more of their contributions across the four different categories ($\chi^2(3, N=2372)=24.82, p<.001$). Analyzing adjusted standardized residuals (Table 7), we can see that there are significant differences in the “Introducing” ($p<.01$) and “Revising” and “Evaluating/Reflecting” categories ($p<.05$). Non-role takers concentrated on introducing topic-related problem or content (Introducing=54 %) (Table 7). Role takers also introduced messages with new problems or contents (44 %), but they were more inclined than non-role takers to link to and build on content that has already been proposed in order to improve or synthesize them (Revising=18 vs. 14 %). Role takers also reflected more on the process being carried out or organization of the activity (Evaluating/Reflecting=15 vs. 12 %). While not a statistically significant difference, roles appeared to foster relationships between group members (Maintaining relationships=22 vs. 20 %).

² All the segments were rated by two raters. After a period of training for the raters, we calculated inter-rater reliability only for a third of the online discourse and the inter rater reliability was calculated at sub category level (all the 17 subcategories).

Table 7 Frequencies and differences in type of messages between Role Takers and Non-Role Takers

Group	Introducing		Revising		Evaluating/Reflecting		Maintaining Relationships	
	<i>n</i> (%)	<i>z</i>	<i>n</i> (%)	<i>z</i>	<i>n</i> (%)	<i>z</i>	<i>n</i> (%)	<i>z</i>
Role taker	499 (49 %)	-4.79**	209 (18 %)	2.66*	175 (15 %)	2.64*	249 (22 %)	1.24
Non-role taker	666 (54 %)	4.79**	178 (14 %)	-2.66*	145 (12 %)	-2.64 %	246 (20 %)	-1.24

* $p < .05$, ** $p < .01$ n =number of segments; %=percentage of total segments; z =adjusted standardized residuals

If we examine the categories and take into consideration the different subcategories, we can see that there are differences in distribution between students with and without role ($\chi^2(4, N=1165)=24.72, p<.001$) in the category “Introducing new problems or contents” (Table 8). Differences were also statistically significant ($p<.01$) for “Personal idea” and “Problems” categories. Non-role takers mainly tended to express their own, personal ideas (43 %). Role takers also expressed personal ideas (31 %), but they tended to propose more problems (2.8 % of their own segments vs. 1.1 % of their own segments) more frequently than those without role.

In the “Revising” category (Table 9), there was also a significant difference in subcategories distribution ($\chi^2(4, N=387)=99.72, p<.001$). We found that the main difference between role takers and non-role takers in the discursive function of synthesizing the discourse (role taker=9.2 %; non-role taker=0.6 %) in order to pose it again for the group’s renewed attention. This is likely due to the presence of a specific role, in which synthesizing the group discussion every week is an explicitly stated responsibility. Another significant difference ($p<.01$) was in “Elaborating their own ideas” category. Non-role takers were more focused on presenting their personal ideas, elaborating them in order to make them more comprehensible to others.

In the “Evaluating/Reflecting” category (Table 10), differences between students with and without role are still significant ($\chi^2(2, N=320)=30.05, p<.001$). Calculating adjusted standardized residuals, we can see that there were significant differences in “Metacognition on processes and organization” and “Comments” categories ($p<.01$). Role takers were more willing than those without a role to reflect on both the processes and the organization of activities (role taker=1.9 %; non-role taker=1.4 %). In either case, the reflective student with a role accepts responsibility for the collaborative knowledge building process to a greater degree than do their colleagues without role. Non-role takers tended to contribute more “Comments” messages more than their colleagues without role.

In the “Maintaining relationships” category (Table 11), role takers tend to activate relationships (4.7 %) more frequently than do their without-role colleagues (1.7 %), but differences were not statistically significant ($\chi^2(3, N=495)=6.68, p=.08$), and for this reason the adjusted standardized residuals are not reported in the table.

Research question 3: Are there also differences between roles in the conversational functions used by role-takers?

Table 12 reveals that, for all role takers, introducing content is the main focus. However, there are some evident differences that we can attribute to correct role assumption. The Skeptic role ($M=11.29, 60\%$) prioritizes working specifically on introducing new problems or contents,

Table 8 Differences in types of messages written by role takers and non-role takers in category a, introducing new problems or contents

Group	Personal ideas		Scientific Information		Experiences		Information from lectures		Problems		Total	
	n (%)	z	n (%)	z	n (%)	z	n (%)	z	n (%)	z	n (%)	z
t8.1												
t8.2												
t8.3												
t8.4	353 (31.1 %)	-3.78**	26 (2.3 %)	1.62	79 (7.0 %)	0.81	9 (0.8 %)	1.93	32 (2.8 %)	3.91**	499 (44 %)	
t8.5	533 (43.1 %)	3.78**	22 (1.8 %)	-1.62	94 (7.8 %)	-0.81	4 (0.3 %)	-1.93	13 (1.1 %)	-3.91*	666 (54 %)	

* $p < .05$, ** $p < .01$
n=number of segments; %=percentage of total segments; z=adjusted standardized residuals

Table 9 Differences in types of messages written by role takers and non-role takers in subcategories of category b, revising

Group	Elaborate own ideas		Elaborate others' ideas		Synthesizing		Repeat others' ideas		Repeat own ideas		Total
	<i>n</i> (%)	<i>z</i>	<i>n</i> (%)	<i>z</i>	<i>n</i> (%)	<i>z</i>	<i>n</i> (%)	<i>z</i>	<i>n</i> (%)	<i>z</i>	<i>n</i> (%)
Role taker	56 (4.9 %)	-5.98**	26 (2.3 %)	-2.48	104 (9.2 %)	9.93**	16 (1.4 %)	-1.55	7 (0.6 %)	-0.84	209 (18 %)
Non-role taker	101 (8.2 %)	5.98**	39 (3.2 %)	2.48	7 (0.6 %)	-9.33**	22 (1.8 %)	1.55	9 (0.7 %)	0.84	178 (14 %)

n=number of segments; %=percentage of total segments; *z*=adjusted standardized residuals

* $p < .05$, ** $p < .01$

Table 10 Differences in types of messages written by role takers and non-role takers in subcategories of category c, evaluating/reflecting

Group	Metacognition on processes & organization		Metacognition on content		Comments		Total reflecting
	<i>n</i> (%)	<i>z</i>	<i>n</i> (%)	<i>z</i>	<i>n</i> (%)	<i>z</i>	<i>n</i> (%)
Role taker	68 (6 %)	5.47**	40 (4 %)	−1.65	67 (5.9 %)	−3.38**	175 (15 %)
Non-role taker	17 (1.4 %)	−5.47**	45 (4 %)	1.65	83 (6.7 %)	3.38	145 (12 %)

n=number of segments; %=percentage of total segments; *z*=adjusted standardized residuals

* *p*<.05, ***p*<.01

while the Synthesizer role ($M=9.79$, 32 %) emphasizes revising of content, particularly to synthesize it. The Social Tutor ($M=6.23$, 32 %) focuses on maintaining interpersonal relationships. The data for the Concept Mapper role does not reveal any peculiarity that distinguishes it from the other roles, because students who assume this role are responsible for acting at the end of the process rather than during the group discussion.

Research question 4: How role taking influences the dynamics of knowledge building discourse?

Students with roles enacted them to varying degrees of success in the 14 groups. The quality of the online discussion in these different groups on the topic of a “good teacher” varied, with a greater or lesser degree of participation by the students and a greater or lesser effectiveness in terms of the groups’ knowledge building.

Analyzing participation quantitatively, we see that the groups vary in the number of messages written, from an average of 1.35 messages written by students in group 3 to 6.46 messages per student in group 2. In terms of the segments within messages written, the groups range from an average of 4.5 in group 4 up to 32.77 in group 2 (Table 13).

To better understand how students acted their role and how they influenced the dynamics of the knowledge building discourse, we now compare 2 groups at the opposite levels of participation and knowledge building (KB). With reference to the previous results, we considered that roles worked better more effectively in groups with a higher level of participation than in the groups with a lower level of participation. We used the following procedure to select the high and low KB groups. To select the low KB group, we first identified groups below the 25th percentile ($P^{25}=1.66$) in terms of notes written (groups 3, 4 and 7). Then, among these groups, we selected the group with the lowest knowledge elaboration in terms of the number of segments created (group 4, low KB; 9 students).

Table 11 Differences in type of messages written by role takers and non-role takers in subcategories of category d, maintaining relationships

Group	Agreement		Disagreement		Social		Activating relationships		Total Maintaining	
	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%
Role takers	22	1.9 %	4	0.4 %	56	4.9 %	42	14.7 %	249	22 %
Non-role takers	37	3 %	8	0.6 %	56	4.5 %	69	11.7 %	246	20 %

Table 12 Differences in the type of messages posted between roles

Role	Introducing		Revising		Evaluating/ Reflecting		Maintaining relationships		Total	
	<i>M</i>	%	<i>M</i>	%	<i>M</i>	%	<i>M</i>	%	<i>M</i>	%
Concept Mapper	7.83	49 %	1.58	10 %	2.33	15 %	4.08	26 %	15.83	100 %
Skeptic	11.29	60 %	2.36	12 %	1.71	9 %	3.57	19 %	18.93	100 %
Synthesizer	10.00	33 %	9.79	32 %	5.50	18 %	5.07	17 %	30.36	100 %
Social Tutor	8.23	42 %	1.54	8 %	3.54	18 %	6.23	32 %	19.54	100 %

M=mean, %=percentage of total segments

Accordingly, to select the high KB group, we first used the 75th percentile ($P^{75}=4.61$) as the threshold to select the groups at the upper level of participation (groups 2, 11 and 14). Next, among these groups, we selected the group with the highest level of elaboration of knowledge in terms of number of segments created (group 2, high KB; 12 students).

Differences in the distribution of global conversational functions among the two groups are statistically significant ($\chi^2(3, N=467)=38.5; p<.001$). Calculating adjusted standardized residuals, we can see that there are significant differences. “Introducing” ($p<.01$) is used more in the group low KB than in the group high KB, whereas “Maintaining relationships” ($p<.01$) and “Reflecting” ($p<.05$) are used more often in the high KB group than in the low KB group.

Analyzing the content of forum discussions reveals that, in the group low KB, knowledge building does not begin. The main global conversational function that is activated is “Introducing” and students simply post their personal opinions on what makes a good teacher (83.3 % of total segments, see Table 14) with statements such as, “*In my opinion a good*

Table 13 Differences in writing between groups

Group	Messages		Segments	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
1	2.00	1.34	11.82	10.14
2	6.46	5.87	35.42	26.29
3	1.35	.50	8.67	5.05
4	1.40	.52	4.50	2.99
5	2.30	.95	18.40	19.20
6	2.30	.82	11.80	5.69
7	1.56	.53	7.56	3.40
8	2.7	1.06	15.10	9.86
9	4.45	2.07	32.45	28.32
10	1.70	1.16	9.00	5.64
11	5.91	5.45	28.00	36.74
12	2.50	1.41	13.88	13.43
13	1.91	.70	5.73	2.53
14	5.10	3.69	24.30	19.93
Groups mean	3.09	3.13	16.59	19.56

teacher must be a person who loves and knows the subject he teaches so as to convey to his students the passion and desire to learn” and “moreover she has to establish a relationship of mutual trust with the students, so that ...”

“Revising” is only expressed by segments aimed at clarifying students’ own ideas and there is no elaboration of the contributions of others (only one segment incorporates the idea of other students). Each student merely reports on their own opinion as to perform an online discussion “task” assigned by the teacher. Students that agreed to take a role actually do not carry it out properly. The Synthesizer simply reports a brief summary of the ideas presented without stressing or problematizing any aspect, and this action does not give rise to any debates. Only the Concept Mapper responds to the synthesis by adding some concepts that they believed had been left out, and that should be considered in order to organize the conceptual map better. The Social Tutor does not contribute towards maintaining relationships, remaining at a superficial, formal level even in the closing of the notes (e.g., “*Yours truly*”). The Skeptic merely posts their own idea “*I believe that a good teacher should pursue his profession with a lot of passion to transmit knowledge and values to those who need to acquire the proper interest in the subject ...*”, without minimally trying to insinuate doubts or to problematize the discussion.

In the high KB group, all the global conversational functions are activated, with “Introducing” (35.3 % of total segments, see Table 14) and “Maintaining relationships” (31.5 %) being the most frequent. “Maintaining relationships” and “Reflecting” are used more often than in the low KB group. Importantly, all students that accepted a role enacted it properly. Particularly relevant in the high KB group is the role of the Social Tutor, who posts 22 notes articulated into 102 segments, of which 42 (41 %) were categorized as “Maintaining social relations,” aimed both at encouraging the participation of the group and at maintaining the relationship with individual students

Analyzing the high KB group’s conversation over time, we see that in the first week (see Excerpt 1) Introducing is the main global conversational function used by students. Similar to the low KB group, students initially merely bring their considerations about how a “good teacher” should act. They respond to the initial question posed by the teacher with personal views or opinions, with only a few revisions and some statements aimed at maintaining relationships.

Excerpt 1

Teacher: Try to describe a “good teacher” from your school experiences.

Eli: In my point of view, the good teacher is one who is able to interact with his students, not only in schools, but also at a personal level. One who does not impose things but that has the ability to make them pleasing in the eyes of the children, using a range of tools (such as in our case, a forum) that allows you to get closer to the material, enriching our knowledge and our learning experiences.

Table 14 Frequencies and differences in type of messages between Low KB (group 4) and High KB (group 2)

Group	Introducing		Revising		Evaluating/ Reflecting		Maintaining Relationships		Total	
	<i>n</i>	<i>z</i>	<i>n</i>	<i>z</i>	<i>n</i>	<i>z</i>	<i>n</i>	<i>z</i>	<i>n</i>	%
Low KB	35	6.02**	5	−0.72	1	−2.42*	1	−4.0**	42	100 %
High KB	150	−6.02**	68	0.72	69	2.42*	134	4.0**	425	100 %

* $p < .05$, ** $p < .01$

Antonio: A “good teacher” should be able to pass on to his students his passion for what he teaches, consequently a professor who has lost the passion for his work, in my opinion, will never be a good teacher as far as its preparation is flawless. [...]
Roberto: A good teacher should be clear, innovative, should try to interest students to the subject, listen to their requests (again!) and welcome those that might be useful for teaching purposes [...]

The conversation continues with 18 more contributions that are rather long and only slightly interrelated with each other. Rather, everyone describes their own vision of a good teacher with no elaboration on the contributions of others. The students do not attempt to integrate, synthesize, and reflect on what has been said by others.

At the end of the first week, the Synthesizer, Eli, posted her first synthesis, which is followed by suggestions for immediate integration and requests to clarify key concepts (see Excerpt 2).

Excerpt 2

Eli (Synthesizer): Let’s take stock of the situation [...]
 From the many responses that my companions and I posted emerge several points of view. A good teacher is one who is able to interact with her students not only in schools but also at a personal level.
 A good teacher should propose discussion topics to inspire children with alternative educational material [...]
 Finally, most important is a non-authoritarian teacher who teaches their subject with enthusiasm.
Daniela: I wanted to add that a good teacher should facilitate integration among students, making them understand each other’s differences, especially between different cultures...
Vittoria: I agree with Eli’s synthesis, but I would like to add that I do not believe that a good teacher should not be authoritarian, but must know how to manage their authority to prevent neither rule by terror nor too much kindness. Some reproach and some “No’s” are absolutely necessary at times. Thank you for your attention, Vittoria.
Serena: I agree with the observation of Vittoria!
 I do not think that a non-authoritarian teacher is equivalent to the figure of a “good” teacher ... a distinction is needed between the two roles (teacher-student) to avoid confusing a figure of guidance (which must nonetheless establish a good relationship of respect and trust with the students) with a figure of friend [...]
Eli: Hello Serena and Vittoria, I wanted to respond to your observation about my summary, as it is just a set of different views from all of you (including me) ...
 Regarding your observation, I can only partly agree because, in my personal experience, although I’ve met some good “non-authoritarian” professors whom I benefitted from on educational and human levels, I have to admit that maybe a little ‘authority’ does not hurt. Cheers, Eli !!!!!
Valeria (Social Tutor): Hi everyone, this discussion seems very interesting to me. I invite you all to join Serena, Vittoria and Eli and express what they think, we are here to discuss with each other, and about this I launch a new explanation...”

Eli’s synthesis acts as a rise-above note and contributes to advancing a better explanation for what makes a good teacher. The discussion focuses both on the synthesis itself, in order to

improve it (Daniela), and on issues that are highlighted in it (Vittoria). The Synthesizer (Eli) activates the process of idea improvement. Vittoria notes the need to clarify a concept and expands the idea of how a teacher should or should not express their own authority without falling into forms of authoritarianism. Thus begins a critical discussion on the issue, which elicits different perspectives and revision of ideas from other students. Like a rise-above note, the synthesis takes stock of the community knowledge advancement by highlighting and raising key ideas to focus the attention of the participants. It produces new discussion threads, which are expressed through different types of conversational functions that involve not only introducing new ideas but also elaborating, evaluating and commenting on the students' own and others' ideas. The explicit references to what had been said by others increased in the students' notes.

The students' responses aimed to clarify concepts, to propose different theories and to build on the ideas of others. According to the principle of idea improvement, students progressively refine the naïve theories drawn from their own personal experiences as would be expected from first-year undergraduates studying pedagogical concepts. These concepts will be taken up again in their classroom lectures and activities to help improve the students' naïve theories. The Social Tutor intervenes to try to support and widen the participation of the group and the discussion continues with four other contributions.

Antonio, a Skeptic, adds two posts that build on what has been said by others, problematizing some aspects. We report here an extract of one of two questions raised (see Excerpt 3).

Excerpt 3

Antonio (Skeptic): I would like to raise a question from what was written by Serena that others agreed with: "The teacher acts as guide who must transmit the right values [...]" I agree with you mostly, but some points of this sentence made me wonder, does the teacher have to transmit the right values?... that puzzles me, I believe that a good teacher should concentrate only on teaching the child the subject and especially to let the child reason, to learn how to use their head, and not transmit values as there is the family for this, [...]

Serena, let me know what do you think, and all the others, let us know what you think about the figure of "teacher/parent."

Regards, Antonio.

Silvia: Hello Antonio, Well, I partly agree with your contribution, because parents play a role in their children's education. It is true, however, that now the school has become a place where parents entrust their children and hand over the role of educating them to others. [...]

Serena: Hello everyone! To build on what Antonio said, I am going to try to better explain what I meant by my idea of a good teacher!

In my opinion, especially in primary schools, it is necessary that the teacher work alongside to the family in the education of the child, indicating which are the right behaviors and which are wrong ones! [...]

The discussion takes shape from the provocation that Antonio inserts while acting in the role of the Skeptic. The Skeptic aims to destabilize the common idea discussed up to that point, that a teacher must convey the right values. Antonio states the need to distinguish the role of the teacher from the role of the parents. The Skeptic thus activates the process of differentiation

and improvement of the ideas. Ten responses to Antonio's contribution build on the common idea of the educational tasks of family and school. Of the 58 segments contained within, many elaborate and problematize what had been said by others.

The Social Tutor often intervenes to support the participation in the group, but also to motivate the participation of each student, empowering all to be legitimate participants consistent with the democratizing knowledge principle (see Excerpt 4).

Excerpt 4

Gianna: Hello everyone !! 😊 I am sharing my opinion on Antonio's question ...

Education and the child's growth occurs in every moment of their life, so it depends on many factors, both social and institutional, and also depends on the environment that you are in. [...]

Teachers constitute for the child a sort of authority figure, and as such it is natural and right that teachers contribute to their education. This way they do not replace or intrude on the figure of the parents, but simply transmit their values through teaching, as both Daniela and Serena stated.

[...]

I can also share an example from my personal experiences ... but then ... you may fall asleep reading such a long message !!!! 😊

Valeria (Social Tutor): Dear Gianna,

Reading your message does not makes us fall sleep at all, of course not! it is right that everyone expresses their ideas. I would be so happy if you tell us more about your personal experience in the next few days, both for educational purposes and to get to know each other better. Good night!!!!

Maria : Good afternoon guys.....

I'm only connecting now, due to various technology problems that I am not going to divulge here. I find out how, in a few days, this forum has grown in terms of ideas and discussions ... there are really a lot of issues addressed, congratulations to the many motivators ... !!!!!!!

I'm hoping to speak my mind, a bit of everything even though I think it will be very difficult given the amount ...;)

Regarding the first question, I think [...]

Regarding the educational role of the school, I agree with those of you who have said that schools and the family play complementary roles in transmitting social values.[...]

Regarding the task of education in general, we need to prepare teachers who can handle the responsibility of educating future generations [...]

I think at this point I'm finished for now...;)

I know that I'm bothering you a bit with all this stuff ... but because of connection problems I couldn't participate in real-time and continuously to the discussions

Bye to everyone ... good evening ...

Valeria (Social Tutor): Maria, don't worry if you can't always connect, it is important that you respond your response seems very rich and not boring ... aren't we all here to cope ??

Courage !!!!!

Valeria, a Social Tutor, legitimates the peripheral participation of Gianna and Maria who contribute only sporadically to the debate, due to problems with their Internet connections. To

motivate participation, the Social Tutor also comments and expresses reflections on the content and process (see Excerpt 2). The climate within the group is marked by cordiality and there are many informal interactions and salutations used.

The Concept Mapper participates in the discussion like all the other students, except at the end of the activity, they are responsible for constructing a concept map during the collaborative face-to-face activity. The Concept Mapper graphically represents the knowledge created by the group and uploads a concept map in the Moodle environment. Paolo, a Concept Mapper, writes:

Paolo (Concept Mapper): Hola !!! I first want to congratulate everyone ... today we did a really good job, and I was pleased to meet you all in person!! I am attaching the colorful concept map that we created ... I hope all of you can open the PDF, which should let you can read and enlarge the map. Otherwise let me know so I can attach another format! Kisses to everyone!

The concept map (Fig. 2) is the artifact representing the knowledge built by the group, and task of the concept mapper is to share it with all the other community groups, as implied by the “community knowledge” knowledge building principle.

In this group, the appropriate action of the role takers contributed effectively to the collective knowledge building.

General discussion

The main goals of the two studies presented were to investigate: 1) whether role-takers and non-role takers differ on level of participation in a blended course and which types of role foster a higher level of participation; 2) what characterizes student’s knowledge building/ conversational functions and how are they different between role takers and non-role takers; 3)

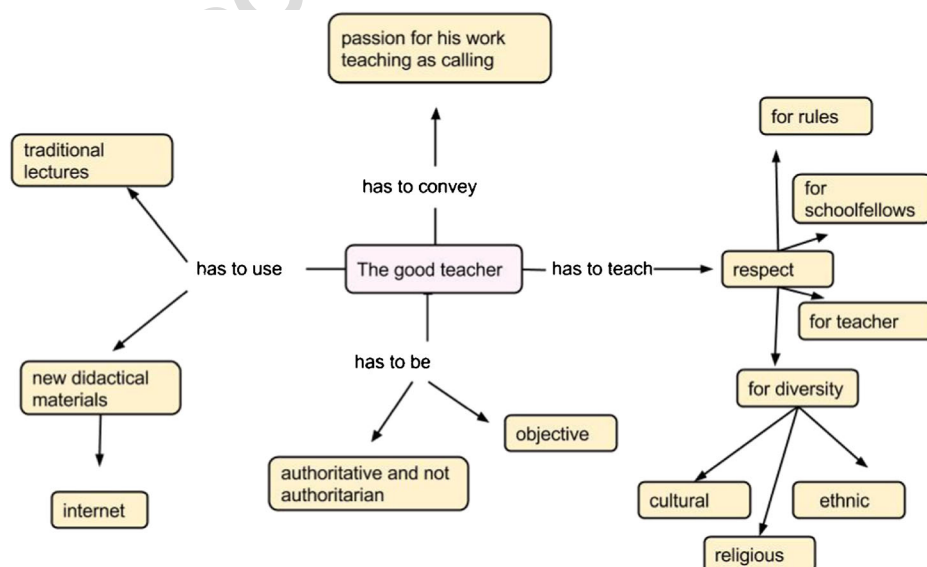


Fig. 2 The concept map of group 2 High KB

What are the differences between roles in the conversational functions used by role-takers; and 4) how role taking influences the dynamic of knowledge building discourse.

Regarding differences in participation between role takers and non-role takers, the results (Study 1) show that students who assume roles in an online course are more active in terms of writing and reading activity in the online environment. Assuming a role seems to be, then, a “triggering event” (Garrison et al. 2000) for the students that promotes participation. In order to explain this result, we can distinguish between different levels of analysis, including the social, motivational, and metacognitive levels as viewed from the knowledge building perspective.

At the social level, the assigned roles seemed to work as interaction organizers, indicating the nature of the contributions expected from each role-taking participant in the online discussion. Along these lines, De Wever et al. (2010) state that roles support the coordination and promotion of effective interaction patterns, as shown by the positive effects in improving task performance and satisfaction among participants, while also alleviating problems of non-participation and domination of the interaction by one group member. In addition, the “democratizing knowledge” knowledge building principle states all the participants are legitimate contributors to the shared goals of the community (Scardamalia and Bereiter 2010). Thus, role taking can help all students to become authentic contributors to the community knowledge improvement.

At the motivational level, to understand why role taking can activate a higher level of participation, we consider Strijbos and De Laat’s (2010) analysis that highlights the student’s orientation to individual and group goals during a collaborative learning activity, but not necessarily orientation to both kinds of goals. For instance, lurkers are more oriented toward individual goals because they invest only a minimal amount of effort in the collaborative activity. This issue is particularly relevant in knowledge building that has the creation of knowledge of value to others as its goal, as emphasized by the “community knowledge principle” (Scardamalia and Bereiter 2010). It is plausible that taking a role aligned with knowledge building principles can stimulate students to change their prior goal orientation towards integrating personal and community goals. The assigned roles can help to deepen students’ understanding of the importance of working together in a joint effort, to improve the community knowledge.

At the metacognitive level, scripted roles allow individual students to understand how to position themselves with regard to the group’s engagement in the knowledge building process in asynchronous discussion. Students accept a specific cognitive responsibility to create a strategy of work consistent with the role attributed. Scardamalia (2002) expresses a similar idea when she writes about the collective cognitive responsibility that emerges when students participate in a knowledge building community. Scardamalia does not mention the assumption of roles by students, but the concept of an online activity orchestrated with interdependent roles seems useful for knowledge building, taking care to avoid “reduction to activities” – reducing the emergent, self-organizing nature of students’ knowledge building discourse to role taking activities (Bereiter 2002). The notion of scripting and orchestration in this paper aims to scaffold the knowledge building process without “over-scripting” or inhibiting the student’s self-regulated application of higher-level internal collaboration processes (Dillenbourg 2002; Fischer et al. 2013). Scripted roles specify the kinds of actions that are considered relevant for the collaborative learning according to knowledge building principles (Scardamalia and Bereiter 2010), that learners rarely engage in spontaneously, such as giving explanations, constructing arguments, and resolving conflicts productively (Strijbos and Weinberger 2010).

In terms of roles that foster a higher level of participation, the results (Study 1) show that the role of “Synthesizer” is the most active among the roles in terms of writing and the second most active for reading activity. As suggested by De Wever et al. (2010), the role of “Synthesizer” (or “Summarizer,” as they called it) requires a stronger focus on building on others’ contributions, whereas other roles require less building on previous messages (e.g., initiating topics and starting new discussions, as in the Social Tutor, Concept Mapper, and Skeptic roles in our study). Interestingly, these authors report that the Summarizer role has the largest positive effect on the level of knowledge construction (Schellens et al. 2005). In addition, recent studies suggest that rise-above note in knowledge building is associated with synthesis or summary functions that bring about pivotal moments in knowledge building (Fujita 2013; Teplov and Fujita 2013). Our findings are consistent with previous research. When a student works to synthesize an online discussion, this student takes on cognitive responsibility to define the advancements in the community’s knowledge through the creation of rise-above notes that support shared understanding about the common problem of inquiry. Thus, the Synthesizer may stimulate the knowledge building process in the community by contributing more frequent written messages and analyzing the evolution of knowledge creation through high levels of reading activity. We have seen also that students who assumed the role of Social Tutor read more than the others roles. It is probable that the student who plays this role is interested in verifying, through the content of the messages, the participation of the other members of the group and the presence of a positive dynamic in the group.

In addition, with reference to the second research question (Study 2), we note with interest that role takers tended to vary the nature of their contributions by using a larger repertoire of global conversational functions than non-role takers, whose messages mainly functioned to introduce new problems or contents. Considering that global conversational functions coding categories were designed to capture the knowledge building principles in the student discourse, role takers seemed to have enacted, in their activity, more knowledge building principles than their colleagues without roles. Additionally, the content analysis confirms that these students effectively engaged in specific conversational functions that are considered relevant for the process of collaborative learning and knowledge building: they tend more to propose problems, synthesize the discourse, and reflected on both processes and the organization of activities. These activities seems to be consistent with the principle of “epistemic agency” (Scardamalia 2002) that describes students in a knowledge building community as being able to set goals for inquiry, identify methods to achieve them, recognize gaps in their own knowledge and discern weaknesses in collaboration activities. In other words, students in our study assumed through their roles the collective cognitive responsibility for knowledge building. It is also consistent with Strijbos et al. (2004) claiming that roles increase students’ awareness of active collaboration and this may enhance knowledge construction (De Wever et al. 2010).

Furthermore, with reference to the third question, results (Study 2) show that for all role takers, “Introducing problems and content” are the main global conversational function activated. However, there are some evident differences that we can attribute to correct role assumption. The Skeptic role prioritizes working specifically on introducing new problem and content, while the Synthesizer role emphasizes revising content, particularly to a synthetic end. The Social Tutor privileges maintenance of relationships. The data for the Concept Mapper role does not reveal any peculiarity that distinguishes it from the other roles, because students who assume this role are responsible for acting at the end of the process rather than during the group discussion. These results show that students assumed the roles that were proposed to

them and performed the consistent global conversational functions, in particular for those in the roles of Skeptic, Synthesizer and Social Tutor.

Finally, in relation to the fourth question, we have seen in the analysis comparing the high KB group (group 2) and the low KB group (group 4) that there are some differences in participation patterns depending on the way the students assumed the assigned roles. In the low KB group, participation is quantitatively lower than in the other groups and the quality of their discourse is weak. The main global function activated in the low KB group is “To introduce new problems and contents.” The students who agreed to take a role in this group actually do not carry it out properly. In contrast, in the high KB group, participation is quantitatively higher and their discourse qualitatively richer, with all the global conversational functions activated. The students in the high KB group also effectively play their assigned roles. The influence of role taking on knowledge building can be interpreted as follows. The correct role assumption in the high KB group allows effective implementation of knowledge building principles on which the roles have been designed. The messages of role takers stimulated the use of the all global conversational functions useful for the knowledge building evenly by emerging among students in the group. These functions engage the students to delve deeply in the knowledge building process (as shown by the greater number of messages and segments) and it indicates that students really assumed collective cognitive responsibility for knowledge building as theorized by Scardamalia (2002).

Conclusions

Although previous studies that analyzed role taking in blended courses highlight that the assumption of a scripted role guides the activity of individual students and regulates their interactions within the group, they have not explicitly focused on how roles may be designed and operationalized to foster collaborative knowledge building.

As Spada (2010) states, analyzing the function of roles in CSCL is highly relevant to understanding the effects of learning in groups and for designing roles that have favorable effects on collaborative learning, or in our case, knowledge building. The present study focused explicitly on investigating the relationship of roles to online reading and writing activities for knowledge building (Scardamalia and Bereiter 2010), and provide some interesting answers. First of all, it is necessary to design roles to create the socio-cognitive conditions for collective cognitive responsibility. From this perspective, we can view roles as fostering conversational functions that students can assume to guide individual behavior that regulate group interactions consistent with the knowledge building principles, which are interdependent and designed to work together. Second, in our study, a second condition is to define a coding scheme that can identify relevant “global and specific conversational functions” according to the knowledge building principles.

The results obtained are useful in understanding how scripted role taking can be designed for knowledge building in large enrolment university classes that are delivered in both blended and fully online formats. When the class size is very large, as in our case, it is helpful to create groups to foster active participation online, but it is still difficult for teachers to model knowledge building in all of the different groups. In our study, instructors introduced scripted roles to encourage students to share collective cognitive responsibility for knowledge building. Although we assert that the Synthesizer has a particularly crucial role in knowledge building, the roles of Social Tutor and Skeptic may also be useful both for blended and fully online

courses. In addition, the Concept Mapper role was specifically designed to enhance face-to-face meetings in blended courses. However, it is possible to also implement this kind of role that reifies knowledge created by a group by using synchronous videoconference sessions to share knowledge artifacts created by a smaller group with the whole class or larger audience. From a Design-Based Research approach, in future iterations of this study, designs of roles can be improved to enrich the knowledge building process. For example, if the Synthesizer role currently functions to summarize the discussion, then in the next design iteration the role might include the creation of a summary as well as identification of what questions remain to be addressed. Similarly, the Concept Mapper role in the next iteration could include in the concept map not only the final synthesis of the group, but also emergent problems that remain unanswered and that may be presented in a whole class session with all the groups to advance the state of knowledge created by his group.

The present research has some limitations. First, the membership of the participants at the same university limits the generalizability of the results. Second, the limited number of males involved may have had an effect on role assumption, particularly with regard to the relationship aspects. This implies that, in a possible replication of this work, diversifying the universities involved and balancing the gender composition would increase rigor. A third limitation concerns the strategy of “pooled results” used. The students in the different conditions compared (role taker or non-role taker) are nested within different groups. This strategy do not allow us to analyze the effect of the role assumption in terms of patterns of interactions emerged in different groups, but it is important to consider that this was not a matter of the present study. Further studies could test whether role taking as a design would bring benefits to the group knowledge building generally, comparing groups with roles and those without roles.

Some contributions that this research makes to the literature and directions for future research of this study can be identified. First, the current research found that having a scripted role stimulates students to a higher level of participation in knowledge building from both quantitative and qualitative points of view. In future studies, it would be interesting to compare online courses implemented, on one hand, with the perspective of the “scripted roles” and, on the other hand, with the perspective of the “emergent roles,” to analyze the differences in participation. It would also be interesting, in a blended course, to consider the relationship of scripted and emergent roles and to examine if students assigned scripted roles sustain their earlier roles or adopt new roles after their period of work with the assigned scripted roles.

Second, of the roles investigated, the Synthesizer and Social Tutor roles seem to have pivotal functions in online discussion for knowledge building. It would be interesting to analyze temporal sequences of messages to understand more specifically the moments in the online discussion when they contribute, to determine the effects of their contributions, and to identify which kind of contributions are particularly effective in sustaining knowledge building. Furthermore, other roles specifically designed for knowledge building can be explored in the future, for example, roles connected to the specific conversational function such as using theory to ground the discussion or bring in relevant external sources (Wise et al. 2012). As personality factors (e.g., learning styles) could influence the way in which students participate in online activity, it could be interesting to consider for instance, how students with a specific learning style may favor a specific role for knowledge building.

Methodologically, this research employed a coding scheme that analyzes both global and specific kinds of conversational functions to understand the particular contributions to the knowledge building process. An interesting analysis would investigate the effects of the roles

attributed to the students in terms of patterns of interaction that emerge in the groups. Theoretically, considering the higher level of participation of students with roles, it would be useful to understand how the presence of roles can alter the dynamic of knowledge building discourse. It could be possible, for instance to examine what happens to the overall participation of all the students in the group, or in the way that online discussion works (e.g., conflict management, negotiation process to reach consensus, etc.).

More future research is needed to explore these questions to understand how the role taking perspective can support knowledge building in online courses.

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