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Blending asynchronous discussion groups and peer tutoring in higher education: An exploratory study of online peer tutoring behaviour

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Abstract

In the present study cross-age peer tutoring was implemented in a higher education context. Fourth-year students ($N = 39$) operated as online tutors to support freshmen in discussing cases and solving authentic problems. This study contributes to a better understanding of the supportive interventions of tutors in asynchronous discussion groups. Peer tutor interventions were studied by means of a content analysis scheme based on the e-moderating model of Salmon [Salmon, G. (2000). A model for CMC in education and training. E-moderating. The key to teaching and learning online. London: Kogan Page]. The descriptive results reveal that the type of tutor activities varies over the consecutive discussion themes. No evidence was however found for a significant evolution from introductory and social talk to contributions eliciting cognitive processing and critical thinking along the themes. Tutors' social support seems to be of continuous importance. Further, cluster analysis resulted in a classification of the tutors into three different subtypes or tutor styles ('motivators', 'informers' and 'knowledge constructors'), which was interpreted as confirmation of Tutor-dependent online peer tutoring behaviour.

Keywords: Computer-supported collaborative learning; CSCL; Higher education; Peer tutoring

1. Introduction

During the last decade, a growing body of empirical studies has been published considering the task and role of facilitators in the context of computer-supported collaborative learning (CSCL) (Bonk, Wisher, & Lee, 2004; Garrison, Anderson, & Archer, 2000; Rickard, 2004; Salmon, 2000). The discussion about the role of facilitators in CSCL is related to a debate about the critical potential of collaboration in online learning contexts. It has been argued that collaboration does not systematically produce learning (Dillenbourg, 2002). In this respect, the present CSCL-debate focuses especially on the conditions that foster productive

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interactions, leading to higher order cognition and enabling learners to develop as independent thinkers (McLoughlin & Luca, 2000). Recent studies discuss for instance the need for guidance and structure (Bonk et al., 2004; Johnson & Johnson, 1996; Laurillard, 1998), scaffolding (McLoughlin & Marshall, 2000; Mercer & Wegerif, 1999; Rickard, 2004), or facilitation (Clouston, 2005) as mutually dependent factors facilitating meaningful online discourse. Based on a number of both theoretical and empirical arguments, it can be argued that tutors can play a beneficial role in this context.

As to the importance of structured activity in online collaboration, it should be taken into account that although interactive media are seen as giving much greater freedom of control to the user, this self-control can lead to difficulties in organising the input of information, in structuring the discussion, and in developing a personal overview, resulting in lower levels of knowledge construction (Schellens & Valcke, 2005). In this respect, some authors point at a critical precondition to consider the learner's need to discern structure in the messages (Laurillard, 1998). Johnson and Johnson (1996) for example underscore that, whether the cooperative setting makes use of technology or not, structuring the activity is essential for academic success. Moreover, Cohen (1994) stresses that tutors can play a compensating role in low-level interactions, since the structuring interventions of tutors can raise the level of the discourse and can ensure that disengaged students get reconnected.

A second and related critical factor to foster productive interactions in collaborative settings is the explicit student need for assistance. The need for guidance and online support in CSCL settings is comparable to the need of classroom support in face-to-face settings (Lazonder, Wilhelm, & Ootes, 2003). Bonk et al. (2004) state that the guidance and moderating skills of the instructor are vital for online team success. Falchikov (2001) refers to the importance of helping behaviour to empower students to learn and collaborate online. In this respect, scaffolding, which plays a critical role in Vygotsky's 'zone of proximal development' (Vygotsky, 1978), can be considered as a central concept. Scaffolding is provided to learners by a more capable expert, teacher, or peer helping the learners to perform a task they would normally not be able to accomplish by working independently. It advances the learners' activity from a current level of understanding to a point where support is no longer required (McLoughlin & Marshall, 2000). Research of McLoughlin and Marshall (2000) points at the legitimate nature of scaffolding offered by peers in computer conferences to support cognitive development. This is consistent with the statement of Jaramillo (1996), who describes how learners progress from zone to zone with the help of the scaffolds they present to one another. Moreover, it appears that the similar role position of peers supporting one another as compared to staff support entails beneficial effects on motivation (Neville, 1999).

Building on the empirical base regarding the importance of structured and guided collaboration, a research study was set up integrating cross-age peer tutoring into the context of asynchronous discussion groups. Peer tutoring can be defined as 'people from similar social groupings who are not professional teachers, helping each other to learn, and learning themselves by teaching' (Topping, 1996, p. 322). 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, 1998). As to the definition of peer tutors, Falchikov (2001) argues that peer tutors are often defined by what they are not. They do not have a professional qualification, they do not have a formal evaluation role, and finally, peer tutors have no control over the curriculum or materials used. Two large categories of peer tutoring can be distinguished. Students can be paired with other students from within their own class groups. This variant is called same-age peer tutoring. The second variant is called cross-age peer tutoring and refers to older and more knowledgeable students tutoring younger students.

2. Theoretical background

In the context of the present research, cross-age peer tutors were introduced to provide structure and scaffolds in order to foster cognitive development in online group discussions. Taken into account the definition of peer tutoring (Topping, 1996, 1998), tutors were expected to help less experienced tutees to learn in a collaborative context. The principle of co-construction of meaning, which is linked to learning in collaborative settings, is in line with Vygotsky's socio-cultural theory, focusing on the assumption that 'action is mediated and cannot be separated from the milieu in which it is carried out' (Wertsch, 1991, p. 18). As to the description of how mediation takes place, Vygotsky (1978) proposed the concepts of internalisation and zone of proximal

development. In the present study, the milieu in which peer tutors adopt the role of mediator is characterized by student interactions in a CSCL-setting. In this respect, it should be taken into account that the demands of being an online tutor are somewhat different than those of a face-to-face tutor (Duggleby, 2000; Falchikov, 2001). Next to the specific needs for online facilitation according to the context in which the facilitation is carried out, the gradual shift of students moving to a next zone of development as a consequence of guided exchange and internalisation has been put forward in literature. The idea of mediation pertains to the concept of peer tutoring since a cross-age peer tutor may adopt the role of mediator, converting his exchanges into learning opportunities for the tutees. The gradual shift of students moving to a next zone of development as a consequence of a guided exchange activity and internalisation has also been put forward in the context of online learning. For instance, Salmon (2000) presents a five-step model to direct e-moderating skills that is taxonomical in structure. Hence, the initial e-moderating activities are conditional for future support. The model aims at guided exchange activity that – at stage five – results in self-regulated contributions of students in the collaborative environment.

In the following paragraphs, the consecutive roles and tasks of e-moderators as grounded in the hierarchical model are explained in more detail. The model can help to get a better understanding of online peer tutoring behaviour. Nevertheless, transferring the model for e-moderating to a peer tutoring context has raised the question whether tutor performance is a matter of evolution in contrast with studies reporting that tutors apply person-specific tutoring styles.

2.1. E-moderating

A review of the literature focusing on support approaches in electronic collaborative learning environments results in a variety of concepts (e.g. e-tutoring, online mentoring, e-coaching, e-moderating) being used to address the roles, tasks, and responsibilities of online facilitators. E-moderating is indicated as a central concept (Bonk et al., 2004; Fahy & Ally, 2005; Salmon, 2000) commonly associated with computer mediated conferencing (CMC). In this respect, Salmon (2000) connects e-moderating to the need of making the content and social interactions in CMC meaningful to all participants. A multi-faceted approach to direct e-moderating

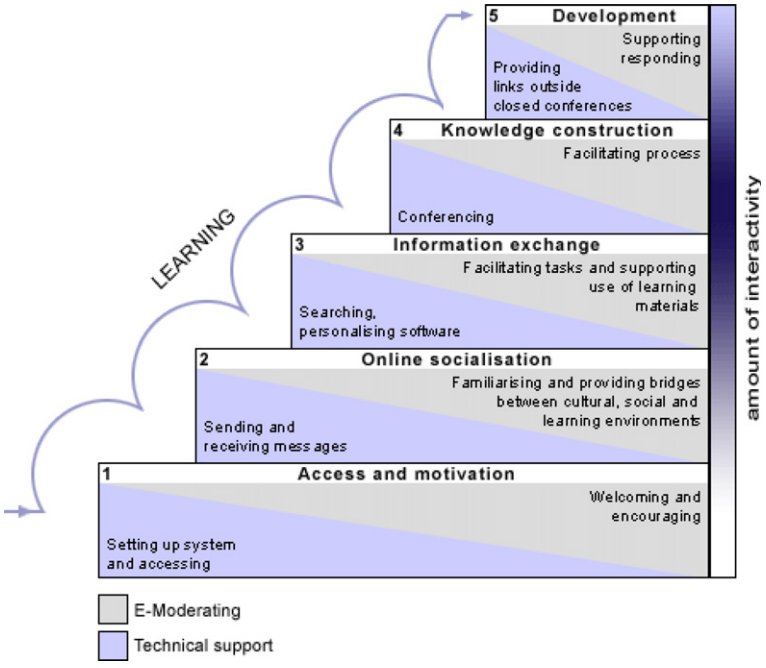

Fig. 1. Five-step model for e-moderating from Salmon (2000). Retrieved from: http://www.atimod.com/e-tivities/5stage.shtml.

skills is presented in a five-step model. In addition, the specific structure of the model is especially helpful in view of training student tutors in discussion groups (see Fig. 1).

The first moderation stage '*access and motivation*' centres on welcoming participants and offering them technical support to get online. In this respect, online e-moderators pay attention to the participants' readiness to learn in a digital environment. When participants feel comfortable with the medium, they start submitting contributions. Getting to know each other, sharing empathy, and having a clear sense of the 'discussion group audience' is the priority at the second moderation stage '*online socialisation*'. At this stage, e-moderators help establishing a feeling of 'community'. The e-moderator guarantees that everyone feels respected and heeds respect for the input of others. A pleasant and constructive atmosphere is fundamental for further learning. At the third stage of '*information exchange*', learning is becoming the more prominent objective. The role of the e-moderator is giving direction by submitting plenty of messages. The moderator's messages help to focus on the task or problem, shed light on the most relevant topics, and provide supportive content-related information. Central at the fourth stage '*knowledge construction*' are social negotiation and task-related engagement. Knowledge construction occurs when participants explore issues, take positions, discuss their positions in an argumentative format, and reflect on and re-evaluate their positions. In this respect, e-moderators have the role of a facilitator, not a transmission role. They ask questions, reformulate input, keep an eye on the structure of the debate, and summarise what has been stated thus far. The overall purpose at this stage is sharing meaning and building common understanding. At the fifth and final stage '*development*', participants reassess their own thinking and explore the social learning processes. Key ingredient at this stage of personal development is reflection and becoming responsible for one's own learning. In this respect, e-moderators need to challenge learners' thoughts, for example by playing the devils' advocate and by encouraging critical thinking. The more participants rethink and reconsider their contributions, the more stage five has been reached.

2.2. Peer tutoring: A matter of evolution?

The taxonomical model of Salmon (2000) is consistent with literature indicating that social and planning behaviour is of central importance to foster knowledge construction and reflective thinking in a CSCL-setting (Billett, 1996; Garrison et al., 2000; Schellens & Valcke, 2005). Referring to the model for e-moderating, this means that although every phase in the model is important, in the long run one should reach the highest phases in the negotiation. Notwithstanding the fact that the Salmon model is frequently mentioned in the literature, little research has been set up to study the actual adoption of the proposed stages in online discussions. The development of e-moderation over time neither is examined empirically.

McLoughlin and Marshall (2000) argue that tutors' scaffolds are rather dynamic than fixed considering the full complexity of collaborative learning in online discussions. According to Lycke, Stromso, and Grottum (2003), computer-supported problem-based learning implies contextual circumstances that may affect tutor performance. Further, previous research suggested that development in tutors' behaviour refers to the extent to which tutors' supportive interventions interact with task, group, and individual student characteristics (Johnson & Johnson, 1996; Schellens, Van Keer, Valcke, & De Wever, in press; Slavin, 1995). In line with these interaction effects on the nature of online facilitation, it could be hypothesized that Salmon's taxonomical model takes the situation-specificity of tutor performance (Lycke et al., 2003) into account. As can be derived from the model, a distinction can be made between beginning and advancing in the role of e-moderator. Moreover, during computer-mediated conferencing, e-moderators are assumed to move along the five stages of e-moderating dependent on contextual variables. With regard to the dynamic characteristics of e-moderators, the present study focuses on and explores the nature of peer tutors' scaffolds over time.

2.3. Peer tutoring: A matter of style?

As mentioned above, e-moderating can be described as a multidimensional concept, which is assumed to be dynamic dependent on the assignment features and students' discourse acts and needs. Furthermore, e-moderating is supposed to be dependent on individual traits, especially those of the moderator himself (Lycke et al., 2003). In this respect, we are interested in whether peer tutors, in the role of e-moderators,

develop a certain tutor style when facilitating the interaction and learning processes in asynchronous discussion groups. The work of Hakkarainen and Lipponen (1998) has already reported that tutors apply person-specific tutoring styles. Recently, Pata, Sarapuu, and Lehtinen (2005) supported the notion of person-related scaffolding styles in network-based role-play. More specifically, they report a passive and active tutoring style. The passive tutoring style consisted of less frequent process and content scaffolding acts with the tutor not in the dominating role. In the case of the active tutoring style, the tutor used frequent scaffolding acts and led the decision-making process by keeping the initiative. These findings of more or less stable and individual tutoring styles can be compared to what has been studied in the field of 'approaches to studying' (Entwistle, Tait, & McCune, 2000), 'student learning styles' (Fahy & Ally, 2005; Kolb, 1993), and 'approaches to teaching' (Kember, 1997), where certain *styles* have been identified. Grasha (2002) identified the following teaching styles as a description of prevalent aspects of teacher presence in the classroom: expert, formal authority, personal model, facilitator, and delegator. For Pratt (2002) most teachers have only one or two perspectives as their dominant view of teaching: transmission, developmental, apprenticeship, nurturing, and social reform. The different styles have been developed and used in varying educational contexts to explain and accommodate individual differences in the organisation of teaching and learning practices.

3. Research objective

Building on the theoretical framework, the aim of the present study was to explore cross-age peer tutor behaviour in asynchronous discussion groups. Taken into account Salmon's five-step model for e-moderating, it may be expected that tutor interventions evolve from – initially – introductory and social talk to – finally – contributions eliciting cognitive processing and critical thinking along consecutive discussion themes. Related to our view that the five-step model for e-moderating on the one hand interacts with task and group characteristics and on the other hand with individual student (incl. tutor) characteristics, there is the idea of tutors preferring a certain tutor style, reflected by specific tutor behaviour. This argumentation introduces the present research question whether tutor behaviour can be regarded as *dynamic* and consequently evolving and differing over time or rather as *tutor-dependent* reflecting a tutor's preferred style.

4. Method

4.1. Setting

The present study was set up in a naturalistic higher education setting at Ghent University in Belgium. The online discussion groups were a formal component of a 5-credit freshman course 'Instructional Sciences', which is part of the first-year curriculum of students studying Pedagogical Sciences. This introductory course is set up in a blended format. Next to the weekly face-to-face sessions, all first-year students ($N = 257$) had to participate in asynchronous discussion groups in order to discuss problems and cases building on the theoretical base. In the discussion groups, peer tutors supported the work of the students. Tutors were fourth-year Educational Sciences' students performing the e-moderating activities as a part of their educational and teaching internship (a 6-credit course).

4.2. Participants

Thirty-nine 4th-year student tutors were involved in the study. They worked in 18 pairs and 1 group of three tutors to support asynchronous discussion groups. The majority of the peer tutors (90%) were female, aged between 22 and 24 years. Both tutors and tutees represented the entire population of fourth- and first-year students enrolled for the first semester of the academic year 2004–2005. Nine to 11 freshmen were enrolled in each discussion group. Tutor pairs were composed on a voluntary base as opposed to the 257 tutees who were randomly assigned to a discussion group. We opted for co-tutorship in the peer tutoring setting to reduce the workload of the internship. However, this did not imply that the two tutors gave support simultaneously. One of both tutors took turns to support the members of their asynchronous discussion group. The

non-active tutor worked in the background, followed closely the interaction, and shared ideas with the co-tutor in view of the tutoring activities.

4.3. Procedure

4.3.1. Online tutoring

During 12 weeks, peer tutors supported the freshmen in discussing six successive authentic cases and problems, related to central themes in the Instructional Sciences course: behaviourism, cognitivism, constructivism, instructional design, and evaluation. In line with the constructivist principles, the discussions were based on real-life situations. Moreover, relevant links to websites and supplementary questions were added to refine and structure the task completion. The students were expected to work during two weeks on each discussion assignment. After two weeks, the discussion was only accessible on a read-only base and a new discussion theme was presented for each discussion group. As the peer tutors worked in dyads, the tutors alternated the support of the discussion group with their co-tutors. In this respect, three pairs of discussion themes can be distinguished: each tutor moderated a discussion group for the first time during the first or second discussion theme, led their group through the third or fourth discussion assignment, and completed their internship during the fifth or last discussion theme.

4.3.2. Tutor training programme

There is a widespread agreement in the peer tutoring literature that students must be trained in order to become a proficient tutor (Duggleby, 2000; Falchikov, 2001; Parr & Townsend, 2002; Van Keer, 2004). Peer tutoring activities are less effective without a preceding training programme (King, 1997; Palincsar & Brown, 1984). In the present study, preliminary training was organised two weeks before the onset of the asynchronous discussion groups. Guidelines were given collectively in a face-to-face setting during two three hour sessions. By the end of this training programme, participants received a manual including practical examples and reminders. The tutor training programme was grounded in the theoretical models and frameworks for training coaches (Costa & Garmston, 1994; Irwin, Hanton, & Kerwin, 2004), tutors (Lentell, 2003; Moust & Schmidt, 1998), mentors (Jonson, 2002; Rickard, 2004), and e-moderators (Bonk et al., 2004; Salmon, 2000). In this respect, the five-step model for e-moderating of Salmon (2000) was discussed. Furthermore, tutors were encouraged to go through the first year course as well as through transcripts of previous discussion groups in which freshmen negotiated course contents without peer tutor assistance. Additionally, responding to content mistakes, conflicts, unclear arguments, and tutees' non-participation in the discussion group was exercised.

4.3.3. Focus groups

In order to foster the peer tutoring activities, focus groups with the fourth-year tutors were organised on a regular base. In addition, they were asked to write a personal internship logbook consisting of critical reflections and the identification of indicators of personal progress (Seale & Cann, 2000). This requirement for tutor reflection is grounded theoretically in the literature concerning professional development of teachers (Rueda & Monzó, 2002).

4.4. Content analysis

Content analysis was applied to analyse the complete dataset of 114 transcripts generated during the asynchronous discussions (19 groups $\times$ 6 discussion themes).

4.4.1. Unit of analysis

The 'unit of meaning' in a message was chosen as the unit of analysis. Following Chi (1997) a unit of meaning is defined as a unit that represents a consistent idea, argument chain, or discussion topic. Since tutoring is a multidimensional activity and units of meaning were chosen as the unit of analysis, it is clear that the tutor contributions can reflect a variety of tutoring categories within a single message. The identification of the units of meaning was carried out by three trained and independent coders. As suggested by Strijbos, Martens, Prins,

and Jochems (2006), a procedural distinction was made between the segmentation process into units of analysis and the content analysis and coding process.

4.4.2. The content analysis coding scheme

To explore the tutor contributions, a new coding scheme was developed, rooted in the five-step model of Salmon (2000). Seventeen categories, representing the five stages, were distinguished as concrete and operational indicators of tutoring behaviour. Table 1 represents and exemplifies the coding categories.

4.4.3. Reliability analysis

Three independent coders received a training to carry out the segmentation procedure. A sample of 151 tutor contributions was segmented in units of meaning by each individual coder. Next, the researchers compared and discussed the segmented units of meaning in order to reach consensus about the segmentation

Table 1
Coding scheme based on the five-step model for e-moderating (Salmon, 2000)

E-moderating	Indicators of tutor behaviour	Examples
Access and motivation	Elucidating the digital learning environment as well as conceptions about the tutor role	*Please, use the reply button. I have to challenge all of your thoughts.*
	Being accessible to computer-related problems	*Maybe, you can use the quick edit help link.* *I send the text in an attachment to your personal inbox.*
	Encouraging participating and wishing good luck	*Please, do not hesitate to login. Good luck!*
Socialisation	Informal talk	*I would like to wish you a nice New Year's Eve.*
	Appreciating and confirming contributions	*Interesting discussion! Well done! Very good!* *Thanks for the explanation!*
	Showing commitment	*Kind regards. Indeed, this is a difficult learning task.*
Information exchange	Modelling and illustrating the contents with examples, personal views, and concepts	*The theory of PDP describes the following idea . . .*
	Bringing in other content information	*You can draw inspiration from the media mentioned in the course book and on the Internet.* *I would like to advise this website.*
	Organisational arrangements and planning	*We are reaching the end of the discussion theme, so it is time for finishing contributions.* *From Tuesday until Monday, we can make the comparison between behaviourism and cognitivism.*
	Unravelling the learning task	*Tutors repeat or divide the assignments in parts.*
	Explaining the learning task	*I think that they mean to point out some arguments.*
Knowledge construction	Asking for content explanations and clarification	*Please, can you give an example?* *So, the point is that . . ., can you rephrase . . .*
	Asking to summarise	*It would be nice that someone makes a scheme of the given arguments.*
	Giving feedback about learning and social processes, giving suggestions to both the individuals and the group	*During this discussion theme you all have done the best to motivate each other, to cooperate, to answer my questions, to add extra information, and to present personal experiences.*
Development	Call for further reflection	*Well, if you try to work with advance organisers, what might happen then with the declarative, procedural, and/or metacognitive knowledge?*
	Elaboration. This is a type of communication that invites students to put earlier ideas in another or new context	*Pictures make propositions less complex. Can someone draw the link between this assumption and the information processing model?*
	Playing devil's advocate. This is a type of communication that creates doubts during contributing. For example, tutors prompt counterarguments, reverse the reasoning, and/or posit 'what if' questions	*Imagine that you are a teacher, how should you react now? Going back to your own school context, does the model stay attractive?*

process. In addition to the segmentation training, the coders also received a training to apply the 17 subcategories grounded in Salmon's five-step model (Salmon, 2000). The three hour training resulted in a high level of interrater reliability. The reliability sample consisted of 508 units of meaning or 9% of the full sample and we calculated overall percent agreement (0.91) as well as Krippendorff's α (0.84). The overall agreement rate shows the overall percentage agreement of the three coders across all subcategories. Krippendorff's α demonstrates the level of agreement beyond chance between the three coders (De Wever, Schellens, Valcke, & Van Keer, 2006). Both indices were calculated and reported since there is no general agreement on which should be used. Percent agreement is considered an overly liberal index by some researchers, whereas the indices, such as Krippendorff α, which do account for chance agreement, are considered overly conservative and restrictive (De Wever et al., 2006).

5. Results

5.1. Descriptive results

During the 12 weeks and 6 consecutive themes, tutors posted 1955 messages. As can be derived from Table 2, the highest number of messages was posted during the second discussion theme. There is a gradual decrease in the average number of tutor contributions. Within the 1955 messages, the coders identified 5472 units of meaning. As presented in Table 3, it is apparent that although triggering reflection is hardly present, peer tutors appear to use a variety of tutoring activities as suggested in the preliminary training. A high proportion of tutor behaviour focuses on exchanging information. In the vast majority (almost 30%) of the units of meaning within tutors' contributions, tutors pay attention to planning, separating, and explaining the learning tasks, bringing in additional sources, and modelling the discussion. In about 27% of the units of meaning in tutor postings, tutors concentrate on the creation of a motivating learning environment. Further, in about 24% of their contributions they watch over discourse clarity and they structure the discussion in order to facilitate students' knowledge construction. Peer tutors show a clear social commitment in 18% of their messages. Finally, in only 1% of the interventions, tutors stimulate personal development and reflection.

5.2. Can tutor behaviour be regarded as dynamic? Is there an evolution over time?

With regard to the question whether tutoring evolves over time, we refer to Table 3. The results indicate that 'information exchange' occurs most often within each discussion theme in comparison with the other e-moderating stages and this from theme 2 on. The number of tutor contributions with regard to 'develop-

Table 2
Absolute number of messages per theme ($N = 39$ tutors), means and standard deviations per tutor

	Theme 1	Theme 2	Theme 3	Theme 4	Theme 5	Theme 6	Total
Sum	388	461	368	312	210	216	1955
Mean	20.42	24.26	19.37	16.42	11.05	11.37	17.15
SD	7.69	8.08	6.49	6.74	6.11	5.83	8.26

Table 3
Percentages of the occurrence of the five categories from Salmon (2000) identified within the tutor messages per theme

Theme	Access and motivation	Socialisation	Information exchange	Knowledge construction	Development
1	29.80	14.90	29.50	24.90	0.90
2	22.90	16.20	31.70	28.20	1.00
3	24.10	17.60	28.60	27.90	1.80
4	29.90	17.70	30.30	21.10	1.00
5	27.10	21.70	28.10	21.40	1.70
6	26.50	26.50	28.00	17.70	1.30
Total	26.60	18.10	29.60	24.40	1.20

ment' is relatively stable over time. Remarkably, the incidence of contributions focusing on 'socialisation' increases over time, while a declining trend can be seen in contributions stimulating knowledge construction. In order to test the changes in the proportions of tutor behaviour throughout the successive discussion themes, χ^2 analysis was applied.

As can be observed in Table 4, significant changes occur in tutors' behaviour over the six themes in general, and between themes 1 and 2 and between themes 3 and 4 in particular. Looking in more detail at the evolution between the first and the second discussion theme, a decrease in contributions concerning 'access and motivation' is found in favour of an increase of units of meaning encouraging tutees' knowledge construction. In the transition from themes 3 to 4 on the other hand, an opposite trend can be noticed. In this respect, it can be concluded that there is some evolution in tutoring behaviour over time. However, this development is not consistent and does not reflect a gradual increase in higher levels of peer tutoring activities as reflected in the Salmon model.

To refine the analysis, two broad types of tutor communication within the Salmon model were identified. On the one side, tutors reflect social and emotional communication (SEC), which encompasses all tutoring interventions focusing on 'access and motivation' and 'online socialisation'. Secondly, the remaining types of e-moderating interventions are combined and labelled as communication about cognitive processing (CPC). To verify whether tutor interventions evolve from introductory and social talk to contributions reflecting cognitive processing and critical thinking, a univariate analysis of variance (ANOVA) was applied. The proportion of SEC-interventions was included as the dependent variable; discussion theme was included as the independent variable. The results reveal a significant upward trend in social and emotional communication and thus a significant downward trend as to the level of communication concerning cognitive processing throughout the six discussion themes ($F = 3.51$; $\mathrm{df} = 5$; $p < 0.01$). However, posthoc analyses (Sheffe's criterion), only reveal a single significant difference between the second and the last discussion theme ($p = 0.022$). These results question the idea of a gradual shift in the nature of tutoring behaviour and imply that each new discussion theme appears to require a mixture of different tutoring interventions.

5.3. Can tutor behaviour be regarded as tutor-dependent? Is it possible to distinguish different tutoring styles?

This question focuses on exploring tutoring styles on the basis of tutor behaviour during the subsequent discussions. To examine tutor profiles, cluster analysis was carried out. The purpose of cluster analysis is to derive a classification scheme for grouping a number of individuals or objects into clusters, so that individuals or objects within a cluster are more similar to each other than those from other clusters (Aldenderfer & Blashfield, 1984; Gore, 2000). The purpose of the analysis is thus to arrange objects into relatively homogeneous groups based on multivariate similarity (Gore, 2000). Since no a priori assumptions regarding the number of relevant clusters could be derived from the literature, an exploratory hierarchical cluster analysis was carried out. Hierarchical cluster methods proceed by stages producing a sequence of partitions each corresponding to a different number of clusters. They can be either 'agglomerative', meaning that groups are gradually merged until one large cluster is formed, or 'divisive', starting with all cases in one cluster, which is partitioned into smaller clusters at each stage. Hierarchical agglomerative cluster analysis techniques, as used in SPSS, start with each case representing a separate cluster. Cases close to one another, as assessed by their correlational Euclidean distance, or other similarity measures are joined, forming progressively more inclusive groups or clusters. This process is repeated until all cases form a superordinate cluster. A decision must then

Table 4
Results of the χ^2-analyses with regard to the evolution of the occurrence of contributions in the five categories (Salmon, 2000) as indicator of tutor behaviour over time

Evolution in tutor behaviour over time	χ^2	df	p
Evolution from theme 1 to theme 6	38.47	4	0.000
Evolution from theme 1 to theme 2	15.01	4	0.005
Evolution from theme 2 to theme 3	5.30	4	0.258
Evolution from theme 3 to theme 4	17.77	4	0.001
Evolution from theme 4 to theme 5	6.12	4	0.191
Evolution from theme 5 to theme 6	5.13	4	0.274

be made regarding which number of clusters best represents the data (Beauchaine & Beauchaine, 2002). In the present study, the Ward hierarchical method was adopted, which implies that within-cluster differences are minimized (Hair, Anderson, Tatham, & Black, 1998). The squared Euclidean distance was used as a similarity measure. To determine the optimal number of clusters, the agglomeration schedule coefficients were examined. For a good cluster solution, one should look at a sudden jump in the distance coefficient or a sudden drop in the similarity coefficient between two adjacent sets. In addition to reviewing the changes in clustering coefficients at each step, the number of clusters was also verified by visual inspection of the dendograms and of the individual and group profiles within and across clusters. The hierarchical cluster analysis was performed on 6 classification measures, reflecting tutors' process of moderating the asynchronous discussion groups. More specifically, the following variables were included in the analyses: the proportions of tutors' contributions in the different stages of e-moderating distinguished by Salmon (2000) (i.e. access and motivation, online socialisation, information exchange, knowledge construction, and development) and tutors' presence throughout the different discussion themes, as reflected in the total number of messages posted during the discussions. The data were not standardised prior to using the squared distance measure, since the scale measurements were comparable for all classification measures.

As to the results of the analysis, the agglomeration schedule indicates a large increase in the distance coefficients when moving from a three cluster to a two cluster solution. Therefore, a three cluster solution was chosen and consequently three tutoring profiles were distinguished, consisting of respectively 28.2%, 38.5%, and 33.3% of the tutors. Table 5 presents the mean scores and standard deviations of the six classification measures of each cluster. The profiles, labelled as 'motivators', 'informers' and 'knowledge constructors', are displayed in Fig. 2. Except for the rather rare occurrence of tutor contributions stimulating freshmen's personal development in all clusters, the clearly different course of the three profiles indicates that tutors' behaviour differs both in quantity and in quality of the contributions.

The first tutor profile ($N = 11$) is primarily characterized by a low level of presence in the ongoing discussions and a high proportion of contributions with regard to gaining access and stimulating freshmen to participate in

Table 5
Means and standard deviations of the classification measures per cluster (Hierarchical clustering)

Classification measure	Cluster 1 'Motivators' ($N = 11$)	Cluster 2 'Informers' ($N = 15$)	Cluster 3 'Knowledge Constructors' ($N = 13$)
Access and motivation	32.47 (4.80)	26.90 (4.14)	22.64 (6.31)
Socialisation	21.51 (4.30)	17.16 (4.24)	18.76 (6.51)
Information exchange	23.81 (5.56)	33.43 (4.71)	27.02 (4.83)
Knowledge construction	20.11 (5.38)	21.46 (2.93)	30.19 (4.91)
Development	2.09 (3.46)	1.05 (1.25)	1.39 (1.37)
Presence	12.00 (3.14)	19.72 (3.39)	18.86 (6.22)

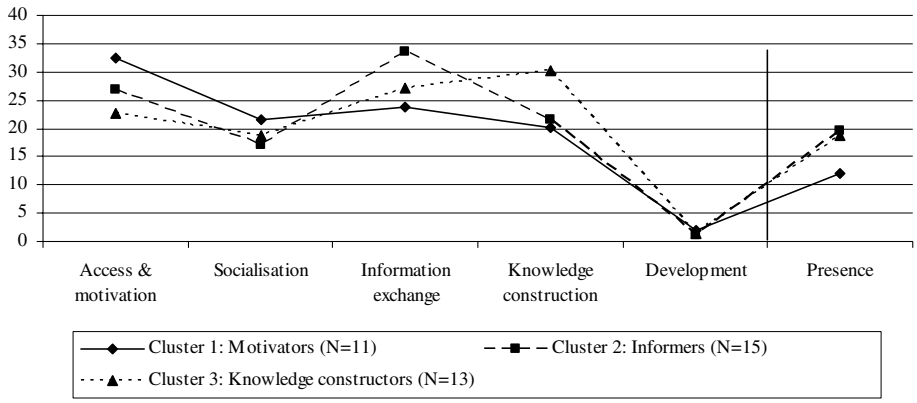

Fig. 2. Mean scores of the six classifications measures per cluster.

the asynchronous discussion groups. Further, tutors in this cluster show average proportions of online socialisation contributions, whereas postings reflecting information exchange and knowledge construction occur less frequently than in the other clusters. The second cluster ($N = 15$) shows a quite different pattern and is characterized by a high proportion of exchanging information tutoring behaviour on the one hand and a low proportion of online socialisation messages. This implies that these tutors attach great importance to illustrating the content with examples and their personal point of view, add alternative sources to the discussion, plan the discussion activities, and unravel and explain the learning task. The main focus of the third cluster of tutors ($N = 13$) is on eliciting knowledge construction. Further, these tutors demonstrate average proportions of contributions with regard to gaining access and stimulating participation and with regard to information exchange. A rather low engagement in contributions reflecting appreciation, confirmation, and commitment is shown.

Multivariate analysis of variance (MANOVA) was used to test the differences in tutoring types statistically. The tutor profiles were entered as independent variables to compare the five Salmon tutoring interventions and the degree of tutor presence in each cluster. Based on the Wilks' lambda criterion, the multivariate test shows a significant cluster effect ($F(10,64) = 8.454$; $p < 0.001$; $\partial\eta^2 = 0.569$). The corresponding ANOVA's also reveal significant effects on the proportions of tutors' contributions with regard to access to the learning environment and motivation ($F(2,36) = 10.942$; $p < 0.001$; $\partial\eta^2 = 0.378$), information exchange ($F(2,36) = 12.712$; $p < 0.001$; $\partial\eta^2 = 0.414$), knowledge construction ($F(2,36) = 19.615$; $p < 0.001$; $\partial\eta^2 = 0.521$), and tutors' presence throughout the discussion themes ($F(2,36) = 10.656$; $p = 0.001$; $\partial\eta^2 = 0.372$). No significant differences between the three clusters were found when considering tutor contributions about online socialisation ($F(2,36) = 2.303$; $p = 0.114$; $\partial\eta^2 = 0.113$) and development, ($F(2,36) = 0.765$; $p = 0.473$; $\partial\eta^2 = 0.041$). The $\partial\eta^2$ indicates that the clusters explain respectively 38%, 41%, 52%, and 37% of the occurrence of tutors' contributions with regard to access to the learning environment and motivation, information exchange, knowledge construction, and 37% of tutors' presence throughout the discussion themes. Significant posthoc analyses (Scheffe criterion) associated with the effect of the variable cluster are summarised in Table 6.

As recommended by Borgen and Barnett (as cited in Gore, 2000) and Gore (2000) the hierarchical cluster analysis, which can be regarded as a data exploration tool, was supplemented with a *k*-means partitioning method to confirm the previously established cluster solutions. The *k*-means clustering was performed with the same variables as in the hierarchical clustering (the proportions of tutors' contributions in the five stages of e-moderating and tutors' presence throughout the different discussion themes). The results showed three parallel tutor profiles, consisting of respectively 33.3% 'motivators', 53.8% 'informers', and 12.8% of 'knowledge constructors'. Table 7 presents the mean scores of the six classification measures of each profile as distinguished by *k*-means clustering. In both clustering methods most tutors fit into the second profile, which is mainly characterized by information exchange. The three cluster distribution for the two distinct methods of clustering is outlined in Table 8. For only 10 out of 39 online peer tutors, dissimilarity in the cluster allocation was observed between the hierarchical and *k*-means clustering.

In order to check whether the three distinguished tutoring styles are stable in time and thus mainly tutor-dependent, *k*-means clustering was performed on the three pairs of discussion themes. In this respect, the stability of the clusters throughout the tutorship is tested from the start (themes 1 and 2), over the intermediate (themes 3 and 4), to the closing discussion themes (themes 5 and 6). The results are presented in Table 9. The

Table 6
Overview of significant differences of the post-hoc analysis between the clusters per classification measure

Classification measure	Multiple comparisons			
	Clusters	Mean difference	Standard error	*p*
Access and motivation	1–2	5.57	2.04	0.033
	1–3	9.83	2.10	0.000
Information exchange	1–2	−9.62	1.98	0.000
	2–3	6.41	1.89	0.007
Knowledge construction	1–3	−10.08	1.80	0.000
	2–3	−8.73	1.67	0.000
Presence	1–2	−7.72	1.78	0.001
	1–3	−6.86	1.84	0.003

Table 7
Means of the classification measures per cluster (*k*-means clustering)

Classification measure	Cluster 1 'Motivators' ($N = 13$)	Cluster 2 'Informers' ($N = 21$)	Cluster 3 'Knowledge constructors' ($N = 5$)
Access and motivation	31.22	25.64	22.14
Socialisation	21.47	18.76	12.94
Information exchange	22.32	32.33	29.15
Knowledge construction	23.08	21.99	34.73
Development	1.91	1.28	1.05
Presence	12.00	19.73	20.53

Table 8
Cross-classification of the hierarchical and *k*-means clustering

	Hierarchical clustering			Total
	'Motivators'	'Informers'	'Knowledge constructors'	
k-Means clustering				
'Motivators'	9	0	4	13
	23.1%	0.0%	10.3%	33.3%
'Informers'	2	15	4	21
	5.1%	38.5%	10.3%	53.8%
'Knowledge constructors'	0	0	5	5
	0.0%	0.0%	12.8%	12.8%
Total	11	15	13	39
	28.2%	38.5%	33.3%	100.0%

Table 9
Means of the classification measures per cluster and per tutorship phase (*k*-means clustering)

Discussion theme	Classification measure	Cluster 1 'Motivators'	Cluster 2 'Informers'	Cluster 3 'Knowledge constructors'
Theme 1–2	Access and motivation	36.35	21.00	23.08
Starting phase	Socialisation	17.89	15.19	16.63
	Information exchange	23.95	39.14	26.34
	Knowledge construction	19.37	24.53	32.39
	Development	2.44	0.15	1.55
	Presence	18.58	31.44	20.18
	N	12	9	17
Theme 3–4	Access and motivation	34.46	21.48	12.89
Intermediate phase	Socialisation	18.52	14.29	34.36
	Information exchange	27.94	31.67	24.79
	Knowledge construction	18.22	30.63	27.17
	Development	0.86	1.94	0.79
	Presence	14.24	23.79	16.00
	N	21	14	3
Theme 5–6	Access and motivation	30.93	25.22	30.62
Closing phase	Socialisation	36.23	23.12	17.69
	Information exchange	19.65	33.53	16.49
	Knowledge construction	10.12	17.17	32.51
	Development	3.07	0.96	2.69
	Presence	6.71	13.82	8.33
	N	7	22	9

three successive cluster analyses all resulted in three final cluster centers matching to the overall three profiles of both the hierarchical and *k*-means clustering. Looking in more detail to the clustering centers and to the evolution within a cluster over time, it appears that in the last themes the 'motivators' show a predominant increase in socialisation (mean = 36.23) next to their constant high proportion of contributions with regard to gaining access and stimulating freshmen to participate in the asynchronous discussion. As to the 'informers', the tutor contributions remain mainly characterized by information exchange. However, in themes 3 and 4 they additionally show a high proportion of interventions in the fourth stage of e-moderating, namely eliciting knowledge construction (mean = 30.63). Finally, whereas tutors belonging to cluster 3 primarily focus on knowledge construction, they also fluctuate in the sense of having considerably more contributions aiming at the lowest stages of e-moderating beginning from the third theme.

Finally, to deal with the question whether tutor behaviour is tutor-dependent reflecting a tutor's preferred style, we controlled the cluster allocation at the start, intermediate and closing discussion themes for each individual tutor. In this respect it appears that 30% of the tutors do shift from cluster in all discussion themes. Sixty-five percent of the tutors keeps the same typology two times, while only 5% of the tutors reflect the same preferred style during the starting, the intermediate, and closing phase of their tutorship.

6. Discussion

The present study aimed at gaining insight into the tutoring behaviour of cross-age peer tutors in asynchronous discussion groups. Training was set up to allow peer tutors to adopt a rich mixture of tutoring behaviour that aims at shared knowledge construction and reflective behaviour in tutees. From the descriptive results it can be argued that cross-age peer tutors perform a blend of tutoring activities, with a slight predominance of giving additional information, clarifying the learning task, and planning activities.

With regard to the evolution in peer tutor behaviour, it can be concluded that the nature of the overall tutoring behaviour is not completely stable over time. The results more specifically point at peer tutoring as a dynamic process in which task specificity plays a role. This is consistent with findings from the literature on problem-based learning (Moust & Schmidt, 1998). The significant decrease in 'access and motivation' tutoring behaviour from theme 1 to theme 2 can be explained by the students getting acquainted with the CSCL learning environment. In the light of Salmon's taxonomical model, it was expected that from the third theme on more peer tutoring activities would be directed towards 'knowledge construction'. However, a significant decrease in this type of tutoring behaviour was observed when comparing discussion themes 3 and 4. This can probably be attributed to the nature of the fourth discussion theme. In this theme, all knowledge from the previous three themes had to be considered when solving the task. This discussion assignment was extensive and complex for the freshmen, necessitating the peer tutors to invest again in tutoring activities such as 'access and motivation' and 'information exchange'. This is in line with the findings of Solomon and Crowe (2001) who also observed how peer tutors convey a permanent sense of worry and a feeling of responsibility for ensuring that their colleagues addressed the objectives adequately.

Further, it was explored whether peer tutor contributions would evolve over time from introductory and social talk (SEC) to contributions reflecting cognitive processing and critical thinking (CPC). Univariate analysis of variance however rejected this prediction. This finding suggests that each new discussion theme requires a mixture of all types of peer tutor support as distinguished in the e-moderating model of Salmon (2000). The continuous importance of motivating and social interventions also confirms the lowest phases in the hierarchical structure of the model. In addition, the finding can be linked to the studies of others on non-peer tutor support (Billett, 1996; Garrison et al., 2000) who state that social and emotional presence are of continuous importance to foster cognitive processing. Next to these empirical and theoretical explanations for the initial e-moderating activities being conditional for future support, arguments can be added building on the nature of the asynchronous learning environment. First, tutors and tutees do not see and know each other while interacting. As a consequence building a feeling of community is a prerequisite in the text-based learning environment. Hammond (2000) therefore highlights that a communicative approach within online forums always remains both task-centred and personal. Second, it can be hypothesized that social and emotional communication is attractive tutor behaviour to start with during the first experience of helping peers. This can be connected to an opportunistic point of view in which some tutors primarily prefer to focus on socialisation

when intervening on the one hand and to peer tutors' difficulty to diagnose low levels of knowledge construction within the discourse on the other hand. As a result, they tend to agree with the contents of the discussion and thus praise when contributing. 'Students being too friendly to one another' has been mentioned by other authors to be a problem in e-learning settings (Bonk et al., 2004). These authors suggest providing online facilitators with reflection schemas or question guides in order to encourage tutor and tutee reflection. Thirdly, the discussion task might have been too complex and extensive to be able to deal with during the two negotiation weeks. The period might have been too brief for peer tutors to be able to go beyond a focus on communication to a more cognitive oriented focus. Additionally, since each discussion theme was based on a new body of knowledge, little transfer in contributions aiming at knowledge construction from a former discussion theme could occur (Schellens & Valcke, 2005).

In addition to the study of the evolution in peer tutor behaviour, the purpose of the present study was to explore whether different types of cross-age peer tutors can be distinguished in order to confirm the construct of personal tutoring style. Three distinct clusters emerged from the analysis showing quantitative and qualitative differences in the types of e-moderating as distinguished by Salmon (2000) and their presence during the discussions. In addition, comparable clusters were found along the successive discussion themes. The slight variability in cluster appearance over the different discussion themes as presented in Table 9 is an interesting finding since this confirms the notion of relatively consistent instead of completely consistent tutoring styles over time. Notwithstanding the small variation in the characteristics of the tutor styles throughout the discussion themes, it appears that for the majority of the peer tutors tutor behaviour can be regarded as tutor-dependent: 70% of the peer tutors holds on to their cluster in at least two phases of the tutorship. This finding confirms earlier research recognizing learning and teaching styles as individual, consistent, and measurable (Fahy & Ally, 2005; Grasha, 2002; Kolb, 1993; Pratt, 2002). As to the specification of each tutoring style, in the first cluster or 'motivators' profile we could observe few messages and low frequencies of knowledge construction oriented tutoring behaviour. This is in line with research of Pata et al. (2005) distinguishing a passive scaffolding cluster in which process and content scaffolding was performed less frequently than in the active scaffolding cluster. The low presence and high proportion of contributions with regard to 'access and motivation' might be related to the quality and/or the duration of the training provided to the peer tutors. This training might have been too restricted to stimulate a subgroup of peer tutors to go beyond a certain type of tutoring behaviour. Moreover, we could use information obtained from the cluster solution to optimise tutor training. For example, the pros and cons of all three tutor profiles as well as their expected influence on students' discourse acts could be outlined in more detail. As suggested by Gore (2000), it is advisable to consider the cluster study as a first step and not as an end in itself.

In summary, the present study affiliates with the idea of Lycke et al. (2003) that contextual circumstances may be reflected in tutor performance. However, the rather prominent differences in tutor activity do not seem overly contextual, but fairly appear to be the result of a person-related tutoring style. Nevertheless, more research is needed to replicate these results and to study the peer tutor typology in more detail. In this respect, additional attention should be paid to indicators of peer tutors' preferred style in online interaction, such as their role perceptions during activity and their efficacy beliefs.

7. Limitations, implications and directions for future research

The present study reflects 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 course in only one university setting. Future research should try to replicate the findings involving other student populations, and set up in alternative instructional settings or knowledge domains. Follow-up research could also focus on the question whether the peer tutor activities found in this study would be different for non-peer tutors.

The present research is also limited since solely quantitative approaches have been adopted in the research design. Content analysis has been used in order to gain insight in tutor's behaviour to support students' negotiation of subject-matter in asynchronous discussion groups. In order to increase the validity of interpreting the dynamics of online tutor action, triangulation of research methods is needed. Network analysis could, for instance, focus on the structure of the interaction that is (or is not) induced by the peer tutors. Tutors might be interviewed to study their perceptions about being/becoming a coach (Cossentino, 2004).

A third comment centres on the need for replication studies that focus on the validation of the content analysis instrument used in the present study (De Wever et al., 2006). A new content analysis instrument was developed for this study, based on the five-step e-moderating model of Salmon (2000). To our knowledge, no alternative analysis scheme is currently available to study the tutoring interventions in parallel. Future studies could aim at studying the concurrent validity of the applied instrument, and moreover, all subcategories could be explored separately to figure out their distinct appearance and evolution within and along the successive discussion themes.

Fourth, a shortcoming of the cluster analysis technique has to do with the fact that the selection of classification measures is critical for the results. Although there is no clear-cut rule of thumb determining the variables to include in a cluster analysis, Gore (2000) argues that studies guided by theory will have an advantage in specifying which variables are most likely to contribute to a meaningful cluster solution. The present study is built on Salmon's stages of e-moderating (Salmon, 2000). More specifically, the proportion of tutors' contributions in the different stages, and tutors' presence throughout the different discussion themes were included in the analysis. To validate the applied coding scheme based on the work of Salmon (2000) and the identified clusters, additional research employing alternative coding schemes is however necessary. Another critical issue in cluster analysis is how many clusters should be extracted. Since there is no generally accepted statistical criterion for this, the choice must primarily be based on the meaningfulness of the clusters. However, based on the agglomeration schedule coefficients and visual inspection of the dendograms, three well-defined tutor profiles could be discriminated.

Parallel to a number of methodological limitations, suggestions can be made that inspire follow-up research. Peer tutors differ in behaviour 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, discussion time per theme, degree of group cohesion, freshmen's level of prior knowledge, tutoring style, tutor's efficacy or role beliefs, etc.). With respect to individual tutor characteristics, it is also important to realise that although the peer tutors involved in the study are all fourth-year students, they do not represent a homogenous group. The following individual characteristics could be considered: gender, age, experience in working with groups, and ICT knowledge and skills. Accordingly, design characteristics such as the constellation of intervening alone while working in pairs and the preliminary training could have influenced the observed diversity in tutor behaviour. In this respect, future research should investigate the distinct as well as mixed effects of contextual circumstances on tutor performance in more detail since results are always better understood in the light of the background and setting in which they take place. Moreover, similar studies with larger sample sizes and a wider range of higher education tutors can help to better understand the impact of these inter-individual differences on peer tutor behaviour (Irwin et al., 2004).

The present study is to be considered as a pilot study. At present, the tutor typology should be regarded as exploratory and descriptive rather than as an explanatory typology that is grounded in a peer tutoring theory. More research is needed to confirm whether the number and the tutoring types are stable and are also to be found in other groups of peer tutors and other tutoring settings. According to Aldenderfer and Blashfield (1984), this cross-validation is important to verify whether the cluster solution found has a certain degree of generality. If the cluster structure in the present study is stable, similar clusters should re-emerge in the analysis of other samples.

Further, it will be interesting to examine the relationship between tutoring behaviour, the peer tutor typology and the nature, and the quality of the tutees' contributions in asynchronous discussion groups. These new studies could finally also focus on impact on the quality of the knowledge constructed in the discussion groups and the resulting performance on tests, tasks, or evaluation activities.

8. Conclusion

Although the findings of this study provide mixed evidence for the contextual influences of tutor behaviour, it is clear that they cannot provide robust support for the expected evolution in time when analysing tutors' transcripts. According to the results, tutors' interventions differ throughout consecutive discussion themes, but they do not significantly evolve from introductory and social talk to contributions eliciting cognitive processing and critical thinking. Whereas there is no apparent tendency in the orientation of tutors' contributions, the

results further reveal peer tutor behaviour as being tutor-dependent reflecting a tutor's preferred style. As a result of cluster analysis methods, the following tutor profiles were distinguished inspired by Salmon (2000): 'motivators', 'informers', and 'knowledge constructors'. Apart from future research on larger sample sizes and contextual influences on tutor performance, additional studies should also focus on exploring those three peer tutor styles according to more specific research questions.

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