Original article

doi: 10.1111/j.1365-2729.2007.00256.x

# Distributed collaboration activities in a blended learning scenario and the effects on learning performance

**M. Gerber,* S. Grund† & G. Grote***

*Department of Management, Technology, and Economics, Swiss Federal Institute of Technology, Kreuzplatz, Zurich, Switzerland
†University Zurich, Plattenstr, Zurich, Switzerland

**Abstract** The aim of this study was to investigate the nature of tutor and student online communication and collaboration activities in a blended learning course. The hypothesis that these activities are related to student learning performance (exam results) was tested based on the number of messages posted, as well as the nature of these messages (type of content transmitted in terms of course content-related, interpersonal and organizational activities). Descriptive results show that tutors were mainly involved in organizational tasks, whereas students communicated mostly at content-related and interpersonal levels. Student performance was not related to the quantity of tutors' activity, but to the quantity of students' activity. Closer examination of the nature of different activities showed that not only tutors' interpersonal, but also students' own content-related and interpersonal messages had an impact on students' learning performance. This study raises the possibility that the nature of messages is more important than their quantity. It calls into question former research, which has indicated the importance of the amount of activity while mostly neglecting to discriminate between the differences in nature of activities and which has based its findings almost entirely on subjective ratings for both activities and performance. Implications for evaluation of activities and design of personal support are discussed.

**Keywords** computer-mediated communication, cooperative/collaborative learning, evaluation methodologies, teaching/learning strategies.

## Introduction

Maintaining or even increasing learning effectiveness is an important question in distance education (Russell 1999). Based on situated learning and constructivist learning theory, learning effect resulting from interactions among students and between students and tutors has been examined and validated in online courses on various occasions (Jiang & Ting 2000; Swan *et al.* 2000; Shea *et al.* 2001). The positive findings are debatable, as only subjective ratings for both learning performance and interaction measurements were carried out. Only Picciano (2002) related interaction with actual learning performance. Further research using behavioural data was strongly recommended. More importantly, only quantities of activities were examined in previous studies, neglecting the actual nature of these activities (Rovai & Barnum 2003).

Besides computer-supported cooperative learning, personal learning support by tele-tutors and their contribution to learning effectiveness is of growing interest. Systematic evaluations of tele-tutoring are still missing, especially evaluations combining behavioural

Accepted: 26 July 2007
Correspondence: Marius Gerber, Swiss Federal Institute of Technology, Department of Management, Technology, and Economics, Kreuzplatz 5, 8032 Zurich, Switzerland. Email: mgerber@ethz.ch

and questionnaire data. From different case descriptions and classifications of tutor functions in computer conferencing (Mason 1991; Rossman 1999; Coppola *et al.* 2001), three tutor roles were identified: content-related, social and organizational support. An important step towards a more differentiated view on tutoring was taken by Anderson *et al.* (2001), who analyzed tutoring based on the model of critical thinking and practical inquiry proposed by Garrison *et al.* (2000).

The aim of this study was to analyze systematically tele-tutoring as a vital element of the learning context and student behaviour in a blended learning course at a university. The relation of the activities observed and learning performance of the students were investigated, using content analysis and survey methods.

## Theory

In the first section, research findings concerning interactions of tutors and students and learning performance of the students are presented. In the second section, work on tutor roles and previous category systems are discussed. Existing research gaps are outlined in both sections of the paper.

### Interaction and learning

Online distance education settings are capable of supporting all components of instructional processes, including interactions among students and between students and teachers. Such interaction is considered significant for successful learning by active learning models following situated learning theories (Vygotsky 1978; Brown *et al.* 1989; Lave & Wenger 1990). From a conceptual perspective, one would hypothesize that there are significant relationships between the amount of interaction and student learning process and performance. The positive relationship between interaction and learning performance has been clearly documented in traditional classroom settings (Powers & Rossman 1985). In web-based distance learning, a number of studies showed that students typically report increased learning (Jing & Ting 2000; Swan *et al*. 2000; 2001; Picciano 2002; Rovai & Barnum 2003) and satisfaction (Jing & Ting 2000; Swan *et al*. 2000; Hong 2002; Richardson & Swan 2003), depending on the quantity of interactions with peers and the instructor. However, usually both student–student and student–tutor interactions and performance were investigated with student self-assessments. Although the perception of students seems to be accurate in terms of (perceived) interaction and actual number of postings (Jing & Ting 2000; Swan *et al*. 2000; Picciano 2002), there is no empirical evidence to suggest that students can assess their performance accurately. Jing and Ting (2000) reported that perceived learning was weakly linked to the actual number of student messages and the average number of instructors' responses per student. Rovai and Barnum (2003) showed that active participation, operationalized by the number of messages posted by students, was related to perceived learning. Picciano (2002) linked actual interaction (number of messages) with actual performance (exam and written assignment scores). He found no overall relationship, but when learners were divided into a high/low interactivity group according to their interactivity level, students in the high interactive group had a higher score in the written assignment, though not in the final exam.

In previous studies, the amount of interaction was mostly examined (e.g. Swan *et al*. 2000; Shea *et al*. 2001). However, it can be predicted that not only the quantity of interaction but also its nature will be significantly correlated with learning performance (Shea *et al*. 2001; Rovai & Barnum 2003). Analyses of interaction patterns have already been carried out (Hara *et al.* 2000; Fahy *et al.* 2001; Aviv *et al.* 2003; Brace-Govan 2003; Lipponen *et al.* 2003), including, for example, length of the messages or exchange patterns. Nevertheless, most of these analyses do not take into account the nature of messages, e.g. whether the message content is relevant to the discussion or merely organizational. The nature of the messages, which is the type of content transmitted, is from now on referred to as 'quality' of the message. According to situated learning theories, it can be predicted that content-related discourse, participation and social, mutual exchange processes lead to greater learning performance (Vygotsky 1978; Brown *et al.* 1989; Lave & Wenger 1990). The importance of social tutor roles as well as social presence for student learning has been stressed by many authors (e.g. Richardson & Swan 2003; Swan 2003; Liu *et al* 2005). Shea *et al.* (2003) and Shea *et al.* (2005) measured the quality of activities by asking students questions about each dimension of the teaching presence of both tutors and/or students (instructional design and organization, facilitating discourse and direct instruction; see Garrison *et al.* 2000).

Shea *et al*. (2003) found strong correlations for each dimension of teaching presence with perceived student learning. Based on a factor analysis, Shea *et al*. (2005) later created two dimensions of direct facilitation – a revised category incorporating elements of both discourse facilitation and direct instruction – and instructional design and organization. Both dimensions were related strongly to perceived learning and feeling of connectedness. Shea *et al.* (2003) concluded that tutors' activities are even more important for students' performance than interactions with their peers, thereby supporting assumptions about the significance of student–tutor interaction in web-based learning emphasized by other authors (Jing & Ting 2000; Swan *et al*. 2000; Hong 2002). In general, student–tutor interaction was rarely surveyed and, if it was, with measures that did not go beyond subjective ratings. Behavioural data allows the investigation of the nature of the interactions and the role undertaken by tutors and students in the forum discussions, which will be presented in the next section.

### The role of online tutors

Much has been published about the design of online courses, didactic aspects of learning environments or the effectiveness of online learning (e.g. Swan 2003), and more recently, the concept of blended learning has also been incorporated (Kerres & de Witt 2003; Garrison & Kanuka 2004; Stubbs *et al.* 2006). The blended learning concept raises the issues of learning support for participants and online moderation; a requirement that has often been ignored in online instruction (Kerres *et al.* 2004). The research has focused so far more on integrated technical support tools ('intelligent tutoring systems') rather than on personal support (e.g. Hwang 2003; Ertl *et al.* 2006). The kind of personal support participants need in order to use tools appropriately and to learn efficiently remains unclear.

While there is a growing body of literature that discusses functions and roles of online instructors, detailed empirical analyses is missing (e.g. Collison *et al.* 2000; Salmon 2000). Out of the debate on teletutoring functions, three general roles have emerged: content-related, social and organizational support (Mason 1991; Berge 1995; Paulsen 1995). In the content-related function, a tutor provides information, gives explanations to critical concepts and leads the discussions. The social task of the tutor is to facilitate and maintain the interest and the motivation of the participants. The process of planning and designing class activities is an administrative function. Rossman (1999), Berge and Collins (2000), Coppola *et al.* (2001) and Liu *et al*. (2005) used survey research and interviews to investigate tutor functions. They reached consensus on the three roles described above but only a few, if any, guidelines were provided by which the tutoring could be assessed. Anderson *et al.* (2001) and Rourke and Anderson (2002a) based their work on the model of Garrison *et al*. (2000) and proposed that tutor's roles first be studied using content analysis. Similarly Aviv (2000) developed a framework to analyze the content of messages and the nature of student interactions. He identified three processes in asynchronous learning network discussions: social processes, response processes and reasoning processes. Heckmann and Annabi (2003) integrated the work of Garrison *et al*. (2000) and Aviv (2000) into a final framework consisting of four dimensions: social, teaching, cognitive and discourse. To summarize the studies presented, three main categories can be identified in each category system (content, social and organizational categories), but there is no consensus on a more detailed category system. Further content analyses with more detailed category systems applying to both tutor and student activities in combination with survey and interview data could provide a more complete picture of the role of the tutor and are strongly recommended (Rourke & Anderson 2002b; Brace-Govan 2003; Glenn *et al.* 2003).

### Research questions

This study investigated tutor and student activities using content analysis and questionnaire data. Subjective ratings were measured to achieve a complete picture of tutor and student activities. From the research and theory presented the following research questions were derived:

- What are suitable, detailed categories for tutor and student activities?
- How are these activities divided among tutors and students? Which roles do the tutors play?
- Is the quantity of tutor activities positively related to the learning performance of the students?

- Is the quality of tutor activities in terms of content-related and social activities positively related to the learning performance of the students?
- Is the quantity of student activities positively related to their learning performance?
- How relevant is the quality versus the quantity of student activities with respect to their performance?

## Method

A complex study of an existing semester-long blended learning course in corporate finance was carried out to obtain behavioural data, subjective student and tutor ratings and performance measurements during the whole course.

In the first week of the course, an extensive online user profile questionnaire (pre-test) was administered to the students. At the end of the course, an evaluation questionnaire was delivered to both tutors and students (post-test). Furthermore, tutors filled out coaching diaries detailing the different coaching activities they carried out and the time used for each of these. Students' learning performances were recorded with two measures: results reached in seven exercises during the course and final exam marks.

### Blended learning course (eCF) concept

The 'electronic Corporate Finance' (eCF-) blended learning course concept was designed to replace a classic classroom lecture (4 h per week, over a period of 14 weeks). The course content of eCF was stored in eCF-Basic. 'BSCW®-Basic Support for Cooperative Work' was used as collaboration platform. Nine content modules were subdivided into three to four learning units. During the autonomous learning phase (19 lectures out of a total of 28 lectures), an online-learning path guided students through the learning material. Elements of autonomous learning included reading assignments, exercises and self-assessments. Additionally, a database provided direct and self-controlled access to the entire course content. Interaction during the online part of the course was supported by BSCW®. Three asynchronous communication channels were assigned to specific functions of the course concept (blackboard channel, formal and informal forum). The course started with a short introductory event and two classic lectures followed by the online part, which lasted 10 weeks. During this period, students were divided into 12 classes of up to 24 participants. At the end of the term, six lectures were given by the professor.

Key course concepts were tele-tutors. Each class was supposed to get support during the online part of the course for *content*, *social* and *administrative issues* via online coaching in order to facilitate learning effectiveness. In the following the less ambiguous term 'interpersonal' instead of 'social' is used, to emphasize the focus on this subset of behaviour related to interpersonal, phatic actions in addition to course content or organizational actions. The basic documentation for the online coach was laid down in a coaching handbook. It was developed in accordance with Salmon (2000) reflection on e-moderating.

Students had to solve a maximum of seven individual test tasks and one group task to achieve a minimum of 30 points out of 45 points and to be accredited for the final exam. The exercise points served as an incentive for active student participation. The group task was a detailed case study that required working collaboratively.

### Data collection

Data on the course activities was gained through content analysis of the class discussions, questionnaire inquiries at the beginning (for students) and end of the course (for both students and tutors), as well as coaching diaries.

A category system for content analysis of messages in the different BSCW® communication channels was developed and implemented. The content of messages is referred to as quality of messages. Three tutor roles were taken out of the literature (content, social, organizational; see Anderson *et al*. 2001) and concept-based subcategories for a more detailed analysis were developed. The message unit was used as the unit of analysis (see Rourke *et al.* 2001b). Multiple coding was allowed, thus one message could have up to seven subcategories. For the final category system, the interrater reliability value of Cohen's kappa was $k = 0.79$.

The seven subcategories (from now on referred to as categories) were as follows (see Table 1):

1 *Course content-related* messages relate to course material/issues. They contain explanations of course material, presentations of specific issues,

Table 1. Coding scheme for the activities of the tutors and students.

| Category | Subcategory | Indicators | Examples |
|---|---|---|---|
| Content | Course content-related<br>Course exercise-related | Course content/material<br>Exercise content | 'I asked myself what the relation was in Unit 1.4 between. . .'; 'I have a problem with exercise 2: what should I do. . .' |
| Interpersonal | Course interpersonal-related<br>Interpersonal private | Course content/ organizational issues<br>Personal issues | 'A very good contribution! I'm wondering what others are thinking . . .'; 'Who was at the big party on Saturday and did you like it?' |
| Organizational | Organizational exercise-related<br>Organizational administrative<br>Organizational technical | Exercise organization<br>(Remaining) administrative issues<br>Technical issues | 'Dear all, exercise 2 is in the exercise file'; 'Today you should start unit 1.4'; 'The server crashed! The problem has been solved and the course is online again!' |

summaries of the discussion, and knowledge additions from diverse sources or clarification of content-related misunderstandings.

**2** *Course exercise-related* messages refer explicitly to the individual and group tasks: questions about the formulation of the task, references to specific issues in the tasks, hints on apparent difficulties or the pointing out of the relation to the course content.

**3** *Course interpersonal-related* messages try to maintain the interest, motivation and engagement of the participants. They refer to content-related and organizational messages: the encouragement of the participation and interaction between the students, enhancing mutual support, reinforcing contributions, drawing in others, seeking to reach consensus/understanding, identifying areas of agreement, attempting to maintain/keep the discussion alive, helping each other, and appreciation and emotional support.

**4** *Interpersonal private* messages do not concern content-related or organizational issues. They refer to personal communication, informal discussions, humour, jokes or small talk.

**5** *Organizational exercise-related* messages concern fixing deadlines, acknowledging the receipt of an exercise, questions about the handling of the exercises, uncertainty about the final exam/grading of the exercises or the coordination of the group task. These kinds of messages do not refer to content-related but organizational/administrative issues in the exercises.

**6** *Organizational administrative* messages neither concern the exercises nor technical aspects of the learning environment: setting the curriculum/class attendance, establishing time lines for the learning units, giving other instructions according to the coaching handbook, or handling notifications of absence because of illness.

**7** *Organizational technical* messages refer explicitly to technical issues of the course/BSCW®: problems with login, explanations of technical features of the learning environment, difficulties with downloads, problems with operation systems or transmission speed.

After having defined the categories in an iterative process using messages of one class, the communication of all 12 classes and all three communication channels was coded. For each message, seven binary decisions were required: the message contains/does not contain each of the categories. The total number of messages across the 10 weeks and 12 classes was 1805. Thus, 12 635 decisions were made by the coder, resulting in 2383 assigned categories.

## Participants

A total of 164 students – mainly of economics – participated in this study (39 women, 122 men). The average age was 24 years old (SD = 2.9). The students had 9 years' (SD = 3.6) of computer experience. On average, they rated their computer competence on a scale from 1 (no competence) to 100 (high competence) with 67

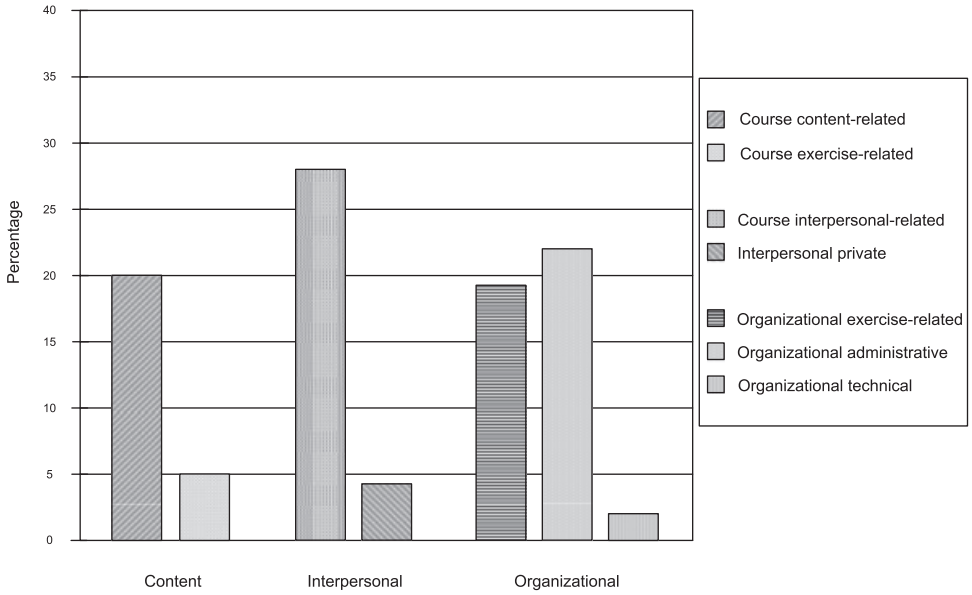


Fig 1 Percentages of categories observed in the messages posted by tutors.

points (SD = 16). Two-thirds of the students had no experience with Computer-Based Training (CBT) and Web-Based Training (WBT). Fifty-three per cent had worked with computer-supported cooperation tools such as BSCW®.

## Results

The results are divided into two parts: (1) descriptions of the activities of the tutors and students based on their activities in classes, the questionnaires and coaching diaries; and (2) examination of the relations between the activities and the learning performance of the students based on their final exam marks. Unfortunately, results showed that exercises in this course were too easy and an average of 44 out of 45 points was obtained by the students (SD = 1.57). Because of the low variance, it was decided to use only the final exam marks as an indicator of student performance.

### Tutoring activities

The 12 tutors posted between 72 and 122 messages with an average of 92 messages (SD = 25.6). The content of the messages was assigned to the seven subcategories. On average, 138 assignments (SD = 28.3) were made per tutor. The tutors wrote, on average, nine messages per week during the 10 weeks of the course. Altogether, 12 tutors wrote 1100 messages. In those 1100 messages, 388 (26%) content-related, 498 (33%) interpersonal and 623 (41%) organizational categories were identified. Counting all seven subcategories (see Fig 1), 20% of the tutor categories were course content-related and 5% course exercise-related. There were some course interpersonal-related activities (28%), but few interpersonal private ones (4%). Many categories were organizational exercise-related (19%) and organizational administrative (22%). Few categories were of technical content (2%).

The analysis of the coaching diaries showed that on average, tutors spent a total of 78 h on coaching activities (SD = 19.5). The largest part of this time was spent with administrative tasks (34 h/44%; collecting the exercises, other administrative tasks). The work in BSCW® took 29 h (37%; reading and writing). The remaining 15 h were required for emails (11%, reading and writing), meetings with other coaches (6%) and face-to-face appointments with the class (2%).

The answers in the tutor questionnaires corresponded with the behavioural data and the coaching diaries, as the organizational and administrative tasks were rated as especially time-consuming. On a 6-point scale (1 = very low to 6 = very high), the tutors rated that the time used for the correction of the exercises (M = 4.17; SD = 1.47) and especially for the group task (M = 5.08; SD = 0.9) was high. The time spent for answering

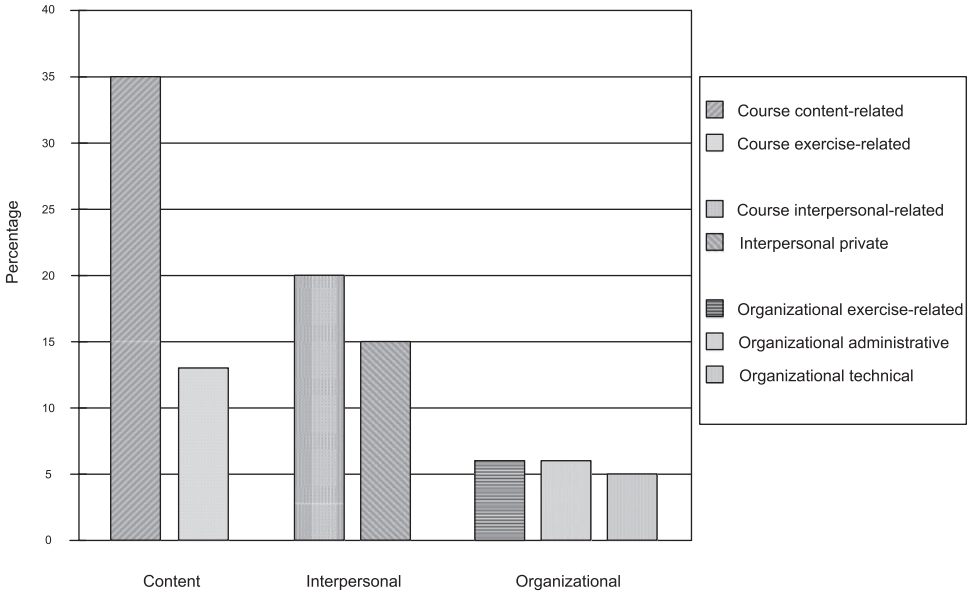


Fig 2 Percentages of categories observed in the messages posted by students.

general course-related questions (M = 3.75; SD = 0.75), specific course material-related questions (M = 3.58; SD = 1.16), for the collection of the exercises (M = 3.33; SD = 1.78) and organizational/administrative questions (M = 3.33; SD = 1.5) was moderate.

The analysis of the tutor assessment of the communication and cooperation in the classes (rating agreement on statements on a 5-point scale with 1 = fully correct to 5 = not correct at all) confirmed that few content-related discussions had occurred in the classes. The tutors felt that they had been successful in stimulating (content-related) communication (M = 3.17; SD = 0.83) or cooperation (M = 3.08; SD = 1.08) in their classes only in part. In their opinion, cooperation took place in BSCW® to a small extent (M = 3.08; SD = 0.9) and few interesting discussions that resulted (M = 3; SD = 0.85). The tutors felt that no sense of belonging to a group had developed in their classes, neither via BSCW® (M = 3.83; SD = 0.72) nor face-to-face (M = 3.58; SD = 1.08).

### Student activities

In total, 11 classes were included in the evaluation of student activities. One class could not be assigned individually to the students. The students wrote 681 messages altogether and these contained 781 categories. In total, 377 (48%) categories were content-related, 276 (35%) were interpersonal and 128 (16%) were organizational (see Fig 2). The students often wrote not only course content-related messages (35%) but also many messages referring to course exercise-related categories (13%). The interpersonal subcategories were equally distributed across course interpersonal-related (20%) and interpersonal private (15%). The organizational subcategories were equally distributed across organizational exercise-related (6%), organizational administrative (6%) and organizational technical (5%). During the course, the students wrote on average five messages, containing on average five subcategories.

### Comparison between tutor and student activities

A comparison of the categories content, interpersonal and organizational showed that the tutor activities contained many more organizational categories (57%) than the students' (19%). Instead the latter contained more content-related categories (55%) compared with 35% for the tutors (see Table 2).

### Activities and student learning performance

The quantity of tutor activity (number of messages per tutor) was not significantly correlated with the

Table 2. Absolute/relative frequency of the three categories of the tutors and students (referring to the number of postings), $n = 2290$.

| | Content | Interpersonal | Organizational |
|---|---|---|---|
| Tutors | 388 (35%) | 498 (45%) | 623 (57%) |
| Students | 377 (55%) | 276 (41%) | 128 (19%) |

The sum of the percentages is higher than 100% because of multiple codings.

Table 3. Correlations for the three activity categories of the tutors/students and the final exam marks of the students.

| | Content | Interpersonal | Organizational |
|---|---|---|---|
| Tutors | 0.01 | 0.58* | 0.27 |
| Students | 0.31*** | 0.21* | 0.10 |

$n = 12$ for the tutors; $n = 152$ for the students.
*$P < 0.05$; ***$P < 0.001$.

performance of their students (average exam marks) $r = 0.11$ ($P > 0.05$). Regarding content of tutor activities, it was found that interpersonal activities were positively correlated ($r = 0.58$, $P < 0.05$) with student performance (see Table 3).

Student activities in terms of quantity yielded a significant correlation of $r = 0.29$ ($p < 0.01$) to the final exam. It seems that active students tended to perform better in the final exam than their less active classmates. An examination of the correlations between the different categories per student and performance showed that students with many content-related or interpersonal activities also tended to achieve better levels of performance ($r = 0.31$ and $r = 0.21$, $p < 0.05$) (see Table 3).

Furthermore, stepwise regression analyses were conducted to clarify the importance of student activities for their learning performance with the control variables age, number of semesters, gender, number of years of computer experience, subjective rating of computer knowledge, number of CBT and number of WBT courses attended. The regression with all control variables and all seven subcategories showed that course content-related activities ($\beta = 0.28$; $P < 0.05$), organizational technical activities ($\beta = -0.18$; $P < 0.05$) and number of semesters ($\beta = -0.19$; $P < 0.05$) accounted altogether for 12% of the variance of the final exam marks. The beta weight for course content-related activities is positive, while for organizational technical activities and for number of semesters the beta weights are negative.

## Discussion

The different data sources gave a detailed and consistent picture of tutor and student activities. The category system was applicable to analysis discussions and provided reliable results. The time needed for this type of analysis is balanced out by the number of advantages it provides. The analysis can be used for diagnosis of teaching problems and improvement of tele-tutoring. It is equally well equipped for analyzing student behaviour and can be embedded in the evaluation of course design.

Possible explanations, comparisons with previous studies and implications are discussed in the following sections.

### Tutoring and student activities

The analysis of tutoring showed that the tutors acted mainly as organizers. On the interpersonal level, tutors were less active, which is a particularly relevant result because it was also found that only tutor interpersonal activities were related to student performance. The tutors communicated even less on the content-related level. The answers in the questionnaire as well as the coaching diaries verified that the tutors saw themselves mainly as ‘organizers’ or ‘coordinators’.

The results corresponded only partially to the existing research literature. Anderson *et al*. (2001) and Rourke and Anderson (2002a) found in their online courses that tutors mostly showed content-related activities. Reasons for this difference may be found in the different conceptions that exist of the tutor role, but also simply because of the fact that in their courses only one tutor was studied.

The subcategories provide possibilities for a more detailed analysis of tutoring activities. The tutors carried out more course content-related than course exercise-related activities. This result can be explained by the fact that exercises were quite easy and did not require special support. The tutors sent more course interpersonal-related than interpersonal private

messages, which probably resulted in a low social presence. Tutors handled many organizational exercise-related and organizational administrative issues, but dealt with few technical questions. The former may have happened because of the coaching handbook and the obligatory exercises. Many questions were handled by the formal technical support person by email. On the basis of these results, in future course design the organizational burden of the tutors should be reduced in order for them to have more time for content-related and interpersonal issues.

The activity of the students in this course was mainly content- and interpersonal-related. Messages with organizational categories were rare. These results were in accordance with the concept of the course developer. However, every third student wrote no message at all. Based on this fact, the issue was raised with the course developer as to how these students could be motivated to participate more actively and to a greater extent on a content-related level. Increasing participation in online communities, especially those of lurkers, is an area of growing interest (e.g. Preece *et al.* 2004; Bishop 2007). The subcategories showed that students sent course content-related messages most of all and an approximately equal amount of course interpersonal-related and interpersonal private messages. Given that both types of activity were found to be related to student performance, it appears that students developed sensible activity patterns, though overall, not much activity happened from their side.

**Activities and student performance**

The quantity of the tutors' activities was not related with the marks of their student classes. This result contradicts existing research that emphasizes the importance of the tutors' activity (in terms of its quantity) for student performance. However, earlier research was usually based on subjective ratings. There, the tutor activity – student performance relation seems to disappear when measured using behavioural and objective data. Mazzolini and Maddison (2007), who measured activities in terms of postings, even found that the number of tutor postings was negatively related with the number of student postings and length of the discussion threads. On the one hand, it could be suggested that the number of messages is not an adequate measure of interaction. Research missed to discuss the problem of operationalization of interactions so far. On the other hand, subjective ratings usually used to measure interactions are probably prone to attribution failures, as well as Hawthorne-effects (Roethlisberger & Dickson 1950). As mentioned above, proof that students can adequately assess their performance is still missing. Furthermore, different course concepts have not sufficiently been taken into account up to now. The more comprehensive inclusion of contextual factors would better enable future results to be compared.

This study points out the possibility that the content of the messages is more important than its quantity. Surprisingly, it was not the content-related message, but the interpersonal message that turned out to have a strong relation to the final exam marks of the students. As for the missing relation between content-related tutor activities and student performance, it can be assumed that the type of content-related activity has to be differentiated. Tutors may have communicated factual knowledge mainly and induced not so much higher type of cognitive learning. According to Bloom (1956), it is necessary to achieve the stages of analysis, synthesis and evaluation to enhance cognitive performance. However, this study has not differentiated between different types of content-related activities. In fact, the rater of the postings confirmed that the content-related messages of the tutors referred a great deal to the transmission of factual knowledge of course content, which in Blooms' classification would apply to the stages of 'knowledge' or 'comprehension'. Concerning the relation between tutors' interpersonal messages and students' performance, it can be assumed that the interpersonal messages of the tutors as a form of motivational support promoted interactions between the students, enhanced their occupation with the course material and, as a consequence, also their learning performance. Active participation, high involvement and exchange processes among participants should lead to a greater learning performance and shared knowledge according to situated learning theories. The social presence in the classes was also probably increased by the interpersonal messages of the tutors. The construct of social presence has received great interest in recent times and seems to be of crucial importance for the success of online courses (Gunawardena 1995; Gunawardena & Zittle 1997; Tu 2000; Rourke *et al.* 2001a; Picciano 2002; Tu & McIsaac 2002; Richardson & Swan 2003; Swan 2003; Baker 2004). Thus, the

interpersonal messages of the tutors may have enhanced the performance of the students by increasing the social presence in their classes. These results should influence the training/instruction of tutors: to prepare them better for their interpersonal function within the class – to create (teacher) immediacy, a sense of social presence, as well as offer encouragement to the participants (Rourke & Anderson 2002b; Aragon 2003; Shea *et al*. 2005; De Smet *et al.* in press). This claim gains an even higher level of importance in light of recent research, which has clearly shown that tutors are often not aware of their social role and its possible contribution to student learning in online teaching (Conrad 2004; Liu *et al*. 2005).

Shea *et al*. (2003) related the content of the activities of tutors and students with (perceived) performance. They found that all three categories (content, interpersonal and organizational) were equally related to performance (between $r = 0.58$ and $r = 0.61$, $r < 0.001$). Categories and performance were both rated subjectively by the students, the behaviour of the tutors was also rated by the students. In the latest study (Shea *et al*. 2005), it was found that direct facilitation and instructional design and organization are both related to perceived learning ($r = 0.78$ and $r = 0.73$, respectively) and connectedness ($r = 0.61$ and $r = 0.48$, respectively). The missing relation between the content-related categories and performance of the students found in our study may be due to the fact that it was not the task of the tutors to impart course content to the students in our study. Unfortunately, the coaching concepts in Shea *et al*. (2003) and Shea *et al*. (2005) are not described and more information would be needed concerning the tutor/course concepts to compare results in detail.

In terms of its quantity, the activity of the students seems to have some importance as regards their performance. More active students tended to be more successful in the final exam as opposed to their less active classmates. This corresponds to the idea that students should be rewarded for their participation in the forums. Rovai and Barnum (2003) made an interesting observation supporting our findings. They showed that only active participation, but not passive interaction (frequency of access to the course discussions per student), was a significant predictor of perceived learning. Similarly, many students read but did not actively participate in the present course. Preece *et al.* (2004) reported in accordance with Rovai and Barnum (2003) that lurkers benefit less from the online community than posters. Altogether, the present results do not confirm the suggestion that lurkers can gain a lot from their interactions with others, rather that their non-contribution seems to be detrimental as regards their learning performance.

The content of the students' messages was also related to their performance: content-related and interpersonal messages correlated significantly with student performance. The relationship with the content-related activity would especially be expected. The regression analysis, indeed, showed that only the course content-related categories were significant predictors.

## Conclusions

Further content analytic studies should be carried out to replicate the results of the present study and to validate the category system. The categories introduced in this study can be used to diagnose problems in online teaching and to identify 'good' tutoring. In the future, more specific hypotheses should be examined. Social presence measures should be added and related to the tutoring and performance outcomes. Rather than testing hypotheses about the effects of tutoring per se, future efforts should establish the conditions under which assumptions grounded in social learning and situated learning theories approaches hold.

Age, number of semesters, gender, computer experience and number of CBT/WBT courses attended were controlled, but the search for further personal intervening variables (e.g. learning time, self-efficacy, learning/communication styles) which determine the performance of the students should be taken into consideration. Only a small part of the variance of performance could be explained with the activities of the students and tutors during the course. Looking at teletutoring, we examined only one aspect of the context, in which learning took place. In the future, underlying course and tutor concepts should get greater attention in order to achieve more comparable results.

We measured elements of interaction and combined them with survey data, as recommended by Rourke and Anderson (2002b). The operationalization of interaction, however, remains a crucial problem. The present study focused on activities and the content of these activities. Future research should not only combine behavioural and questionnaire data to investigate the

nature of activities, but at the same time focus on the interaction patterns of these activities (e.g. Schrire 2006; Liu & Tsai, in press). Finally, as long as the students do not see a relation between their activities during the online course and their performance at the end of the course, they will not be motivated to participate more in their classes – which is a waste of opportunities especially in a blended learning scenario with many different learning settings.

## Acknowledgements

The authors would like to thank the eCF-get involved team for their constructive cooperation and their openness towards critical self-assessment and evaluation.

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