Cross-age peer tutors in asynchronous discussion groups: A study of the evolution in tutor support

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Abstract

The present study explores cross-age peers' tutoring behavior in order to support freshmen collaborating online in asynchronous discussion groups. In this respect, the study fits in with the need to inquire into the process of peer facilitation and support for students working together in CSCL-environments. Contrary to the clear presence of peer tutoring effect studies in the literature, much remains to be learned with regard to this particular issue of peer tutor support. More specifically, the present study focuses on a depiction of the different types of peer support and on the evolution in peer tutoring behavior over time.

The study was conducted in a naturalistic setting at the Ghent University, with 19 pairs of fourth-year students, each tutoring one asynchronous discussion group of 9 to 11 freshmen (*N*=257) during a complete semester. A quantitative content analysis coding scheme was developed based on the work of Weinberger and Fisher (2006) and Garrison et al. (2000) to analyze tutors' contributions. Full transcripts of all tutor contributions were coded and units of meaning were chosen as units of analysis.

As to the types of peer support, the results reveal that peer tutors use a variety of tutoring interventions. Most often tutors provide organizational and social support. Further, they facilitate tutees' argumentative knowledge construction and concentrate on elucidating the learning contents. Only exceptionally tutors are engaged in off-task talk. As to the evolution in peer tutoring behavior over time, the results show a gradual decline in the amount of tutor contributions. Further, multinomial logistic regressions reveal an evolution in the occurrence of the different types of tutor support. Peer tutors did however not evolve from supplying examples or modeling behavior to calling for input or coaching behavior. Additionally, no development was found with regard to alternating between addressing the group or individual students. At all times tutors preferred addressing their interventions to the entire group

Keywords: computer-supported collaborative learning; CSCL; higher education; peer tutoring

Introduction

Learning in a peer tutoring setting can be considered as a specific type of collaborative learning (Griffin & Griffin, 1997; Topping, 1996). Participants are assumed to negotiate meaning on a regular basis either in small groups or in fixed pairs. Moreover, one peer clearly takes a supportive role as peer tutor. In the research literature on peer tutoring, numerous benefits are discussed for both student tutors and tutees (Millis & Cottell, 1998). In her book outlining research on peer tutoring in higher education, Falchikov (2001) has summarized multiple benefits to the undergraduate tutors in particular. Generic skills development, reinforced subject knowledge, and personal satisfaction were reported. Tutees also appear to profit in various ways, especially due to the interventions of their tutor. Nath and Ross (2001), for example, reported (meta)cognitive advantages of just-in-time or rather immediate corrective feedback provided by a human facilitator on students' argumentations during peer-assisted collaboration. Additionally, Vincent and Ley (1999) mentioned that many tutors function as (cognitive) role models for their tutees, implying that peer tutors can effectively model study skills, such as concentrating on the material, organizing work habits, and asking questions. As for Parr and Townsend (2002), the interplay between peer influences and learning is largely related to the cognitive benefits of informal talk, often unrecognized by teachers or staff tutors.

Few studies, however, specifically focus on the quality or nature of the helping task and role of a peer tutor while tutoring. Except for the research of McLuckie and Topping (2004) discussing transferable skills for online peer learning, this particular issue of tutor support remains underexposed in the peer tutoring literature. Most peer tutoring studies are effect studies, conducted within a face-to-face context (Carroll, 1996; Duran & Monereo, 2005; Topping, 1996; Webb, 1992). In this respect, the present study intends to broaden the

preceding research and combines two aspects needing extra attention. More specifically, we explore the quality of peer tutor support within an online peer tutoring context.

Theoretical framework

Peer tutoring

Peer tutoring has been conceptualized as a form of collaborative learning (Griffin & Griffin, 1997) in which "people from similar social groupings who are not professional teachers help each other to learn, and learn themselves by teaching" (Topping, 1996, p. 322). Recently, Duran and Monereo (2005) indicated collaboration as being the central core of peer tutoring explaining both inter- and intrapersonal advantages. In the literature, researchers investigating collaborative learning in general and peer support in particular frequently refer to theoretical frameworks building on Vygotsky's social-constructivist theory.

Vygotsky's theory emphasizes that, at any given age, full cognitive development requires social interaction in terms of problem solving under adult assistance or in collaboration with more capable peers (Falchikov, 2001). More specifically, Vygotsky (1978) highlights knowledge to be interpersonal before it becomes intrapersonal. In order to foster interpersonal knowledge construction, social interaction is crucial. Consequently, the presence of peer collaboration and intensive and task-oriented social interaction can be regarded as an important benefit of collaborative learning in general and of peer tutoring in particular. Further, Vygotsky's theory about the 'zone of proximal development' (ZPD) appears to be connected with the effectiveness of collaboration among peers. The ZPD is "the distance between the actual developmental level as determined by independent problem solving and the level of potential development as determined through problem solving under adult guidance or in collaboration with more capable peers" (Jaramillo, 1996, p. 139). The ZPD

pertains to peer tutoring since this type of collaborative learning is characterized by specific role taking, where one partner is clearly taking a direct pedagogical role (McLuckie & Topping, 2004). More specifically, a more capable, knowledgeable, and experienced peer with a supportive role is called the 'tutor', while less experienced students receiving help from a tutor are called 'tutees' (Topping, 1996, 1998). In this respect, the tutor is considered to adopt the role of facilitator, converting the collaboration into learning opportunities. Within the scope of this study, the fixed supportive role of peer tutors is the central point.

Evolution in tutor support

Related to the social-constructivist idea of knowledge being interpersonal before becoming intrapersonal (Vygotsky, 1978), peer tutors' supportive contributions should evolve over time implying a gradual transition from tutor-centered activities to student-centered learning activities. This gradual transition is interesting to explore since it appears to be intertwined with helping processes to make sure that all members in the learning group benefit from the 'zone of proximal development' (Pata, Sarapuu, & Archee, 2005).

Literature concerning teachers' tutoring roles in problem-based learning environments (Moust & Schmidt, 1994) has extensively discussed the evolution in tutor support over time. In order to pronounce upon a development in tutoring behavior, research on problem-based learning (PBL) frequently refers to the Cognitive Apprenticeship paradigm (Brown, Collins, & Duguid, 1989), which emphasizes the social base of knowledge construction and brings students' learning in relation to a dynamical enculturation process wherein facilitators gradually fade out their prominent presence. Therefore, facilitators' presence can be interpreted as a human tool to help students become independent learners. Building on social constructivism, Cognitive Apprenticeship theory emphasizes 'learning-through-guided-experience' in order to help learners acquire an integrated set of cognitive and metacognitive skills through processes of observation and supported practice (Collins, Brown, & Newman,

1989). Following the work of Moust and Schmidt (1994) exploring the tutor roles in PBL, in the present study it is stressed that the assistance of the tutor switches from 'model' to 'coach' when tutees become more experienced and skilful in structuring the discourse within the online discussion groups. More specifically, the tutor is expected to start as a 'model' when the contributions of the tutees are still insufficient to support social construction of knowledge. At this stage the tutor clearly exemplifies how the learning activities within the discussion group can be facilitated, for example by summarizing the dialogues, by concretizing theoretical concepts, by rephrasing, and by pointing at discrepancies and similarities. Alternatively, a tutor acting as 'coach' does no longer model, but elicits response and gives suggestions to improve the discourse while students themselves take the lead in the discussion. The coach should only intervene when there are misconceptions and failures in understanding. Finally, a tutor in the role of 'consultant' should challenge students with 'tricks of the trade' dependent on his acquaintance with subject matter.

In addition to the Cognitive Apprenticeship paradigm, the dynamic nature of peer tutor support during interaction can be related to research building on Bruner's (1986) scaffolding concept. As for Pata, Sarapuu, and Lehtinen (2005), scaffolding means providing assistance to students on an as-needed basis with fading out of assistance as the competence increases. Mason (2000) indicates that the core of the term scaffolding lies in fading out the structure in the activities so that students come to internalize what teachers were demonstrating. According to Mason (2000), the process of scaffolding and fading tends to be a process of moving from explicit through indirect prompts by the teacher to spontaneous use by the students. Moreover, the purpose of fading is encouraging students to integrate useful ways of thinking into their own functioning or inner monitor. In the initial phase of the interaction, the facilitator mainly focuses on explicit questions which gradually become more indirect prompts until they disappear and become part of the inner system of the students over time.

This process endorses the model-coach-consultant movement as described by Moust and Schmidt (1994), and is also in line with Bruner's (1986) initial use of the term scaffolding to describe the teacher doing for the student what the student could not currently do for him or herself. Within a specific peer tutoring context, learners can be assisted in building new knowledge structures with the help of more advanced peers who model the desired learning strategy or task and then gradually shifts responsibility to the students (Pressley, Hogan, Wharton-McDonald, Mistretta, & Ettenberger, 1996).

Tutor support in CSCL

During the last decades, it has been shown that computer-supported collaborative learning (CSCL) environments can play a successful role in facilitating knowledge construction (Gunawardena, Lowe, & Anderson, 1997; Weinberger & Fisher, 2006) or higher-order thinking (Garrison, Archer, & Anderson, 2000). However, much remains to be learned with regard to the quality or nature of the supportive process in response to the need to empower people who are collaborating online (Falchikov, 2001).

Although there is theoretical evidence to suggest that peer tutors should take online facilitation as a multidimensional activity in which they supply various degrees of assistance depending on the learners' progress (Packham, Jones, Miller, & Thomas**,** 2004; Rickard, 2004; Salmon, 2000), more empirical research is needed. As learners' abilities grow, the assistance formerly available should be gradually withdrawn until they can learn independently (Mason, 2000). In line with the search for meaningful support in CSCL, a particular challenge for online facilitators - peer tutors in this study - lies in deciding when and how a tutor intervention in discussions can promote tutees' argumentative knowledge construction (Weinberger & Fisher, 2006) without actually taking over the group process. In this respect, Mazzolini and Maddison (in press) indicated that the facilitating role in asynchronous discussion forums can vary from being the prominent 'sage of the stage', to a

more constructivist ‘guide on the side’, or even an observing ‘ghost in the wings’. Further, the authors underlined that a supervisor does not need to respond to every student post but instead should determine the appropriate time to jump in, make a comment, ask another question, or redirect the discussion. Mazzolini and Maddison (in press) observed that online discussions that are progressing well, are best left largely alone.

In addition to the evolution of tutors’ degree of assistance, a supplemental indicator of varied online tutor support is whether peer tutors’ individual assistance does alternate with group support. More specifically, since peers’ interaction is viewed as a resource for learning in groups, it is desirable that the tutor alternates checking his understanding of individuals’ ideas with redirecting tutee input to the group in general (Christensen, 1991).

Aim and research questions

This study aims to picture peer tutors’ contributions in asynchronous discussion groups. Therefore, tutoring in this research is both cross-age, online, and asynchronous. Building on the theoretical framework, this study further explores the extent to which online peer tutors change and gradually withdraw their assistance over time. More specifically, we focus on the following research questions and hypotheses:

- Which types of support characterize peer tutors’ interventions in asynchronous discussion groups?
- Do peer tutors’ interventions evolve over time? More specifically, the following aspects of evolution are considered:

    (1) Evolution in the specific types of tutors’ support;

(2) Evolution from model to coach. More specifically, we hypothesize that tutors fade out assistance and evolve from supplying working examples themselves to calling for input from the tutees;

(3) Alternating between addressing individuals and addressing the group.

Method

Participants and setting

The present study was conducted in a naturalistic higher education setting at the Ghent University, with 19 pairs of fourth-year students, each tutoring one asynchronous discussion group involving 9 to 11 freshmen (*N*=257). The online discussion groups were a formal component of a 5-credit blended course 'Instructional Sciences', part of the first-year bachelor of Educational Sciences' curriculum. Tutors were fourth-year Educational Sciences' students (option Pedagogics), performing the support activities as an element of their educational internship (a 6-credit course). Moreover, the peer tutors were aged between 22 and 24 years, and the vast majority (90%) was female. Both tutors and tutees represented the entire population of respectively fourth- and first-year students enrolled for the first semester of the academic year 2004-2005. In this respect, the present study joins in with the research of Carroll (1996) focusing on cross-age peer tutoring where older students are involved in tutoring younger students. The general task for the tutors was stimulating tutees' knowledge construction and self-directed learning during online task-based interaction. In view of this task, they received a specific training.

Procedure

Assignments

During the full first semester of 12 weeks, the tutors supported freshmen working on six successive authentic assignments, related to five themes in the course: behaviorism, cognitivism, constructivism, instructional design, and evaluation in educational settings. Next to these distinct topics, an integrative theme was put forward in which the tutees were required to incorporate key principles of different learning theories. Negotiating and completing the group assignment lasted two weeks for each discussion theme. After two weeks, the discussion was accessible on a read-only base and a new assignment of similar difficulty as the previous one was presented for each group. The thematic group assignments were identical for all discussion groups in the study and can be characterized as open-ended tasks, implying no standard approach, nor single right answers. Furthermore, the assignments were quite complex and extensive, so a single group member could not solve the task on his/her own. In view of our research objective, the six discussion themes were clustered in three tutorship phases. In this respect, tutors' scaffolds are studied from the starting (theme 1 and 2), over the intermediate (theme 3 and 4), to the closing (theme 5 and 6) tutorship phase.

Tutor Training

There is widespread agreement in the literature that peer tutoring activities are less effective without a preceding tutor training (Falchikov, 2001; Jenkins & Jenkins, 1987; Parr & Townsend, 2002). Therefore, a preliminary training was organized in a three hour face-to-face group session two weeks before the onset of the discussion groups. The training was compulsory for all involved peer tutors and was developed and provided by the first author of the article. By the end of the training program, participants received a manual including hands-on examples and reminders. Inspired by the work of Collins et al. (1989), Rickard (2004), and Salmon (2000), all tutors were trained equally to make them confident with the expected evolution in tutoring behavior and to acquire necessary organizational, (meta)cognitive, and social strategies to moderate discussion groups. The participants were

introduced to the multidimensional nature of tutoring in order to master a relevant mix of tutoring skills. They were informed about and practised functional skills, such as socialization (Pelliccione & Albon, 2004) and community building (Rourke, Anderson, Garrison, & Archer, 2001; Rovai, 2002), asking questions (Fishbein, Eckart, Lauver, Van Leeuwen, & Langmeyer, 1990; Strong & Baron, 2004), triggering reflection (Korthagen, 1993; Schön, 1987; Seale & Chann, 2000), and providing descriptive feedback (Gallacher, 1995; Narciss, 2004; Smith & Coenders, 2002). Moreover, "examples of good practice" were discussed in order to promote transfer of the skills dealt with in the training (Halpern, 1998). At the end of the tutor training, the CSCL-environment was demonstrated and additional practical information (e.g. internship rules, group composition, planning, etc.) was made available on a tutor website.

Focus groups

In order to support in a more continuous way the tutors and to improve the peer tutoring activities, every two weeks focus groups were organized with the fourth-year tutors. These meetings were set up in small groups of about ten tutors. In addition, tutors were asked to develop their personal internship logbook consisting of critical reflections on freshmen's performance in the discussion groups and their personal progress in providing assistance. This requirement for tutor reflection is grounded theoretically in the literature concerning the professional development of teachers (Rueda & Monzo, 2002).

Content analysis

Coding scheme

Quantitative content analysis was applied to analyze tutors' contributions. The research technique designed for the "objective, systematic, and quantitative description of the manifest content of communication" (Berelson, 1952, p. 18), is a traditional method of studying mass

media messages. In content analysis, researchers establish a set of categories and then count the incidence of each category in transcripts (Silverman, 2001).

In this study, first a literature review was conducted in order to get acquainted with essential competencies for online tutors (Ally, 2004; Garrison et al., 2000; Nath & Ross, 2001; Weinberger & Fisher, 2006). On the basis of this literature search, a coding scheme was developed to document tutors' input. The coding scheme is rooted in two existing instruments to study collaborative discourse in online learning environments. More particularly, we intertwined the framework to analyze Argumentative Knowledge Construction in CSCL of Weinberger and Fisher (2006), and the Community of Inquiry Coding Template of Garrison et al. (2000). Both models build on social-constructivist principles highlighting the computer as an interesting tool for purposes of worthwhile moderating and learning transactions.

In CSCL-environments various kinds of support are necessary, and as a result a variety of roles, tasks, and responsibilities have been put forward (Packham, Cramphorn, & Miller, 2001; Packham, Jones, Miller, & Thomas**,** 2004; Rowntree, 2005). What is clear from the theoretical and empirical literature is that online facilitation is described as a multidimensional activity (Garrison et al., 2000; Tagg, 1994). Recently, Weinberger and Fisher (2006) pointed out four multiple process dimensions of argumentative knowledge construction that could be inspirational to both questions of how to provide assistance to students negotiating meaning in CSCL-environments, and how to analyze this kind of data? At first, the participation dimension affirms that encouraging learner participation is of importance since active participation incorporates elaboration and equal-status interaction. Depending on the task, the epistemic dimension requires different activities such as construction of problem space, conceptual space, and adequate relations between problem and conceptual space in order to foster knowledge acquisition. The argumentation dimension focuses on the integration of arguments and counterarguments. Finally, the dimension of

social modes of co-construction reflects commitment in the sense of externalization, elicitation, quick consensus building, integration-oriented consensus building and conflict-oriented consensus building.

Taking into account the specific tutoring context of the present study, as well as the literature review, the content analysis scheme we developed focuses on four process dimensions containing one or more coding categories, namely tutors' (1) social and organizational support in the learning community, (2) domain specific support with regard to both the learning content and the group task, (3) individual or group support by modeling or eliciting tutees' argumentative knowledge construction, and (4) off-task behavior. Of central importance for this study is the subdivision of the third process dimension fostering tutees' argumentative knowledge construction into tutor contributions focusing on individual students and/or on the group as a whole. Moreover, in the same process dimension another distinction is made between tutor contributions aiming at either modeling or coaching tutor behavior. According to literature (Mason, 2000; Moust & Schmidt, 1994), in this study peer tutors' explicit prompts such as summarizing and providing examples are categorized as modeling behavior while indirect prompts or invitations to contribute a summary or example to the discussion are categorized as coaching behavior. Table 1 presents and exemplifies the subcategories of the coding scheme in more detail.

[Insert Table 1 about here]

Coding strategy and reliability

The full transcripts of all tutor contributions were coded by means of the abovementioned analysis scheme. Three trained coders performed independently the coding. Since tutoring and e-moderating can be considered as a multidimensional activity (Packham, Jones, Miller, & Thomas**,** 2004; Salmon, 2000), it is clear that tutor contributions can reflect a variety of tutoring categories within a single message. Therefore, units of meaning were chosen as units

of analysis. Following Chi (1997) a unit of meaning is defined as a unit that represents a consistent idea, argument chain, or discussion topic. In our analysis, each unit of meaning received only one code. While segmenting tutor messages and afterwards applying the coding scheme, each tutor contribution was seen as part of the larger ongoing discussion. A three-hour training was provided to all coders and included: (a) a thorough explanation of the segmentation and coding process; (b) written guidelines elucidating the segmentation and coding procedure; (c) authentic examples enlightening each code; and (d) practice with sample data. Group discussion helped to get acquainted with the particularities of the coding scheme and to reach mutual agreement about the coding subcategory to be chosen. The reliability sample consisted of 508 units of meaning or 9% of the full sample of 5552 units of meaning. A moderate Krippendorff's alpha (.64) was calculated indicating the level of agreement between the three coders beyond chance (De Wever, Schellens, Valcke, & Van Keer, 2006; Krippendorf, 1980). As to the authors, an alpha between .40 and .80 corresponds to 'fair to good agreement beyond chance'.

Statistical analysis

Frequencies of the incidence of all subcategories are reported to give an overview of the occurrence of the different types of tutor interventions. Further, multinomial logistic regressions were performed to study the differences in tutor behavior over time. The occurrence of different components of tutor behavior serve as dependent variables for the analyses and are treated as nominal variables. The three tutorship phases serve as the independent variable, comprising three categories: starting, intermediate, and closing tutorship phase. Table 4, Table 7 and Table 9 present the results of the multinomial logistic regressions in further detail. More specifically, the tables report the estimated parameters (estimate), the standard error (SE), the Wald statistic (Wald), the p-values (p) of the Wald test, the odds ratio (OR = exp (est)), the inverse odds ratio (OR^{-1} = exp (-est)) in case the odds ratio

is smaller than 1, and the 95% confidence interval (CI) for the odds ratio, comprising a lower bound (LB95%CI) and an upper bound (UB95%CI). Statistical findings are presented per research question.

Results

The collected data comprise the transcripts of 29 discussion groups. During the 12 weeks or three consecutive tutorship phases 19 pairs of fourth-year students posted 1955 messages. Within the 1955 tutor messages, the coders identified 5552 units of meaning.

Which types of support characterize peer tutors' interventions in asynchronous discussion groups?

First, we present an overall analysis of the four dimensions of tutor support. As presented in Table 2, peer tutors use a variety of tutoring activities. In the vast majority (about 56%) of the units of meaning distinguished in tutors' contributions, tutors pay attention to organizational and social support, such as monitoring participation, providing technical help, and reinforcing good discussion behavior. In about 16% of the units in tutor postings, tutors concentrate on facilitating the learning contents by elucidating the group assignment and clarifying theoretical concepts. Further, in almost 23% of their contributions they watch over discourse clarity and they structure the discussion in order to facilitate tutees' argumentative knowledge construction. Finally, only 4% of their contributions tutors reflect off-task talk.

[Insert Table 2 about here]

Since the dimensions of tutor support only provide a global overview of peer tutors' interventions in asynchronous discussion groups, the subsequent descriptive results focus on the occurrence of the different subcategories of tutor behavior. As can be derived from Table 2, the incidence of the single indicators for facilitating organizational and social support

varies per subcategory. Especially the proportions of contributions coded as 'provides participation guidelines', 'encourages enduring participation', and 'reinforces good discussion behavior' are quite high (about 13%) compared to the other subcategories. Further, it appears that peer tutors' facilitation of the learning contents mainly refers to segmenting and clarifying the group assignment (about 5%). As to the occurrence of tutors' facilitation for argumentative knowledge construction, Table 2 presents the incidence of all indicators in the coding scheme along the subcategories 'modeling' versus 'coaching behavior' and 'individual' versus 'group support'. In the next paragraph, we present the most important findings.

As to the occurrence of modeling behavior, contributions coded as 'discusses process, progress, and results' appear to occur most frequently (about 3%). This category fits into modeling behavior addressed to the group, whereas another popular modeling intervention of tutors is 'controlling for argument understanding' addressed to individuals (1.7%). Further, Table 2 affirms that the most prominent type of coaching tutor behavior is 'controlling for argument understanding'. Both individual students and the group as a whole are regularly (respectively about 3.3% and 6.1%) invited to clarify, to reformulate or paraphrase their point of view. In addition, we observe that peer tutors without doubt preferred to invite tutees to check their understanding of arguments above controlling the understanding of argument. Finally, it appears that asking for examples building on a given argument (0.7% for individual students versus 1.2% for the group) occurs only occasionally in contrast to the other indicators for facilitating argumentative knowledge construction.

Do peer tutors' interventions evolve over time?

In order to give an overview of the evolution in tutors' contributions, the overall occurrence of the main process dimensions of tutor support was studied over time. Underneath, the three components of this research question are presented separately.

The first part of the research question on evolution intends to consider the variation in the specific types of tutor support over time. In this respect, the descriptive results on the various tutorship phases as presented in Table 3 show a downward tendency of the occurrence of organizational and social support in the learning environment. According to the occurrence of tutor contributions stimulating argumentative knowledge construction a similar declining tendency is found. On the contrary, the incidence of tutor interventions aiming at facilitating the domain-specific learning content and off-task informal talk increases over time.

[Insert Table 3 about here]

To study the occurrence of peer tutors' organizational and social support, facilitation of the learning content, contributions stimulating argumentative knowledge construction, and off-task behavior along the three tutorship phases more in particular, multinomial logistic regressions were performed. The likelihood ratio test confirms an overall significant effect of tutorship phase (χ^2 (6) = 97.642, $p < .001$). Since the descriptive results in Table 3 show a predominance of 'organizational and social support' (about 56%) as well as the constant prevalence of this type of tutor behavior over time, this particular process dimension of the dependent variable was chosen as reference category in a more comprehensive multinomial logistic regression analysis. The intermediate tutorship phase was selected as reference category of the independent variable. Table 4 presents the results of the multinomial logistic regression analyses.

The findings show that both the odds of supporting the learning contents and the odds of off-task talk versus organizational and social support increase considerably per tutorship phase ($p < .01$). However, no significant evolution in occurrence is found when comparing tutor support for argumentative knowledge construction with organizational and social support over time. More particularly, it appears that during the intermediate tutoring phase,

the odds of supporting the learning content versus organizational and social support are 1.27 higher compared to the starting phase whereas in the last phase, the odds are 1.39 times higher than in the intermediate phase. With regard to off-task behavior versus organizational and social support, the evolutions in occurrence over time are more pronounced. Compared to the intermediate tutorship phase, the odds of tutors' off-task behavior are 2.93 times lower in the starting phase and 3.17 times higher in the closing phase.

[Insert Table 4 about here]

The second interest in exploring the differences in peer tutors' interventions over time, entails the tutor evolution from model to coach. More specifically, quantitative differences in tutor messages were studied over time. Second, a distinction was made between supplying input and tutor's inviting to in order to stimulate argumentative knowledge construction.

As can be derived from Table 5, the highest number of messages was posted within the first tutorship phase. Subsequently, a gradual decrease in the number of tutor contributions is found.

[Insert Table 5 about here]

With regard to the facilitation of argumentative knowledge construction, Table 6 indicates that tutors can be situated more in the role of 'coach' than in the role of 'model' (almost 61% versus about 39%). This general finding also applies to the starting and intermediate phase in particular, but not to the closing tutorship phase.

[Insert Table 6 about here]

In order to check the significance of the differences over time in tutors' modeling or coaching support for argumentative knowledge construction, multinomial logistic regressions were performed. With respect to the argumentation dimension in the coding scheme, Table 7 indicates significant differences in the occurrence of modeling towards coaching behavior

between the three tutorship phases (χ^2 (2) = 34.500, p < .001). It appears that the odds of modeling versus coaching increase significantly per tutorship phase. More specifically, the odds of modeling behavior are about 1.31 times lower in the starting tutorship phase compared to the intermediate phase. Furthermore, the odds of taking a modeling position are about 2.29 times higher in the closing tutorship phase as compared to the intermediate tutoring phase.

[Insert Table 7 about here]

In addition, we assume that a gradual decline in the average number of messages of a tutor can be considered as a complementary element to explore the evolution from model to coach. Therefore, as a test on the significance of the differences in the amount of tutor interventions per tutorship phase, a univariate analysis of variance was performed. The results reveal significant differences between the three tutorship phases (F = 16.09; df = 2; p < .001). More specifically, post hoc analyses (Sheffe's criterion) disclose a significant decline in postings between the first and the final tutorship phase (p = .000) and between the intermediate and the closing tutorship phase (p = .006). These results indicate a gradual decrease in the amount of tutor contributions along the successive tutorship phases.

The final interest in exploring the evolution in peer tutors' interventions over time concerns tutors' alternation between addressing individuals and addressing the group. In general, peer tutors prefer addressing the group (about 71%) instead of to individual students (almost 29%) in their interventions with regard to argumentative knowledge construction. Looking in more detail to the descriptive results in Table 8, this finding is applicable in every tutorship phase.

[Insert Table 8 about here]

Although tutors expressed more group than individual support at all times, significant differences are found in the occurrence of tutors' individual versus group support between the tutorship phases (χ^2 (2) = 10.727, $p < .01$). As can be seen in Table 9, group support within the argumentation dimension is chosen as reference category for the dependent variable in order to perform the multinomial logistic regressions. The odds of individual versus group support are 1.97 times lower in the closing tutorship phase compared to the intermediate one. Further, no significant differences in individual versus group support were revealed for the starting compared to the intermediate tutorship phase.

[Insert Table 9 about here]

Discussion

Considering the tutor as a protagonist in facilitating tutees' learning processes, the main interest of the present study was on the analysis of peer tutors' online contributions. This focus on tutors' perspective fits in with the need to inquire into the process of peer facilitation and support for students working together in CSCL-environments. As studying the variety and evolution in tutor support might precede effectiveness studies on the extent to which the tutoring behavior contributed to tutees' worthwhile learning, the first aim was to explore the types of support characterizing peer tutors' interventions in asynchronous discussion groups. With regard to the second research question, the subsequent aspects of evolution were considered: evolution in the specific types of tutors' support, evolution from model to coach, and alternating between addressing individuals and addressing the group. A content analysis coding scheme was developed to explore tutors' activities over time during tutees' discussions on group assignments. Further, multinomial logistic regressions were applied to study the impact of tutorship phases on tutors' behavior. The results indicate that tutorship phase, as an indicator for one's growing experience in tutoring over time, has an effect on the occurrence

of facilitating learning content, facilitating argumentative knowledge construction, and off-task talk compared to organizational and social support. Moreover, the starting, intermediate and closing tutorship phase is of considerable importance in the occurrence of modeling versus coaching behavior, and individual versus group support over time. In the next paragraphs, we discuss the results per research question in further detail.

Training was set up to allow peer tutors to adopt a rich mixture of tutoring behavior. With regard to the first research question, the descriptive results confirm that cross-age peer tutors do perform a blend of tutoring activities. However, there appears to be a persistent predominance of giving organizational and social support. Peer tutors more specifically focus on providing participation guidelines, encouraging enduring participation, and reinforcing good discussion behavior. The enduring occurrence of organizational and social support corroborates the work of Hammond (2000) highlighting that a communicative approach within online forums should always remain both task-centered and personal. On the other hand, it can also be concluded that tutor interventions do not evolve from talk elucidating the learning environment over support for the learning contents to contributions stimulating tutees' argumentative knowledge construction. This finding is in line with an earlier study of online peer tutoring behavior (De Smet, Van Keer, & Valcke, in press). It also confirms the findings of other studies (Billett, 1996; Garrison et al., 2000; Salmon, 2000) who state that social and emotional presence are of continuous importance to foster cognitive processing. As to the researchers' observations during the project, tutees benefited and felt supported by their cross-age tutors for several social reasons. It seemed that particularly tutors' peer understanding, get-at-able presence, and rather immediate feedback (Nath & Ross, 2001) were beneficial for tutees' perceived self- and collective efficacy, which are psychological constructs principally studied by Bandura (2000).

In addition to exploring variety in tutor support, it was aimed to look for development in tutors' helping interventions. As defined by Mason (2000), the process of scaffolding and fading tends to be a process of moving from explicit through indirect prompts to spontaneous use by the students. Therefore, in the present study a distinction was made between modeling and coaching peer tutor support in order to foster tutees' argumentative knowledge construction. More specifically, peer tutors' input supplies, such as summarizing and providing examples were categorized as modeling behavior, while indirect prompts or invitations to contribute a summary or an example to the discussion were categorized as coaching behavior. In this respect, one part of the second research question focused on tutors' evolution from modeling to coaching behavior. As to the results, it can be concluded that apart from the last tutorship phase peer tutors act more in the role of coach than in the role of model. More particularly, an upward trend of modeling behavior was found over time, with a predominance of modeling in the last phase. The upward trend of modeling support over time as well as the overall predominance of modeling versus coaching in the closing tutorship phase, however, does not confirm what was expected from the literature (Brown et al., 1989; Collins et al., 1989; Moust & Schmidt, 1994). Although univariate analysis of variance has shown that tutors significantly fade out their assistance during the last tutorship phase in terms of less participating (Pata et al., 2005), the few times tutors intervene to facilitate tutees' argumentative knowledge construction they opt for the modeling way. A first explanation for the growing occurrence of modeling interventions in the last themes could be intertwined with the discussion task that might have been too complex and extensive to be able to deal with during two negotiation weeks. Additionally, since each discussion theme was based on a new body of knowledge for freshmen, little transfer in knowledge construction from a former discussion theme could occur (Schellens & Valcke, 2005). A final reason for the strong

modeling function of peer tutors in the last tutorship phase could have had to do with tutees' drop-out necessitating tutors to keep argumentative knowledge construction on track. A temporary difficulty of freshmen being busy with some other activities during the final themes (Christmas holidays and exams in January) could be connected with this drop-out hypothesis. Also the finding of increasing proportions of tutors' off-task behavior could interact with tutees' demanding agenda.

The predominance of coaching behavior as found in the starting and intermediate tutorship phase could be explained too. More specifically, it was highlighted in the preliminary training that tutors should not be overly directive in order to allow tutees to take full responsibility for their own learning process and progress. This emphasis in the training might account for the fact that they started their facilitating role with more stress on coaching than on modeling interventions. Moreover, this finding can be related to tutors' perceptions and expectations at the start of their internship as well. As reported by the tutors in the two-weekly focus groups, it appears that peer tutors overestimated the capacities of the first-year tutees and therefore were not (yet) interceding in a prominent way. With regard to the decline in postings per tutor, in the focus groups tutors explicitly stated that they consciously faded out participation over time in order to create opportunities to make independent learners from tutees. Moreover, some tutors even mentioned it was not easy to keep in the background and decide not to jump in the discussion for that reason.

Furthermore, another purpose of the present study related to the second research question was to explore the extent to which tutors alternate between addressing individuals and addressing the group. The results indicate that during the consecutive tutorship phases tutors always preferred addressing their interventions to the group instead of to individual students. This finding could be understood in light of the collaborative aspect of online discussion

groups. Building on their preparatory training, it is clear that peer tutors like to promote the dialogical interchange in CSCL (McLuckie & Topping, 2004).

Finally, the results yield design guidelines in ameliorating training activities for online peer tutors. More particularly, a future tutor training program should shed a light on different elements of tutors' evolution from model to coach. In addition to withdrawing their average amount of messages, tutors must be aware of the advisable development from supplying working examples to calling for input. In addition, tutors are expected to achieve the right balance between individual and group support. Exercises on discussion groups of earlier student populations could help them to get acquainted with those capacities.

Limitations, implications, and directions for future research

The present study implies a number of limitations. First, the study has been conducted in a particular setting with a medium-size group of peer tutors, studying a specific freshman blended course in only one university setting. Future research should try to verify the findings involving other student populations, and in alternative instructional settings or knowledge domains. It is further a challenge to find out if, and how, the strategies adopted by the peer tutors in this research may be different from those of other kinds of online tutors.

The present research is also limited since only a quantitative approach has been adopted. Quantitative content analysis and logistic regressions have been used in order to gain insight in tutors' behavior to support tutees' negotiation of subject-matter in asynchronous discussion groups. As to increase the validity of interpreting the dynamics of online tutor interaction, triangulation of research methods is needed. Network analysis or discourse analysis could, for instance, focus on the structure of the interaction that is or is not induced by peer tutors.

Further, tutors can be interviewed to study their perceptions about being or becoming a coach (Cossentino, 2004). In addition, the possibilities of stimulated recall (Calderhead, 1981; Lyle, 2003) to explore the perspectives and intentions underlying tutor interventions can be promising as well when studying future peer- and/or tutor populations. Apparently, the parallel use of qualitative methods could give added value in answering the question of how peer tutors should intervene in student discussions to promote tutees' argumentative knowledge construction. Even tutees' perceptions within the peer tutoring constellation might nourish a prospective qualitative design.

Another comment centers on the need for replication studies that focus on the validation of the coding scheme used in the present study (De Wever et al., 2006). A new content analysis instrument was developed for this study. To our knowledge, no alternative analysis scheme is currently available to study peer tutoring interventions in general and to explore the distinction between modeling and coaching behavior in particular. Taken into account the plea of De Wever et al. (2006) to reinforce the empirical base of content analysis instruments, future studies should aim at studying the concurrent validity of the applied instrument.

Next to the abovementioned needs for future research, an additional suggestion for follow-up research can be made. Peer tutors differ in behavior and shift their supportive activities due to a mix of task, group, and individual student variables that we did not figure out in more detail (e.g. task complexity, degree of group cohesion, freshmen's level of prior knowledge, tutor style, tutor's efficacy or role beliefs, etc.). With regard to individual tutor characteristics, it is also important to realize that although the peer tutors involved in the study are all fourth-year students, they do not represent a homogenous group. In future research the following individual characteristics can be considered: gender, age, experience in working with groups, and ICT knowledge and skills. Accordingly, design characteristics such as the constellation of intervening alone instead of working in pairs and the preliminary training could have

influenced the tutors' behavior. In this respect, future research should investigate the distinct as well as mixed effects of contextual circumstances on tutor performance in more detail. For example, it is to be stressed that the expected evolution in tutoring behavior is not to be considered as a one-sided decision of the tutor and the mere result of following a strict protocol as presented in a tutor training. Tutoring behavior is the result of an interaction process between tutor and tutees and builds on the evolutionary demands and grounding acts of the tutees (Pata et al., 2005). Therefore, we can expect that differences and evolution in tutoring behavior can occur considering the differences that can be observed in the task execution of the group and their growth in knowledge construction and collaborative effectiveness.

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Tables

Table 1. Coding scheme for quantitative content analysis of tutor support.

Process dimensions in peer tutor support	Addressing the group or an individual
Organizational and Social Support	
Introduces oneself. *Personalizing and getting tutees acquainted with peer tutoring.*	Group
Provides participation guidelines. *Providing posting guidelines, deadlines, planning, establishing ground rules and structure.*	Group
Monitors participation guidelines. *Monitoring posting guidelines, deadlines, planning, and ground rules.*	Group
Deals with non-participants. *Controlling for non-participation.*	Group
Encourages enduring participation. *Stimulating participation and dialogue.*	Group
Reinforces good discussion behavior. *Making learners compliments for good interventions and recognizing appropriate behavior.*	Group
Evaluates the collaboration. *Giving feedback on group cohesion and group dynamics.*	Group
Provides technical help. *Resolving technical difficulties or referring to a specialist.*	Group
Facilitating the Learning Contents	
Segments the assignment. *Providing structure in the assignment or dividing it in topics.*	Group
Clarifies the group assignment. *Giving additional information with regard to the formulation and purpose of the assignment.*	Group
Keeps dialogue considering the assignment on track. *Focusing the discussion on the group task.*	Group

Refers learners to supplemental reading material in addition to the handbook.	Group
Providing or referring supplemental reading material in addition to the handbook.	
Refers learners to supplemental materials in order to solve the assignment.	Group
Providing or referring supplemental reading material in addition to the handbook.	
Clarifies concepts in the handbook.	Group
Clarifying meaning and/or use of concepts in the handbook.	
Clarifies concepts in the assignment.	Group
Clarifying meaning and/or use of concepts in the assignment.	
Facilitating Argumentative Knowledge Construction	
Controls or invites to control for argument understanding.	Group; Individual
Clarifying, reformulating, paraphrasing, requesting responses.	
Gives or invites to give a personal opinion.	Group; Individual
Providing a personal view.	
Gives or invites to give an example.	Group; Individual
Qualifying the argument with an example or personal experience.	
Elaborates or invites to elaborate on the argument(s).	Group; Individual
Situating the given argument in a new context based on prior knowledge, other knowledge domains, etc.	
Supplies or invites to supply a warrant for the argument(s) coming from the handbook.	Individual
Situating the argument in the handbook.	
Distinguishes or invites to distinguish details from key elements in the discussion.	Group
Raising key arguments.	
Summarizes or invites to summarize the arguments.	Group
Reducing the arguments by summarizing them.	
Links or invites to link contributions together.	Group
Analyzing and integrating contributions.	

Builds or invites to build consensus.	Group
Building consensus.	
Articulates or invites to articulate a group decision.	Group
Articulating a group solution.	
Discusses or invites to discuss process, progress and results.	Group
Evaluating during discussion.	
Introduces a new topic for discussion.	Group
Playing devil's advocate to spark debate or making a suggestion to give the discussion a new direction.	
Off-task	
Informal talk apart from learning in discussion groups.	

Table 2. Overview of the occurrence of tutor behavior split up in separate process dimensions and indicators.

Process dimensions	Tutor support indicators per category	%
Organizational and social support		
	Introduces oneself.	10.5
	Provides participation guidelines	13.2
	Monitors participation guidelines	1.7
	Deals with non-participants	1.6
	Encourages enduring participation	13.0
	Reinforces good discussion behavior	13.7
	Evaluates the collaboration	0.5
	Provides technical help	2.2
	Total[a]	56.4 (3181)
Facilitating the learning contents		
	Segments the assignment	5.9
	Clarifies the group assignment	5.0
	Keeps dialogue considering the assignment on track.	2.5
	Refers learners to supplemental reading material in addition to the handbook.	0.2
	Refers learners to supplemental materials in order to solve the assignment.	1.2
	Clarifies concepts in the handbook.	0.9
	Clarifies concepts in the assignment.	0.6
	Total[a]	16.3 (874)
Facilitating argumentative knowledge construction		
	Sublevel: Modeling behavior addressed to an individual	
	Controls for argument understanding	1.7
	Supplies a warrant for the argument(s) coming from the handbook	0
	Gives a personal opinion	0.5
	Gives an example	0.2

Elaboration on the argument(s)	0
Sublevel: Modeling behavior addressed to the group	
Controls for argument understanding	1.0
Gives an example	0.3
Elaboration of the argument(s)	0.1
Gives a personal opinion	0.4
Distinguishes details from key elements in the discussion	0
Summarizes the arguments	0.3
Links contributions together	0.2
Builds consensus	0
Articulates a group decision	0.3
Discusses process, progress and results	3.0
Introduces a new topic for discussion	0.6
Sublevel: Coaching behavior addressed to an individual	
Invites to control for argument understanding	3.3
Invites to supply a warrant for the argument(s) coming from the handbook	0.1
Invites to give a personal opinion	0
Invites to give an example	0.7
Invites to elaborate on the argument(s)	0.1
Sublevel: Coaching behavior addressed to the group	
Invites to control for argument understanding	6.1
Invites to give an example	1.2
Invites to elaborate of the argument(s)	0.2
Invites to give a personal opinion	0.4
Invites to distinguish details from key elements in the discussion	0
Invites to summarize the arguments	0.6
Invites to link contributions together	0.3
Invites to build consensus	0

	Invites to articulate a group decision	0.5
	Invites to discuss process, progress and results	0.6
	Total[a]	22.7 (1297)
Off-task	Total[a]	4.4 (189)
Non-definable	Total[a]	0.2 (11)
	Total[a]	100 (5552)

[a] Percentage and total number of units of meaning.

Table 3. Occurrence of the main dimensions of tutor support per tutorship phase.

Tutorship phase	Organi-zational and social support	Learning contents	Argumenta-tive knowledge construction	Off-task	Non - definable	Total[a]
Start	59.5%	14.2%	25.2%	0.9%	0.2%	100% (2431)
Intermediate	57.5%	16.3%	23.2%	2.8%	0.2%	100% (1937)
End	52.1%	18.5%	19.7%	9.6%	0.1%	100% (1184)
Total[a]	56.4% (3181)	16.3% (874)	22.7% (1297)	4.4% (189)	0.2% (11)	100 % (5552)

[a] Percentage and total number of units of meaning.

Table 4. Multinomial logistic regression estimates indicating the differences between the tutorship phases with regard to the occurrence of the four main dimensions of tutor support.

Process dimension	Tutorship phase	Est.	Std. error	Wald	df	Sig.	OR	OR^{-1}	LB95 %CI	UB95 %CI
Learning contents[a]	Intercept	-1.551	.136	130.914	1					
	Start	-.238	.092	6.653	1	.010	.788	1.269	.658	.944
	Intermediate	ref.cat								
	Closing	.329	.109	9.099	1	.003	1.389		1.122	1.719
Argumen-tation[a]	Intercept	-1.102	.116	90.560	1					
	Start	.004	.078	.003	1	.955	1.004		.863	1.169
	Intermediate	ref.cat								
	Closing	-.001	.101	.000	1	.993	.999	1.001	.820	1.217
Off-task[a]	Intercept	-2.477	.288	74.015	1	.000				
	Start	-1.075	.267	16.224	1	.000	.341	2.933	.202	.576
	Intermediate	ref.cat								
	Closing	1.153	.193	35.773	1	.000	3.168		2.171	4.623

[a] The reference category is ‘Organizational and social support’.

Table 5. Total number of messages per tutorship phase, means, and standard deviations per tutor per tutorship phase.

	Theme 1	Theme 2	Theme 3	Theme 4	Theme 5	Theme 6	Total
	Starting tutorship phase		Intermediate tutorship phase		Closing tutorship phase		
Total[a]	849 (43.43%)		680 (34.78%)		426 (21.79%)		1955 (100%)
Mean	44.68		35.79		22.42		34.30
SD	13.96		11.90		10.42		12.09

[a] Total number of messages and percentages.

Table 6. Occurrence of the model or coach subcategories of the argumentation dimension per tutorship phase.

Tutorship phase	Argumentation dimension		
	Model	Coach	Total[a]
Start	34%	66%	100% (614)
Intermediate	38.7%	61.3%	100% (450)
End	53.2%	46.8%	100% (233)
Total[a]	39.1% (507)	60.9% (790)	100% (1297)

[a] Percentage and total number of units of meaning.

Table 7. Multinomial logistic regression estimates indicating the differences between the tutorship phases with regard to the occurrence of modeling towards coaching within the argumentation dimension of tutor support.

Process dimension	Tutorship phase	Est.	Std. error	Wald	df	Sig.	OR	OR^{-1}	LB95 %CI	UB95 %CI
Model[a]	Intercept	-1.044	.220	22.550	1	.000				
	Start	-.271	.132	4.249	1	.039	.762	1.312	.589	.987
	Intermediate	ref.cat								
	Closing	.826	.183	20.502	1	.000	2.285		1.598	3.268

[a] The reference category is 'Coaching tutor behavior within the argumentation dimension'.

Table 8. Occurrence of the individual or group support subcategories of the argumentation dimension per tutorship phase.

Tutorship phase	Argumentation dimension		
	Individual	Group	Total[a]
Start	30.1%	69.1%	100% (614)
Intermediate	32%	68%	100% (450)
End	18.9%	81.1%	100% (233)
Total[a]	28.8% (373)	71.2% (924)	100% (1297)

[a] Percentage and total number of units of meaning.

Table 9. Multinomial logistic regression estimates indicating the differences between the tutorship phases with regard to the occurrence of addressing individuals or addressing the group within the argumentation dimension of tutor support.

Process dimension	Tutorship phase	Est.	Std. error	Wald	df	Sig.	OR	OR^{-1}	LB95 %CI	UB95 %CI
Individual[a]	Intercept	-.821	.231	12.616	1	.000				
	Start	-.095	.136	.490	1	.484	.909	1.100	.696	1.187
	Intermediate	ref.cat								
	Closing	-.677	.212	10.162	1	.001	.508	1.968	.335	.770

[a] The reference category is 'Group support within the argumentation dimension'.