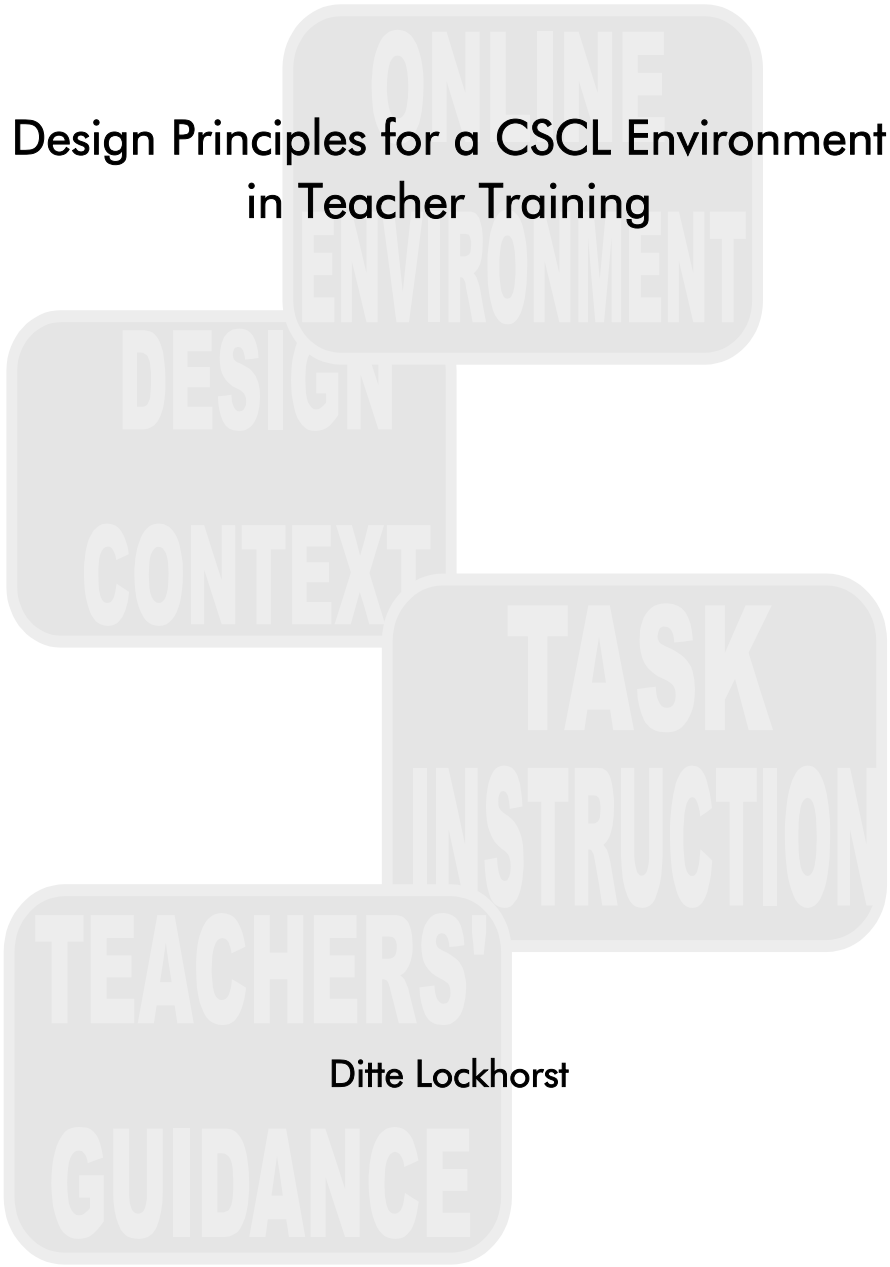
Design Principles for a CSCL Environment in Teacher Training



Ditte Lockhorst

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Design Principles for a CSCL Environment in Teacher Training

Ontwerpprincipes voor een CSCL-omgeving in de lerarenopleiding

(met een samenvatting in het Nederlands)

Proefschrift

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Chapter 1: Introduction

The identification and description of the principles for an effective design of a Computer-Supported Collaborative Learning (CSCL) environment, in which student teachers learn collaboratively, is the research problem reported on in this book. In our research, we studied student teachers' learning in interaction and collaboration with others, which has become an important way of learning in teacher training. We regard CSCL a way to enhance the construction of knowledge in peer interaction and collaboration by means of technology, a way for sharing and distributing knowledge and expertise among community members, and a way to facilitate group processes in manners not achievable in face-to-face (F2F) communication.

The role of ICT in teacher training is twofold: from a programmatic perspective it is a way of meeting a growing diversity in the enrolment of students by creating flexibility in their training, and from a didactical perspective it facilitates the learning processes and prepares the student teacher for the pedagogical use of ICT in the professional practice (Dillemans, Lowyck, Van der Perre, Claeys, & Elen, 1998; Inspectie van het Onderwijs, 2002).

Three teacher training courses[1], in which small groups of students[2] worked together on collaborative assignments, were studied. These courses were given in the teacher training programme of IVLOS, the Institute of Education of Utrecht University in the Netherlands.

1.1 Occasion for the Research

> "So, they [the students] use the possibility to communicate at a distance, which saves time, and they also use each others' expertise and professionalism. [Why is the implementation of ICT in teacher training important?] Firstly, because students have to work for themselves with ICT as a teacher. Secondly, you cannot go without it. Not as a teacher, but neither as a human being. Thirdly, it offers you other possibilities than the traditional pedagogical ways of teaching.

[1] Although the units of study of the teacher training programme are not courses in the strictest sense of the word, we choose to label them as such for purposes of readability.

[2] We will use the terms 'student' and 'student teacher' for the student teachers from the training programme. Both 'teacher' and 'teacher educator' denominate the teacher educators of the programme.

> Fourthly, it offers the possibility of distance education, which can be an advantage in these times of people, many routes, the need for flexibility. With ICT you can do things you cannot do with other ways of learning. Distance learning also belongs to this, for instance uploading a document and instantly discuss and change it. Or using, downloading each other's lesson materials. You can find information on the Internet which you will not find elsewhere. [...] Virtual sites or models have a surplus value. Email is an easy accessible way of communication. [...] Those three are important in secondary education and teacher training. For teacher training it is very important to create distance-learning possibilities. It does not require more of the teachers' time, but it simplifies the students' learning process and offers more flexibility.
>
> [...] It is a challenge, ICT and collaborative learning. [...] ICT does have its limitations. Eventually, I ended up with the expert model in telematic collaborative learning situations every time. I need to be more creative to exploit the ICT possibilities. Collaborative learning is very important for teachers. [...] You need to collaborate more than you did before as a teacher. And we [the teacher training programme] should model the use of ICT and collaborative learning."

This statement of one of the teacher educators involved in this research, illustrates the three prevailing reasons for stimulating the use of an e-learning environment[3], more specifically a CSCL environment, in teacher training. These reasons are, (1) exploit the possibilities of learning and training in ways other than the traditional ways of learning, (2) prepare students for pedagogical usage of ICT in their professional practice, and (3) create flexibility in the teacher training programmes to meet the diversity among the students.

The teacher training programmes have gone through a transition towards ideas on training based on social constructivist ideas. Active and authentic learning is important, realised in a strong link between theory and practice. Learning in collaboration and interaction with others has become the main way of learning (IVLOS/Institute of Education, 2002). The use of e-learning in teacher training should be stimulated to facilitate this way of learning. Moreover, to prepare students for their future work at schools increasingly oriented on (social) constructivism as a leading theory of learning and teaching, it is inevitable that teacher training itself functions according to the principles of constructivism. To create congruency between teacher training and the principles guiding modern secondary education, teacher trainers must have the competence to adapt to the per-

[3] In this book, an e-learning environment is referred to as an environment in which a broad array of ways of learning may take place, supported by hardware, software and staff, using the Internet to connect the learning environment to homes and places of work and training (Klas, 2004). In this study the conditions and arrangements of the e-learning environment are focused on support of the formal learning process (Rubens, 2003).

sonal needs of their students and to the characteristics of 'New Learning' (Simons, Van der Linden, & Duffy, 2000a) in the schools.

Second, the students have to be prepared for the pedagogical use of ICT in their professional practice. In the Netherlands, there is a gap between the technological situation in the schools, which are increasingly integrating technology and providing increased access to students and teachers, and the level of competence of graduating students in the teacher training programmes. By order of the Dutch Ministry of Education a quick scan research was performed on successful and potential applications of ICT in teacher training. The results of the quick scan show the top priorities of both teachers and the teacher training programmes to be: to ensure teachers become competent personal users of ICT, competently using ICT as a mind tool, mastering a range of educational paradigms using ICT, and competently using ICT as a tool for teaching. One of the educational paradigms the beginning teacher should be competent in is the use of e-learning environments for asynchronous and synchronous collaboration (Inspectie van het Onderwijs, 2002; Kirschner & Selinger, 2003). To prepare student teachers for their pedagogical tasks, they should experience the use of appropriate e-learning throughout their training programme, as one required class is inadequate to prepare teachers to use technology effectively (Boshuizen & Wopereis, 2003; Casey, 1994; Inspectie van het Onderwijs, 2002; Pryor & Bitter, 1995; Resta, Christal, Ferneding, & Kennedy Puthoff, 1999; Strudler, McKinney, & Jones, 1994). Teacher training programmes should teach what they preach. At IVLOS, both management and teacher educators support the idea of modelling ICT usage, in order to stimulate the transfer of the student teachers' ICT experiences during their training to the use during their professional career.

A third reason for using CSCL in teacher training is that, as a consequence of the varying initial backgrounds and demands of students entering teacher training, there is a need for flexibility of the programme. Participants of university teacher training programmes can be classified into three groups: (1) students who want to obtain their teaching certificate during their initial study at the University, (2) students who have finished their study in a certain discipline and are already working as a teacher but still lacking a teaching certificate, and (3) a growing group of people who see teaching as a second career. Being committed to family and home situations or having obligations to the schools they are working at, it is difficult for the students of the latter two groups to adapt to the usual circumstances of teacher training. This diversity of students originates from a shortage of professional teachers in secondary and primary education, which forced the Dutch government and the teacher training programmes to consider and implement new, flexible ways of training (Beijaard, Verloop, Wubbels, & Feiman-Nemser, 2000; Korthagen, Klaassen, & Russel, 2000; Rijlaarsdam, 2003; Stijnen, 2003). At IVLOS too, we find ourselves facing a growing diversity of stu-

dents. Groups consist of students with diverse backgrounds and working situations, which complicates F2F interaction and collaboration. Both the need for more time and place independent learning and the need for using these different backgrounds of student teachers in the learning process were reasons for studying the possibilities of CSCL applications to support the training of diverse groups of students.

CSCL can be useful in teacher training, as argumented above. However, the use in teacher training is limited. In 2003, most Dutch teacher training institutes purchased an e-learning environment (Ministerie van Onderwijs en Wetenschappen, 2003), Blackboard (http://www.blackboard.com) and WebCT (http://www.webct.com) being the most common. Many teacher training institutes, of both universities and colleges for Higher Education, use these e-learning environments for organizing courses and communication between students, teachers and the institute. Commonly, the application is used as a discussion platform for the exchange of classroom experiences and the guidance of students during their practical training periods in the schools (see for example studies of Admiraal, Lockhorst, Wubbels, Veen, & Korthagen, 1998; Angeli, Valanides, & Bonk, 2003; DeWert, Babinski, & Jones, 2003; Whipp, 2003). In the Netherlands, the use of digital portfolios is a popular way to integrate e-learning in teacher training (Van der Neut & Vreugdenhil-Tolsma, 2002). E-learning applications in which parts of the teacher-training programme are facilitated by ICT are rare. Often, as is the case at IVLOS, preparing students for professional usage of ICT is fragmented and depends on initiatives of individual teacher educators (Van der Neut & Vreugdenhil-Tolsma, 2002). At the start of our research in 1999, initiatives to use an e-learning system were only just being taken. A few teacher educators experimented with the use of an e-learning environment as a way of guiding their students during the students' practical training period. Other teacher educators were quite sceptical at that time. The development of educational applications of e-learning environments has since become relevant at IVLOS. In 1998, IVLOS started the project 'Telematic Learning Environments in Teacher Training', funded by the Dutch Ministry of Education, in which framework the present research was initiated. One of the aims of the project was to provide ICT support to parts of the IVLOS teacher training programme, using an e-learning environment. A particular focus was the use of ICT in parts of the programmes, which had the students collaborating on tasks, in other words, the design of CSCL environments. Our research, which was linked to this project, included the design and evaluation of the CSCL environments used. Two of the three courses, which were subject of study in this research, were part of this project. The third course was developed outside the framework of the project, but its design was based on the other two courses.

Presently, in 2004, the use of WebCT and Blackboard is widely spread at IVLOS. They are used for the organisation and communication with the students, the used e-learning environment facilitating parts of the programme. Various teacher educators and groups of students are now using parts of the courses we studied. A transition to having substantial parts of the programme entirely online has not taken place.

1.2 Relevance

The relevance of this research is twofold. Firstly, it was undertaken to identify and describe a wide spectrum of principles for an effective design of a CSCL environment in teacher training. Secondly, it was carried out to contribute to the training of student teachers.

1.2.1 Scientific Relevance

Many studies focus on the process of knowledge construction (Lipponen, 2001). Our work concentrates on the process of students' interaction, as we consider this interaction process the foundation of the knowledge construction process. We adopted an integrative approach to study the interaction in a CSCL environment, as we agree with Kanselaar, De Jong, Andriessen, and Goodyear (2000) in that the CSCL environment should be studied as a complex unit of factors. Our research attempts to contribute to a better insight in the whole range of aspects of a digital pedagogy of CSCL as has been called for (see for instance Bronkhorst, 2003; Simons, 2002). We studied the students' interaction in terms of participation, and the nature of the interaction in terms of cognitive, regulative, and social aspects. We also studied the reasons for the students' interaction, taking into consideration task instruction, teachers' guidance, online environment and all kinds of aspects of design context, such as the student himself[4] and the intra-group relations. We particularly focused on the task instruction, an aspect less studied in CSCL research, but which has received much attention in research on collaborative learning (Cohen, 1994). To gain insight into the effects of task instruction, we used different ways of instruction, varying in the character of the task, the structure of the task, and the group composition.

In Chapter 2 it is indicated that there is a relatively limited amount of information on the use and design of CSCL environments in teacher training. Student teachers are a specific group of students, who learn in practice, often concern

[4] Whenever we use 'he' in relation to persons in a general meaning, one can equally read 'she'.

based. With this research we aim to generate information about the possibilities and design of CSCL environments in the training of this type of students.

1.2.2 Relevance for Training Student Teachers

This study aims to contribute to the innovation of teacher training by exploring the way we should design CSCL environments in teacher training. Concretely, the present research provides information on how task instruction, group composition, and teachers' guidance influence the CSCL in teacher training and how these aspects should be designed to create an effective learning situation. Our research should also generate information as to the requirements of the electronic learning environment and how all sorts of aspects of the design context relate to the CSCL process of the students.

By using digital means in parts of the teacher training programme and providing students with the possibility to experience using e-learning in learning situations, we aspire to contribute to improving the training of starting teachers by better adjusting the level of competence of graduating students in the teacher training programmes to the pedagogical use of technology in the schools, which are increasingly using all kinds of forms of e-learning.

By having parts of the teacher training programme supported with ICT, students are able to follow their training independent of time and place. At IVLOS, for instance, several teaching methods are based on peer supported learning, collaborative learning, and learning in tutor groups (IVLOS/Institute of Education, 2002). Thus, it is customary that students collaborate on tasks, and reflect on their daily experiences at school in peer groups. As e-learning applications allow for training different groups of students simultaneously, the teacher training programme is even able to use the heterogeneity among the students in its training situations.

1.3 Research Methodology: Main Points

To explore the design principles of an effective CSCL environment in teacher training, we applied the methods of design research (as for instance described by Van den Akker, 1999; Shavelson, Phillips, Towne, & Feuer, 2003), in order to generate, make explicit and evaluate design principles. Three designs of CSCL environments were implemented in three different courses. The research method was iterative of nature. For the first study, we designed a CSCL environment based on literature and an expert consultation. The second and third designs are based on the (preliminary) evaluation of the former. The designs were developed in collaboration with the teacher educators of the courses.

We used both qualitative and quantitative data to answer our research questions. The linkage between both kinds of data enables us to confirm our results by triangulation, a typical process in design-based research (The Design-Based Research Collective, 2003), and to develop or elaborate the analysis, providing richer detail (Miles & Huberman, 1994). The three designs were evaluated similarly. For this purpose, student teachers completed questionnaires and were interviewed. The teacher educators involved were also interviewed, and the electronic communication saved and stored. The questionnaires and interviews were used to gather information on the student teachers' and teacher educators' evaluation of the collaborative process, and on the relation between the design elements and this collaboration. The content of their electronic communication is used to analyse the student teachers' collaboration and the role of the teacher educator in it.

1.4 Organisation of the Book

The dissertation focuses on the identification and description of principles for an effective design of a CSCL environment in teacher training. This chapter explains the reasons for the research.

In Chapter 2, we describe our theoretical framework of CSCL, leading to further refinement of the research problem into five research questions. The study of theoretical concepts and notions from research in the fields of CSCL and collaborative learning resulted in the operationalisation of three clusters of design elements (task instruction, online environment and teachers' guidance) in the design of CSCL in teacher training. The literature appeared to be too limited to fully operationalise our design clusters. Consulting three experts in the field of CSCL in Higher Education and teacher training assisted us in further refining the operationalisation of the design variables. Chapter 3 presents the results of this consultation, next to the designs of the three courses we studied in our research, and the implementation of these designs.

Chapter 4 describes the research method, dedicating a major part to the development of the instruments we used. Important instruments are a coding system for the analysis of the interviews with the student teachers and teachers educators, and a multi-perspective method for analysing the electronic communication, including five perspectives of analysis: the frequency of participation, the nature of the communication, the interaction patterns, the level on which students exchanged information on content, and the regulative communication.

Chapters 5 through 9 report on the evaluation of the CSCL processes during the three courses. Chapters 5 and 6 describe the collaboration, Chapter 5 focusing on the student teachers' and teacher educators' opinions of the students' collaboration. Chapter 6 describes the students' collaboration in the small sub-

groups in which the student teachers collaborated, analysing the electronic communication of the students using the multi-perspective method of analysis. Chapters 7 through 9 present the evaluation of the designs of the three courses. Chapter 7 reports on the relation between the task instruction and the students' collaboration, which is analysed on task level for each course. To identify aspects of the task instruction influencing the students' collaboration, we analysed the results cross-course, also relating them to the data from the questionnaires and interviews with students and teachers. Chapter 8 describes the students' and teachers' evaluation of the influence of the online environment on the students' collaboration. This chapter also includes their opinions of the influences of aspects of the design context, such as students' personal circumstances, or individual student behaviour. The relation between the teachers' guidance and the students' collaboration is described in Chapter 9, analysing the teachers' electronic communication using parts of our multi-perspective method of analysis. However, due to the limited communication of the teachers, their electronic communication is studied cross-course only at certain points. Additionally, the students' opinions of the teachers' guidance is related to the teachers' role in the electronic communication.

Finally, in Chapter 10, we translate the results from Chapters 5 through 9 into design principles for a CSCL environment in teacher training. This will be followed by a discussion about the interpretations of the results, the limitations of the research, and possible directions for future research. In an epilogue, I will reflect on the use of CSCL in teacher training now and in the future, as well as the merits of the results of this study for the design of CSCL.

Chapter 2: Designing CSCL

This chapter presents a theoretical exploration of the field of CSCL, with a view to gathering information on design elements for CSCL environments in teacher training. The social constructivist view shapes the foundations of many CSCL studies. These theories and perspectives are summarized in 2.2. From the perspective of social constructivism, collaborative learning has been identified as a suitable method of instruction, providing authentic tasks are used and students are actively involved. Literature findings on collaborative learning are presented in 2.3. CSCL is a way of collaborative learning supported by technology, which has its own characteristics. The virtues of CSCL are described in 2.4. Recent CSCL studies have been studied to provide an overview of the trends and topics in the CSCL area, as far as they are relevant to this study (2.5). We inferred three clusters of design elements useful for designing CSCL environments in teacher training: task instruction, teachers' guidance and online environment (2.6). Our literature findings are reflected in the research questions of this study, which are presented in 2.7. After this introduction, the method of the literature study is described in Section 2.1. A summary of this chapter can be found in the last section, 2.8.

2.1 Method

The literature study was focused on identifying design aspects of CSCL environments in teacher training. We used four methods to retrieve relevant literature.

First of all, we used several electronic databases: the Educational Resources Information Centre (ERIC) Database, electronic catalogues of the Dutch Central Catalogue, the Utrecht University Library catalogue, the BNSW catalogue (for Dutch and Flemish politics and social-cultural sciences), the Social Science Citation Index, the SWIDOC (Social Science Information and Documentation Centre) online literature catalogue, and Psyclit (Psychological references). In order to secure a manageable amount of information, a first selection in ERIC and other databases was made, using a list of keywords partly based on the ERIC search by Lowyck, Elen and others (1995). We extended the list with keywords and descriptors in the literature found. This yielded an extensive list of keywords, presented in Appendix A1. Reading the abstracts, it became clear that not all literature we

found was relevant. We further selected the literature by combining keywords. The most useful combination keywords were CSCL, collaborative learning, teacher training, Internet or World Wide Web. Finally we selected only literature focusing on CSCL in secondary and higher education.

Secondly, we searched the Internet, more specific the World Wide Web and Usenet, which resulted in relevant books, articles, papers etc., and websites on CSCL environments, CSCL course materials and CSCL (research) projects. The keywords and combination of keywords we used are included in Appendix A1.

Thirdly, relevant journals are (continuously) studied (see Appendix A2 for an overview of the journals).

Finally, we checked the relevant literature from project work, conferences and other parts of our literature study, for useful literature and URL references, and we consulted colleagues at conferences and professional development groups ('snowball method').

2.2 Social Constructivism in Relation to Our Research

In the field of education, one finds an evolution towards new ways of learning (Simons, Van der Linden, & Duffy, 2000b). Mainly based on social constructivist ideas, independent learning in social interaction is an element of this new way of learning. We have attempted to incorporate several aspects of social constructivism in the courses which are the objects of our research.

First, the active learner (the student teacher) is central in our courses, constructing knowledge in social interaction with others (student teachers and teacher educators). Knowledge is acquired through collaborating and negotiating with other people, or, in other words, in interaction with others. Learning is also distributed, which refers to the idea that knowledge is distributed among people and knowledge is negotiated in interaction with others, creating a learning community which embodies certain beliefs and behaviours to be acquired (Lave & Wenger, 1991). In our courses, the student teachers, interacting with peers and teacher educators while working on learning tasks, are primarily responsible for the progress of their study. The learning process is planned to be guided by the students' motivation and initiatives. The students define targets, make a plan and monitor and evaluate the execution of their plan, enabling them to prepare for the next steps in the learning process.

Next, although the context of our courses is a training context, the students' learning activities are as much as possible related to the authentic context. The students are provided with problem-based and open-ended tasks, which have to be solved in interaction with other students. As far as possible this learning in

interaction takes place in a "real-life context", its the environment rich in information and in which there is no correct answer (Kirschner, 2000), which implies that the student will undergo meaningful experiences, and acquired knowledge is functional and applicable, in situations familiar to the student. Learning is a function of the activity, the context and the culture in which it occurs (situated learning). This contrasts with most learning in classrooms, which occurs out of context, and makes learning in schools using school-based cues such as textbooks, fragile (Brown, Collins, & Duguid, 1989). Most subjects of the tasks are closely related to the students' practice periods at schools, their concerns and experiences serving as input for solving the task.

A third aspect of social constructivism we have tried to incorporate in our educational design, is related to the social-cultural view on learning, in which new generations use the attainments of their predecessors. Knowledge is more than assimilated information; it is stored in tools, procedures, and especially in humans' actions (Lockhorst, 2003; Wells, 1999) let learning take place in the zone of proximal development (Vygotsky, 1978), collaboration with more experienced people is needed. In social-cultural teaching models, the teachers' role includes more than being the learners' guide. The teacher prepares the learning environment in such a way that the student becomes initiated in his subject in a meaningful manner. The teacher is a model and a source of information, and represents the subculture the students are assimilated in, which is characterized by its way of working and thinking, but also by its beliefs and behaviour (Lave & Wenger, 1991). In our courses, the teacher, to a far greater extent than technology, guides the students in the learning process by scaffolding both the collaborative and the cognitive processes, after preparing the students' learning environment. Although in the constructivist view the learning process should be more student-led, we had to contend with courses in an existing teacher training programme in which the teachers had an important share in determining the students' learning process (teacher-led). Still, although the teacher educators determined the task subject and design, the tasks were focused on stimulating the students themselves to determine the way to solve the task, setting out procedures, organising their own learning processes and involving themselves actively in their own learning processes.

Important in our view on learning in teacher training is, that student teachers learn in social interaction with others, within an authentic context, while scaffold in their joint activities of knowledge construction by the teacher educator. In Chapter 1 we indicated that in teacher training, learning in interaction is often realised by collaborative learning on different tasks. For various reasons, also outlined in Chapter 1, ICT is used to support the collaborative process. The remainder of this chapter will see us explore literature on collaborative learning and CSCL, focusing on the design of CSCL environments.

2.3 Collaborative Learning

CSCL developed from research on computer-supported collaborative work (CSCW) and collaborative learning. Contrary to CSCW, with its focus on the end product, CSCL focuses on what is communicated. The field of CSCL is relatively young, and Lipponen (2002) observes that the ambiguity of the empirical studies in CSCL research "makes it difficult to make any conclusion that a particular approach, instructional method or application would give better results than some others. One does not know exactly the circumstances in which one set of results can be extended to another context." (p. 75). Lipponen (2002) noticed a variation in research procedures, for example duration of study, number of students participating, whether students worked individually, in pairs, or in small groups. He also found that CSCL studies vary in the technologies used and how they are used. In many studies students work at the computer, networks support collaborative learning in other ones. In some studies, technology is used to structure the collaboration, in others to mediate the collaboration. Research on collaborative learning seems an attractive alternative when it comes to the design of CSCL environments. Collaborative learning has a long tradition in research (e.g. Johnson & Johnson, 1994; Sharan, 1994; Slavin, 1995) and the educational practice (see for instance Kagan, 1994), and is well documented. Theories, models and views on collaborative learning are often the foundation for CSCL applications and studies.

Before discussing theories, models and methods of collaborative learning, we will define the concept of collaborative learning as used in this research. Collaborative learning and co-operative learning are both terms that are used extensively in the literature. According to Erkens (1997), in co-operative activities, tasks are divided so that they may be carried out individually, independent of time and place. Erkens defines collaborative learning as those learning situations in which the learner carries out a learning task in interaction with one or more actors under shared responsibility and with an aim or product shared by all participants. Collaborative learning is the aim of the courses used in this research. Although in some definitions, the teacher figures as an active partner in the collaboration (Laurillard, 1993; Romme, 1998) and learning material or software is seen as a partner (Erkens, 1997), we consider collaborative learning as a process between students. The teacher assists the students by generating instructional tasks and subject information, and he guides them during the process. Collaborative learning has some distinct characteristics, all referring to the concept of collaboration: group behaviour, incentive structure, task structure and group motive (Hooper, 1992). These four characteristics indicate that collaborative learning can only occur when the learning environment is structured in terms of instruction and

group processes (see also Slavin, 1995). Based on the literature quoted above, we used the following definition of collaborative learning for our research:

Collaborative learning is that type of learning which takes place in a situation in which a student carries out learning tasks in interaction with one or more other students under shared responsibility and with an aim shared by all participants, in a learning environment that has been structured by teachers or experts in terms of group dynamics and task instruction.

Extensive research has been carried out into the design, process and product of collaborative learning. Well-known theories of collaborative learning and its use in practice are those of for example Johnson and Johnson (1994), Kagan (1994), and Slavin (1995). The "Handbook of cooperative learning methods" (Sharan, 1994) describes various collaborative methods. Common in most theories about collaborative learning is that the learners are part of a small group, working on shared products, providing each other with feedback, assessing each other, and showing cognitive strategies, skills and effective interaction. As a group, they are responsible for both the tasks at hand and the learning processes of the individual as well as the group. Students will learn from each other because their discussions of the content are characterized by exchange of ideas and creative problem solving takes, points of views are exchanged and explained, cognitive conflicts will arise, inadequate reasoning will be exposed and a higher quality of understanding will emerge, all this by means of verbalisation, and all of which helps the individual grow cognitively (Cohen, 1994; Haenen, 1998; Hooper, 1992; Nyikos & Hashimoto, 1997; Oxford, 1997; Slavin, 1995). Old knowledge structures are reconstructed into new knowledge when confronted with other (conflicting) perspectives. According to Hooper (1992) and Slavin (1995) learning can be enhanced by creating cognitive conflicts among group members, provided that the group dialogues and process are properly managed. Cohen (1994) refers to several studies in which experiments have been done with the use of controversy in collaborative learning. In these studies small groups were provided with controversy tasks, showing better performance on achievement tests than other groups and showed the most verbal rehearsal, exchange of materials, active search for information and re-evaluation of the students' own position.

According to Hooper (1992) collaborative learning may result in productive learning when collaborative groups are high in terms of equity and mutuality. Equality refers to equity between group members; mutuality refers to the degree of engagement between group members. When equality is high, members may be more willing to interact within the group, and mutuality is also likely to be high. Johnson and Johnson (1994) developed a model for such effective collaborative learning. In the design of the three courses of this research we have used the work of Johnson and Johnson as our point of departure. They distinguished

five premises for collaborative learning, which we have tried to incorporate in our designs. These are described in the next five sections.

2.3.1 Positive Interdependence

Positive interdependence is the participants' perception that he is linked with others in such a way that he cannot succeed unless his group members do (and vice versa). Whenever the group members lack a feeling of interdependence, effective group behaviour may not be expected. Positive interdependence can be stimulated by several means: goal-, reward-, and resource interdependence. Goal interdependence occurs when members of a learning group have a mutual set of goals they are all striving to accomplish, in which they can only succeed if all members attain their goals. It can be reached by task division and role assignment. Reward interdependence is created by providing the group with shared rewards, for instance by awarding bonus points to each member when any individual scores 90%. Resource interdependence is described by Johnson and Johnson (1994), and Slavin (1995) as allocating certain resources to each individual group member, and can be fostered by task instruction. Each member has only a part of the information, resources, or materials necessary for the task to be completed and the members' resources have to be combined in order for the group to achieve its goal. According to Cohen (1994), interdependency should be fostered by challenging tasks, intrinsic motivation of learners and collaborative skills to interact. Collaboratively working on an open-ended and conceptual task with ill-structured problems requires interaction. Influencing factors are the degree to which one has familiarized himself with the task, its degree of structure, and whether there are one or multiple solutions to the problem. However, too much structuring and describing of procedures can limit the group process, especially with adult learners.

2.3.2 Individual Accountability

Individual accountability exists when the performance of each individual student is assessed and the results are fed back to both the group and the individual. Slavin (1995) indicates that methods simply encouraging participation may be inadequate to ensure learning and to prevent the 'free-rider effect'. Therefore, each individual's effort must be obvious and measurable by other members. The use of individual rewards based on group scores, achievement contingencies and task specialisation (each group member being responsible for a part of the task) are ways to stimulate individual accountability. By strongly emphasizing rewards, the students may become more focused on incentive and perform along the line of least resistance, instead of focusing on the task and become creative. Incentives

do not seem to be required when students are motivated to complete a challenging and interesting task (Cohen, 1994).

2.3.3 Promotive Interaction

When the individual efforts to help and support other group members to achieve the group goals are high, Johnson and Johnson (1994) speak of promotive interaction. Important influencing factors are group composition (heterogeneous versus homogeneous), personal variables (e.g. age), an individual feeling one's contribution has a positive effect, confidence in group performance, and advisory feedback preferably aimed at effort (process) and not success-orientated (product). Personalisation is an additional factor which, in our opinion, can be added to promotive interaction. Personalisation can be described as the process whereby one values others as unique individuals and is experienced oneself as a unique individual. Through personalisation, initial opinions about partners in communication may be overcome. Especially in situations in which group members have met each other only a few times, initial opinions of group members may override objective lines of thinking and knowledge judgement. Some group members might be seen as an authority on a subject, causing their contributions to be perceived as the more valuable ones (Cohen, 1994; Hooper, 1992; Slavin, 1995). Hubscher-Younger and Narayanan (2003), in their study on software design, describe such mechanisms as causing students to converge in representations. They argue that students will learn more deeply when they develop and share their own diverse understandings of a concept. However, due to their perceptions of the quality of some of their group members, they inclined to converge, instead of contribute their own divergent understanding. Personalisation also relates to enjoying safe surroundings when discussing and showing divergent opinions. Ronteltap and Van der Veen (2002) mention several pitfalls of collaborative learning using ICT, one being a limited group feeling when group members do not know each other. This results in students having a limited view of their group members, which can easily lead to conflicts. We would like to point out that personalisation can also lead to status generalisation in the way that getting to know one another can lead to, for instance, a reassuring belief that someone is particularly good in a subject, which may result in a free rider effect shown by those group members who tend to perceive themselves as having a low status.

2.3.4 Group Processing

Group processing refers to intra-group reflection, in order to identify supportive and ineffective interaction, and to decide which activities to continue and which ones to terminate. Group members discuss how well they are achieving their goals, thus maintaining effective working relationships. Meta-cognitive processes

are important in group processing. Such processes help the students build a well functioning collaborative group. Teachers should stimulate students to reflect on the group process and their individual roles. Lateral relations or talks between the students are more effective than direct supervision. Supervision does diminish the communication of students with one another (Cohen, 1994).

2.3.5 Collaborative Skills

Research shows that collaborative learning requires students to learn new behavioural patterns and other skills (both social and cognitive) than are required in the traditional classroom. Training of the social skills needed in collaborative learning, is essential according to Johnson and Johnson (1994). These skills include leadership, decision making, trust building, communication and conflict-management skills. Just as in the collaborative group process, content interaction should be stimulated and induced as well. Elaborating, explaining, asking for help, and reciprocally exchanging are at the core of the collaborative learning process. To stimulate elaboration and exchange, one may use training of these skills, structuring the assignment with suggestions for elaboration and usage of scripts outlining specific activities for students to follow. By presenting the students with ill-structured problems of an open-ended and conceptual nature, reciprocal exchange can be stimulated. In reciprocal exchange each actor's output becomes input to each actor. Using open-ended problems, which need procedural discussion in order to reach a solution, and discussion of many possible solutions, provokes interaction and exchange between group members. Reciprocal exchange can be fostered by collaboration based on built-in controversy, incorporating the creation and use of different viewpoints in assignments. The use of role-taking has also been said to stimulate reciprocal exchange. Role assignments can help students ask 'thinking questions', hypothesize, interfere, etc. (see Taylor Richards, 1998) as long as the amount of role-taking does not become too restrictive for discussion. Roles do not seem to have a consistent effect on fostering interaction. Cohen (1994) argues that, "If the labour is divided and each person is given a different role, such as artist, script writer, presenter, and so forth, the result may be each person quietly working on his or her task; there may be very little interaction at the group level. In contrast, a role such as group facilitator may have the effect of fostering interaction." (p. 17).

2.3.6 An Additional Premise: Motivation

All five premises of the model of Johnson and Johnson (1994), integrate motivational aspects of collaborative learning, and link them to the cognitive side of learning. The individual group member wants to perform well, as an individual and/or as a group, and is therefore motivated to collaborate with group mem-

bers. All kinds of stimuli, such as rewards, may be used to motivate group members so as to reach a positive end result. In his model of factors influencing learning gains in co-operative learning, Slavin (1995, p. 45) points at motivation to learn and encourage and help others learning, as key factors for elaborative activities, which in turn enhance collaborative learning. Contrary to Johnson and Johnson in their model, Slavin points at the importance of the affective side of motivation for collaborative learning. Having shared learning goals, students do whatever necessary to succeed and wanting to learn raises the social status of the individual. Being motivated to learn and act accordingly, is appreciated by group members and has social consequences for the individual.

2.4 The Virtues of CSCL

Although CSCL shares many characteristics with collaborative learning generally, it also has its own, making it a powerful learning tool for several reasons.

A first set of reasons relate to the fact that learning activities in CSCL are *time and place independent*. Students are more flexible in their learning activities and their choice of communication partners and media (a-synchronous versus synchronous).

A second group of reasons concerns the manner of communication in CSCL environments. Communication in most CSCL applications occurs by means of *text mediation*. Warschauer (1997) considers text mediation as an effective means to use as thinking devices by which the students together can generate new meanings. The students are not able to use non-verbal communication, which means they have to explain and elaborate to transfer their ideas, opinions, arguments, etc., resulting in profound verbalisation. Collaborators have to test their hypothesis, justify their propositions, and make their goals explicit in writing, which may lead to a more reflective and conscious control, to and awareness of the process (Kanselaar et al., 2000). The communication of the CSCL environment can be *stored, archived, re-evaluated, edited and rewritten*, by which means students are able to follow their own and others' work and learning process (see for instance Lipponen, 2002; Watabe, Hamalainen, & Whinston, 1995). CSCL tools make the sequence of interaction events more visible for participants, which opens *better possibilities for mutual understanding* among students and between teacher and students (Lehtinen, Hakkarainen, Lipponen, Rahikainen, & Muukkonen, 1999). CSCL creates possibilities to reflect on information from group members. Group members of a CSCL environment together construct knowledge, *linking reflection and interaction* (Warschauer, 1997). It allows the students more time to react to one another, enabling them to re-read the discussion and re-write their argumentation, all of which results in a deeper and more

profound discussion between the students (Admiraal, Lockhorst, Korthagen, Veen, & Wubbels, 1996). However, a disadvantage of written communication is that it can be time consuming compared to face-to face (F2F) communication.

A third cluster of reasons concerns the interaction in CSCL environments. CSCL discussion tends to be more *equal* than F2F discussion, because status, gender, and race of group members are less distinct, which turns relations between group members more equal. This makes the flow of information more easy and bilateral (Hooper, 1992). Several studies (Admiraal et al., 1996; Warschauer, 1997; Watabe et al., 1995) show that individuals who tended to withdraw from F2F discussions, became full partners in a-synchronous discussions. On the other hand, the anonymity of computer-mediated communication can reduce the group feeling and thus affect the collaboration of group members. Veen, Lam, Lockhorst and Thoolen (1998) indicate the importance of creating collaborative groups of learners that are acquainted to some extent. Research also shows the computer networks in which people communicate cannot operate without human networks. A lack of F2F communication can also lead to wrong interpretations, possibly resulting in discussion partners entertaining preconceptions. Another aspect of the relations between those interacting in CSCL environments, is that using CSCL, situated learning can take place at micro-level in the classroom, but can also occur at macro-level with students from other places or even cultures (Warschauer, 1997). This will intensify the *cross-reference of ideas* and views of group members and the cognitive conflicts in the group (see also Pulkkinen & Niemi, 1997).

A fourth set of CSCL characteristics relates to the possibilities for reflecting on information from outside the group, which may increase the authenticity of the learning process. Working in CSCL environments, students have easy access to information (e.g. from the Internet) and other technological applications such as simulations, which may be integrated. This increases the possibilities of *authenticity of the learning materials*, which can easily be incorporated in the collaborative learning activities (Nicaise & Barnes, 1996). Furthermore, CSCL environments based on Internet technology create the possibility of publishing information.

These characteristics of CSCL play a role, one way or another, in the assignments provided in the three courses studied in this study. The students worked time and place independent, used a-synchronous and synchronous communication options for interaction by means of text mediation, and used the CSCL environment to support their reflection and discussion within and beyond their group, and to create a shared product.

2.5 Trends and Topics in CSCL Research

This section presents trends and topics in CSCL research which are relevant to this study, using literature from our search and particularly the CSCL conference proceedings from 1999 onwards (Dillenbourg, Eurelings, & Hakkarainen, 2001; Hoadley, 1999; Maastricht McLuhan Institute, 2001; Stahl, 2002b; Wasson, Ludvigsen, & Hoppe, 2003). One might say the CSCL research community has shifted from tentative empirical research into various subjects and mainly networked technologies in real-life settings, through a period in which researchers have been searching for the roots and foundations of CSCL, to a time of more detailed research on the characteristics of the electronic discourse, CSCL participation and interaction patterns, and a new wave of empirical studies experimenting with new technologies.

At the CSCL1999 conference, CSCL design and the development and use of technology have been topics of discussion in many contributions, several of which focusing on the development of groupware facilitating collaboration of the participants (e.g. Cambridge, 1999; Guzdial et al., 1999). Nagarajan and Hmelo (1999) describe the development of a modelling tool enabling medical students to experiment with testing a cancer drug. The tool comes with a collaborative workspace for discussing test results. Schank, Fenton, Schlager, and Fusco (1999) report on the development of a MEOW (Multi-user Educational Online Workspace) which can be scaled to handle large virtual communities and is built on MOO technology. In the CSCL1999 proceedings, a few contributions can be found on CSCL methods of analysis, such as the use of Social Network Analysis (e.g. Nurmela, Lehtinen, & Palonen, 1999; Wortham, 1999).

Study of the contributions of the CSCL2002 conference revealed that, besides several contributions on theoretical issues concerning CSCL, the development of all kinds of subject-specific technical tools, such as modelling tools, 3D tools, simulations, and the so-called agents (tools to help the learner in his interaction with other learners) are a growing trend. Specifically reported tools are those used for the analysis of the communication in CSCL environments (e.g. Soller, Wiebe, & Lesgold, 2002).

The main themes during the CSCL2003 conference were knowledge building and group interaction (Wasson et al., 2003). At the CSCL2003, supporting the learning process by means of scaffolding was a topic of several contributions (see e.g. Rummel, Spada, Caspar, Ophoff, & Schornsetin, 2003; Zumbach & Reimann, 2003).

Knowledge Building (Scardamelia & Bereiter, 1994) has been a topic of interest from the beginning. It has been a foundation for the development of ideas on CSCL and its environments (e.g. Stahl, 1999). In the Knowledge Building theory, knowledge is created by the social interaction and the development of collective

understanding is a central issue. Meaning making can be seen as a theoretical basis of Knowledge Building. Meaning making is the joint activity of a group, focusing on the collaborate effort of two or more individuals to generate knowledge, which has to be made clear for all participants (Koschmann, 2002; Stahl, 2003). Scardamelia and Bereiter (1994) introduced the Knowledge Building Community model as an alternative to the traditional classroom. Such a community is a group of individuals dedicated to sharing and advancing the knowledge of the collective. Individual understanding is driven on by the dual need to be familiar with the knowledge of the collective and the desire to advance that knowledge. Recently, research is focused on the process of knowledge construction and how to support this process, e.g. by means of scaffolding, or tools.

2.5.1 Main Issues in CSCL

A large part of the research in the field of CSCL is focused on the process of knowledge construction and the design of the technical environments needed to support this process. To a lesser extent, attention has been paid to task arrangement, group dynamics, the role of the teachers, and the effects of CSCL on learning and achievement, which in a way is surprising considering the amount of research which has taken place into these aspects of the field of collaborative learning. The literature on collaborative learning shows that task arrangement, with all its elements such as type of task, task instruction, group composition, role-taking, degree of task-structuring, etc., is generally perceived as very important for the collaborative work. Research on collaborative learning also stresses the influence of the group process on the collaborative process and the outcomes. All sorts of student characteristics, and groups' dynamics influence the process taking place (see Cohen, 1994).

Development of Technical Tools

In the CSCL1999 contributions the development of networking tools, e.g. groupware, was a focus of attention, while in the CSCL2002 proceedings the development of all kinds of subject-specific tools had become the focus of a significant part of the contributions.

In contrast, several CSCL studies (Baker, Quignard, Lund, & Sénourjé, 2003; De Graaff, De Laat, & Scheltinga, 2004; Kanselaar et al., 2000; Kozma, 1999; Van der Veen, 2001) showed that, although themselves focusing on the development of technical tools, the amount and nature of the collaboration between partners has less to do with the availability of software and more with the way the instructor designed and structured the task. Only when activities and materials (such as equipment) are structured around a common task or a shared product, collaboration is more likely to occur. Van der Veen (2001) also stresses the im-

portance of the human factor when referring to motivation, skills, expertise, and background. Alexander (2002) performed a Delphi Poll among those administering a presentation at of the CSCL1999 conference, to determine the components of an optimal constructivist, collaborative online learning environment. Remarkably, only two of the top-ten ranked components are technological tools, the others being components focused on awareness and shared representations, both types assisting in the process of knowledge building.

Knowledge Construction

While the development of technological tools has always been a topic of interest, attention has increasingly focused also on the co-construction of knowledge. Whereas at first the outcomes of the knowledge construction were the focus of attention, more recent CSCL research focuses on analysing the process of knowledge construction itself (Lipponen, 2001). This research focuses on particular perspectives of interaction, such as the use of argumentation in students' electronic discussions (see for instance Veerman, 2000) and anchoring, or on interaction processes such as grounding communication with comments from fellow students and teachers (see for instance Makitalo, Hakkinen, Salo, & Jarvela, 2002; Van der Pol, Admiraal, & Simons, 2003) and on the construction of shared representations of knowledge by the users of a CSCL environment (see for instance Fischer & Mandl, 2002). A well-known model for teaching and learning aimed at knowledge construction is developed by Salmon (2000). In the first stage access to the system and motivation to spend time and effort are key issues. In the second stage, students get used to finding themselves in the new online environment: socialization takes place. In the third stage, students start exchanging all sorts of information, as they experience the free and easy flow of information. In the fourth stage the actual knowledge construction takes place. The students' interaction becomes more exposed and conferences start evolving. In the last stage, students look for more benefits of the used system to help them achieve goals and learning and reflect on their learning process.

Social Dimension of CSCL

Recently the social dimension of collaborative learning has been gaining attention in CSCL research. Earlier, Reffay and Chanier (2003), and Woodruff (1999) stressed the importance of creating a learning community. Woodruff (1999) defines the community as "a group of individuals who engage in discourse for the purpose of advancing the knowledge of a collective knowledge building" (p. 678). The social interaction of the collaborative process which is needed to create the learning community is often underexposed. Social interaction is important to support the cognitive processes and to create a social space where mutual trust may develop, and in which each other's values and beliefs are respected if

not shared. Social interaction prevents participants from feeling alone in the CSCL environment, which creates a group feeling (Coa & Greer, 2003; Haythornthwaite, 1999; Kirschner, Jochems, & Kreijns, 2003; Kirschner, Kreijns, & Jochems, 2003; Kreijns, 2004; Lehtinen et al., 1999). It stimulates tacit knowledge being shared, which is a relevant way of learning in teacher training, as part of the learning process is based on experience. In a study of the interaction in a distance class and the use of media, Haythornthwaite (1999) found that "group work may serve an important role in CSCL classes in promoting community by having the intermediary effect of increasing the size of close social circles" (p. 221). When socializing, an element necessary for interpersonal bonds as well as promoting feelings of belonging to a community, is high, students in the distance class maintained larger circles or stronger ties with other students. Kirschner, Kreijns and others (2003) argue that one of the ways to create collaborative relationships in a CSCL environment is the creation of conditions that stimulate learners to interact. They describe three ways for provoking interaction. First, a cognitive approach in which the realisation of 'epistemic fluency' is central. Epistemic fluency can be described as cognitive concept formation, which can be reached by interlacing several dedicated learning activities in the assignments, such as describing, presenting criticism, and predicting. The next way is a direct approach in which techniques for collaboration are used to structure task specific learning activities. Examples are the Student Teams-Achievement Divisions of Slavin (1994) and the Jigsaw (Aronson & Patnoe, 1997). Finally there is the conceptual approach in which collaboration is commanded by creating interdependency. The authors refer to the conditions of the Learning Together model of Johnson and Johnson (1994). In his thesis on sociable CSCL environments in distance learning, Kreijns (2004, p. 59) mentions possibilities to promote the social interaction, using social affordances, "which are defined as the properties of a CSCL environment that act as social-contextual facilitators relevant for the learners' social interaction". These affordances increases the chance that learners in the environment 'meet' and interact, they stimulate informal conversations and provide learners with awareness tools indicating (past) presence of other learners in the environment. According to Kreijns, these social affordances can help creating a social space.

2.5.2 Main Problem in CSCL

The observed problems in generating learning in CSCL environments are similar. The amount and quality of the interaction is disappointing in many studies (Lakkala, Ilomaki, Lallimo, & Hakkarainen, 2002; Lipponen, 2002; Lockhorst, 2000; Ronteltap & Van der Veen, 2002; Sorensen & Takle, 1999; Van der Pol et al., 2003; Veen et al., 1998; Van der Veen, 2001; Veldhuis-Diermanse, 2002). Free

rider effects also occur in CSCL environments, and often even more severely as working online makes it is easier to withdraw from the collaborative process. The various authors state different reasons for the disappointing amount and quality of the interaction. The digital environments are often quite open, which is cited as one of the main reasons why students often work in an unstructured manner or do not work at all (Ronteltap & Van der Veen, 2002; Veen et al., 1998). In their study of virtual inquiry-based learning in Middle Schools, Lakkala and others (2002) identify several causes. First, task differentiation reduced the need for shared knowledge construction in the whole community. Second, the environment used in their study of group work in secondary education, was very simple, only offering discussion threads. It lacked options for scaffolding the inquiry process, or did not allow sharing of common products. Thirdly, as they point out, the assessment procedures did not fit these applications, based as it was on grades. Students worried about their grades, which influenced the number of contributions to the discussion negatively. Van der Veen (2001) suggests that students did not use the discussion platforms as they had been presented in combination with other ways of communication, such as F2F, allowing for more easy communication. In addition, using heterogeneous groups with respect to age, skills, and motivation created conditions which turned collaboration difficult.

Others like Guzdial and Carroll (2002) think the degree of interaction is less important. They argue that learning can happen even in situations where interaction is minimal. Vicarious learning can arise because posting notes to fellow learners provides an opportunity for reflection, even when the students do not post the note in the end.

2.5.3 CSCL in Teacher Training

When compared to other CSCL research, the studies on the use of CSCL environments in teacher training do not differ significantly in subject, research methods and results, except for the fact that in many studies on teacher training, the students' limited motivation, their attitude towards CSCL generally, or the subject of the assignments, are indicated as important aspects influencing the student teachers' participation and interaction in the collaborative process. Angeli and others (2003) studied the use of an electronic conferencing system to facilitate Pre-service teachers communication outside the classroom, and to foster quality discourse and promote students' critical thinking skills. The results of their study show that the student teachers mostly exchanged personal experiences and did not show well-supported reasoning. Moreover, after three weeks the students' interest decreased over time. The student teachers thought the electronic environment was a mechanical procedure, because they also met each other and the teacher every week. The authors suggest three reasons for the limited motivation

of the student teachers. First, a lack of assessment strategies may have resulted in limited critical thinking. Second, the students were involved in a teacher training course for the first time and might have lacked the critical thinking skills required to be fully involved in the discussions. Third, the teachers' role was limited, because of which students were not externally stimulated to contribute to the discussions. In a study of Brett, Woodruff and Nason (1999) on mathematical knowledge building communities, Pre-service mathematic teachers discussed the use of mathematical concepts in an electronic conference. Two aspects relating to the motivation of the student teachers influenced the participation and interaction. First, the students were unfamiliar with the use of an electronic conference system, which resulted in some hesitance to contribute to the discussion and expose oneself to criticism. Second, negative feelings towards mathematics influenced the contribution to the discussion.

2.6 Design Elements in this Study

Our research addresses the process of interaction which is required for constructing knowledge, and the conditions needed to make this interaction happen. In evaluating the interaction process and its conditions, we have adopted an integrative research approach including all aspects that may influence the interaction in the CSCL environment and we analyse their relation with the interaction process. We agree with Kanselaar and others (2000), who state that 'the relationship between the mode of communication, task environment, knowledge domain and the roles of teachers and students are quite complex and far from understood' (p. 74), and in fact plea for more integrative research relating several above mentioned aspects.

Our research focuses on three clusters of design elements: *the task instruction, the teachers' guidance,* and *the online environment*. We use the concept of clusters of design elements, because each consists of various elements. Besides these clusters, we identify aspects that influence collaborative learning in electronic environments, but which cannot or only to a very limited extent be controlled by the designer. We refer in this respect to Lehtinen and others (1999), who argue that the context of the CSCL learning situation should be taken into account and should be an area of study in itself. We summarized these aspects with the concept of *the design context*.

The *task instruction* refers to the type of task, more specific the degree of self-responsibility, the instructional method, and the learning objectives of a task. The task instruction also includes the role-taking by the collaborative group members, the structure of the task operation, the task organization, and the group composition.

The teachers' guidance refers to the teachers' instruction and communication during the online task, and the training of the students in the technical aspects of the CSCL environment and in the desired collaboration in relation to the CSCL assignments. This cluster also includes the technical assistance of the students.

The design cluster *the online environment* refers to the functionalities of the groupware used, its usability, such as navigation and structure of the program, and the electronic teaching materials such as manuals including suggestions on online collaboration.

The *design context* includes the student teachers technical home situation and their ICT skills, the educational facilities of the teacher training institute such as computer rooms, the teaching programme itself, the practical trainee school, students' personal circumstances and individual behaviour in the collaborative process.

In the next sections, we will present the relevant research findings from the literature with respect to the three clusters of design elements. The design context has been left out of our theoretical exploration, as the aspects of the design context are more or less unique within each study and because they are at best hardly under the control of the designer, if at all.

2.6.1 Task Instruction

Although many consider task arrangement an important aspect of designing a CSCL environment, it is hard to find studies providing a detailed description of the task used, or design considerations concerning the task. In her literature review on collaborative learning, Cohen (1994) provides some clues for the design of the task instruction, which results in information on the type of task, task structure, and group composition.

Type of Task

The nature of a task can vary along a continuum from well defined to ill-defined, open-ended tasks. The first type of learning tasks focuses on factual recall, understanding of assigned reading, or application of procedures and concepts in a relatively routine fashion. In an ill-defined or open-ended task, the outcomes are left open, and are problem-based. These tasks are often used in ill-structured domains (Cohen, 1994). The tasks provided at teacher training institutes often belong to this latter category.

Ill-defined, problem-based tasks differ on several aspects: degree of shared responsibility, learning objectives, the instructional method. The degree of shared responsibility refers to the degree an assignment prompts the assignee to conceive it as an individual or a group responsibility. Johnson and Johnson (1994) refer to individual accountability; each individual is assessed and the results are

given passed back to the group and the individual. In their learning objectives, CSCL assignments differ in relation to both subject related objectives and ability objectives, such as the ability to collaboratively perform research in an educational (school) setting. In teacher training, CSCL assignments focusing on the exchange of experiences and related to the daily practice of the classroom are often successful, as is for instance described by Admiraal, Lockhorst and others (1996). Collaborative learning can be arranged using various instructional methods. Collaboration can for instance be established by debate with built-in controversy, by means of tasks incorporating controversial positions or attitudes of the group members. As Cohen (1994) argues, controversy promotes verbal interaction, exchange of points of view, elaborated reflection and the students re-evaluating their own positions, thus fostering maximum interaction and in-depth discussion. Controversy promotes reciprocal exchange in which one actor's output becomes the other's input, which results in an all sided examination of the problem at hand. Aimeur and Frasson (1996) describe the positive effects of the use of 'learning by disturbing' in an experiment at the University of Montreal using a computer based intelligent tutoring system, in which a so-called 'trouble-maker' interferes in the learning process with provoking statements. It challenged learners to argument and motivated them to be involved in the discussion. Producing a shared product online is another instructional method that may create collaboration. Pulkinnen and Niemi (1997) argue that production of learning materials stimulates reflective discussions. Veldhuis-Diermanse (2002) warns that co-writing products such as a collective report, can stimulate students to subdivide the task into individual subtasks.

The various aspects of the type of task will be studied in this research. They are described in Chapter 3 on the design of the courses.

Task Structure

Electronic environments are often quite open, one of the main reasons why students often work in an unstructured manner or do no work at all (Ronteltap & Van der Veen, 2002; Van der Veen, 2001; Veen et al., 1998). The literature is diverse in its solutions. Structuring the task is often used to remedy a low level of interaction. Task structure refers to the level of description of all parts of the task, the milestones, task distribution, the description of participation and interaction, in other words: 'who will be doing what and when'.

Some mention the need of a strong pre-imposed structure and students should be obligated to hand in products on a regular basis for which they be credited. Sorensen and Takle (1999) describe the outcomes of a study into the collaboration between students of two online courses in an international higher education setting. They argue that constructivist theories do not allow for the idea of a pre-imposed structure as students should be motivated in other, more learner-driven

ways to become engaged in dialogue. However, they mention that requiring the students to put in a certain amount of notes did help them becoming engaged in dialogue as it forced them to put their thoughts into writing, which also was a useful learning activity. It also generated the idea of 'presence' and 'shared space'. Required input of comments ensures an ever present body of notes, which gives the students a feeling of social presence. A pre-imposed structure may also assist students in raising the level of their discourse and ensures the participation of disengaged students. The University of Phoenix courses may serve for an example of strongly structured online courses, with the students involved completely dependent on their online collaboration. A strong structure of the tasks helps the students to keep on track (University of Phoenix, 2003).

Others (like Cohen, 1994) observe that, especially with adults, a strong pre-imposed structure in collaborative learning situations may also have opposite effects. Cohen (1994) refers to the studies of Hertz-Lazarowith (1989) and Nystrand, Gamoran and Heck (1991), implying that the interaction in a group will be less elaborated unless groups determine their own procedures. That also improves the initialisation of these procedures by the group members. Cohen (1994) also refers to studies in which the authors warn against adopting a pre-imposed structure for problem-based and open-ended tasks. Instruction should not constrain production, but foster maximum interaction, mutual exchange and elaborated discussion, which are processes required for learning from problem-oriented tasks. Groups should determine their own procedures in these tasks, or else interaction will be less elaborated. Ronteltap and Van der Veen (2002) argue one should find a balance between structuring the process and giving students a clear image of what is expected on the one hand, and self-management of the learning process on the other. The latter can be an important aspect of the learning process. This could mean that the degree of task structuring is related to the students' experience with collaborating in electronic learning environments.

When the task suits the students' professional practice, the students will have an almost intuitive notion of the process, product, the required role-taking, etc.. In this respect, Lave and Wenger (1991) refer to learning in a community of practice as opposed to education apart from professional practice. Not only does the student acquire the technique of the professional practice, but he also learns to employ its language and conduct. The learning or production process evolves more naturally and easily, and lessens the need for a (strong) task structure. In teacher training, the link to the professional practice is clearly visible and tangible, as the professional practice of the student teacher is often the point of departure for the learning process.

Role-taking is another aspect of task structure. Singley, Fairweather, and Swerling (1999) identify several roles in collaborative learning: the observer (watching the more skilful problem solvers setting goals and performing activities, asking

them to explain and justify their actions), the apprentice (the one who performs simple activities such as completing a table), the specialist (mastering and responsible for handling certain problem schemata which appear major sub goals in the problem), the leader (establishing the overall strategy for solving the problem), and the coach (observing and criticizing actions of others, responding to requests for assistance, supporting the leader). Strijbos, Martens, Jochems, and Broers (2004) studied the use of functional roles, i.e. roles to counter process losses as a result of demands from co-ordination. Such roles include the 'Project Planner' (responsible for project planning and monitoring), the 'Communicator' (responsible for communication with others outside the group, e.g. the teacher), the 'Editor' (responsible for editing the input of all group members so as to turn it into a shared report), and the 'Data Collector' (responsible for gathering information). Their study focused on the impact of the use of such roles on the group performance. These roles did not affect the group's overall grade, but they did influence the students' awareness of intra-group interaction and collaboration. Contrary to the authors' initial intentions of using functional roles, they increased the number of coordinating statements. They also increased the number of statements on the content of the task, although this is unclear, as in our opinion the category 'content of the task' as defined by Strijbos and others includes coordinating statements besides statements of content. Beck, Brown, Marshall, and Schwarz (2002), found that in collaborative teams of Pre-service teachers focusing on observing and reporting on classroom activities, a specific role developed: the Reflective Communicator, writing highly reflective contributions, and sending and receiving many messages, being a central point in the discussion. These highly Reflective Communicators tended to communicate primarily with each other. For the groups, the reflective communicators were important by providing the whole group with examples of good reflections.

All of this indicates that the findings on task structure in CSCL and collaborative learning are inconsistent. In our research we varied the use of pre-imposed structured tasks, the use of roles, and the period of time available for the assignments, in order to analyse the effects of using structured tasks. Due to the assessment structure of the teacher training programme, in which students are assessed on their portfolios at IVLOS, we will not include the use of rewarding in-between products.

Assessment

Little research is found on assessment in CSCL environments. Kanselaar and others (2002) indicate that new ways of learning in schools and universities are often not accompanied with other ways of assessment. Assessment should be more focused on the process rather than the product, to which end portfolios provide a useful instrument. The use of rewards as a way to stimulate individual

accountability, advocated in literature on collaborative learning, does not suit new ways of learning. Moreover, it would seem that students are inclined to work for such external rewards rather than being intrinsically motivated to work on the end product of a task. In teacher training, portfolios are used as an instrument of assessment rather than for rewarding.

Time Available for the Assignment

A few studies report on the period of time available for the assignments. In general, online tasks take more time than F2F due to the amount of time needed for the interaction (in a-synchronous media). Heilesen, Cudrio Thomsen, and Cheesman (2002) found that students involved in an academic distance education course spent much time on tasks which normally take only a limited amount of time. Their course was tightly scheduled, much like regular courses, and this appeared to be too short as to create intensive discussion. In a project on storytelling by elderly people, Ellis and Bruckman (1999) argue that time available for the assignments was one of the factors influencing online collaboration between children and elderly people. The assignment took three weeks, but this limited period of time prevented the students from feeling ownership for their interactions with the elderly people as they could only send and receive two messages, due to the a-synchronous character of the communication. On the other hand, a long period of time may negatively influence the degree of student participation. It may cause longer periods of silence and limited use of the CSCL environment (De Wever, Valcke, Van Winckel, & Kerkhof, 2002).

Blended Learning

Some studies stress the importance of blended learning (Mantyla, 2001), more specifically alternating F2F meetings and online activities. Veldhuis-Diermanse (2002) for example, mentions several aspects that appear important for using CSCL in education, based on six studies in Higher Education, one of them regularly organizing F2F meetings. She experienced that communication in a CSCL environment becomes more natural and easy when students also meet regularly. They also feel more compelled to participate when meeting fellow students F2F. Cheesman and Heilesen (1999) too, studying a distance CSCL course with adult students of the Roskilde University, used a combination of virtual and F2F contact, as this, according to them is "indispensable to the success of the course". (p. 95).

Group Composition

A limited amount of literature on CSCL and collaborative learning can be found on group size. Most literature refers to age and gender differences and multi-ethnicity in groups, which is less relevant to our target group. Various studies mentioned how 'small groups' (≤ 6 group members) seem to function better than large ones in which some members tend be 'asleep' or excluded from interactions, and which encourage lurking (Dillenbourg & Schneider, 1995; Heilesen et al., 2002; Veldhuis-Diermanse, 2002). Veldhuis-Diermanse (2002) also gives the advice of using heterogeneous groups, based on for instance discipline or prior knowledge of students, as students have to defend their own interest or bring in their specific knowledge and experiences, which stimulates interaction. Dillenbourg and Schneider (1995) mention an "'optimal heterogeneity', i.e. some difference of viewpoints is required to trigger interactions, but within the boundaries of mutual interest and intelligibility". However, heterogeneous groups may also discourage interaction, due to the absence of ties between group members (Heilesen et al., 2002).

2.6.2 Online Environment

Clearly, it is essential for the students to have access to the online environment, whatever system is used. Additionally, technical skills of both the students and the teachers are prerequisite for working in CSCL environments. Heilesen and others (2002) argue that the competence to work and learn in CSCL environments may be an important academic qualification.

Functionalities

There are various software programs to support CSCL. We make a distinction based on the purpose of usage, although programs may have been developed from different perspectives. The programs used in our research, BSCW (http://bscw.gmd.de/) and WebCT, do not differ very extensively in their communication and organizational tools. Both meet our educational needs, and we have decided therefore to consider them useful tools for communication and collaboration in an educational setting. This is in contrast to other classifications, such as the one from De Graaff and others (2004), who distinguish virtual learning environments from groupware. According to them, virtual learning environments are web-based programs, designed to provide course and content information, and they include tools for collaboration. They consider WebCT such a tool. Groupware, which they consider BSCW to be, is described as tools designed to support collaborative processes. Some groupware applications are specifically designed to support collaborative *learning* processes and include scaffolding tools to that end. De Graaff and others view Knowledge Forum as representing this type of

software. Such education-oriented groupware is often more difficult to master. For reasons of reading ease, we shall refer to groupware and make no further distinction when stating the software used in our research.

Most groupware includes three elements: a content related part, a communication area and organisational functionalities (Droste, 2000). The content related part allows for information to be produced, exchanged, and archived. The communication area offers all kinds of options for supporting cognitive processes by structuring the discussion. Threads offer users a way to keep the forum discussion conveniently arranged. A chat facility provides the user with the possibility of synchronous communication. Organizational functionalities offer options for coordinating the group process. A calendar, planning options, and status information are examples of such options. Group composition can be organised also, as closed group areas can be made. It is possible on several levels to allocate more or less limited user rights to individual users.

Lipponen (2002) adds one element to those of Droste (2000). Recent groupware oriented on knowledge building includes community-building tools, such as awareness tools to alert users as to the presence of other users and information (e.g. B. R. Johnson, 2002), and anchoring tools providing options to anchor parts of contributions to others or to a shared document (Bernheim Brush, Bargeron, Grudin, Borning, & Gupta, 2002). These affordances scaffold the student in his collaborative process, and help organize the group discussion (Eleuterio, Barthès, & Bortolozzi, 2002; G. Johnson, 2002; Leinonen, Virtanen, Hakkarainen, & Kligyte, 2002; Tanimoto et al., 2002). Recently, the development of collaborative agents is emerging. These 'intelligence agents' may for instance use user profile information to help students create networks with each other.

Recent years have seen a development of more sophisticated tools. But we must beware of creating tools so sophisticated that they outgrow their usefulness for students. Students are likely to experience difficulties when all kinds of functionalities are added. In such cases, rather than supporting the learning content, ICT usage tends to become a goal in itself. Van der Veen (2001, p. 270) concludes that students prefer simplicity (a limited number of easy to use tools) to specific functionality provided by all kinds of tools which are difficult to manage. In a study using a simple collaborative tool, Rick, Guzdial, Carroll, Holloway-Attaway, and Walker (2002) show that learning does occur, and that it is not always necessary to use especially geared CSCL tools. Helpful in keeping groupware tools clear and structured, is the separation of the communication on content, and organisation (Lakkala et al., 2002) and social aspects. It prevents the content related processes from becoming intertwined with other processes concerning the collaboration.

Haythornthwaite (1999) argues that multiple means of communication must be available in order to encourage interaction among peers. In her study on

intra-class interaction in four classes of the distance course of the Masters of Science in Library and Information Science, she found that the more frequent communicators in a CSCL environment used more types of media.

This section on groupware functionalities focused on the more traditional teacher-driven applications. Education is currently going through a transition to applications more directed to self-directed learning, and in just a couple of years the present groupware will be followed by other types of software such as Learning Support Systems focusing on collaboration rather than administration as current Learning Management Systems do. The educational use of these kind applications demands a change in the organisation of our educational system. However, the current organisation of our educational system is based on more traditional ways of learning and the use of more teacher-driven applications, e.g. groupware like WebCT. For this reason, we have studied the use of more teacher-driven groupware in our research.

Discussion Areas with Thread Option

In the courses we studied in our research, the discussion areas which offer possibilities for a threaded structure of the discussion turned out the most important functionality of the groupware we used. For that reason we studied the literature with a specific focus on the use of threaded discussion in CSCL environments. Despite the fact that most of the computer conferencing systems do offer threaded discussion, threaded communication is rare, and the options are used in other ways than expected. We refer to Guzdial and Turns (2000) to describe what effective discussions in CSCL environments should look like. They argue that discussions should be sustaining and focused on the topic of learning, containing a number of contributions and extensive dialogues in which hypotheses are explored, perspectives negotiated, and in which shared understanding is developed. The discussion should be reflective and constructive, and should enjoy wide participation among group members. Lipponen (2001) adds that, in his view, the participation network should be dense and participation should be equally divided among its practitioners. However, several studies show that discussion threads in online environments appear to be quite short and do not meet the scale and character for effective discussion (Guzdial & Turns, 2000; Hewitt & Tevlops, 1999; Lipponen, 2001). Hewitt and Teplovs (1999) studied 4086 notes across 1521 distinct threads, collected from seven graduate-level distance courses. They developed a way to calculate the growth possibilities of threads and observed that most of the 1521 threads were short: over 80% of the threads containing four notes or less. Most responses in a thread were written within the first few days after the first note had been posted. The chances of response dropped dramatically over time. The longer a thread had been left inactive, the greater the chance it would remain so. Once a thread contained more than five

notes, the possibilities of growth decreased over time. Lipponen (2001) too, reports short threads. In a study of a CSCL discussion, which included 21 elementary students and one teacher, working in three courses and producing 700 notes, the mean size of a thread was 3.76 notes. Students often do not use the thread option in the way it was meant by the designer of the bulletin board (Arnseth, Ludvigsen, Wasson, & Morch, 2001). Students write new notes without considering whether a reaction would be more appropriate, or use the threads as a simple way to write notes. Muukkonen et al. (1999), and Stahl (1999) report that participants of online discussions find longer threads difficult to follow and sustain, and experience them as time- and effort-consuming. The research results indicate using threads is a skill students and teachers should acquire in training and by experience. This may not be true for the new generations of learners, used to communicating in different ways, using more condensed, short lines of communication, focusing on the essence of the communication at hand (Lindstrom, 2003). Veen (2000) refers to the new generation as 'homo zappiens', learners with an active attitude towards discontinuing information, used to multitasking, scanning of computer screens in an integral way, and using non-linear ways to generate knowledge. Short threads in discussions among representatives of this new generation of learners, may not correspond with superficial discussion, it may actually lead to effective discussion.

2.6.3 Teachers' Guidance

Although the role of the teacher in education generally is changing, from the 'sage on the stage' to the 'guide on the side', online educational situations demand different ways of guiding. In preparing a course or task, the teacher has become a designer, not only with the expertise of designing educational activities, but also able to relate his design to the technological possibilities of today (Horton, 2001).

So far, there is little information on teachers' guidance in CSCL. Teachers and designers are trying to discover which aspects of their guiding routines work well in CSCL environments, and which new guiding principles should be developed. In some studies, the role of the teacher has been supportive, assisting students in focusing on the task, whereas others report the students' process being disrupted by teachers' interventions. Noticeably, recent studies of scaffolding students in CSCL environments (Reiser, 2002; Weinberger, Fischer, & Mandl, 2002), can be seen as an excellent answer to critics of the introduction of ICT in learning, claiming the role of the teacher would decrease. Whatever type of learning process, guided or active learning, the students still need being scaffolded by a person or an artefact to assist them into the next zone of their proximal development.

Teachers' Roles

Veldhuis-Diermanse (2002) reports on one of the few experimental studies on the role of moderators or teachers in a-synchronous CSCL environments. In her research into CSCL in Higher Education, she experimented with two different moderator roles, one for stimulating social aspects such as increased interaction, the other one helping the students focus on content. As to the first role, no effects were found on the interaction and the number of affective and meta-cognitive learning activities used. As concerns the second role, Veldhuis-Diermanse found that moderated students debated more, used more external information and linked more factual ideas and remarks presented in the discussions than the self-regulated students did. However, we think this applies to all guiding situations. She argues that, working in a CSCL environment, the teachers guidance needs to change in several aspects. First, the moderator must use the right tone and the right moments for responding to students' contributions, and these might be different in CSCL environments than in F2F situations. Second, the teachers' activities geared to creating a positive atmosphere and an atmosphere of critical thought are also different in CSCL situations. Third, as Veldhuis-Diermanse (2002, p. 144) mentions, "it is very difficult, if not impossible, to instruct teachers to moderate a-synchronous discussion in the short term. Although guidelines can be given and practised, teachers must become familiar with CSCL and moderating discussions. [..] Guidelines for moderation must fit the personal way of teaching".

Based on literature on computer conferencing, Paulsen (1995) describes three essential functions of computer conferencing moderators. The first, the organizational function, refers to structuring the discourse. Secondly, within the social function, the moderator creates a friendly and social environment for learning, encouraging participation and providing (quick and friendly) feedback. Within the third, the intellectual function, the moderator focuses on the content of the discourse, stimulating students to respond to other comments, focusing students on main points, etc. Paulsen (1995) distinguishes various moderator roles, with different emphasis on the three functions, such as the 'Facilitator' (high on all three functions), the 'Lecturer' (high on intellectual function, low on social function), and 'Host' (high on organizational function).

Salmon (2000) distinguishes three roles: the author of the subject course, the tutor (assessor and guidance provider) and the e-moderator, who is the online tutor enabling the meaning making by the students. Characteristics and qualities of the e-moderator are that he should at least be confident, constructive, developmental, and facilitating. Experienced e-moderators are also focused on knowledge sharing and they are creative in using CMC approaches. She described the e-moderators' interventions along the five steps of her model on teaching and learning. During the first two steps, the teacher is focused on the process of col-

laboration, while in the last three steps the teacher supports the cognitive activities of the students.

Students in a study of Cheesman and Heilesen (1999) thought the most important function of the teachers' role had been the ability of monitoring the students' progress and intervening when things went wrong. Ronteltap and Van der Veen (2002) mention as one of the problems of collaborative learning in electronic learning environments that teachers experience difficulties in monitoring the students' learning processes, because it can be very time-consuming. Van der Veen (2001) recommends a strong pre-imposed structure to limit teacher time spent.

All this emphasises that we can distinguish three types of guiding tasks. First, guidance should be focussed on structuring the communication. Second, the teacher should stimulate the students' collaborative process. Third, interventions are needed on the content of the students work. These three aspects of the teachers' guidance will be explored in this study, as they have been integrated within the existing routines of the teacher educators.

Teachers' Interventions

Within the teachers' roles, teachers' interventions can be studied with respect to their frequency as well as their content. Lally and De Laat (2002) closely examined the relation between the teachers' interventions and the students learning in a CSCL environment. In a WebCT environment, students worked together during online workshops of several months on a part-time programme designed to provide participants with a comprehensive grounding in the theory of networked teaching and learning. They found a relation between the point in time of the teachers' interventions and students' learning activities. A peak in teachers' interventions corresponded with peaks in learning activities. Their analysis does not provide information on the direction of this relationship. Ronteltap and Van der Veen (2002) report on a research in which students indicated that regular feedback of the teacher stimulated them more than occasional, albeit extensive feedback. In a study on the use of a conventional discussion board and a software tool supporting anchored discussion, Bernheim Brush and others (2002) compared the teacher actions in both conditions. Their study shows the friction in the choice between, on the one hand, the passive teacher who leaves the discussion to the students, while leaving questions of students unanswered, and on the other hand, the active teacher who responding to all questions and requests, stimulating students to participate, but also constraining them in their freedom of content as they know the teacher will read their contributions.

Except the question as to whether, and if so how frequently teachers should intervene, the question of which kinds of interventions are preferable in CSCL is still left open. Teachers' interventions can be related to the three types of tasks we

distinguished before: organisation of the communication, guidance in the process of collaboration, and the guidance as to task content. As regards the organisation of the communication, the teachers' interventions have the character of directions, for instance on structuring group areas, and the location of files and notes.

In the terms of the role definitions of Paulsen (1995) and Salmon (2000), the second type of interventions is part of the social function of the e-moderator. The interventions which focus on the process of collaboration are particularly important when guiding groups new to collaborative learning or CSCL. On the one hand, process-oriented interventions can focus on the learning activities used in the discourse. For example, the level of questioning is important in order to set a good discussion in motion and to get group members to produce explanations of value to the one asking the question. Except for training, teachers' suggestions or modelling of how to ask questions can help foster good questioning. On the other hand, process-oriented interventions can have a more meta-reflective character. For instance, teachers can stimulate reciprocal interdependence by indicating the importance of individual effort and contribution in the group process (Cohen, 1994). Another example is the evaluation of the individual's role during the process as a way to create individual accountability in adult groups. Strom and Strom (1996) discuss a system they developed, in which students have to evaluate each other anonymously and in which the results are passed back to the students. The system focuses on the student's group behaviour. In some cases, these meta-reflective processes can be supported by software tools enabling automatic feedback to groups and individuals about the groups' well-being, its member support and its production, based on the groups' own contributions. Such meta-reflection helps groups to progress and collaborate (Zumbach & Reimann, 2003). Earlier this chapter, we mentioned the teachers' role in CSCL environments can be quite time consuming. Using these tools saves teachers time, allowing them rather to focus on interventions dedicated to content, or specifically to process guidance when needed.

Content related interventions are part of the intellectual function of the moderator (see Paulsen, 1995), or according to Salmon (2000) of the tutors' task. With her categorization of teachers' roles in online courses, Salmon indicates that the teachers' guidance related to task content does not differ distinctively from other guidance situations.

Our research will study both frequency and content of the interventions. As teachers and students alike are new to CSCL, besides being content-directed the interventions by the teachers will focus on the process of collaboration. The use of methods for evaluating the individual contributions to the group process will be subject of study.

2.7 Research Problem and Questions

Our exploration of the literature yielded three clusters of design elements, which we will now use to further define the research problem into research questions. This study focuses on the design features of a distributed CSCL environment, which contributes to the effective collaboration of students in a teacher training programme. The problem of our research can be described as:

What are the principles for an effective design of a computer-supported collaborative learning environment to be used by student teachers?

Based on the literature, three clusters of design elements can be identified: the task instruction, the teachers' guidance, and online environment. In addition, the design context has been acknowledged as important. The problem definition is further defined into six research questions, which are researched in three studies which had student teachers working in three different CSCL environments, on a total of eight assignments.

Research questions 1and 2 refer to the empirical evaluation of the three designs. An evaluation of student teachers and teacher educators is needed to obtain a view on the users' perspectives. Students and teachers' perspective can help identify important factors for the design of successful CSCL environments. According to Simons (2002), "the learner is an important (f)actor in the success of e-learning", and he observes that there has been done little thorough research on the students' perspectives (experiences, frustrations and concerns) on e-learning. Others confirm this is also true for CSCL research (Hakkinen, Jarvela, & Makitalo, 2003; Hara & Kling, 1999; Nakos, Deis, & Jourdan, 2002; Veldhuis-Diermanse, 2002). The first question, answered in Chapter 5, will be:

1. *How do student teachers and teacher educators evaluate the student teachers' collaboration in the CSCL environments designed within the framework of this research?*

In order to judge the influence of the clusters of design elements, we require a description of the actual collaborative processes that have taken place in the three respective CSCL environments. In this study, we take the common activity of the members of the learning community (in this case students of the IVLOS teacher training programme) to construct knowledge as the point of departure, founding ourselves on Vygotsky's ideas of mutual engagement and co-construction of knowledge. Our study focuses on participation and discourse processes, instead of individual knowledge acquisition and individual learning outcomes. We will study the learning process itself and the quality of the interac-

tion. In fact, one might say we focus on the conditions needed to make the process of knowledge construction possible. In that manner, our research can be classified as part of the participation paradigm (as opposed to the acquisition paradigm) of learning, in which learning is a matter of participation and interaction, and construction of knowledge is an aspect of practice, discourse and activity. Our units of analysis are the collaborative group and the individual who has its role in the collaborative group, as the individuals and social participants together constitute an unified learning system (Van der Linden, Erkens, Schmidt, & Renshaw, 2000). More specific, we studied the student teachers' participation, interaction, nature of communication, information exchange, and regulative communication. This resulted in the second research question, answered in Chapter 6:

2. *How can the communication in the CSCL environments be characterised in terms of participation, interaction and content?*

In the next phase of our research, the evaluation of the relation between the aspects of the three clusters of design elements and the design context on the one hand, and the collaborative learning of the student teachers on the other hand was the object of study. This study should reveal how the task instruction, the online environment, the design context, and the teachers' guidance influence the collaboration of the student teachers. The four research questions with respect to the design clusters and the context are formulated as follows:

3. *In what way are elements of the task instruction related to the student teachers' CSCL process?*

4. *In what way are elements of the online environment related to the student teachers' CSCL process?*

5. *In what way are elements of the design context related to the student teachers' CSCL process?*

6. *In what way are elements of the teachers' guidance related to the student teachers' CSCL process?*

2.8 Summary and Conclusions

Social constructivist perspectives served as the foundations of our educational designs. Central in the design of our courses is the active learner (student teacher), who constructs knowledge in social interaction with others (student teachers and teacher educators), within an authentic context, driven by his own motivation. Both technology and the teacher educator can scaffold common activities of knowledge building, situated in the context and culture in which they occur. One method for learning in interaction is collaborative learning, which concept has been further explored in this chapter, by describing five premises of collaborative learning (positive interdependence, individual accountability, promotive interaction, group processes, and the development of collaborative skills), as identified by Johnson and Johnson (1994).

CSCL is a way of collaborative learning which, supported by technologies, provides the field of education and training with a powerful learning tool because it has the capacities of time and place independence, information storage, communication facilitation by text mediation, stimulation of knowledge construction by linking reflection and interaction, of leveling out discussions between otherwise non-equivalent partners, and of an increased authenticity of learning.

Over the years, CSCL research has shifted from tentative empirical research into various subjects and into mainly networked technologies in real-life settings, through a period of searching for its roots and foundations, to a more detailed study of the characteristics of the electronic discourse and of the participation and interaction patterns.

Main issues in CSCL research have been the cognitive processes of knowledge construction and the design of technical environments to support these processes. Meanwhile, we think the significance of task instruction, group dynamics and the role of the teacher are generally underestimated. Recently however, the social dimension of collaborative learning and scaffolding processes in CSCL environments are gaining attention. The problem of generating learning in CSCL environments is central in many CSCL studies, where the amount and quality of interaction are often found disappointing.

We found three clusters of design elements: *task instruction*, *online environment*, and *teachers' guidance*. We also identified the *design context*, including factors not or barely under the control of the designer (teaching context and the technical situation the student teachers have to work in, their ICT skills, personalities, attitudes towards the collaborative process, their prior knowledge and cognitive styles).

In Table 2.1 we translated our research findings from the literature into design considerations for each of the design elements in the three clusters.

Table 2.1
Summary of design considerations

Cluster	Design element	Design considerations
Task environment	*Type of task*: determining aspects are the degree of shared responsibility, the learning objectives, and the instructional method.	• Open-ended, problem based tasks suitable in adult learning in ill-structured domains, create interdependency. • Built-in controversy promotes verbal interaction and exchange of views.
	Structure of the task: description of all parts of the task, milestones, task distribution, description of the participation and interaction including role-taking.	• Pre-imposed structure is needed to keep students on track and ensure a certain degree of interaction. • Use of pre-imposed structure in open-ended, problem-based tasks can constrain production; groups should determine their own procedures to encourage interaction. • Degree of structure is dependent on students' experience with work in CSCL environment. • Task specialisation can stimulate individual accountability. • Literature shows divergent and little results of the use of roles.
	Assessment procedures.	• Assessment should be focused on process instead of product. • Individual rewards can stimulate individual accountability, but also focus on incentives.
	Time available for the task.	• A task needs more time in online environment, but a longer period of time for a task may result in longer periods of silence, and in limited use of the CSCL environment.
	The balance in blended learning.	• Regular F2F meetings create personalisation and stimulate a more natural online communication, and students feel more compelled when meeting group members F2F.
	Group composition: group size and group structure.	• Small groups function better than large groups. • Heterogeneous groups based on subject background or prior knowledge may stimulate interaction.
Online environment	*Functionalities*: tools within technical environment.	• The technical environment should be chosen based on purpose of use, in consideration of the need for a content related area, communication, organizational, and community-building tools. • Simplicity of technical environment is preferred to all kinds of functionalities. • Separate content discussion area from organizational and social discussion areas. • Include multiple means of communication.
	Discussion area with option of threaded structure.	• Use of threads is a skill that student and teachers should gain by training and experience.

Table 2.1 (continued)

Cluster	Design element	Design considerations
Teachers guidance	*Teachers' roles*: designer, 'guide on the side' and e-moderator (organizing, social and intellectual function).	• Moderator must find right tone and right moment to respond to students' contributions. • Teacher should create a positive atmosphere for critical thinking. • Guidelines for moderation must suit the existent personal way of teaching.
	Teachers' interventions: frequency and content.	• Regular feedback stimulates students' participation. • Monitoring the students' discussion enables teacher to intervene when things go wrong. • At the start of the course, process oriented interventions are needed, focusing on group dynamics and collaborative learning. • Individual accountability in adults groups can be stimulated by evaluation of the individuals' role in the group process. • Teachers' role is time consuming, but tools can help teachers save time.

Chapter 3: Design of the Courses Introduction

3

This chapter describes the educational designs of the three courses which form the objects of our study. The chapter sets out providing background information on the teacher training institute where the designs were implemented (3.1). Although Chapter 2 presents some principles for CSCL design, when designing our courses, we found contemporary literature offered insufficient information to actually design CSCL environments for our teacher training programmes. Therefore, we turned to experts in the CSCL field, the results of which consultations have been summarized in 3.2. In 3.3 we present the way in which we operationalised the design clusters in our courses (task instruction, online environment, teachers' guidance). The designs of the three courses are described more specifically in 3.4, 3.5 and 3.6. The chapter is concluded with a summary and an overview of the design clusters' operationalisation in the three designs (3.7).

3.1 Context of the Courses

IVLOS, the Institute of Education of the Utrecht University, provides one year (full time) teacher training programmes for the upper secondary level. Annually, around 150 students enrol in one of the 18 school subjects IVLOS provides courses for. These courses are taken either following their four or five-year subject-oriented programme or simultaneously. The courses described in this study were attended by students who had finished their subject-oriented programmes.

The teacher training programmes are directed at the acquisition of integrated competence, i.e. basic teaching skills and the capacity to develop oneself professionally through reflection (IVLOS/Institute of Education, 2001). Pedagogical issues such as lesson preparation, the actual lesson, and its evaluation, are discussed in meetings at IVLOS. Other topics, such as subject-oriented teaching methods, the role of the teacher outside the classroom, educational research, and workshops on several subjects, are part of the institute's programmes, too. Reflection on one's experiences, problems, views and performance is considered essential for the professional growth of the student.

During their programmes, students experience two periods of school practice. In the first one the students are at their practice schools in groups of three, orientation on the teaching profession and gaining first experiences with actual teaching constituting the main goals. The second period is individual, with the student fully responsible for at least 10 lessons per week, over a period of three months.

All student groups had their own 'teacher educator', to guides the students, in conjunction with teaching methodologists. The students also receive guidance at their practice schools, by a co-operate teacher. An important part of the programmes is that the students also support each other through peer consultation.

As to ICT, when we started our research IVLOS used an e-learning environment to prepare students for professional use of ICT in their classes, and to organise and manage courses. Since 2001, students are also required to produce a digital portfolio to guide them, and to assist them in self-assessment during the programme. Also, the portfolio is used as an instrument for their assessment by their teacher educators. Some parts of the programmes are supported by an e-learning environment, which is used to exchange information and to communicate about and work on assignments.

In total, four types of programmes can be identified at IVLOS. The first, the Pre-service programme, runs parallel to the students' subject oriented studies, or is taken directly upon having finished them. Next, the In-service programme is intended for students wishing to combine their training programme with a job in secondary education. On average, these students teach for about 12 hours a week, while also visiting IVLOS on a weekly basis. Thirdly, the so-called 'Specialty' programme is geared to the needs of each individual student, and meant for the more experienced teacher who desires to obtain a university teaching degree, and/or works more than 16 hours per week as a teacher. Finally, the Bilingual and International Teacher Training Programme (BITEP) is intended for those interested in working at bilingual and/or international schools, or abroad. The programme is presented in English and includes a number of additional training components. The individual school practice period takes place abroad (IVLOS/Institute of Education, 2001). The research for this study has occurred into three groups. One mixed group of students covered all four types of training programmes, and focussed on History Teaching Methods. The second group consisted of students from the BITEP programme, the third group of In-service students.

3.2 Consulting Experts on Educational Design

The literature provided us with several design considerations related to three clusters of design elements: task instruction, online environment, and teachers' guidance. Many of these considerations are based on the literature on collaborative

learning. When designing our courses, we were faced with limited input from the CSCL research field of educational design aspects of CSCL. Therefore, we consulted experts with research experience in the field of pedagogical design of CSCL.

3.2.1 Expertise and Procedures

We selected three European experts from different areas of expertise in the field of educational technology in Higher Education, also for their work in international projects in this field. One is an expert on the pedagogical approaches of online teacher training. The second has been involved in many CSCL projects focused on training teachers, both as a teacher and a researcher. The third expert was involved in developing an e-learning environment for university teaching.

The consultation consisted of two one-hour interviews with each expert. The first interview focused on their experiences with CSCL in teacher training, their pedagogical view of learning and teaching in an online context, the technical design, and their opinions as to the role of the teacher. Additionally, they were asked to compare e-learning environments with regular learning environments. Furthermore, we invited them to provide suggestions on our planned designs, to advise us on further literature and to offer general background information about their occupational tasks.

The second interview, a couple of days after the first one, was used to elaborate and complete the topics from the first round. Due to time constraints, one expert could only be interviewed once, and another one's second interview had to be performed by means of video conferencing.

The experts received the interview topics prior to the first interview (see also Appendix B1). The interviews took place in the period from December 1998 until March 1999. The interviews were audio-recorded and the content has been summarized.

3.2.2 Results

The experts' various suggestions and considerations for designing CSCL environments are summarized in Table 3.1, and clustered into the three categories of technical design, teacher role, and task instruction. The design considerations related to aspects of technical design concern the functionality and usability of CSCL environments. One expert particularly stressed the importance of technical design. The programs adopted should be tailored to course content, and technical aspects should not hamper students in proper usage of the software. This means that all employed media should be integrated into one package, and that the software must have a clear structure and be very user-friendly. Users should be able to move from one part to the other and use the different functionalities in a straightforward manner.

The design issues related to the teacher role refer to interventions during online work, the roles of the teachers, and the skills teachers should possess, such as the skills to communicate in an a-synchronous environment.

Concerning task instruction, the experts mentioned design factors concerning the creation of the learning community, pedagogical considerations and task structure. In relation to the CSCL pedagogy, one expert emphasized the importance of the participants being motivated to be involved in discussions, or to work on assignments at all. The geographical distance, specific task subjects, or tasks geared to collaborative learning are all means to enhance students' intrinsic motivation. When these are absent, students of credited courses can be motivated by external factors such as a pre-imposed structure with moments of assessment. Students involved in non-credited courses are difficult to motivate externally.

As to task structure, one expert underscored the importance of structuring students' work-related activities. A rigid structure helps students in getting started and in having efficient, content-related and reflective discussions. He favoured a pre-imposed structure with a strict planning and milestones, a clear task description, and regular product assessment.

Table 3.1
Suggestions and considerations of experts for the design of CSCL environments in teacher training

Category	Suggestions/considerations
Technical Design	Functionalities • promote emotional side of online context by opening a separate discussion area for social exchange; • decide to what extent design should be an information retrieval system, and to what extent a communication system; • include possibility in discussion for different threads for separate subjects; • combine F2F and a-synchronous communication to provide possibilities for spontaneous reacting, but also to stimulate reflection while writing; Usability • personalise the communication to stimulate reflection; • differentiate in degrees of structuring in the course, dependent on experience and skills of participants; • integrate all media in one interface; • allocate pedagogical associations to labels or menus, instead of technical ones; • connect the discussion platform directly to the content area; • include pre-structured discussion for more efficient discussion;
Role Teacher	Guidance • instruct students how to work in the environment (act as change agent of the learning culture); • use scaffolding; • stimulate mental reflection in groups to develop learning culture within the group; • be part of the group on same level as students.

Table 3.1 (continued)

Category	Suggestions/considerations
	Roles • determine the structure of the course; let students bring in the content; • take up the roles of expert, facilitator, instructional designer, assessor, and tutor; • use experts to work on products together with students. Skills • technical, didactic, communicative, and design skills are important.
Task Instruction	Learning community • create a virtual group with its own learning culture (stimulates reflection) and let group work together for longer time, include F2F contact, e.g. start with F2F meeting; • create group feeling to stimulate emotional side of collaboration; • use external experts; • let students work together in an international setting: this widens the cultural context and deepens the reflection of the student; • use heterogeneous groups to increase exchange of ideas and knowledge (learn from each others views and knowledge). Pedagogy • combine F2F and online activities. F2F meetings are used for preparation of online collaboration of work on assignment; • use discussion groups to stimulate learning from each other; • use assignments heading for 'learning from each other': online presentation of own thoughts and products, online modification and evaluation of work (online reflection on work); • use collaborative learning methods only when suiting the subject; • let students publish half-products online (allowing for meaningful discussion); • let students produce products together online; • consider jigsaw method as method to be used online as well. Structuring • structure course by: clear learning goals at beginning of course, library with resources already classified and categorised by teacher; study guide with planning, goals, pedagogical structure, regulations on submitting parts of the assignments, and clear description of assessment aspects; • use structure at start of course to teach students how to learn and behave in e-environment, and create more openness at end to give students more responsibility for own learning processes; • for teacher's benefit, avoid cluttered discussion, obligate students to send in work for feedback regularly; • structure the course and stimulate involvement in collaborative work by a strict schedule of assignments and assessments; • schedule sufficient time for students to respond to each other, and mind students have no time to study large amounts of emails.

3.3 Operationalisation of Design Elements

Based on the information from Chapter 2 and the expert consultation (3.2), we developed and implemented three designs in three courses, which were selected for various reasons. Collaborative learning should be the main instruction method of the courses. Next, we wanted to involve courses in which CSCL could

have a clear added value because of existing problems, e.g. participation of a diverse group of students. In other words, our selection was problem-directed. A third criterion was to have courses with teacher educators with a positive attitude towards usage of e-learning.

The courses ran successively, the first one, on history teaching methods (HTM), during the first half of the academic year. Based on the preliminary results of this course, a design was drawn up for the BITEP course, which was scheduled during the first months of the second half of the whole of the teacher training programme. The third one, the In-service course, was designed using the preliminary results of the first and second courses. A particular aim was to increase students' interaction during their collaborative work on their assignments. This course too was scheduled during the second half the training programme.

This research took place in an existing teacher training programme. When designing the courses we had to consider existing assumptions concerning learning and training. As a consequence, the learning process has been more teacher-led than might have been expected in view of our social constructivist perceptions on active learning (Simons et al., 2000a).

The courses differ in the operationalisation of various elements of the clusters of design elements and in the context of the designs. Table 3.4 provides an overview of the three designs. We did not vary some of the design features presented in Tables 2.1 and 3.1 because of their limited relevance to our research questions, and for their limited feasibility.

3.3.1 Task Instruction

In order to promote interdependency, the *type of tasks* adopted in all three courses can be characterised as open-ended, ill-defined, and problem-based. As procedures need discussing and many solutions are presented and reviewed, open-ended problems tend to provoke interaction and exchange between group members. The discussion tasks in the HTM course and the built-in controversy in the In-service course were included to stimulate verbal interaction and exchange of views, or, in other words, in order to generate reciprocal exchange (Johnson & Johnson, 1994). Other assignments included online creation of products, which is also mentioned by our experts as generating discussion and interaction.

The *structures of the tasks* vary in the use and degree of a pre-imposed structure, dependent on the students' experience with CSCL environments in their learning process. A pre-imposed structure may limit interaction, and groups should determine their own procedures. In the HTM course, we used more structured assignments at the start of the course, and more openness at the end, in order in the beginning to teach students how to work in the environment. One of the BITEP assignments included task specialisation (each group member being responsible for a part of the task). We varied the degree of task structure in the

other BITEP assignments. For the In-service course we used a pre-imposed structure, including built-in controversy.

As concerns *role-taking,* the literature shows divergent opinions of the use of roles in CSCL environments. Providing group members with roles may stimulate content-discussion, but may also restrict participation in the whole process of collaboration. To study role-taking in CSCL environments in teacher training, we included the use of roles in some of the assignments.

The *assessment* procedures have not been changed in the courses. In the teacher training programme, assessment is focused on the process of learning and teaching rather than the product, and a reward structure is absent.

We varied *the time available for the assignments*. We used short assignments of 2-4 weeks and assignments of 10-15 weeks.

Blended learning (alternating F2F meetings and online collaboration) is used in the HTM course. Regular F2F meetings were included as the HTM students did not know each other at the start of the course. Our experts emphasized the importance of creating group feeling in stimulating the students' involvement and the emotional side of the collaboration.

As to *group composition*, we used small groups in all courses (three to four students). In some of the assignments, heterogeneous groups based on divergent teaching backgrounds were used to stimulate the exchange of ideas, from their various frames of reference. The groups were composed ad random as to age and gender.

3.3.2 Online Environment

In Chapter 1 we referred to the fact that many Dutch institutes in Higher Education have only just begun to introduce electronic learning environments and groupware, applications that are more teacher-driven and suit more traditional ways of learning. The introduction and usage of electronic environments and groupware has also been a topic of interest in teacher training, providing an answer to the educational needs of teacher training programmes. It is for this reason that we used groupware applications in our study.

The technical environments adopted in the courses were selected for their communication *functionalities* and options for working on products in groups. In our research we used BSCW© version 3.3 (http://bscw.gmd.de/) and WebCT version 3.1 (http://www.webct.com), both rather basic programs. They offer possibilities for threaded discussion and file exchange, and include all media in one interface. Moreover, BSCW© also offered the possibilities for linking the discussion directly to the content and to work with different versions of a file. WebCT allows for synchronous communication using a chat facility. Also, both groupware applications include a separate social area designed to separate social communication from the content communication. The third course did not include a

social area. All course environments were furnished with a variety of course materials.

3.3.3 Teachers' Guidance

In relation to the *teacher educators' role*, we decided not to alter their personally established ways of teaching and guiding, because other research on the use of ICT in teaching and training shows that it is difficult for teachers to change routines (Veen, 1994; Veldhuis-Diemanse, 2002). In all three courses, the teacher educators planned to monitor the students' progress, to which end e-learning is an excellent instrument. An educator of history provided advice on the HTM course subject matter.

The teacher educators were free to decide as to *frequency and content of their interventions*. However, we did discuss the possible ways of communication while guiding students in CSCL environments with the teacher educators, and we provided them with some assistance. We decided with the HTM and BITEP teacher educators, to have them focus on both content and the students' collaborative process. The HTM course included one F2F 'interim' evaluation of the group's collaborative process, and regular F2F meetings between students and teacher were scheduled. As the students did not know each other at the start of the course, a F2F kick-off meeting was also scheduled. Agreements were made with the In-service course teacher educator as to the frequency of intervening.

3.4 The HTM course

3.4.1 Design Context

The HTM course was presented during the second half of 1999, the objectives being to increase students' knowledge and experience with history teaching methods, use of ICT and collaborative learning. The course was scheduled at the beginning of the teacher training programme, running parallel with other courses and the first school practice period. Students' workload for the online part of the course has been 120 hours. The course participants were 15 students from the Pre-service, BITEP, In-service and Specialties programmes, all having a Masters' degree in history. In its original form, this course took place solely at the institute in F2F sessions, causing logistical problems with a diverse group of students participating. To overcome constraints of time and place, an online learning environment was installed, allowing students to work on assignments collaboratively.

The students had to provide their own computer at home. IVLOS provided the students with a modem and an Internet connection, but the students had to pay their own telephone bills. Two computer labs were available at IVLOS. Students

could receive technical assistance from a technical assistant and the IVLOS helpdesk.

3.4.2 Task Instruction

The design included four online assignments of an ill-defined, open-ended and conceptual nature, focusing on the discussion of ideas and intermediate products, differing in their degrees of pre-imposed structure, the first assignments being more structured in order to help students on their way. Overall, the tasks had little pre-imposed structure, requiring the students to plan the assignment by themselves, dividing the tasks online. Table 3.2 presents an overview of the subject, available time, focus, structure, group composition, and an assessment of each assignment.

Table 3.2
Variation of design features of the assignments of the HTM course

Assignment	Duration	Instructional method	Structure	Group composition	Assessment
Assignment 1: Shared proposition	2 weeks	Debate	Medium pre-imposed structure with clues for handling task	Heterogeneous[1]	Defence of group statement in F2F meeting and portfolio
Assignment 2: Criteria effective teaching methods	2 weeks	Common written end-product	Mediate pre-imposed structure with some time limits given	Heterogeneous	Presentation of assignment in F2F meeting and portfolio
Assignment 3: Series of lessons	4 weeks	Common written end-product	Low pre-imposed structure	Heterogeneous	Presentation of series of lessons in F2F meeting and portfolio
Assignment 4: Educational curricula	2 weeks	Common written end-product	Low pre-imposed structure	Homogenous[2]	Presentation of assignment in F2F meeting and portfolio

[1] Heterogeneous: HTM students from different teacher training programmes (Pre-service, BITEP, In-service, Specialty) working together.
[2] Homogeneous: HTM students from the same programme working together.

The first assignment allowed the groups two weeks to produce a shared proposition about the future of history teaching in secondary education, based on literature. It also had the additional function of providing the students with the options of gaining experience with the online course environment and helping them create a learning culture within their group. Technical problems could be identified and solved during these weeks. The second assignment had each group make a list of criteria for effective teaching methods. These lists of criteria were needed

for the third online assignment, which had to be completed in two weeks. Next, the third assignment allowed them four weeks to compose a series of lessons on a specific topic. Finally, Assignment 4 had the students study literature on various educational curricula, each group being responsible for one curriculum. The final part of the assignment was that groups compared the components of the different curricula online. The instruction for the assignments was included in the online course environment, as were the literature and online resources. The assignments are included in Appendix C1.

The students were required in their portfolios to include the end products of their different assignments as well as reflect on the collaborative process. To stimulate individual accountability, the students were also required to include a reflection on their contributions and their role in the group's work. These reflections had to be illustrated with contributions by the student and other group members, to show how they had influenced the group process.

The original F2F course programme was rewritten so as to include a series of assignments, all entirely online except for the presentation of the group outcomes, which took place at nine F2F meetings, which were also used to explain each new online assignment and to evaluate the collaborative group process. Most of the time at these F2F meetings was reserved for additional assignments. The first three weeks, the whole group met once a week. Later, they met every other week.

The HTM course had three groups of four and one group of three students collaborate on four tasks. During the first three assignments, they worked in the same heterogeneous groups (based on students of different teaching programmes). For the nature of its content, homogeneous groups were used in Assignment 4.

3.4.3 Online Environment

The online course environment consisted of a website with information about the course, manuals on how to work with the Internet, directions for collaborative learning, a diary including all deadlines and milestones, hyperlinks to educational resources (pre-selected and pre-arranged by the teacher), the assignments, and a link to an expert (experienced history teacher) for feedback on individual teaching experiences and assignments.

BSCW© was linked to the course environment as the workspace for the group work. It was selected for its possibilities of working with different file versions, of connecting the discussion directly to the files, and of creating threaded discussions. Moreover, IVLOS' technical staff had some previous experience in running this program with groups of students. In BSCW©, folders were created for each subgroup. The groups had reading access to the other groups' folders. Each group had to structure their own group folder.

Webboard™ Version 3.5 (http://webboard.com), which had already been used frequently in the teacher training programmes, was used as a social meeting area. Figures 3.1 and 3.2 present screendumps of the course environment.

Figure 3.1. Screendumps of the HTM homepage .

Figure 3.2. Screendump of a group discussion area in BSCW©.

3.4.4 Teachers' Guidance

The teacher educator's interventions focused on both task content and the students' collaborative process. The HTM teacher educator stimulated their individual accountability, and tried to motivate them working together rather than working for individual excellence. He also paid attention to the values and agreements for organising and managing the group process. Moreover, he tried to stimulate

reciprocal exchange by motivating the students to give their own points of view, and by stressing the importance of individual efforts and contributions to the group process. The online learning environment being relatively new to most, the HTM teacher provided the students with some guidelines as to how to proceed in the discussion but avoided applying a rigid structure to the assignments.

As mentioned before, we decided not to change established teaching routines and let the teacher educators decide for themselves how to intervene. The regular evaluations of the online work at the start of each F2F meeting provided set moments of intervention. In addition, halfway through the course a more elaborated evaluation required the students to reflect on their own roles within the group and on the group as a whole, based on the evaluation system of Strom and Strom (1996). Throughout the whole course, students could have F2F contact and personal online communication with the teacher educator.

The students received training on how to use the website and exchange messages and files in BSCW© and Webboard™. There were two reasons for aborting the idea of training collaborative skills, as advised by Johnson and Johnson (1994). First, taking their Masters' degree into account, we expected these particular student teachers already to dispose of a many of the skills required for working collaboratively. Second, these skills are also used, and trained *en passant* while working on other parts of the teacher training programme.

3.5 The BITEP Course

3.5.1 Design Context

The second course took place in 2000 as part of the international teacher training programme, with the students in their practical period at an (international) school abroad. Objectives of this part of the programme were to train the students in teaching strategies, to guide them during their school practice, and to keep them in contact with each other and with the training institute. The course also enabled them to continue study parts that had already been started at the institute.

This practice period of three months is scheduled at the start of the second half of the programme. Seventeen students of various subject backgrounds were divided into small groups of two to four students, students of each group working at the same school, some even sharing the same house. The students had no F2F contact at all with their teacher educators, nor with students from other groups, or other students from the institute. Two students remained in the Netherlands and performed their practical period at international schools. Some students continued their school practice abroad for another four to six weeks. Many had to continue working with the online learning environment to complete their assignments

after returning to the Netherlands. The students had the online learning environment at their disposal until the end of the entire teacher training programme.

IVLOS ensured every student having access to the online learning environment either at the practice school or at the co-operating teacher training institute. If the students desired to be connected the internet at home, they had to provide for their own computer and Internet connection, as well as pay their own telephone bill.

3.5.2 Task Instruction

In this course, three assignments were designed, implemented and evaluated (see Appendix C2 for a description of the assignments). Table 3.3 compares the three assignments with the focus on the assignment, the structure used, assessment and group composition.

The first assignment of this study, the so-called TIE (Teaching in English) assignment, constituted the main focus of our research into this course (student workload around 75 hours). The assignment required the students, with the help of their group mates, to design, revise, and actually administered a lesson in a second-language class.

The teacher educator composed seven groups, each ideally consisting of two same subject students and one student of English. However, two groups consisted of subject students from different backgrounds simply because there were no other students in the group with similar background. All three members of each group were located in different countries. Both subject students had to plan, carry out and evaluate a lesson and comment on each other's lesson. The English student had to take part in two or three groups, commenting and providing feedback on the language aspects of each subject students' lesson.

The task was given a highly pre-imposed structure. Preliminary analyses of the data from the HTM course had shown that using ill-defined, open-ended tasks and heterogeneous groups had not yielded the interaction we had aimed for. Results of other studies of teacher training programmes show that a highly structured schedule assisted students in working online (Lockhorst, 2000). We expected such a pre-imposed structure to compel the students to work at a regular pace, delivering their products and comments in prescribed weeks while helping them to stay on course and evaluate their group process. In the TIE assignment, different roles were explicitly pre-described in order to stimulate the students to take responsibility for their parts in the group process. The groups received a week to week schedule, stating what was expected of them and specifying the content, role and planning of the assignment.

Preliminary analyses of the first course also showed that the period for the tasks (two to four weeks) was too short. Therefore this assignment was scheduled for 14 weeks.

The students' assessment was based on their reflections on their end-products and how they viewed the benefit of the TIE assignment in their portfolios. Members of a group that had rarely worked on the TIE assignment received another, individual, assignment upon their return.

To enable us evaluating the consequences of using a pre-imposed structure, two assignments with a very low pre-imposed structure were included. These assignments required the students to compose their own group, and to determine the subject, planning, timeline, and task division themselves. The CSCL environment could be used voluntarily.

Table 3.3
Variation of design features of the assignments of the BITEP course

Assignment	Instruction method	Structure	Group composition	Assessment
TIE assignment	Commenting on each others' products	High pre-imposed structure	Seven groups of three members composed by teacher	Portfolio
TOC assignment (voluntary)	Common end-product (F2F presentation)	Low pre-imposed structure	Five groups of three or four members composed by students	Written report
Research assignment (voluntary)	Common written end-product	Low pre-imposed structure	Three groups of three or four members composed by students	F2F presentation of end-product

One assignment focused on collecting information about a subject related to the topic 'teacher outside the classroom' (TOC assignment). The student workload abroad was around 60 hours. Five groups worked online on the TOC assignment, group size varying from three to four students. Groups also varied with respect to the student's subject backgrounds. During the so-called Research assignment, students conducted (limited) research into an educational topic. The students had to invest 300 credit hours in total for this assignment, but were free to decide how many hours to spend abroad. Only three groups of three or four students worked on this assignment. Seven students did not use the CSCL environment for their internal communication during the assignment. All three Research groups, composed of members from varying subject backgrounds, started their work while still abroad, completing the assignment back in the Netherlands. In both assignments, the students used their practice period for information gathering purposes, and the period back home for analysing the data and writing their reports or preparing their presentations.

The students received the TOC and Research task assignments at F2F meetings. The task descriptions were not available on the course site.

3.5.3 Online Environment

We selected WebCT for the online course environment, because the teacher educator as well as the students felt that BSCW©, the online environment of the first course, was too unorganised, and students did not use the specific BSCW© facilities, such as working with different versions of one document. Moreover, WebCT had already been used at IVLOS during other parts of their training and the preliminary experiences were positive.

The WebCT environment included course information, student homepages, a bulletin board, an e-mail facility, a chat facility and the Student Presentation area in which students could exchange documents and create HTML pages. The course information areas were used to explain the TIE assignment in more detail and describe its pre-imposed structure.

In the Student Presentation area, group areas were created in which each group could exchange documents. Group discussion folders (see Figure 3.4) were created in the Bulletin Board, in which discussion threads could be used. A separate 'Social Talk' folder allowed students to exchange all sorts of information not related to the assignments. A chat facility was included, which the students were free to use for their work or for socializing. Figures 3.3 and 3.4 present screendumps of the course environment.

Figure 3.3. Screendump of part of the instruction of the TIE assignment of the BITEP course.

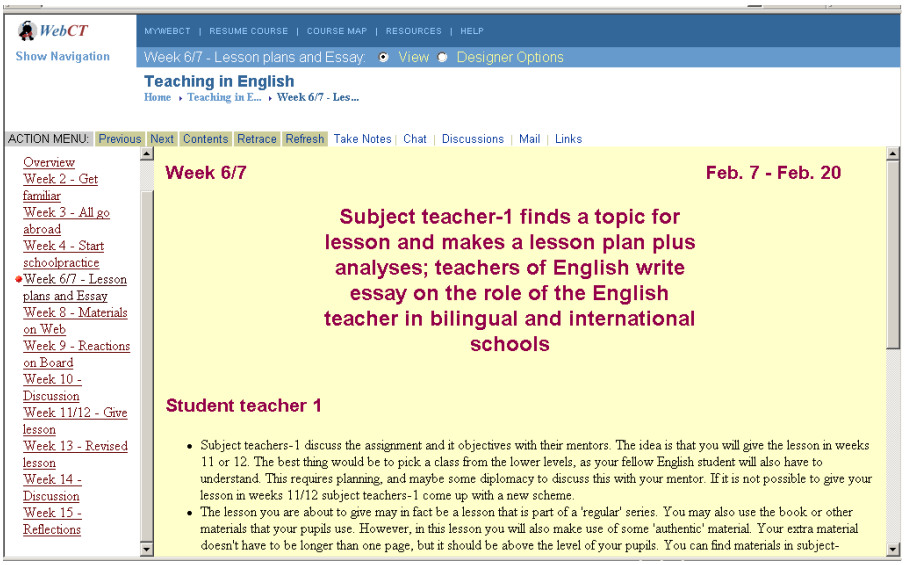
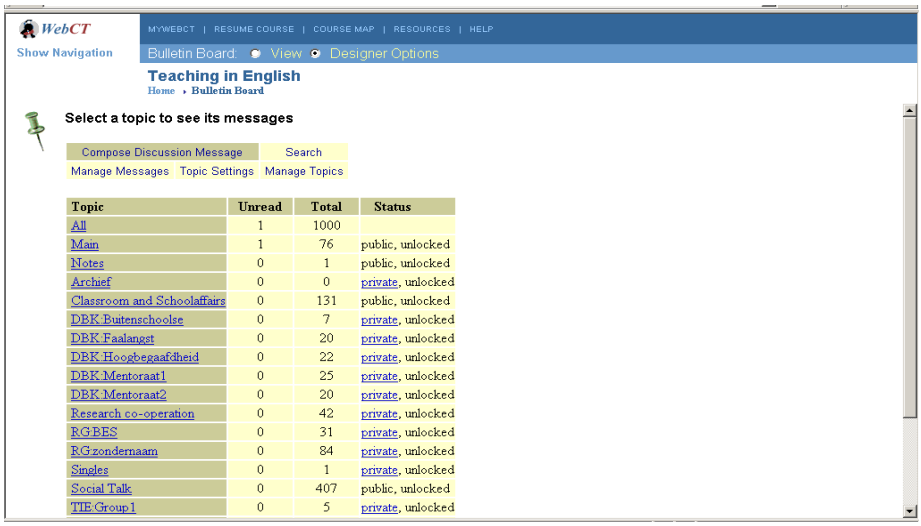


Figure 3.4. Screendump of overview of group folders of the Bulletin Board.



3.5.4 Teachers' Guidance

One teacher educator responsible for general guidance of the group during the whole teacher training programme guided the students through the TIE assignment. Three different teacher educators, one of them the teacher educator guiding the TIE assignment, guided the three research groups. The TOC teacher educator transferred his guidance, which included mostly co-ordinating tasks, to one of the students. This student did not have to perform the assignment.

The teacher educators decided how and when to intervene, as we did not want to affect their teaching routines. The teacher educator guiding the students during the TIE assignment had intended to provide feedback on content as well as on (online) regulative aspects of the group work, but concentrated on the regulative issues (see chapter 9). The teacher educators guiding the Research groups concentrated on task content and content-related discussion. The co-ordinating student's task in the TOC assignment had been intended to stimulate all groups to work on the assignment and organize the central presentation of the end products, but he actually took a very small role.

Before leaving for their school practice period, students received a three hours training including instruction on the task and usage of the WebCT environment, during which they had to work within their group and practice with a small scale mock version of the TIE assignment. This was done in order to ensure they understood both the online environment and the procedures and structure of the assignment. The students received a manual on the use of WebCT on paper and online. During the entire course, IVLOS provided technical assistance.

3.6 The In-service Course

3.6.1 Design Context

The CSCL assignment of the third course (students' workload: 15 hours) was offered as an alternative to part of an original series of three assignments in which students had to reflect on their performance and development as a teacher during the teacher training programme. In the original version, students were required to keep a diary in which to describe their lessons and reflect on them. The nine students opting for the online version were allowed to skip the last assignment. They had to compose their own groups and were responsible for obtaining their own equipment. They worked in groups of three, and differed in their subject of teaching.

3.6.2 Task Instruction

The online part of the course included only one assignment (see Appendix C3). In our study of this course we decided to give priority to the purpose of increasing the students' interaction during their collaborative work. To that end, we designed a task in which students were completely dependent on each other in order to achieve an end product. This approach relied on aspects such as a high pre-imposed structure, built-in controversy, and role-taking. Participation was voluntary, as we aimed for having already motivated and involved students.

In various rounds, groups wrote an 'autobiographical' or fictional story about a well functioning teacher, each writing part of the story, including three reflective elements on his own performance as a teacher. The other group members had to respond to these elements and the story as a whole, and one of them had to propose a change in one of the story's elements, which then had to be discussed by all group members. Finally, the writer had to rewrite that part of the story. This task design had us anticipate intensive discussions.

During a F2F session, the students discussed their product, their contributions to the discussions, and their reflective elements with the teacher educator. The assignment had to be carried out in 10 weeks. The whole assignment had to be performed online, despite the fact that the students also met every week for other educational purposes.

3.6.3 Online Environment

In view of the positive responses of the BITEP students, we selected WebCT for the working environment, which included an assignment instruction and a manual on how to use WebCT in the context of this assignment. The Bulletin Board offered possibilities for threaded discussions, and files, including parts of the story, could be up and downloaded in the Student Presentations area. The story could be

written in MS WORD® or HTML. Each group had its own group area for discussion in the Bulletin Board and the Students Presentation area. Students were obligated to check their group space at least three times a week. Appendix C3 includes a visualisation of WebCT usage. A chat facility was available in WebCT. The CSCL environment did not have a separate area for social communication

3.6.4 Teachers' Guidance

During the assignment, the teacher educator or a technical assistant was available for technical feedback and queries, the first also for feedback on content. We made agreements with this teacher educator as to the frequency and content of his interventions. He provided feedback after the first part of the story had been presented and subsequently discussed, to inform groups as to whether they were on the right track. He also offered feedback on the whole story after the last round.

Already within their group, the students received training in the use of WebCT, which included instruction as to task content, based on a mock version of the assignment.

3.7 Summary of the Designs

All three designs of our study concerned part of the teacher training programmes of IVLOS, the Institute of Education of Utrecht University. Students of different programmes were involved, placed in course groups varying according to type of teacher training programme and number of participants. This chapter has shown the differences and similarities between the three designs in relation to design context, task instruction, online environment, and teachers' guidance (Table 3.4). The courses were run successively throughout the IVLOS programmes. The first course, on history teaching methods (HTM), was scheduled during the first half of the academic year. Based on its preliminary results, a design was developed for parts of the BITEP course, which was then scheduled during the first three months of the second half of the BITEP programme. The design of the third course (the In-service course) was developed, based on the preliminary results of the first and second courses, geared to increasing students' interaction during their collaborative work on the assignments.

The courses differed as to the operationalisation of various elements of the clusters of design elements, and in the context of the designs. The operationalisation is based on information from both literature and our experts. Due to the fact that we worked within a framework of existent educational practices, we were not able to fully control the design of the CSCL environments.

Our focus being task instruction, the three designs differ mostly in that aspect. As to task instruction, the design of the courses varies depending on type of task,

task structure, role-taking, assessment, time available for the assignment, compulsory or voluntary participation, and degree of blended learning. As concerns online environment, the designs differ in the groupware program used, the HTM course adopting BSCW©, the BITEP and In-service courses WebCT. The functionalities of these programmes are comparable, but interface and user-friendliness differ. Design interventions in teachers' guidance have been limited, not disturbing personally developed ways of guiding and teaching. All teacher educators involved were new to the use of CSCL environments. The teacher educators were free to decide on frequency and content of their feedback, although we did made agreements with the HTM teacher to have him focus on guiding the groups' collaborative processes. Also, we agreed with the In-service teacher as to the frequency of intervening. Finally, with respect to design context, the courses differed in the technical situation of the students, type of students, number of students involved and the courses' scheduling and subjects.

Table 3.4
Overview of the three designs

Design Element	HTM course	BITEP course	In-service course
General characteristics			
Period	September '99 – January '00	January '00 – May '00	February '00- April'00
Subject	History Teaching Methods	Teaching in English (TIE) Teacher outside the classroom (TOC) Research	Reflection on teaching performance
Type of student	Mixed (pre-service, in-service, BITEP, specialty)	BITEP	In-service
Total number of students	15	17	9
Technical situation	Received modem and Internet access from teacher training institute	Teacher training institute made agreements with educational institutes about Internet access abroad	Students were responsible themselves for good hardware and Internet access
Task instruction			
Structure	Low pre-imposed structure by means of manual about how to work collaboratively Interim products to teachers	Main assignment: strong pre-imposed structure by means of description of tasks, planning and role-taking Other assignments had no pre-imposed structure	High pre-imposed structure by means of describing tasks and role-taking, with built-in controversy Planning of tasks was optional
Type of assignment	Ill-defined, Open-ended Group study task Focused on discussion of ideas and (interim) products	Ill-defined Open–ended Task specialization in TIE assignment Group study task in TOC and Research assignments Focused on discussion of ideas and (interim) products	Ill-defined Open-ended Group study task Focused on discussion of reflections and interim products
Compulsory or voluntary participation	Everyone must participate	Everyone must participate in TIE assignment Optional online collaboration in other assignments	Voluntary basis
Duration of assignment	2 or 3 weeks per assignment	14 weeks	10 weeks
Number of assignments	4 (of which 3 in same groups) assignments	1 main assignment 2 other assignments	1 assignment
Assessment	Portfolio: products, reflection on ICT skills and collaborative learning process	TIE assignment: portfolio TOC assignment: F2F presentation and by portfolio Research assignment: written report, and by portfolio	Discussion about group work with teacher and other group members, and by portfolio
Role-taking	No	Yes	Yes
Online/F2F combination	Yes	No (internationally diverse locations)	No (but students met each other F2F during other units of study)

Table 3.4 (continued)

Design Element	HTM course	BITEP course	In-service course
Group composition	Groups of three or four members Heterogeneous teaching backgrounds Homogenous teaching backgrounds for one assignment Group members did not know each other at start of course Ad random as regards gender, age	Groups of three or four members Homogeneous in teaching background Heterogeneous in subject background Group members knew each other at start of course Ad random as regards gender, age	Groups of three members Homogeneous in teaching background Heterogeneous in subject background Group members knew each other at start of course Ad random as regards gender, age
Online Environment			
Groupware	Website with Webboard™ and BSCW©	WebCT	WebCT
Access to information	Resources and course materials online and on paper	TIE course materials in WebCT	Course materials in WebCT
Type of communication	A-synchronous	A-synchronous Synchronous (by means of chat)	A-synchronous Synchronous (by means of chat)
Social discussion room	Social Area	Social Forum	No
Tutoring			
Technical training	Yes	Yes	Yes
Training collaborative working during assignment	No	During technical training practice with assignment Teaching in English	During technical training practice with assignment
Expert	Yes	No	No
Teachers role	1 teacher, 1 technical assistant	1 general teacher, 4 teachers for different assignments, 1 technical assistant	1 teacher, 1 technical assistant
Frequency of interventions	Free	Free	Two interventions: after round 1 and at the end
Nature of interventions	Content Collaborative learning process (mainly F2F)	Content Collaborative learning process	Content
Type of interventions	Free	Free	Free
Kick-off meeting	Yes, during first F2F meeting	No	No
Interim evaluation of collaborative process	Yes during F2F	No	No

Chapter 4: Research Methodology

Our research can be characterised as a design research, which type of research is further explained in 4.1.1. We used various ways of data gathering, such as interviews, questionnaires, and the electronic communication of the student teachers and teacher educators. The process of data gathering is described in 4.1, next to a profile of the participants of this study. The operationalization of the variables into research instruments is presented in 4.2. The instruments were checked for their quality, and the results presented in 4.3. Methods of analyses are described in 4.4. A summary of this chapter can be found in 4.5.

4.1 Research Character, Participants and Data Gathering

4.1.1 Research Characterisation

The research before can be characterised as a *design research*, also called developmental research (Van den Akker, 1999).

> "The aim is not to elaborate and implement complete interventions, but to come to (successive) prototypes that increasingly meet the innovative aspirations and requirements. The process is often cyclic or spiral: analysis, design, evaluation and revision activities are iterated until a satisfying balance between ideals and realisation has been achieved." (p. 7).

Purpose of our research was not to develop an optimal design for a particular teacher training context, but to provide principles for an effective design of a CSCL environment in teacher training. Van den Akker (1999) mentions this as one of the two specific goals of design research.

> "The major knowledge to be gained from development research is in the form of (both substantive and methodological) 'design' principles to support designers in their task. [...] Obviously those principles cannot guarantee success, but they are intended to select and apply the most appropriate knowledge for specific design and development tasks." (p. 9).

Shavelson and others (2003) describe several characteristics of educational design research, most of which applicable to the research at hand, which can be seen as *process-focused* as we studied the influence of design elements of CSCL environments on the collaborative learning process. Our research goal is *utility-oriented*, aiming as it does to improve the effectiveness of the CSCL environments we used. It is also *theory driven*, on the one hand because it is founded on theories of the design of collaborative learning and CSCL, while on the other hand we hope our research will contribute to these theories. In nature, the research methodology is *iterative*. Successively, three designs of CSCL environments are implemented in three different courses. The design for the first study is based on literature and on expert consultation. The second and third designs are based on a (preliminary) evaluation of the first. Intertwining theory and practice is also important in development research. Researchers and people from educational practice collaborate on feasible interventions, and together are responsible for the best possible implementation. We designed the CSCL environment in close collaboration with the teacher educators who were also responsible for content and guidance during the course, all of which characterises ours as *collaborative* research. The designs used in our research were implemented in vivo, in non-experimental training situations within the IVLOS teacher training programme. This makes our research *interventionist* of character, as we were designing and modifying real-life settings.

4.1.2 Participants

Our research involved 36 student teachers and 5 teacher educators, all teacher educators employed at IVLOS. The student teachers were engaged in different types of IVLOS teacher training programmes, from which we studied three courses. The HTM and the In-service courses each involved one teacher educator to guide the student teachers in their work in the CSCL environment as well as in other, F2F (parts of the) courses. The BITEP course had one teacher educator responsible for various parts of teaching and guidance of the student teachers, guiding them through one of the online assignments. In another assignment he also guided a subgroup. Two other BITEP teacher educators each guided one group in one assignment, and one of the students was assigned student co-ordinator for the third assignment. Although we did use the online communication of these two teacher educators and the student co-ordinator, they were not interviewed. All student teachers and teacher educators were inexperienced with learning and teaching in a CSCL environment.

A technical assistant was available during all three courses, responsible for designing the digital learning environment and helping students with technical problems and questions. Table 4.1 provides information about the participants of each of the courses.

Table 4.1
Information about respondents of each course

	HTM	BITEP	In-service
Teacher educators (*N*)	1	1 (questioned) 3 (not questioned; including 1 student co-ordinator)	1
Student Teachers (*N*)	15	17	9
Gender			
Male	7	4	5
Female	8	13	4
Type of student (*N*)			
Pre-service	4	-	-
BITEP	4	17	-
In-service	4	-	9
Specialty	4	-	-
Subject of student (*N*)			
History	15	4	1
Geography	-	3	-
Biology	-	3	-
Science	-	1	-
English	-	3	1
Dutch	-	-	4
Religion	-	-	2

4.1.3 Data Gathering Methods

We used various methods for gathering data on the collaboration and evaluation of the student teachers' collaboration and the design clusters (Table 4.2).

Table 4.2
Method of data collection in relation to the research questions

Variable	Questionnaire	Interview students	Interview teachers	Electronic communication
Evaluation of collaborative process	X	X	X	
Collaborative process				X
Task instruction	X	X	X	X
Online environment	X	X	X	
Teachers' guidance	X	X	X	X
Design context	X	X	X	

Data with respect to the evaluation of the student teachers and teacher educators were gathered by means of a structured questionnaire distributed among the student teachers of all three courses, and semi-structured interviews with all student teachers and teacher educators of the HTM course, the In-service course and the main teacher educator of the BITEP course. Directly after the course, the student teachers completed a questionnaire during a meeting at the institute. Purpose was to obtain information on the opinion of the student teachers about the collaboration and outcomes of the courses, and their evaluation of the design clusters and design context. All student teachers were interviewed in the first three weeks after the course. The audio recorded interviews, introduced by the teacher educators at F2F meetings with the student teachers, were conducted by a professional interviewer of the teacher training institute, each interview taking 45 to 60 minutes. The recordings were transcribed in protocols. The respondents received a small attention at the end of the interview. The three teacher educators were also interviewed in the three weeks directly after the courses, for about 60 minutes each, which interviews were also audio recorded and transcribed. All student teachers and the three teacher educators fully co-operated, yielding a 100% response. As they participated in two courses, five student teachers went through the whole procedure twice.

The data required to describe the student teachers' collaboration were obtained by saving and storing all notes and documents from both student teachers and teacher educators. Print-outs of the threaded structures of the BSCW© and WebCT Bulletin Boards were also made.

To describe the relation between the clusters of design elements (task instruction, online environment, teachers' guidance) and the students' collaboration, data were collected by means of students and teachers responses to the questionnaire and interview items, and by means of the electronic data.

Prior to the courses, the student teachers were informed as to the research and asked for their participation. We acquired their consent for using their electronic notes and documents with a view to content analysis. The co-operation of the three teacher educators was prerequisite as design and implementation of the CSCL environment occurred in their courses. Anonymity was guaranteed in all research reports.

4.2 Instruments

4.2.1 Student Teachers' and Teacher Educators' Evaluation

Student teachers' and teacher educators' opinions were gathered using questionnaires and interviews. The questionnaire included items about the collaborative process and its outcomes, task instruction (more specifically their interest in the

assignments, group composition, structure of the assignments), functionality and usability of the online environment, students' attitude towards and experience with ICT and collaborative learning, and the role of the teacher.

The questionnaires consisted of at least 44 items with a 5-point Likert scale (1 = *I do not agree* or *not at all*, and 5 = *I agree completely* or *completely*), plus a number of open questions. We used a similar questionnaire for all three courses, although some items were slightly revised and some added or removed for not pertaining to a particular course. Appendix D1 presents the relevant items of the questionnaire and some descriptives. The questionnaire was tested during the evaluation of another online course (not part of this study), in which student teachers collaborated on tasks. The analysis and results showed the items of the questionnaire were satisfactory.

We grouped some of the items into scales (see Table 4.3). The items included differ for each course as some items were only relevant to a particular course. Examples of items in the scale Collaboration are: 'How satisfied/dissatisfied are you with the number of notes and documents that has been exchanged in your group?' and 'I think the online collaboration with peers has been a positive experience'. Examples of items in the scale Outcomes are: 'How satisfied/dissatisfied are you with the quality of the end products of your group?', and 'I have learned a lot in this assignment by sharing my experiences and learning moments with other student teachers'.

Table 4.3
Scales in the student questionnaires with some descriptives

Scale	Items (*N*)	Description	*M*	*SD*
Collaboration HTM	4	Satisfaction about interaction (frequency and content of messages and responses)	2.7	.1
Collaboration BITEP TIE	6	Satisfaction about interaction (frequency and content of messages and responses) and opinion about collaboration	3.0	.0
Collaboration In-service	6	Satisfaction about interaction (frequency and content of messages and responses) and opinion about collaboration	4.0	.1
Outcomes HTM	3	Outcomes of collaborative work in HTM course	3.1	.7
Outcomes BITEP TIE	5	Outcomes of collaborative work in BITEP TIE assignment	1.9	.5
Outcomes In-service	6	Outcomes of collaborative work in In-service assignment	3.5	.2

The interviews were aimed to collect information on the student teachers' opinions of their collaborative learning processes, the reasons for their collaborative behaviour, and their opinions of the various design elements. The students expressed their opinions on collaboration, task instruction and teachers' guidance with respect to each assignment. The interviews had a semi-open structure, start-

ing with one main question, followed by questions we used as a checklist to be sure to gather information about all design elements of the research.

We wanted this structure to stimulate the students to feel free to talk about their issues. thus providing us with the most important information from their points of view. The interview checklist is presented in Appendix E1.

The 41 interviews resulted in an amount of data we needed to downsize to manageable chunks of information for analysis.

We used a Grounded Theory like method (Strauss & Corbin, 1998) to develop an instrument for analysing the interview data. Sensitising concepts were the clusters of design elements identified in Chapter 2 (task instruction, online environment, teachers' guidance) and students' collaboration.

We used Atlas.ti (http://www.atlasti.de/index.html) for coding the interviews. After several rounds of adding concepts (group composition and context) and refining other ones, saturization of the concepts occurred. Then, all information from the interviews was coded by means of a combination of time and event sampling. First, the coding units were determined by speech turns from interviewer to interviewee and vice versa. Second, we developed a coding system with the saturized concepts as the main categories (see Table 4.4). An event sampling procedure means each unit was coded with only one category of the coding system.

After coding the interview data into categories, the data of each category were summarized for the student teachers of each course. Box 4.1 presents three examples of coded parts of notes.

Table 4.4
Coding system for interview analysis[1]

1 Group and task behaviour (1:GB)
Category 1:GB includes statements on collaborative behaviour during work on assignments, provided these statements are not related to categories 2:GC, 3:GI, 4:TWE en 6:TI. Category 1:GB concerns statements in which the respondent describes the collaboration or gives his or her opinion about the collaboration, unrelated to statements about the categories of design elements. Statements about behaviour, related to categories 2:GC, 3:GI, 4:TWE en 6:TI are included in the category concerned. This relation has to be clear in the text and made within the boundaries of a respondents' answer, but does not have to be made in one and the same sentence.

2 Group Composition (2:GC)
This category includes statements about formal group composition, in other words the group composition as made prior to the start of the assignment, referring to statements as to group size, factors influencing group composition (e.g. type of teacher training programme), whether or not group members were already acquainted at the start of the course, and as to who composed the group. For example: "The group was too big", or "This group collaborated better because I knew the group members beforehand".

3 Guidance (3:GI)
This category includes statements describing the feedback of the teacher educators, referring to feedback in terms of teacher educators' conduct and communication provided while students were working on the assignments.

Table 4.4 (continued)

4 Design Telematic Work Environment (4:TWE)
This category includes statements about the functionalities and usability of the online parts of the CSCL environment. It also includes statements comparing different ways of communication (synchronous-a-synchronous or offline-online).

6 Task Instruction (6:TI)
This category includes statements about the task itself (aim and type), its planning , its structure, the assessment procedures, and the task products. This category relates to the assignment (description) and does not concern the entire CSCL environment as designed by the teacher educator.

8 Context (8:CT)
This category includes statements about the context in which the experiments had taken place. It relates to conditions students worked in, influencing the performance of both the individual respondent and his group in the whole CSCL environment. This may involve individual conditions (personal circumstances such as technical situation at home and in school, educational practice, illness, etc.), and shared group conditions, such as technical facilities at the teacher training institute, or other courses or parts of the training programme .

10 No Coding (10:NC)
This category includes statements which are not relevant, unclear or ambiguous.

11 Rest Category (11: RC)
This category includes all relevant statements which can not be included in one of the other categories.

[1] This is a short version of the coding instrument. The extended version describes specific rules for coding and exceptional cases. Please contact D.Lockhorst@ivlos.uu.nl for more information.

Appendix E2 presents the checklist for the interviews with the teacher educators. Purpose was to get information on the teacher educators' opinion of the students' collaboration and individual behaviour, and on the relation with the design elements and design context. We also discussed the outcomes of student teachers' collaborative learning process, as we anticipated the teacher educators' level of satisfaction with the outcomes of the tasks might influence their opinions of the collaboration. In addition, their role in the online collaboration of the student teachers was discussed. The coding system and coding procedures were the same as used for the student teachers' interviews. For each teacher educator, summaries are made by category.

Box 4.1
Examples of the use of the instrument for coding the interviews

I: How did you experience the collaboration in your group?	
R: [Very well.] [We collaborated before] [and have chosen this group composition consciously, as far as possible.] [Also a rigid planning, settle things as quickly as possible, clear appointments, everyone knows what to do. That works fine.]	1:GB, 8CT 2:GC, 1:GB
I: Has there been a division of roles in your group?	
R: No	1: GB
I: Everyone worked on the same level.	
R: [Yes. I have to say that Clara had to invest most time working on the first part.] [The group members starting the story had to do a little bit more work. You have to create something. You have to come up with something.] [But he invested the same amount of time during the other two sub tasks as we did.]	1:GB 6:TI 1:GB

Box 4.1 (continued)

I: You have sent your feedback, but this is not received by your group members. Did she respond to you that she did not had received your feedback?	
R:[Only after a very long time. At that time I couldn't remember anymore what had went wrong.] [I heard that you can loose something on the WWW, but I was not sure if it was my own fault. This was a little bit annoying.]	1:GB 4:TWE
I: You received feedback from your subject teacher on your work. Did you respond to this? This is what you were supposed to do, isn't it?	
R: [No, I did make an evaluation of my lesson, which was part of the TIE assignment. But I did not upload it on the Web at that time. I did this recently,] [because the teacher wants to have it all.]	1:GB 3:GC
I: Has the teachers' guidance been helpful to you?	
R: [Guidance from who?]	10:NC
I: From [the teacher educator]	
R: [Not for the TIE assignment.][Everything was made clear on WebCT, all instructions. It has been confusing at the start whether or not both subject teachers had to give a lesson or only one and the other one had to provide feedback. But after a while this was clear, you had to make a lesson both and provide each other with feedback.]	3:GI, 6:TI
I: You said you had problems with uploading. How come?	
R: [Because you only have a limited amount of time, you have to do many things between times. You often have only half an hour, during a break, than you want to upload things] [and yes, it is very convenient than to consult your manual. That's one.]	8:CT 4:TWE
[Secondly, when I uploaded something, I did not take much time, personally.] [They explained everything,] [but sometimes I had parents evening or a meeting and I had to go back to school during the course meetings. For this reason I had to work out things for myself.]	1:GB 3:GI, 8:CT
[At the start of the assignment you was all alone in WebCT and could not find a proper workspace, only a more general work area. I uploaded it in this area, instead to upload it in my own workspace.]	4:TWE
[To be honest, I had send an email once in a while in the past, of course. To me it was a advanced typing machine and really surfing on the Internet was new to me.]	8:CT
[I have mentioned this in my portfolio, that my ICT knowledge has improved enormously. Almost a revolution.] [Yes indeed, if everything works after some time, when the technical problems were over, there is no stopping it.]	6:TI 4:TWE

4.2.2 Description of the Collaborative Process

Veldhuis-Diermanse (1999), and Schellens and Valcke (2002) have described and evaluated several systems for analysing CSCL environments. In CSCL research, analytical models and procedures differ. Many studies focus on the cognitive aspects of the discussions, the construction of knowledge, particular categories of interaction such as argumentation or the quality of learning (e.g. Gunawardena, Lowe, & Anderson (1997), Veerman (2000), and Veldhuis-Diermanse (2002). As to cognitive aspects, our focus is not on what student teachers said, but on how they said it and which processes and strategies are used. In addition, we focus on the communication of regulative and social aspects. We think the analytical framework of Henri (1992) best suits our analytical and educational purposes. According to Henri, *"an appropriate, analytical method would identify the learning process and strategies selected or developed by learners. The results of this analysis would constitute a basis for the development of a framework to*

guide interventions and support the learning process." (Henri, 1992, p. 121). Table 4.5 presents Henri's Analytical Framework.

Table 4.5
Henri's Analytical Framework

Dimension	Definition	Indicators
Participative	Compilation of number of messages or statements sent by one person or group	Number of messages Number of statements
Social	(Part) statement not related to formal content of subject matter	Self-introduction Verbal support "I'm feeling great…"
Interactive	Chain of connected messages	"In response to Celine…" "As we said earlier…"
Cognitive	Statement exhibiting knowledge and skills related to learning process	Asking questions Making inferences Formulating hypothesis
Metacognitive	Statement relating to general knowledge and skills and showing awareness, self-control, and self-regulation of learning	"I understand…" "I wonder…"

Note. Taken from Henri (*1992, p. 125*).

An instrument was developed for analysing the communication of the student teachers and teacher educators. We developed a multi-perspective method to analyse the electronic communication, including ways to analyse the participation and interaction, and instruments to map the content of the discourse of the students and teachers. In doing so, we addressed the relation between the participation and interaction sides of the communication on the one hand, and the quality of the students' discourse on the other, as advocated by Lipponen (2002) and Veldhuis-Diermanse (2002). This multi-perspective analysis method includes five perspectives from which to look at the data. These perspectives refer to the participation of all respondents (4.2.3), the nature of the content (4.2.4), the interaction between the participants (4.2.5), the level of information exchange of the participants (2.4.6), and the students' regulative communication (4.2.7), the last two perspectives being an elaboration of Perspective 2. The method is summarized in Table 4.6.

Although various relations between perspectives may be interesting in describing the CSCL process in detail, we analysed only those that in our opinion were relevant to the evaluation of the design principles. The relation between Perspective 3 and Perspectives 2 and 5, and between Perspectives 4 and 5 are analysed.

The coding unit is each note and additional coding rules were developed depending on the various perspectives.

Table 4.6
The multi-perspective analysis method for CSCL

Perspective	Definition	Indicators
Perspective 1: Participation	Amount and directions of notes (message, response, documents) -> interaction patterns show frequency and pattern of communication within group	Number of statements Freeman's degree expressed in outdegree and indegree
Perspective 2: Nature of content	Analysis of type of note on task related (cognitive), regulative or social communication	Percentage of notes with statements of each type of content
Perspective 3: Interaction	Analysis of chains of connected notes (by content)	Notes in threads Notes with statements referring to earlier notes, e.g.: "As X said……" "After examining the discussion…."
Perspective 4: Level of information exchange	Statements exhibiting the nature and quality of the learning process in terms of the level of information exchange	Learning activities of any information exchange level: Repeating Interpreting Arguing Adding new elements Explaining Judging Offering solutions Offering strategies Formulating questions
Perspective 5: Regulative communication	Statements showing regulative knowledge relating to evaluation, planning, and organisation of the collaborative process	Evaluative remarks Planning remarks Organisational remarks Technical remarks

4.2.3 Perspective 1: Participation Patterns

A low participation level appears to impact the continuity and quality of the discourse in CSCL conferences. The degree of participation of group members in CSCL can provide a first impression of the quality of the collaborative process and may be a good starting point for further qualitative analyses (De Laat, 2002; Lipponen, 2001; Nurmela, Palonen, & Lehtinen, 2003; Reffay & Chanier, 2003; Wasserman & Faust, 1994; Wortham, 1999).

Besides the participation level, we consider an equally distributed participation pattern, both in term of sending and receiving messages, another indicator for the quality of the discourse in small groups, as in our case. We used Social Network Analysis (SNA) to describe the participation (De Laat, 2002; Lipponen 2001; Wasserman & Faust, 1994), which will be expressed in terms of centrality, measuring the indegree and outdegree of participants in a network (Freeman, 1978). The indegree represents the number of notes and documents *received* by

an individual, the outdegree relating to the number of notes *sent* by an individual. In addition to the frequency of sending and receiving notes, the direction of the notes is indicated in plots showing frequency and group members receiving and sending notes and documents. When a discussion was started and responses to other discussions were made in one and the same note, we coded these as separate notes. Notes addressed to the entire group, or those lacking a specific addressee are coded as having been received by all group members.

4.2.4 Perspective 2: Nature of the Content

The nature of the communication is expressed in terms of 'task related content', 'regulative', and 'social' communication.

Task related content communication was important because the student teachers were required to meet the knowledge-related learning requirements by means of communication about task content. Regulative communication was important as one of the aims of the courses was to have the student teachers responsible for the collaborative and learning process. Social communication was important for us to analyse as it may foster and indicate group cohesion, motivating students to become involved (see for instance Kirschner, Kreijns, & Jochems, 2003), but it may also distract students from content related discussion.

Table 4.7 shows the instrument we used for measuring the nature of the content of the electronic communication. Regulative and task related content communication are mapped in more detail by means of instruments described in 4.2.6 and 4.2.7.

Multiple codes may be assigned to one note, using event sampling: the moment another code can be attributed to a text quotation, a new coding unit starts. Each note is at least provided with one code. Box 4.2 is an example of the use of the instrument.

Table 4.7
Instrument for coding the nature of the notes including examples

Type of note	Description	Example
Content related (C)	Statements referring to activities related to task content	"I think you should adjust your lesson plan using more time to explain about volcanoes" "I do not agree with your statement about history teaching"
Regulative (R)	Statements such as remarks in discussing planning, role-taking, evaluation of how group doing and work done, supervision of overall cognitive task, matters of organization; includes statements on the organization of the electronic communication	"I think we both are subject student and student 2" "I can not give my lesson in that week, I'll send it next week" "I think we do not need another discussion round to finish the task" "Thanks for your lesson plan" "I have made a new folder where we

Table 4.7 (continued)

		can put the messages about the planning"
Social (S)	(Part of) note directed to off-task communication[1]	"How was your holiday?" "How is your teaching practice period going?" "I have really very nice pupils around here" "Happy reading"
No code (NC)	(Part of) note without functional text	Included lesson materials 'Figure size 56 Kb' 'Numbers applicable'

[1] Greetings, such as "bye" or "see you", were not coded.

Box 4.2
Coding the nature of the communication (Perspective 2)

Hi Siebren, Hi Cathy,	
[Thanks for your comments Siebren,][I will make sure to give the students a short biography of English, but I am not sure yet whether I should tell them about Marx already... if I have enough time I will do it.]	R C
[About chatting today, I cannot make it at all, because the computer rooms at university close early and Danielle will be here today. We are going out for dinner. If we cannot get together for a chat, maybe we can just set something up like a discussion thread in our group, if you know what I mean.	R
Okay, I will wait for your answers.] Talk to you soon, Linda [Cathy: how was your holiday?]	S

Note. C = task related content, R = regulative, S = social.

4.2.5 Perspective 3: Interaction Patterns

Interaction patterns provide a view of the continuity or discontinuity of discussion between group members. The interaction between the participants was mapped by using threads as the line of communication. Threads are composed of content related notes (Lipponen, 2001). Unlike Henri (1992) and for instance Lipponen (2001), who incorporate only those notes in a thread that are linked by the software in use, we identify a series of notes as a thread only if the notes are semantically or conceptually linked. We did not code the messages sent by students in their documents as these were separated from the discussion area by the students themselves. It was impossible for us to decide how to include these messages and responses in the discussion thread. In order to describe the interaction patterns of the groups, we counted the number of threads for each group, their length (number of notes in a thread), and the number of notes not responded to (isolated notes).

4.2.6 Perspective 4: Level of Information Exchange

We developed an instrument for measuring levels of information exchange of task related content in the notes, with a view to gaining an insight into what kinds of learning activities the students adopted while working on the assignments, and their respective quality. The instrument consists of one 5-point Likert type scale, ranging from 1 (*surface*) to 5 (*deep*) level of information exchange. The scale was developed using the work of Entwistle (1987, 1993), Entwistle and others (1983, 1993, 2001), and Henri (1992). Henri used criteria for mapping CSCL discourse, and Entwistle and others developed indicators for in-depth and surface levels of students' approaches to learning. However, our work differs from that of Entwistle and others, because we study the students' behaviour as expressed in learning activities, while Entwistle and others study the intentions of the students. Using the criteria of Henri and Entwistle, we distinguished relevant learning activities (Biggs, 1999; Den Brok, 2001; Veldhuis-Diermanse, 1999) which are used to describe both ends of the scale.

One end of the scale represents the learning activities of students on a surface level, including completion of the task with little personal engagement, showing routine and unreflective memorization, and procedural problem solving with restricted conceptual understanding. The other end refers to deep level learning activities of the student, including understanding, showing active conceptual analysis, use of previous knowledge and experiences, offering ideas and alternatives, all accompanied with argumentation and leading to a deep level of understanding. We distinguish five types of learning activities to be performed on levels ranging from surface to deep. The first type includes learning activities related to the way ideas, statements, solutions of others are approached. At a surface level, students accept such ideas or statements passively, whereas at a deep level students analyse ideas and statements of others critically, using argumentation, judgment, interpretation, and inference. The second type relates to the extent to which students contribute own ideas, new information and solutions. At a surface level this occurs without argumentation, while at a deep level arguments are used and own ideas and solutions are related to information from others. The third type relates to the aim of the student when processing the learning content. At surface level the student is focused on memorization of facts, while at deep level the student works towards conclusions and hypotheses. The fourth type relates to the extent to which the student is able to position the task or problem within a wider framework of knowledge, experiences and information. At surface level the student is not able to see the task or the problem within such a wider framework, and does not relate to information outside the task. At deep level, the student relates the task at hand to a wider perspective, searching for relations between different parts of the task, or for a relation with information outside the group discussion. The last type relates to the degree of students' motivation for accom-

plishing and understanding the task. Students must express this motivation in their communication in order for us to be able to score this type of learning activities. At surface level the student is focused on assessment requirements, while at deep level students want to understand the task for themselves, showing intrinsic motivation.

Each note including 'task related content' (see Perspective 2) is scored on frequency and nature of the students' learning activities. A score of '5' is awarded when the student shows (almost) all types of learning activities of a deep approach (exhibiting variation in learning activities) and/or when the learner is very extensive in the use of one or more learning activities (exhibiting extensive application of learning activities) in one note. The latter occurs only in the case of learning activities in which the student shows argumentation, critical analysis, questioning, hypotheses construction and structuring of facts. A score of '1' is coded when the student does not show extended use of one or more learning activities and very little, if any, variation in the application of learning activities. The 2, 3 and 4 scores on the scale are in-between. Box 4.3 shows examples of notes scored '1' and '5'.

Box 4.3
Coding the level of information exchange (Perspective 4)

✉	Hi Monique, I read your learning methods and it seems alright. [….] Greetings, Robert	1
✉	Explanation on part 3 of the assignment: Elements: 1. Lina [story character] is fully aware of the fact that she is being watched, because she is new at school. I think this is important, as long as you prevent trying to be popular or too friendly. Pupils sense this immediately. She invests time to have contact with the pupils and this is a good start to enlarge the 'nearness' [a category of the VIL]. 2. When you are labelled as friendly and nice in the pupils' eyes, there is a 'risk' that pupils will approach you, because you open for contact with the pupils. This might result in aspects of teaching you are not aware off at first: guidance of pupils in the pedagogical area. I experienced once that a pupil came to me overstrained. I have taken some time to talk to this pupil and let him cry, but you can run into pitfalls having this role. I promised during this conversation I would talk to no one about our meeting. This was not really a problem in this case, because the problems were not that serious, but you can run into a situation that it is unwise that you, as a teacher, are the only one involved (think of suicidal tendency). This is the reason why I let Lina involve the school counsellor. 3. Not preparing your lesson: Did this ever became between you and your sleep? It is impossible to think about your work all day and night, although there is such a threat in this profession. One has to learn to improvise. Kind regards, Sidney	5

4.2.7 Perspective 5: Regulative Communication

We developed an instrument to describe regulative communication in more detail, based on Henri (1992), and Schellens and Valcke (2002).

In accordance with Veldhuis-Diermanse (1999) we focused on those regulative skills relevant to our students' work in the CSCL environments and the tasks provided, and thus found in the communication of the students. We distinguish five types of regulative communication.

Evaluative communication refers to feelings and thoughts connected with a given task, and communication focused on evaluating parts of the tasks, assessing tasks or appraising the knowledge and skills of group members. *Planning* activities are meant to prepare for performance of learning activities (Den Brok, 2001). In a study of the use of a CSCL environment in teacher training, Guribye, Andreassen and Wasson (2003) identify three types of interaction processes, one of which the co-ordination of the collaborative efforts. They describe this as "negotiations about the division of labour and maintaining an awareness of each others work." (p. 391). We define communication as *organisational* if pertaining to division of labour, task, tools, keeping each other informed as to one's activities, and what one was reporting in their communication. Based on a previous analysis of electronic communication (Lockhorst, 2000), we included two other categories: communication about *technical issues* and communication to be seen as a *description* of the student teachers' activities. Table 4.8 describes the instrument.

Table 4.8
Coding instrument for regulative statements

Regulative activity	Definition	Indicator
Evaluative (E)	Give or asking for assessment, appraisal or verification of one's knowledge and skills, and of the efficacy of a chosen strategy. Identify, decipher and interpret (correctly) the feelings and thoughts connected with a given aspect of the task.	"I'm not sure if this the correct translation you give here" "What do you think of the lesson plan?" "You have made a very good summary" "I'm discouraged at the difficulties involved…" "I hope you can use my comments"
Planning (P)	Setting up, selecting, predicting, arranging, choosing, supervising and describing an action or strategy, necessary for the accomplishment of an action or task.	"If we want to accomplish the task in time, we should start with a questionnaire" "Let's first make a description of all task components and then divide these by group member" "Let's have a chat session next week at 10 pm"

Table 4.8 (continued)

Organisational (O)	Planning and regulation of the communication at hand. Remarks structuring the text in notes and documents.	"Here are my comments" "I read your mail" "Please read this very well" "You can find the file under…"
Technical (T)	Remarks and questions about organizing the electronic discussion and technical problems or successes. Even if a the remarks in itself has aspects of evaluation, planning or describing, these are included in this category.	"I can't open your file" "I have problems with the computer" "I suggest we make a group folder" "This awful machine does not work" "I finally have been able to upload my work
Description (D)	Description of activities that have been carried out, without giving a planning or value judgement. Asking for a description is also included here.	"I went to the library" "I did my lesson" "What did you do?"
Rest (R)	Remarks and questions which can not be included in one of the other categories or which are incomprehensible.	

Each text quotation marked regulative communication (see Perspective 2) was a unit to be coded with this instrument. Each text quotation could receive one to five regulative codes. Box 4.4 shows three text quotations coded as regulative communication in Perspective 2, which are now coded with the instrument including the five regulative categories.

Box 4.4
Coding regulative communication (Perspective 5)

✉ Hi everyone,	
[Just a short note to let you all know that I will be in xxx until May 3.] [I have done my interviews, except for one because the teacher and I were not able to make arrangements for an interview.] [I am a bit annoyed with that, but I will tell you the whole story later on.] [Anyway, I have six interviews on tape, and I hope to start transcribing them in xxx. Then, in May and June, we can get together and discuss how to go on and work out our research finding in a paper.] I hope that everyone is doing well. Take care for now, Bea	P D E P
✉ Steven and An, [I read your comments on my story] and actually I agree with you that the third element is my less strongest element. [For this reason I will rewrite this element and upload it as quickly as possible in WebCT.] [I thought it was striking that both of you had a question about the same.] It is a difficult aspect: how much attention you might expect from pupils in the classroom. But to let it takes its course is neither a good way. The teacher is too indolent. [I don't know when I will upload the rewritten version in WebCT, but of course An can move on with her part.] Greetings, Harry	O P E P

Box 4.4 (continued)

✉ Hi Petra,

[FINALLY: here is our questionnaire.] It took us a while to decide if we wanted to have closed or open questions, but in the end we decided to have open questions (and maybe do another questionnaire in Dutch schools to see if Dutch teachers agree with the advantages and disadvantages English teachers give us once we're back in Holland).
[We will give this questionnaire to teachers at Rik's, Barbara's, Carl's and Deborah's school (two comprehensive and two grammar schools) as soon as possible.]
[If you have any comments please give them.]
[I hope that attaching the document works out okay, because it seems as if we are having problems to attach documents and send them. If you haven't received the questionnaire, please let us know!]
Best wishes, Dick

O P E T

4.2.8 Teacher Educators' Communication

Data on the teacher educators' guidance is gathered by interviews with student teachers and teacher educators, and analysis of the teacher educators' communication in the CSCL environment.

Due to a passive role of the teacher educators involved, we had a limited number of teacher educators' notes to analyse, because of which neither content analyses of teachers' notes, nor describing teachers' roles based on researchers such as Paulsen (1995), and Lally and De Laat (2002) seemed useful. We developed a system for measuring to what extend teachers directed students to collaborate (see Table 4.9).

Table 4.9
Coding system for teacher educators' communication

Direction of communication	Description	Example
Content directed (CD)	Notes stimulating students to work on content, or work in a certain direction with respect to content.	"What do you think of this proposition?" "Let me know what topic you take."
Regulation directed (RD)	Notes stimulating students to plan and organise their work, to evaluate the group process or individual group members, or to start work.	"Just writing you to see what you are doing." Please, let me know when you are going to end up your project."
Not directional (ND)	Notes in which teachers provide feedback without being directive.	"I will try to explain my feedback a little bit more. I meant you mix up the teaching methods with the methods to evaluate.. Let's illustrate....",

We distinguish three types of notes: notes of teachers to direct students to work on content, notes to direct students to regulate their collaboration or get going,

and notes in which the teachers do not explicitly direct the students' learning process but answers to questions, provide content related feedback, etc.

First, we had to decide for each teacher note whether it included directional communication or not. If so, it received one, or both of the two directional codes. None of the closing remarks of notes, such as "hope to hear from you soon", are coded. Box 4.5 presents four teacher educators' notes with examples of all three categories.

Box 4.5
Examples of coded teacher educators' notes

✉	Hi Steven, Boris, and An, I will try to explain my feedback a little bit more. Maybe the best way to explain what I meant with mixing up teaching methods and evaluation methods is illustrating this with an example. In your list you mentioned: discuss the problem with several persons. In my view this is a teaching method. The question is how do you evaluate this? How are the pupils assessed? Do discussion partners evaluate each other? Is the evaluation focussed on the discussion skills or the content.	ND
✉	Dear Paulien, I received the questionnaire. I will react as soon as possible. Regards, Henk	ND
✉	Dear Elsbeth and Corine, I haven't heard much from you the last month. I am becoming curious about your progress in the research assignment. Please keep me up to date. Greetings, Dora	RD
✉	Dear Siebren, Cathy, Linda and Oliver, You have already a lot of work uploaded in your work space! Not all notes include acknowledgements. Do not forget them?! [...] When you have made your final choice of history teaching methods, do make a checklist for the teacher. This list has to include recommendation for the teacher about how to choose and to prepare collaborative learning methods. Success and best regards, Will	CD

4.3 Quality of the Instruments

This design research was fitted in existing educational practice. Three designs of CSCL environments were developed and implemented in existing Utrecht University teacher training courses, in close collaboration with three teacher educators. Existing learning and teaching aims of the courses were the starting point for the three designs. Similarly to quality procedures used in other research, the research design and findings have been cross-checked by means of peer debriefing, by discussing them in dissertation meetings and with research colleagues (Lockhorst, Admiraal, Pilot, & Veen, 2001, 2002).

Using Swanborn (1996), who describes quality control criteria for research, we tested the internal validity and reliability of our research instruments. Student teachers' and teacher educators' evaluations of the collaborative process are

mapped by categorizing their interview statements. To check the *internal validity* of this procedure, we verified the relation between the interviewer questions or remarks and the respondents' statements (see 4.3.2). Section 4.3.6 presents the validity of the coding instrument of the regulative communication. The quality of the research instruments is further checked by testing the *inter-observer reliability*. The scales of items of the questionnaires are tested on reliability using Cronbach's α, in 4.3.1. The inter-observer reliability of the coding system of the interviews is tested in 4.3.3. The summaries of the coded text quotations of the interviews are checked, by means of a second observer to verify the procedure of summarizing (see 4.3.4). The various instruments of the multi-perspective method of analysis used to analyse the electronic communication of the student teachers, as well as the coding system for the teacher educators' communication, were tested measuring inter-observer reliability (see 4.3.5 and 4.3.7).

4.3.1 Reliability of the Scales in the Questionnaires

The reliability of the scales used to describe the student teachers' evaluation of the collaboration, as described in 4.2.1, are presented in Table 4.10. Four scales met our norm of 0.80 (Popping, 1988), the two other scales are excluded from the analysis.

Table 4.10
Reliability in terms of Cronbach's α of the scales from the questionnaires

Scale	α
Collaboration HTM	.85
Collaboration BITEP TIE	.95
Collaboration In-service	.89
Outcomes HTM	.65
Outcomes BITEP TIE	.37
Outcomes In-service	.88

4.3.2 Quality of the Interview Procedure

The interviews are conducted by a professional interviewer of the teacher training institute, trained in using the interview checklist. The researcher discussed the checklist with the interviewer and the first interview was evaluated with the assistance of a video recording and the notes of a second present interviewer.

Interviewer interventions may influence respondent statements. In order to determine the quality of the interviews in this respect, we analysed the nature of the interviewer interventions and related them to respondent statements, taking only those statements that directly follow an interviewer intervention. We developed a system of intervention categories, using literature on interview techniques (Emans,

1985) and other research in which student teachers are interviewed and interviewer interventions checked (Admiraal, 1994). Non-verbal aspects, inasmuch as measurable on audio tapings (silences and stressed words) are neglected. The coding system is presented in Table 4.11.

Category (1) 'procedural remarks' refers to questions and remarks directed to procedural aspects, such as moving on to the next question. Category (2) 'explanatory remarks' includes remarks directed at elucidations of the experiment and the assignments. Category (3) 'implicit follow-up-questioning' refers to situations in which the interviewer repeated (part of) the answer or summarized it. Undirected questions or remarks aiming to provoke a more elaborated answer, are coded with Category (4) 'undirected explicit questioning'. Category (5) 'directed explicit questioning' includes explicit questions or remarks aiming to get more information on specific parts of topics discussed or to verify whether all topics are covered. Category (6) 'suggestive questioning' refers to questions or remarks that are put in such a way that one specific answer is more easily given than others. We consider questions and remarks suggestive when the respondent can hardly do anything but confirm or deny, or when the interviewer excludes answer options by his questions and remarks. With 'social-emotional remarks' (Category 7), the interviewer tries to stimulate the motivation and mood of the respondent during the interview. Such remarks are used to avoid respondent resistance, but also to optimise the atmosphere of the conversation. The last category (9) includes incomprehensible questions and remarks of the interviewer. Each interviewer intervention received one code only.

Table 4.11
The coding instrument for interviewer interventions

Category	Example	%
1. Procedural remarks	"I would like to go over to the next assignment"	.8
2. Explanatory remarks	"During assignment 2 you had to make a list of teaching methods"	2.2
3. Implicit follow up questioning	"You said: I do not have any experience"	12.1
4. Undirected explicit questioning	"I do not quite understand what you mean". The interviewer asks Can you tell me more?, but not in so many words.	3.1
5. Directed explicit questioning	R: "I did not like the assignment", I: "What did you not like about this assignment" or "Did you make assignment number 5?"	69.1
6. Suggestive questioning	"Did you really not like this assignment" or "Did you not like the online collaborative work because of the assignment, or WebCT or…	7.6
7. Social-emotional remarks	R: "I wouldn't know. Stupid isn't it?" I: "I would not call that stupid". Or "So that was a emotional experience"	3.1
9. Missing values		2.0

Note. R =respondent, I = interviewer. Frequencies in percentages.

We selected 200 interviewer interventions to check the inter-observer reliability of this categorizing system, which appeared satisfactory with Cohen's $\kappa = 0.85$ (with a 95% confidence interval of $.75 \leq \kappa \leq .96$). We consider 0.70 satisfactory, as little is known about CSCL instruments for qualitative analysis (Nunnally, 1978). Next, we coded 553 interventions to check the quality of the interventions of the interviewer. We used interventions from interviews with three student teachers of each course covering all categories of interventions. Table 4.11 shows almost 8% of interviewer interventions were leading. This is similar to the amount of leading interventions in other research in which student teachers have been interviewed (Admiraal, 1994).

We further analysed the suggestive interventions' content and the responses to these interventions to obtain an impression of the impact of such suggestive questions. We divided the category of suggestive interventions into three types, presented in Table 4.12. Responses were classed into two types: 'positive' (respondent confirms interviewer's suggestion) and 'negative' (respondent denies or at least nuances interviewer's suggestion). Table 4.12 presents the analysis results, showing there seems to be no relation between interventions and responses. Positive and negative responses are given in more or less similar amounts, so the answer could go either way. The results of the analyses of the quality of the interviewer interventions presented us with no reason for excluding data, because the amount of suggestive interventions was moderate to low, and there seemed no relation between the suggestive interventions and student teachers' responses.

Table 4.12
Relation between suggestive interviewer interventions and student teachers responses

Type of suggestive intervention	Positive response	Negative response
Giving own opinion	1	4
Giving opinion of others	2	1
Drawing wrong conclusion from answers of the respondent	9	4

4.3.3 Reliability of the Interview Coding System

After briefly training a second researcher in the use of the coding system for the interviews, two interviews were subsequently coded by two researchers. Cohen's κ was 0.72 and 0.68 respectively, which values fluctuate around our norm of 0.70. The data showed that some categories were far more frequently found than others. This could be one reason for the unreliability of the instrument. Therefore, we selected supplementary data neutralizing the difference in occurrence. From each from the three student course groups we randomly selected one interview. One researcher first identified, than coded the events. We selected the same amount of events for each category. Subsequently, the events were coded by the second researcher. This resulted in a satisfying inter-observer reliability with Cohen's $\kappa = 0.91$ (with a 95% confidence interval of $.84 \leq \kappa \leq .97$). In coding all interviews,

whenever one researcher had serious doubts as to the allocation of a code to an event, both researchers discussed the problem until consensus was reached.

4.3.4 Reliability of the Interview Summaries

In order to determine the quality of the procedure for summarizing the coded text quotations from the interviews, two researchers summarized the coded interview text from one category of one of the courses (category 'task instruction'). These summaries were compared by counting the number of text quotations included in the summary of one coder and not included in the summary of the other coder, and vice versa. The results of this comparison showed that one researcher (Researcher 1) included more information in his summary than the second one. We had planned to have Researcher 1 summarize all interview data, so as not to lose any data, as this particular researcher tended to include more information than the other one. However, comparing summaries we noticed the researchers differed in recording the number of students that had made a certain statement. In our study, we do not think it essential to have insight into the exact number of student teachers making a certain statement. We decided not to report the exact numbers of students mentioning a particular statement.

4.3.5 Reliability of Coding the Electronic Communication

In 4.2 we presented a multi-perspective analysis method to analyse electronic communication. This method consists of various coding instruments, which were also checked for their quality, testing the inter-observer reliability.

As concerns the instrument for coding the nature of the communication (Perspective 2), we tested its reliability by coding 70 events (4% of the total number of events) from 19 notes by two observers. Although these are notes from one of the courses, they represent all categories of the instrument. Each observer defined the coding units and allocated a code. The inter-observer reliability expressed in Cohen's κ was 0.73 (with a 95% confidence interval of $.59 \leq \kappa \leq .88$). We considered this to be satisfactory, particularly because the differences between both observers were caused by small differences in the length of the events. It never occurred that the same event was coded differently by the two observers.

In order to check the reliability of the instrument measuring the level of information exchange (Perspective 4), a sample of 20 notes (7% of all notes with task related content communication) were rated by two observers. These were notes from one of the courses, but represent all the categories of the instrument. The reliability measured in terms of Pearson correlation co-efficient was satisfactory at 0.94 (with a 95% confidence interval of $.91 \leq r^2 \leq .98$). We used only 20 notes to determine the inter-observer reliability as the correlation was already very high with the bottom level of the confidence interval over 0.90.

The regulative communication is described in more detail in Perspective 5. We distinguish five types of regulative communication: communication on technical, planning, organisational, descriptive and evaluative issues. The quality of the coding instrument for regulative communication was also checked for inter-observer reliability. After training a second observer, both observers coded 56 events, which is 9% of all events coded as regulative communication (Perspective 2). We used the Kupper index (Kupper & Hafner, 1989) which measures the chance-corrected concordance between two observers to assess the inter-observer reliability. We found $K_u = 0.68$, which did not meet our norm. Studying the ratings of both observers, we noticed many differences in coding the category of descriptive communication, which differs from the four others as it does not include communication expressing feelings or value judgements. Moreover, we only expected to find descriptive communication in the BITEP student teachers' communication. These student teachers were located in different countries when working on the online assignments. As a consequence, the students being unfamiliar with each other's classroom context and working collaboratively on tasks, description of their contexts would be required. Because of the deviant character of this category we decided to remove the descriptive category from the instrument. The inter-observer reliability was now measured again over 55 events, and we found a K_u of 0.77, which we found satisfactory.

4.3.6 Validity of Instrument Regulative Communication

We consider each of the regulative categories as separate aspects of the regulative communication. Table 4.13 shows the correlations between the four regulative categories, which are very weak in view of the large number of cases. This supports our idea to consider the four categories as separate categories and we will therefore report on them separately.

Table 4.13
Correlations (Spearman r_s) of the four regulative categories (N = 654)

	Technical	Planning	Communicative	Evaluative
Technical	1.00	-.16**	-.15**	-.15**
Planning		1.00	-.23**	.09*
Communicative			1.00	.01
Evaluative				1.00

* $p \leq .05$, ** $p \leq .01$.

4.3.7 Reliability of Coding the Teacher Educators' Interventions

In section 4.2.8 we presented the instrument used to code the level of directions in the teacher educators' notes. To check the reliability of this instrument, a sec-

ond observer used it to code 20 notes (32% of all teacher educators' notes). The inter-observer agreement was computed using a two-step procedure. First, we checked whether notes were coded directive or not. This step resulted into Cohen's $\kappa = 0.90$ (with a 95% confidence interval of $.71 \leq \kappa \leq 1$). The next step was to check the agreement for its kind of direction (content and/or regulative). This was done by means of the Kupper index, which showed an unsatisfactory K_u of 0.60. As a consequence, we will not differentiate in the nature of the directive interventions in our presentation of the results.

4.4 Analysis Methods

We used both qualitative and quantitative data, enabling us to confirm results by triangulation, a typical process in design-based research (The Design-Based Research Collective, 2003). Triangulation also developed and elaborated the analysis, providing richer detail in describing our results (Miles & Huberman, 1994).

To answer the first research question, relating to the evaluation of the collaborative process by the student teachers and teacher educators, we used content analysis of the summaries of the interviews using the procedures earlier described, and descriptive statistics on the data from the questionnaires.

To answer research questions 2 to 6, all on the collaboration, we analysed the data of the online communication of both student teachers and teacher educators, which show a hierarchic structure with data on course level and task level, on the levels of both subgroups and individual students. Chapter 6 describes the collaboration of the student teachers for each subgroup, within tasks and for each course separately. Additionally, we checked whether there were significant differences between students. We performed Social Network Analysis using Freemans' degree (Freeman, 1978) to describe the participation patterns of the subgroups. (Non-)parametric variance tests and *t*-tests to compare means were used to analyse differences between subgroups and students as to degree of participation, nature of communication, thread length used, level of information exchange and use of regulative communication. Chapter 7 deals with the relation between task instruction and students' collaboration (research question 3), at the analysis level of the subgroups, now related to the characteristics of the task, for each course separately. We aggregated students' communication at subgroup level and analysed whether subgroups differed between the tasks, by means of non-parametric tests of variance and *t*-tests to compare means. SNA was used once more to describe the participation of the subgroups within each task. Additionally, we analysed the relation between the use of regulative communication and the level of information exchange. The summaries of the interviews relating to the category of the task instruction are also used to answer research question 3, as are de-

scriptive statistics of the relevant items of the questionnaire. After first selecting relevant interview topics and comparing these to relevant questionnaire results, we used the questionnaire results to complement the interview topics. Then we related the relevant outcomes of the interviews and questionnaires to our conclusions on the collaboration at course, task, subgroup and student levels, and to the student teachers' and teacher educators' evaluations of the collaboration. To organise our findings we used content-analytical summary tables (Miles & Huberman, 1994).

Research questions 4 and 5, dedicated to the online environment and the design context, are answered by analysing the summaries of the relevant interview categories, and descriptive statistics of the relevant items of the questionnaires. A procedure similar to the one used for answering research question 3, including its use of content-analytic summary tables, was used to relate the respondents' evaluation to the collaboration at course, task, subgroup and student levels.

To answer research question 6, relating to the teachers' guidance, we used (non-)parametric tests of variance to map the differences between the interventions by the different teachers on course level. We also used (non-)parametric tests of variance to map the differences between notes of three teachers, each guiding a group of student teachers working on one of the assignments of the second course. Again SNA is employed to describe the participation of the teacher educators in the groups. Finally, in the same way as we answered research questions 2, 4 and 5, a content-analytic summary table is constructed to relate the respondents' evaluations, as measured in the interviews and questionnaires, to the teachers' interventions.

We did not use multi-level analysis techniques, which could provide insights as to whether the variation in the communication was specifically caused by differences between students, groups of students, or tasks. In this study however, we use one level analysis for each level. We think this procedure is sound because we did not include explaining variables on more than one level at the same time.

4.5 Summary

This design research aims to generate, makes explicit and evaluate design principles for an effective CSCL environment in teacher training. For this purpose we developed and implemented three designs of a CSCL environment in three different courses of the teacher training programme of Utrecht University. Our research involved 36 student teachers and 5 teacher educators.

The evaluation of the designs focused on determining the influence of the elements of three clusters of design elements (task instruction, online environment, teachers' guidance) on the collaboration of the student teachers. We analysed the electronic communication of student teachers and teacher educators,

with the purpose of describing the collaborative process. Furthermore, we studied student teachers' and teacher educators' evaluations of the collaboration and the design elements, which were gathered by using questionnaires and interviews. All this to evaluate the relation between the design context and the collaboration. To enable analysis of the electronic communication and the information from the interviews, two coding systems were developed. The coding system for the interviews included six categories: group behaviour, group composition, teachers' guidance, online environment, task instruction and design context. Summaries of the interview transcripts were made for each category.

To analyse the electronic communication, we developed a multi-perspective analysis method, with five different perspectives from which to view the data: participation, nature of content, interaction, level of information exchange, and regulative communication. The quality of the instruments of the multi-perspective analysis method was satisfactory.

The collaboration is described by means of Social Network Analysis, (non-) parametric variance tests, and *t*-tests to compare means. The information from the summaries of the interviews and descriptive statistics of the items of the questionnaires are related to the data on the students' collaboration, using content-analytic summary tables.

Chapter 5: Students' and Teachers' Evaluation of the Collaboration

This chapter presents our answer to research question 1: *"How do student teachers and teacher educators evaluate the student teachers' collaboration in the CSCL environments designed within the framework of this research?"* The data were gathered by conducting individual F2F interviews with student teachers and teacher educators. The students were asked for their opinions of the collaboration of the groups they had been involved in, and for the reasons for their online behaviour (see Appendix E3 for an overview of the students' statements from the interviews). The teacher educators were asked to reflect on the student teachers' collaboration and on their own roles in the collaboration. In addition, the students were asked to complete a questionnaire including items on frequency and quality of the content of the students' notes. The results are presented separately for each course in Sections 5.1, 5.2, and 5.3 respectively. Finally, a summary of the results and a conclusion are presented in 5.4.

5.1 The HTM Course

The student teachers of the HTM course were not satisfied with the frequency and content of the notes, as shown by the mean score of the students on the scale 'collaboration HTM' ($M = 2.7$; $SD = .8$). They were particularly dissatisfied with the number of notes and responses sent in. The student teachers were more satisfied with the content of the notes (see Appendix D1 for scores on each separate item).

Analysis of the interviews confirms the impression that generally student teachers were moderately satisfied, but differ in their opinions of their collaborative processes. Students of one heterogeneous group were very positive when interviewed, stating such positive aspects as themselves having to structure the work, plan each assignment, divide the task, feeling responsibility, reacting to each other, and generally enjoying a good atmosphere.

> "We have made clear agreements. With exact dates and times, when each one had to deliver what parts of the task, when to react, milestones. These were well-defined arrangements. We also agreed on who had the final responsibility. That worked very well".

> "We all had quite a big feeling of responsibility. When one of us had done much at a certain time, the others promised to do the next thing, such as summarizing the work, or taking the final responsibility. This was well divided in our group".

In contrast to all other heterogeneous groups, the members of this group were specifically positive about working in a heterogeneous group, enabling them to use each other's experiences. Their teacher mentioned at the interview, that this group showed a collaborative process he would have liked to have seen in all groups. When interviewed, students from one of the other, less positive groups mentioned that, after working individually on the task, they put together the work at the end of the task period without any discussion taking place. According to the members of this group, their collaborative process improved after a F2F evaluation of the collaborative process halfway through the course (see Chapter 3 for a description of the evaluation procedure). They started making agreements and dividing their task, and their feeling of responsibility increased. Besides evaluative remarks, the students formulated their intentions. These were directed at improving the quality of their inputs, reacting more to group members, communicating when things were not going as hoped for, planning activities, and at improving their motivation. In spite of their positive opinion of this F2F evaluation, it did not generate sufficient improvement for them to be satisfied about their collaboration overall. Group members of the other two heterogeneous groups stated technical problems, sickness of group members, lack of responsibility and a bad atmosphere as reasons for the lack of collaboration in their groups. Although all students showed themselves positive about the F2F evaluation when interviewed, the members of these groups mentioned that finally it had not positively influenced the collaborative process.

We conclude from the students' interview statements on working in homogeneous groups, that the collaborative process has not really been very different from that in the heterogeneous groups. 'Working individually', 'assembling work at the end of the task period', and 'a focus on procedural aspects of the task instead of the content', were regular comments. Only the students of one group were relatively positive, as this group enjoyed a leading group member to divide the task, make a planning, and feel responsible for the work of the group. Except for the students of one group, all students preferred working in homogeneous groups, as is illustrated by statements such as 'they knew each other', 'worked from within the same teaching perspective', and 'were in the same training situation'.

We did not find a relation between the students' evaluation of their collaborative process (scale 'collaboration HTM') and their opinions about the quality of the group's end products ($r = .38$; $p = .2$). In the teacher's opinion, the collaborative process was just as important as the end products. He mentioned during the interview that he thought the students learned much about how to work collaboratively with their peers.

> "The negative experiences [with online collaborative learning] have resulted in learning experiences for a lot of students. They have learned what can go wrong. We asked them to reflect on this in their portfolios. […] because they had to evaluate and make intentions for future actions, they have thought intensively about the organisation of collaborative learning."

Generally, the students also feel that they learned how to collaborate with peers. On the questionnaire item of the learning effects of peer collaboration, they scored a mean of 2.9 ($SD = 1.0$).

All in all, the students of all groups except one, have worked quite individually, assembled the work at the end, often without discussion. Some groups tried to integrate and attune their respective work. The students were quite negative about the collaborative process in the heterogeneous groups as well as the homogeneous groups, despite a relatively more positive attitude towards the work in homogeneous groups. Box 5.1 below lists positive and negative factors influencing the collaborative work, as results from the students' interviews.

Box 5.1
Positive and negative factors influencing the collaboration according to students

Positive

- knowing each other;
- good atmosphere in group;
- sending stimulating and motivating remarks to group members;
- making a planning at the start of an assignment;
- discuss and adjust the planning along the road;
- appointing a leader with the end responsibility for each assignment;
- division of task at the start of an assignment: who is doing what;
- feeling responsible for work progress and end product, and to put effort in the work;
- F2F contact at the start of an assignment;
- F2F contact to attune work and as a social function;
- halfway F2F evaluation of the work process;
- responding to others;
- keeping others informed about what you are doing, even when occupied with other activities;
- clearly organised group areas in groupware.

Box 5.1 (continued)

Negative
- technical problems;
- group members lack skills for working with groupware;
- personal circumstances such as sickness, work pressure, and lack of motivation for working with a computer;
- not working according to plan;
- not taking responsibility;
- lack of social cohesion in group: bad atmosphere in the group, no team feeling, group members difficult to address;
- not responding to others;
- not making a task division at the start of an assignment;
- lack of information about the assignment (procedure, planning, aims, outcomes).

5.2 The BITEP Course

In studying the BITEP course, the emphasis was placed on the TIE assignment. This has consequences for the extent of reporting in this section on each of the assignments of the BITEP course.

5.2.1 The TIE Assignment

Table 5.1 shows the results of the relevant items of the questionnaire presented per TIE group. In general, four groups (TIE 3, 5, 6, and 7) were positive about the collaboration within their group. The students of these groups were satisfied about the frequency and content of the notes, and feel there was sufficient exchange of opinions, ideas and viewpoints. In the interviews, the students specifically mentioned the comments on their lesson plans and the confrontation with different ideas as positive effects.

> "From student Simon, I received useful feedback on the content: on the instructional method. From the other student I received feedback on the linguistic aspects".

The members of only one group proceeded to include questions in order to focus their mutual comments. According to the students of this group, this worked very well as it enabled providing and receiving specific feedback.

Three groups (TIE 1, 2, 4) were quite negative about their collaborative processes, the frequency of sending notes and the content of the notes. During the interviews the members of these groups stated the quality of the group members' comments, and the role of the student of English as negative aspects, the latter as they did not consider comments on their use of the English language very useful.

Table 5.1
Student' scores on items related to the collaborative work (items on a 5-point Likert type scale)

	TIE1 (*N* = 2)		TIE2 (*N* = 3)		TIE3 (*N* = 3)		TIE4 (*N* = 3)		TIE5 (*N* = 3)		TIE6 (*N* = 3)		TIE7 (*N* = 3)		Total (*N* = 16)	
Variable	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
Felt responsible	2.0	1.0	2.3	1.2	3.0	1.0	3.3	.6	3.0	1.0	1.7	.6	2.3	.6	2.5	1.0
Satisfaction # notes	1.5	.7	1.7	.6	3.7	.6	2.3	.6	4.3	.6	4.0	1.0	3.3	.6	3.0	1.3
Satisfaction content notes	2.5	2.2	2.3	1.5	4.0	.0	2.7	1.2	4.0	.0	4.0	1.0	3.7	.6	3.2	1.2
Satisfaction # responses	2.0	1.4	2.0	1.0	3.7	.6	2.3	.6	4.3	.6	4.0	1.0	3.7	.6	3.1	1.3
Satisfaction content responses	1.5	.7	2.3	.6	3.3	1.2	2.0	1.0	3.3	.6	3.3	.6	3.7	.6	2.9	1.1
Sufficient exchange	1.5	.7	2.0	1.0	4.3	1.2	2.3	1.2	4.0	1.6	3.0	1.0	3.7	.6	3.5	2.0
Collaboration positive	2.0	1.4	2.0	1.0	3.7	.6	2.0	1.0	3.0	1.0	2.7	.6	2.7	1.2	2.6	1.1
Collaboration TIE	1.8	1.2	2.1	.6	3.8	.7	2.8	.8	3.8	.6	3.5	.8	3.4	.4	3.0	.0
Satisfaction quality end products	1.7	1.2	2	1.0	3.3	.6	2.3	.6	4.3	.6	3.3	.6	3.3	.6	2.8	1.2

Technical problems too delayed the work in these groups, as was mentioned by several group members. We consider lack of motivation to work on the assignment the main reason for the negative views of these students, resulting as it did in very little mutual response from other group members, as the students repeatedly mentioned during the interviews.

> "I did not receive anything of the student in English. She just wrote: ok. I thought this is not for real…"

> "I did not hear anything from my group mates."

One of the items of the questionnaire measured to what extent each individual group member felt responsible for the outcome of the lesson plans of their group members. Table 5.1 shows that only in TIE groups 3, 4 and 5, members felt responsibility for each other's lessons. When interviewed, students of the other groups stated their lack of feeling responsibility as caused by their idea that the TIE assignment was an individually oriented assignment, the end product being an individual lesson plan.

One of the questionnaire items asked the students whether or not they experienced the collaboration with peers on the TIE assignment positively. Table 5.1 shows only two groups did (TIE 3 and 5). Although at least four groups were positive about the frequency and content of their communication, it seems as if other aspects, such as the task, have influenced their attitudes with respect to the collaborative process as a whole.

Correlation measurements show a correlation ($r = .82$; $p \leq .001$) between the students' opinions about the collaboration during the TIE assignment (scale 'collaboration TIE') and their opinions about the quality of the end products of the TIE assignment. The more students are satisfied with the collaboration within their group, the more they are satisfied about their end products.

The teacher thinks the collaborative work of the students has been successful, because there was much communication within groups. In his opinion, the products are less important than the processes. One of the purposes of the TIE assignment was to see whether students could manage themselves, without a teacher intervening. According to the teacher, the students managed to do so, to a satisfactory level. The students have showed enough effort, they consulted each other, and they had to immerse themselves in the situation of the others.

All in all, groups varied in their opinions of their collaboration. Students of four groups, with a positive view, appreciated the comments of their peers and the confrontation with different ideas. The students of the other three groups were negative about the lack of motivation of their group members to work online, and about the quality of the comments of their group members. Most students had interpreted their assignments as being individually oriented. Based on the stu-

dents' interviews, we have listed the positive and negative factors influencing the collaboration (see Box 5.2).

Box 5.2
Positive and negative factors influencing the collaboration according to the students

Positive
- communication was structured and useful;
- there was group feeling and good atmosphere;
- group members informed each other about progress and provided information on who was doing; what and when (also when a member was late), which motivated
- group members worked according to their own planning (adjustment of schedule in assignment);
- everyone did their share; the work was equally divided;
- group members responded quickly;
- group members were dedicated to the task at hand;
- appreciate group members' feedback, e.g. by letting know what aspects have been used by the receiver;
- quality of feedback was relevant.

Negative
- limited quality of group members' comments;
- technical problems;
- lack of motivation to work online.

5.2.2 The TOC and Research Assignments

The students of the TOC groups vary in their opinions of the question to what extent they experienced the collaboration as satisfactorily, from 2.3 to 3.3 (on a 5-point Likert type scale). Analysing the interview statements of the students about the TOC assignment, it has become clear that they did not seem to be worried by their low frequency of communication and limited collaboration. The TOC assignment had no priority when they were abroad.

> "At the beginning we had some contact. [...] Later we were too busy with other things".

> "You were busy with all other sorts of things. First the TIE assignment, later on the Research assignment".

> "The communication for the TOC assignment has been low. We discussed the TOC assignment shortly during a chat session, but yeah, what to do with it. We decided that everyone does in his or her own country what one think is good. Returning back in The Netherlands we would make an appointment and come to an end product".
> "I did far less than for the TIE assignment. I just did my share. [...] We started late. [...] Yes, we did something, but kept it short."

Partly, the students' limited interest in the TOC assignment may have been caused by the fact that most groups in the end only did most of their work, especially the collaborative part, upon their return to the Netherlands. Only some groups indeed used WebCT to get things started and plan the assignment.

The students showed more satisfaction with the collaboration in the Research assignment ($M = 4.1$; $SD = .7$) than with that of the TOC and TIE assignments. Note that not all students were involved in the Research groups. Most of the students involved, when interviewed, mentioned the collaboration had been fruitful. One of the reasons may be that these groups decided for themselves to adopt WebCT for their work. Another reason mentioned was, that they thought the research assignment to be more important than the TOC assignment. A strong sense of group feeling in the Research groups is also reported.

5.3 The In-service Course

Table 5.2 shows the analysis results of the questionnaire data for each group. Compared to the students of the HTM and BITEP courses, the students of the In-service groups are very positive about all aspects of their collaborative processes. The teacher too, expressed his satisfaction with the students' work:

> "I think the three groups have executed the assignment as was intended. They have tried to execute the assignment as well as possible.[…] They have made a task division. Who is first, who is second and third. One of the students introduces learning elements and the others react to that. As far as I could observe, they have done that."

During the interviews, students mentioned several positive aspects about their collaboration, all reporting a positive group atmosphere, and having appreciated working with a strict planning, including task division. In one group, one of the students took on a leading role, taking responsibility for organizing the work in the groupware, which included file distribution and location, and sending materials to the teacher. All group members were satisfied with this role-taking. The students of two groups frequently provided their fellow group members with feedback, and within a short period of time, the others responding within a period of one to three days. In the third group, group members sometimes waited a week before responding. The students varied in their comments, some restricting themselves to stating what was wrong and why, others offering suggestions for rewriting the product. Many comments included tips on classroom behaviour.

Table 5.2
Students' scores on items related to the collaborative work (items on a 5-point Likert type scale)

	Group 1 (*N* = 3)		Group 2 (*N* = 3)		Group 3 (*N* = 3)		Total (*N* = 9)	
Variable	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
Satisfaction number of notes	3.7	1.2	4.0	.0	3.7	1.6	3.8	1.0
Satisfaction content notes	3.3	.6	4.3	.6	4.0	1.0	3.9	.8
Satisfaction number of responses	3.0	1.0	4.0	.0	3.7	1.6	3.6	1.0
Satisfaction content responses	3.7	.6	4.7	.6	4.7	.6	4.3	.7
Sufficient exchange	3.0	1.0	4.3	.6	4.7	.6	4.0	1.0
Collaboration positive	4.3	.6	4.3	.6	4.7	.6	4.4	.5
Collaboration In-service	3.5	.7	4.0	.0	4.0	.9	4.0	.1
Outcomes In-service	2.8	.6	3.5	.6	4.1	.4	3.5	.2

The students of two groups mentioned some critical points during the interviews.

> "There has been no real discussion and no elaboration of discussion, leading to new knowledge". "That [the discussion] was disappointing. At least, I expected that we would differ more [in their teaching methods and beliefs], and as a consequence would learn more. But we agreed on almost everything. That was a little bit of a bromide."

This corresponds with the teachers' opinion on the limited elaboration of the discussion:

> "They [the students] could have been more critical, but I can imagine they did not do this, due to the limited time available for the assignment. They also protected each other a little bit, and confirmed each other."

The members of the third group showed more satisfaction with the content of their discussions. However, the level of their discussions did decrease over time, due to time pressure and lack of motivation. These group members thought the comments they received from each other were useful, including tips and feedback on classroom conduct, and advice about writing the end product.

We did not find a relation between the students' opinion of their collaboration (scale 'collaboration In-service') and their opinion of the outcomes of the assignment (scale 'outcomes In-service')($r = .53$; $p = .15$).

All in all, the In-service students showed themselves positive about their collaboration, although the discussions could have been more elaborated. A strict planning, positive atmosphere and regular feedback within a short period of time have been positive aspects of the students' collaborative process. The positive and negative points are summarized in Box 5.3.

Box 5.3
Positive and negative factors influencing the collaboration according to the students

Positive
- making a planning with task division;
- working according to this planning;
- good atmosphere;
- when desired: using role-taking (role of organizer);
- responding to each other.

Negative
- elaboration of discussion was limited due to agreement on learning experiences.

5.4 Summary and Conclusions

Comparing the opinions of the student teachers involved in the three courses, the students of the HTM course were least satisfied with the collaboration of their groups, rating the frequency and content of the notes as quite negative. In most of the groups the students worked individually, simply putting their work together at the end of the task period, without discussion. A F2F evaluation of the collaborative process of the groups halfway through the course helped one group to improve their collaboration. The BITEP students differed more in their opinions of the TIE assignment. Some were satisfied, others critical as to both the amount of exchange and the content. They expressed indifference in respect of their collaborative process during the TOC assignment, but were satisfied with their collaboration in the Research assignment. The In-service students were satisfied about all aspects of the collaboration, although they thought their discussion could have been more elaborative.

The teacher educators of the BITEP and In-service courses show satisfaction with the collaborative process of their students. The HTM course teacher educator was disappointed in the work in the groups.

The analyses of the interviews have revealed eight features that may have influenced the collaborative processes.

First, *the atmosphere in the group* has affected a rather large number of groups. Group feeling, positive atmosphere, knowing one another well, it all assists in having students collaborate. Such features being absent affected the collaboration. A fear of being critical in the face of one's peers may also have influenced the discussions' level of elaboration.

Second, *the students' motivation for the assignment and for collaboration* is essential, as a sense of responsibility for both end product and process seems to be just as necessary for having a group function well, as is motivation to work on

tasks and collaborate online. With respect to group atmosphere, personalities must suit.

Third, *structuring the work*, i.e. work planning, task division, and compliance with this structure, proved essential to all groups. Those which did not make such a structure or did not comply are negative about their collaborative processes.

Fourth, *responding* to each other regularly and keeping in contact, even when work is not progressing, as frequent communication is required to keep the group 'alive', and keep group members motivated, both for working on the task and doing so together.

Fifth, *role-taking* helped groups in performing their tasks collaboratively. For some, it proved helpful that one group member assumed a leading role, taking responsibility for keeping the group going, by making a planning and a task division.

Sixth, *the personal contexts of the students*, including such aspects as the technical situation and illness, may feature as a constraint of the collaboration.

Seventh, *type of task* is mentioned as a feature by some of the students, with certain types of tasks more appealing to them to work online collaboratively, whereas other type of tasks rather stimulated an individual way of working, namely tasks that make it possible to divide the work and assemble sub products at the end.

Eighth and finally, *type of group* features as an influence of the collaborative process as, according to most of the HTM students, working in heterogeneous groups based on diverse subject-backgrounds did not stimulate collaboration. Students then lack common educational context and common experiences, and the different training programmes caused specific constraints. Only the students of one of four heterogeneous groups were positive about their collaboration, having taken full advantage of precisely the heterogeneity of diverse subject-back-grounds and diverse teaching experiences.

Chapter 6: Student Teachers' Online Collaboration

This chapter will provide information to answer research question 2: *How can the communication in the CSCL environments be characterised in terms of participation, interaction and content?* To this end, we will analyse the communication by means of the five perspectives described in Chapter 4, each one leading to a sub-question:

1. How did the students participate? (Perspective 1)
2. What was the nature of their communication? (Perspective 2)
3. What kind of interaction patterns can be identified? (Perspective 3)
4. On which level did the students discuss the content of the task? (Perspective 4)
5. What kinds of regulative communication did the students use? (Perspective 5)

The results for each course are presented in Sections 6.1, 6.2 and 6.3 respectively. A summary and conclusions based on the results of all three courses are provided in 6.4. Table 6.1 illustrates the structure of this chapter.

Table 6.1
Structure of Chapter 6

	HTM course	BITEP course	In-service course	Synthesis of three courses
Frequency of participation	6.1.1	6.2.1	6.3.1	6.4
Nature of communication	6.1.2	6.2.2	6.3.2	
Interaction patterns	6.1.3	6.2.3	6.3.3	
Level of information exchange	6.1.4	6.2.4	6.3.4	
Regulative communication	6.1.5	6.2.5	6.3.5	

6.1 The HTM Course

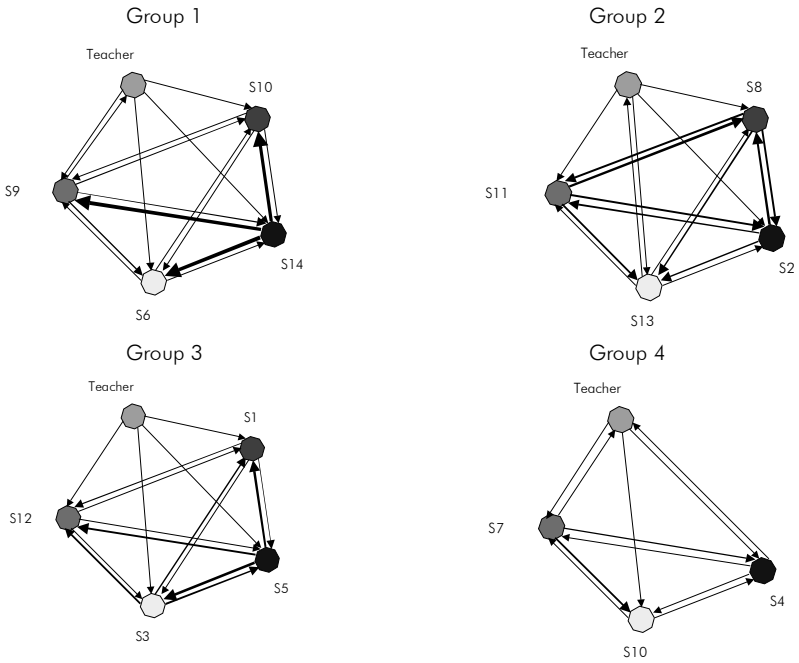
The HTM course had the student teachers working on four tasks in four groups of three to four. In three tasks they operated in groups that were heterogeneous with respect to the type of teacher training programme the students were involved in. Each group consisted of one Pre-service student, one In-service student, one BITEP student and, except for one of the groups, one student from the Specialties

programme. In the fourth assignment, the students worked in groups of three or four in which group members were part of the same teacher training programme.

6.1.1 Perspective 1: Frequency of Participation

The number of notes and documents students sent out to their group members (outdegree), and the number of notes received from their group members (indegree), are summed up for each subgroup. Figure 6.1 visualises the participation patterns of the heterogeneous groups.

Figure 6.1. Participation patterns of the heterogeneous groups of the HTM course.

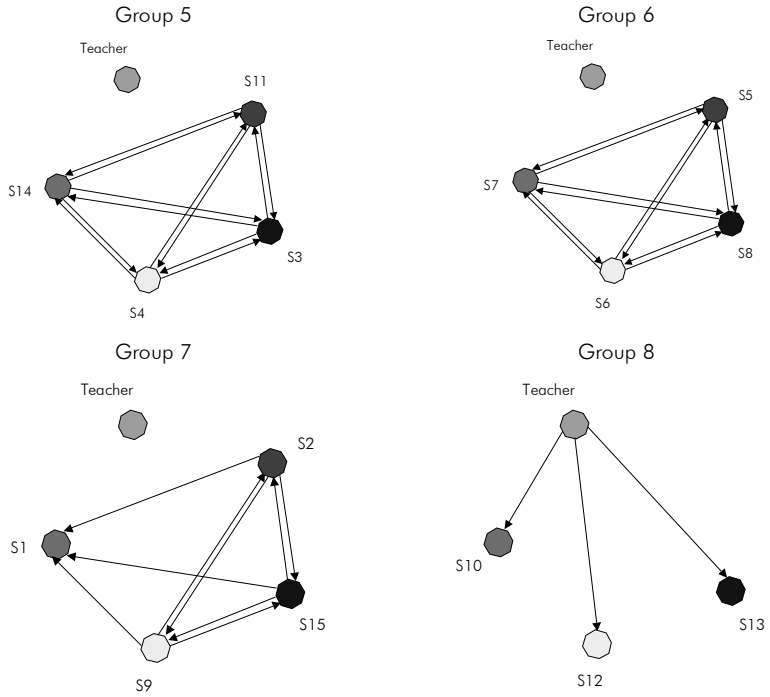


Each group sent around 50 to 70 notes and documents (except group 4, which consisted of only three members, who sent 27 notes and documents). The groups received between 147 and 164 notes and documents; in group 4 this number was 64. The notes and documents addressed to the group, or without any specific addressee, are considered as received by all group members.

Testing the differences *between* the participation patterns of the four groups, we found the groups did not significantly differ in the number of notes and docu-

ments sent[1] (*KW*= 2.6; *df* = 3; *p* = .46) and received (*KW*= 6.3; *df* = 3; *p* = .10)[2]. However, Figure 6.1 does show differences *within* the groups. For example, in comparison to their fellow group members, students 14 and 5, of groups 1 and 3 respectively, played a dominant role by sending many notes and documents. However, the other group members did not withdraw from the collaboration (i.e. did not show a free rider effect) as a result of the dominance of such group members. The participants of groups 2 and 4 displayed a more equally distributed pattern, group members receiving notes and documents more or less at the same rate. We did not find a significant correlation between the number of notes sent and received. Students who sent most notes and documents did not receive more notes and documents from their group members. In addition, the teacher educator showed low participation (ranging from two to eight notes in each group).

Figure 6.2. Participation patterns of the homogeneous groups of the HTM course.



[1] Due to the number of notes, teachers are not included in the Kruskal-Wallis tests.

[2] In our research we used a significance level of 95%. Analysing variance on subgroup or student level on a particular variable, we excluded those subgroups or students sending less than five notes including valued scores.

The participation of the students in the homogeneous groups diverges from that in the heterogeneous groups. On average, students of the homogeneous groups each sent three notes and documents. They worked on only one assignment of two weeks, which partly explains the limited number of notes sent. The subgroups do not differ significantly in the number of notes and documents sent. However, they do differ in the number of notes received ($KW = 10.0$; $df = 3$; $p = .02$)[3]. This means that in some groups the students have addressed their notes to all group members, while in other groups students addressed group members personally. Figure 6.2 clearly shows that group 8 diverges from the others, as the group members did not communicate at all. The other three groups sent between 15 and 20 notes and documents and students received between 38 and 55 notes. The groups show equal participation patterns, although student 1, of group 7, hardly participated, other group members participating quite equally. Again, the teacher educator showed very little participation.

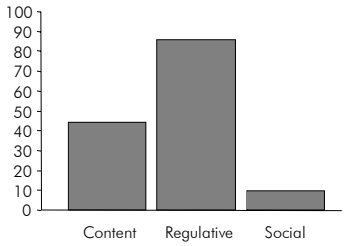
6.1.2 Perspective 2: Nature of the Communication

Next to sharing and constructing knowledge, one of the educational aims of the online assignments in the HTM course was to develop the regulative skills the students needed for CSCL. The amount of structure decreased progressively through the series of assignments, leaving it more and more to the students themselves to plan and regulate the collaborative process. As a consequence, regulative communication could become dominant in the online communication of the student teachers, leaving less space for content related communication.

The distribution of the frequency of all notes for the categories task related content, regulative and social communication, diverges from an equal distribution ($\chi^2 = 62.4$; $df = 2$; $p = < .001$). This is also true for the notes of the heterogeneous group assignments ($\chi^2 = 64.5$; $df = 2$; $p = < .001$) and homogeneous group assignments ($\chi^2 = 57.9$; $df = 2$; $p = < .001$). Figure 6.3 shows that the students indeed were focussed on regulative issues. In almost 86% of a total of 186 notes, arrangement of the task was at issue. The number of notes with task related content is considerably lower (44%), and the students communicated about social matters in less than 10% of their notes, including utterances dedicated to planning social events ("How late are we going to the party?"), informing as to each other's well-being ("I heard you are ill"), describing school matters ("I went to a cultural week with class 4H") and extended forms of greetings ("Hope to see you next week during school practice"). The students had a separate social forum at their disposal, which however was rarely used.

[3] Due to the number of notes, teachers are not included in the Kruskal-Wallis test.

Figure 6.3. Number of notes separate for task related content, regulative and social communication of the HTM course (in %).



Furthermore, we analysed whether subgroups differed from each other in the percentage of notes of content, regulative or social nature. Table 6.2 presents the results of the analysis of variance, separately for the heterogeneous and homogeneous groups. For both type of tasks the subgroups differed from each other in the percentage of students' notes with task related content and social remarks.

Table 6.2
Analysis of variance between subgroups by type of group

	Content		Regulative		Social	
	χ^2	*df*	χ^2	*df*	χ^2	*df*
Heterogeneous	8.1*	3	2.9	3	10.7*	3
Homogeneous	32.9***	2	2.3	2	63.6***	2

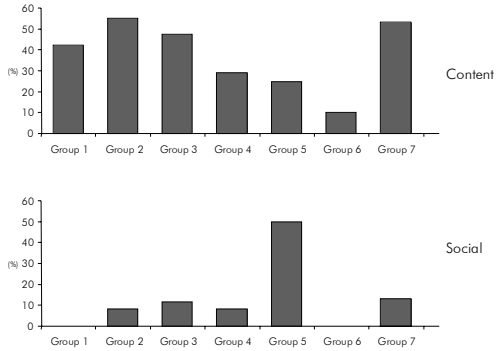
* $p \leq .05$, ** $p \leq .01$, *** $p \leq .001$.

Figure 6.4 shows the differences in the use of task related content and social communication between all seven subgroups, one group relatively socially orientated, two groups not at all communicating about social matters. One of the reasons for this group communicating much about social matters could be that these students were quite close friends.

The members of two groups concentrated on the task content (> 50% of their notes included task related content), whereas in three groups less than 30% of their notes included communication about the content.

Besides the analyses of differences between groups, we examined possible differences between the student teachers of each group.

Figure 6.4. Nature of notes (content and social) for each HTM subgroup (in %)



Note. Groups 1-4 heterogeneous, groups 5-7 homogeneous.

Table 6.3 shows us that students of the heterogeneous groups differ significantly in the task related content and social nature of the notes. This means that, in the heterogeneous groups, the observed differences between students may explain the differences in both the content and social nature of the notes in the sub-groups. Due to the limited number of notes in the homogeneous groups, this analysis had to be limited to the students of the heterogeneous groups.

Table 6.3
Analysis of variance between students[1]

	Content		Regulative		Social	
	χ^2	*df*	χ^2	*df*	χ^2	*df*
Heterogeneous	52.1***	9	4.9	9	106.7*	9

[1] Five students wrote less than five notes and are excluded from this analysis.
* $p \leq .05$, ** $p \leq .01$, *** $p \leq .001$.

6.1.3 Perspective 3: Interaction Patterns

The interaction patterns in the students' communication are expressed in the number and the length of threads. Threads start with a top level note (20% of all notes), and included one or more responses. The total number of notes in threads amounts to 112, i.e. 57% of all notes sent. This means that 43% of the notes were isolated ones, i.e. notes not receiving any response. Information on the interaction patterns in the communication for each subgroup is shown in Table 6.4. Two groups clearly discussed more than the other groups, the number of threads either being higher (group 2) or the threads being longer (group 3).

The students created 37 threads, the length ranging from 2 to 7 notes. The mean size of a thread was 2.9. This means that in the average a thread consisted

of a top level note plus 2 responses. The subgroups do not vary significantly on the mean thread length.

An interesting question is what exactly triggered students to respond to the top level notes and why they ignored the isolated notes. An answer to this question could provide us with clues for writing top level notes. We analysed whether these two types of notes differed in their content but found no significant differences in any of the courses. Content analysis is needed but this was beyond the scope of our research, as will be elucidated in Chapter 10.

Table 6.4
Interaction of HTM subgroups (teachers' notes included)

	Threads (*N*)	Top level notes (%)	Responses (%)	Isolated notes (%)	Notes in BB (*N*)	Thread length *M* (*SD*)
Group 1	5	22	19	59	27	2 (0)
Group 2	16	27	48	25	66	2.9 (1)
Group 3	7	16	40	44	45	3.8 (2.3)
Group 4	3	21	25	54	27	2.8 (1.2)
Group 5	2	25	50	25	8	3 (0)
Group 6	2	20	30	50	10	2.5 (.7)
Group 7	2	13	27	60	15	3 (0)
Group 8	0	0	0	100	3	-
All groups	37	19	37	44	196	2.9 (1.3)

6.1.4 Perspective 4: Level of Information Exchange

The level of information exchange was measured on a 5-point Likert type scale, ranging from a surface level of information exchange to a deep level of information exchange. Only task related content is scored on this scale, which can be found in Chapter 4.

Table 6.5
Level of information exchange by HTM subgroup

	M	*SD*	Notes scored deep level (%)	*N*
Group 1	2.8	1.1	20	10
Group 2	2.7	1.3	29	34
Group 3	2.4	1.1	15	20
Group 4	3.3	1.1	43	7
Group 5	1.0	0	0	2
Group 6	3.0	-	0	1
Group 7	2.6	1.3	25	8
Total	2.6	1.2	24	82

Generally, the mean score for the HTM groups lies near the middle of the scale (see Table 6.5). In almost a quarter of the notes with task related content, the students have discussed on a deep level (scores 4 and 5), and in almost 50% on a surface level (scores 1 and 2). Subgroups did not vary significantly on their mean score at the level of information exchange.

In addition to the analysis of differences between subgroups, we have also analysed differences between students, who vary significantly in their mean score at the level of information exchange[4] ($F = 2.3$; $df = 7, 58$; $p = .04$; $f = .53$)[5]. The differences between the students are quite strong as we found a large effect size. Analysing the students' score, we noticed that four students predominantly used a surface level of information exchange and four students mainly a deep level of information exchange. All subgroups included at least one student working on a surface level and one on a deep level. This would explain why we did not find significant differences between the subgroups as to the level of information exchange.

6.1.5 Perspective 5: Regulative Communication

The students' regulative communication has been measured in the use of communication about technical, planning, organizational, and evaluative issues.

Before the start of the analysis activities, we had a number of expectations about the presence of the various regulative types of communication in the students' notes. We assumed that an important part of the regulative communication would involve communication about planning and evaluation, as part of the assignments was to have students organise and plan the assignments themselves, making them responsible for their own collaborative process. We also expected to find a particular type of communication characteristic of online collaboration, because CSCL environments do not display non-verbal behaviour that organises group communication (e.g. presenting documents, gesture to get attention). We expected to find much communication related to this organization of the communication ('organizational communication'). We further imagined that the student teachers' would communicate about technical problems at the start of each course, but that this would decrease progressively through the courses. Still, we assumed communication about technical problems to be limited as we supported

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[4] The scores of eight students were excluded from this one-way analysis, as these students sent less than five notes with task related content.

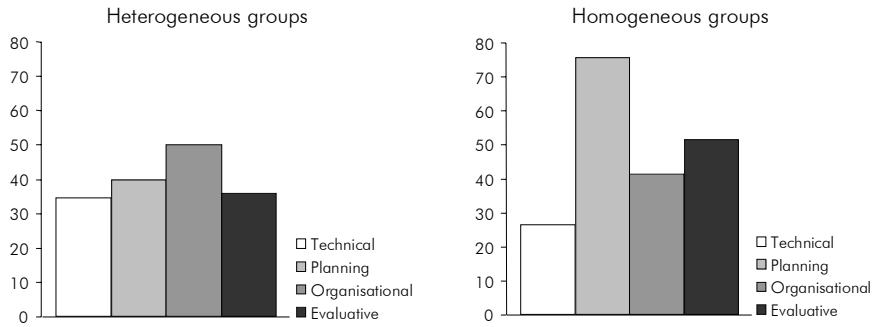
[5] Effect size $f = \sqrt{[\eta^2/(1-\eta^2)]}$, with η^2 equalling the proportion explained variance in the criterion variable. So, the proportion explained variance η^2 equals $[f^2/(1+f^2)]$. Cohen (1988) defined small, medium, and large f values. A small effect size is defined as $f = 0.10$; medium effect size as $f = 0.25$; and larger effect size as $f = 0.40$.

the students with hardware and software, and technical assistance was available all through the course.

Overall, the students wrote in almost 50% of their notes about planning issues and made evaluative remarks in almost 40% of their notes. This means the students invested a considerable amount of time in such regulative communication.

Figure 6.5 shows students in the homogeneous groups did plan their collaborative work intensively, as compared to students of the heterogeneous groups. This result is remarkable, as the students of the heterogeneous groups did not meet F2F, and one might have expected online communication about planning issues to have been more needed for them than for the students of the homogeneous groups, who also met weekly.

Figure 6.5. Frequencies of the regulative categories in all notes of the heterogeneous and homogeneous groups of the HTM course (in % of all regulative communication).



Note. One note may include one or more categories.

A possible explanation could be that the homogeneous groups were composed of students previously belonging to heterogeneous groups, homogeneous members now facing new acquaintances. The homogeneous subgroups differed in their usage of communication about planning issues ($\chi^2 = 17.5$; $df = 2$; $p \leq .001$). Overall, the students do not vary significantly in their usage of communication about planning aspects of the tasks[6].

Working in the homogeneous groups, the students were more focused on evaluation than during the work in heterogeneous groups. The heterogeneous and homogeneous subgroups vary as to their use of evaluative remarks ($\chi^2 = 27.0$; $df = 3$; $p \leq .001$ and $\chi^2 = 13.9$; $df = 2$; $p \leq .001$). In the heterogeneous groups 10 to 46% of the notes included evaluative remarks, the homogeneous groups reaching 33 to 70%. Additionally students show more significant variance in the use of evaluative communication ($\chi^2 = 98.5$; $df = 12$; $p \leq .001$). The

[6] Three students have been left out of the analyses of the regulative communication on student level because they sent less than five notes.

figures of one of the homogeneous groups (group 5) are remarkable, especially in relation to the other types of regulative communication. The students of this group did not sent any note with organisational remarks, but many notes with evaluative remarks. Examining the content of the notes and documents of this group, it appeared that this group included one group member who performed most content related work, which was stored in one big file. The others commented and evaluated this work in notes. So, a pattern of low organisational and high evaluative communication can be expected in case of such role-taking.

Figure 6.5 shows that around 50% of all regulative notes contain remarks organising the communication actually at hand and remarks structuring the text in notes and documents. The homogeneous subgroups differ significantly (χ^2 = 66.6; *df* = 2; $p \leq .001$). Group 5, as described above, is responsible for an important part of the variation found, not having used organizational communication at all, as indicated. Overall, the students also vary significant in their usage of organizational communication ($\chi^2 = 72.8$; *df* = 12; $p \leq .001$).

We may conclude from the frequency of notes carrying communication on technical issues, that the HTM students experienced considerably more technical problems than expected (see Figure 6.5). One should realise that part of the technical problems is not even reflected in the communication, as a few students did not even have access to the groupware at the beginning of the course. The greatest problems were faced in the beginning of the course (see Chapter 8 for a description of these problems). Both heterogeneous subgroups and the homogeneous subgroups vary significantly with respect to the number of notes with technical remarks (χ^2 = 10.1; *df* = 3; $p \leq .05$ and χ^2 = 12.6; *df* = 2; $p \leq .005$), ranging from 15 to 40% of the notes, including technically oriented remarks. Overall, the student teachers also differed in their communication about technical issues ($\chi^2 = 126.2$; *df* = 11; p = ≤ .001).

The subgroups differed in the four types of regulative communication (planning, evaluative, organisational and technical), which can be explained for the last three by differences between students in the use of these kinds of regulative communications.

6.2 The BITEP Course

During this course, the student teachers worked on three assignments. The TIE assignment was a pre-structured assignment in which the students developed a lesson plan and received feedback from group members. In each group, one student (of English) had a specific role in providing the other group members with feedback on linguistic aspects.

The TOC and Research assignments were research oriented. These assign-

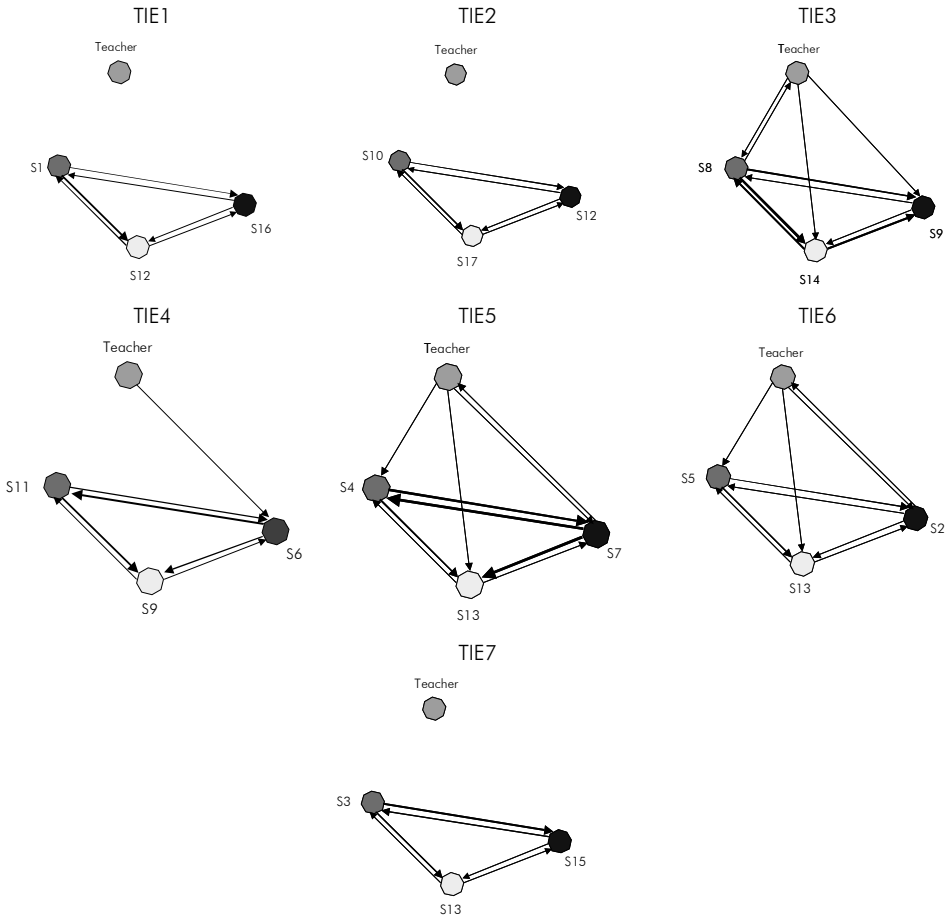
ments were quite open and ill-defined, leaving the students to organise the collaborative process, and to determine the subject and the research method. Online participation in these assignments was optional.

The communication of the subgroups during the three different assignments is analysed separately, because the students worked in different groups during these assignments.

6.2.1 Perspective 1: Frequency of Participation

Figure 6.6 shows the participation (in sending and receiving notes and documents) of the TIE groups.

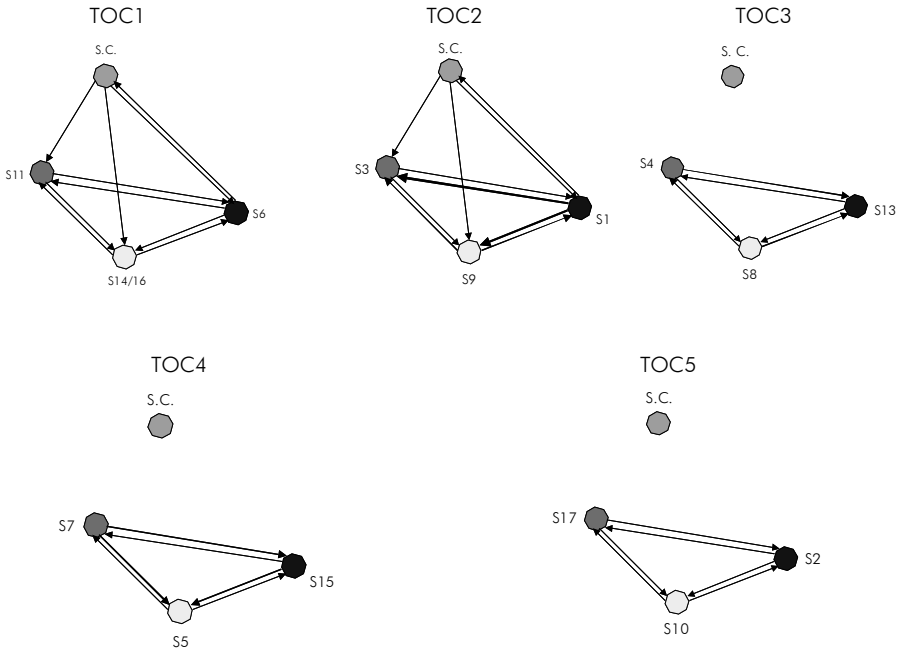
Figure 6.6. Participation patterns of TIE groups in the BITEP course.



Three groups show an equal interaction pattern, meaning that all three group members were involved in the online discussion with similar frequency. One of the groups (TIE5) had a dominant member, sending more than the other group members. In four groups, the students of English sent slightly less notes than their group members.

The subgroups vary as to the number of notes and documents sent (KW = 14.8; df = 6; p = .02), and received (KW= 18.2; df = 6; p = .01)[7]. The groups sent 5 to 46 notes and documents and received between 10 to 90 notes and documents. The notes and documents were sent to all group members, irrespective of the number of notes and documents sent by each group member. The role of the teacher was limited, as he sent and received a couple of notes in only three groups.

Figure 6.7. Participation patterns of the TOC groups in the BITEP course.



Note. S.C. is Student Co-ordinator.

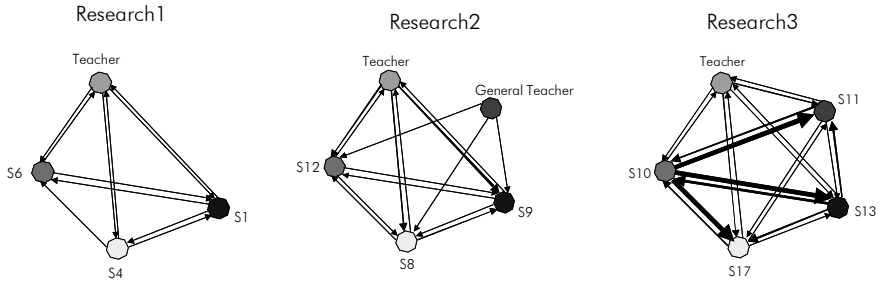
The participation patterns of the TOC groups are presented in Figure 6.7. The TOC groups differ significantly as to the number of notes received (KW = 10.1;

[7] Due to the number of notes, the teachers' notes are not included in the Kruskal-Wallis test.

$df = 4$; $p = .04$)[8]. The groups sent between 9 and 36 notes and documents and received 15 to 73 notes and documents. They show an equally distributed pattern, except for group TOC2, in which one student sent more notes and documents. Generally, the students addressed their notes to all group members. The Student Co-ordinator, as the executory of the teachers' task, had a minor role.

The Research groups show a different picture than the TIE and TOC groups do (see Figure 6.8), sending much more notes and documents. The more intensive participation patterns are caused by the teacher educators' more intense involvement, communicating considerably more as they did than the teachers of the other assignments of this course. The three Research groups vary significantly in the number of notes sent ($KW = 6.8$; $df = 2$; $p = .03$), and received ($KW = 8.0$; $df = 2$; $p = .02$)[9]. Two groups respectively sent 25 and 29 notes and documents (teacher educators' notes not included), Research group 3 sending 121 notes and documents. Respectively, the three groups received 31, 91, and 300 notes and documents. Research group 1 mainly sent out individually addressed notes and documents. The other groups sent their notes and documents to all group members.

Figure 6.8. Participation patterns of the Research groups of the BITEP course.



6.2.2 Perspective 2: Nature of the Communication

As in the HTM course, usage of regulative skills was one of the aims of the BITEP assignments. And again we realised, as a consequence regulative communication could dominate the discourse.

The distribution of the frequency of all notes over the categories task related content, regulative and social, diverges from the equal distribution ($\chi^2 = 45.1$; $df = 2$; $p \leq .001$). This holds true for the TIE ($\chi^2 = 40.9$; $df = 2$; $p \leq .001$), the

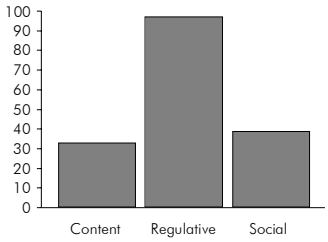
[8] Due to the number of notes, the student co-ordinator' notes are not included in the Kruskal-Wallis test.

[9] Teachers' notes are not included in the Kruskal-Wallis test on subgroups.

TOC (χ^2 = 38.3; *df* = 2; $p \leq .001$), and the Research groups (χ^2 = 57.4; *df* = 2; $p \leq .001$). Figure 6.9 shows students used relatively much regulative communication. In almost 100% of all 391 notes, communication occurred on regulative issues. The number of notes with task related content is considerably lower (32%).

Despite disposing of a separate social forum, the students used their group areas (almost 40%) for social communication, dedicated to wishing group members good luck with their lessons, extended forms of greetings ("Hope to hear from you soon"), questions about personal circumstances such as holidays, well-being, and the like, and off-task content related communication such as experienced problems in the classroom.

Figure 6.9. Number of notes separated by task related content, regulative and social communication of the BITEP course (in %).



We also analysed whether subgroups differed in the percentage of notes with task related content, regulative and social nature. Table 6.6 shows the results of this analysis for the three assignments separately. The TOC subgroups differ as to the number of notes with task related content communication.

Table 6.6
Analysis of variance between subgroups organized by task

	Content		Regulative		Social	
	χ^2	*df*	χ^2	*df*	χ^2	*df*
TIE	10.6[1]	5	.4	6	37.8***	6
Research	5.4	2	.1	2	21.6***	2
TOC	31.5***	4	.7	4	46.3***	4

[1] Due to the absence of notes with task related content, one of the groups is excluded from the analysis.

* $p \leq .05$, ** $p \leq .01$, *** $p \leq .001$.

The subgroups of all three assignments differ in their numbers of notes with social remarks. Looking at the frequencies of each subgroup we see that four groups, distributed over all three assignments, have been oriented on social communication. In more than 50% of their notes they wrote about social topics. There were

no differences in the frequencies of notes including regulative communication: all groups sent many regulative notes.

We also explored possible differences between the individual student teachers of each group. Table 6.7 shows the students of each task group differ significantly as to the percentage of notes with content related and social remarks.

Table 6.7
Analysis of variance between students

	Content		Regulative		Social	
	χ^2	*df*	χ^2	*df*	χ^2	*df*
TIE[1]	79.8***	14	3.04	14	157.0***	14
Research	73.5***	9	1.8	9	160.9***	9
TOC[2]	69.1***	11	5.7	11	86.3***	11

[1] One student wrote less than five notes and was excluded from this analysis. [2] Three students wrote less than five notes and were excluded from this analysis.
* $p \leq .05$, ** $p \leq .01$, *** $p \leq .001$.

We may conclude that differences between students may explain differences between subgroups. This holds with respect to the social nature of the notes, and, with respect to the TOC groups, also the task related content of the notes. Analysing the individual score of each student in the three assignments, we found that students behaved differently during their activities on the TIE, TOC and Research assignments. There are indications of a relation between the students' communicative behaviour and the task. In Chapter 5, we already reported the students mentioned that the tasks influenced their motivation to work on the assignments in various manners.

6.2.3 Perspective 3: Interaction Patterns

The interaction patterns in the students' communication are expressed in the number and the length of threads. The total number of notes in threads amounting to 299, which covers 78% of all notes sent to the Bulletin Board. Threads started with a top-level note (23% of all notes) and were followed by one or more responses (55% of all notes). The remaining 85 notes were isolated notes.

Table 6.8 presents information on the interaction patterns of all subgroups. Five, including three TOC groups interacted relatively more than the other groups, with 62% to 86% of their notes involving a response to other notes. Four groups sent relatively more isolated notes. All subgroups together created 88 threads, the length ranging from 2 to 15 notes. The mean size of a thread being 3.38 notes, averagely there was a starting (top-level) note and two or three responses. The subgroups do not differ significantly with respect to mean thread length.

Table 6.8
Interaction of BITEP subgroups (teachers' notes included)

	Threads (*N*)	Top-level notes (%)	Responses (%)	Isolated notes (%)	Notes in BB (*N*)	Thread length *M* (*SD*)
TIE1	1	20	40	40	5	3.0 (.0)
TIE2	2	22	44	33	9	3.0 (.0)
TIE3	6	19	66	16	32	4.3 (3.2)
TIE4	7	25	57	18	28	3.3 (1.5)
TIE5	6	21	48	32	29	3.3 (2.3)
TIE6	4	33	50	17	12	2.5 (1.0)
TIE7	6	32	53	16	19	2.7 (.8)
R1	7	24	62	14	29	3.6 (2.4)
R2	11	26	55	19	42	3.1 (1.1)
R3	19	23	43	35	84	2.9 (1.4)
TOC1	4	20	70	10	20	4.5 (2.4)
TOC2	6	27	50	23	22	2.8 (1.2)
TOC3	4	20	45	36	20	6.0 (6.1)
TOC4	4	16	80	5	25	3.3 (.5)
TOC5	1	14	86	0	7	7.0 (.0)
All groups	88	23	55	22	383	3.4(2.1)

6.2.4 Perspective 4: Level of Information Exchange

The parts of notes, coded as task related content communications in Perspective 2, are scored on a 5-point Likert scale, mapping the level of information exchange of the students.

The students showed the whole range from a surface level to a deep level of information exchange (see Table 6.9), with a slight emphasis on the surface level. In almost 50% of the notes students communicated on a surface level (scales 1 and 2), and in 33% on a deep level (scales 4 and 5).

Table 6.10 tells us the three tasks together show a strong, significant difference between subgroups at the level of information exchange, whereas within each assignment subgroups do not differ significantly. The differences on course level are quite strong, as we found a large effect size. In Table 6.9 we can read that groups varied from sending deep level notes with a high mean score, to an absence of deep level notes and a low mean score. The fact we did find differences between subgroups on course level and did not between subgroups within each assignment, indicates that the task instruction or the teachers' guidance (as performed by different teachers during the assignments) may have affected the level of information exchange, resulting in differences between subgroups. These differences are partly explained by the scores of the TIE subgroups, as these are

considerably higher than the mean scores of the TOC and Research subgroups (see Table 6.9).

We did not find significant differences between students on the level of information exchange.

Table 6.9
Level of information exchange by BITEP subgroup

	M	*SD*	Deep level notes (%)	*N*
TIE1	-	-	-	0
TIE2	3.2	.7	33	9
TIE3	2.8	1.6	46	11
TIE4	4.0	1.	57	7
TIE5	3.2	1.7	54	13
TIE6	4.8	.5	100	4
TIE7	2.8	1.5	33	12
R1	2.4	.9	13	8
R2	1.8	.8	.0	5
R3	2.7	1.2	33	27
TOC1	2.4	1.2	20	10
TOC2	2.8	1.3	33	9
TOC3	1.5	.5	.0	8
TOC4	2.0	.0	.0	4
TOC5	3.0	-	.0	1
Total	2.8	1.3	33	128

Table 6.10
One-way analysis of variance of the mean score of the subgroups[1]

	F	*df*	*p*	*f*
BITEP, total	2.5	10, 108	.01	.48
TIE	1.2	4, 47	.33	
Research	1.5	2, 37	.24	
TOC	3.1	2, 24	.06	

[1] TIE1, TIE6, TOC14, and TOC15 are excluded from the one-way analysis of variance because these groups sent less than five notes.

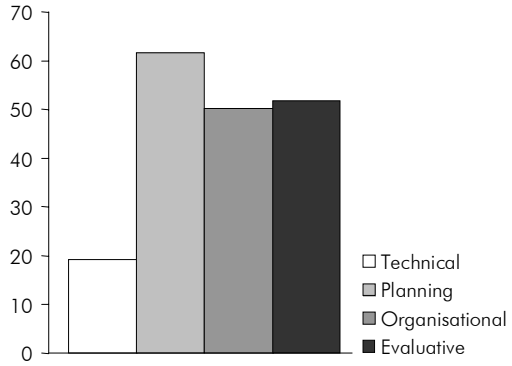
6.2.5 Perspective 5: Regulative Communication

We distinguish four types of regulative communication: communication on technical, planning, organizational, and evaluative issues.

Although one assignment (TIE) was pre-structured, we did expect to find regulative communication in students' communications, as one of the aims of this

online assignment was to have the student teachers responsible for planning, organization and management of the collaborative process. The TOC and Research assignments were ill-defined and open-ended and without any structure, leaving the organisation of the assignments completely to the students. In our description of the regulative communication of the HTM student teachers, we already indicated we assumed to find the so-called organizational communication characteristic of online collaboration. Except for the students working in British Guyana who had to deal with less sophisticated technical circumstances, we expected very few problems on the technical side. In most of the schools where BITEP students worked abroad, the availability of hardware had been checked beforehand.

Figure 6.10. Frequencies of the regulative categories in all notes of the BITEP course (in % of all regulative communication).



The students communicated intensively about regulative matters. Figure 6.10 shows they mostly talked about planning. Overall, students in the subgroups communicated on planning aspects in almost 60% of their regulative notes. The TIE and TOC subgroups vary significantly as to communication about planning ($\chi^2 = 35.0$; $df = 6$; $p \leq .001$ and $\chi^2 = 16.8$; $df = 4$; $p \leq .005$ respectively), the Research groups did not. In addition to differences between subgroups we also analysed differences between individual student teachers. This analysis of variance shows that during work on all three assignments, students differ significantly in their use of communication on planning ($\chi^2 = 37.1$; $df = 14$; $p \leq .001$).

Student teachers quite frequently sent evaluative communication as well. Around 50% of their regulative notes contain evaluative remarks. All groups used evaluative remarks or questions in at least 25% of their notes. The TIE and TOC subgroups vary significantly in the use of evaluative communication ($\chi^2 = 43.0$; $df = 6$; $p \leq .001$ and $\chi^2 = 23.2$; $df = 4$; $p \leq .001$ respectively). Remarkably, one of the TOC groups sent evaluative remarks in almost every note. This group does

not differ noticeably from the other TOC subgroups in other perspectives. Besides analysing the subgroups' behaviour, we analysed whether or not the student teachers varied in the use of evaluative communication, which they did, significantly ($\chi^2 = 36.7$; $df = 14$; $p \leq .001$). This holds for their behaviour during all three assignments. Differences between the students' evaluative communication were large, ranging from 25% to 82%.

In the BITEP course too, the organizational communication was an important part of regulating the collaborative process online. In about 50% of the regulative notes, students used this kind of communication. The subgroups differ significantly in their use of organizational remarks while working on the TIE ($\chi^2 = 58.7$; $df = 6$; $p \leq .001$) and the TOC assignments ($\chi^2 = 82.5$; $df = 4$; $p \leq .001$). One TIE group used organizational communication in more than 80% of their notes. The TOC subgroups vary quite markedly, one group using remarks to organise their communication in more than 60% of their notes, while in another group none of these kinds of remarks were used. Again, we analysed the students' behaviour. Combining the data on all three assignments we found the students differ significantly ($\chi^2 = 56.3$; $df = 14$; $p \leq .001$), ranging from 25% to 78%.

As expected, technical issues, ranging from problems with hardware access to communication about groupware or personal files, did not dominate the communication of the students. However, technical issues were important in some of the subgroups, whereas other groups did not communicate about technical issues at all. This variation between subgroups is significant between the TIE subgroups ($\chi^2 = 92.7$; $df = 6$; $p \leq .001$), the TOC subgroups ($\chi^2 = 113.5$; $df = 4$; $p \leq .001$) and the Research subgroups ($\chi^2 = 16.3$; $df = 2$; $p \leq .001$). In addition to the analysis of the differences between subgroups we also analysed possible differences on student level. During all three assignments, students differed significantly ($\chi^2 = 283.3$; $df = 14$; $p \leq .001$), ranging from 0% to 75%.

So, all three assignments had the students writing many notes on aspects of planning, organization and evaluation and less about technical aspects. There were significant differences between all regulative kinds of communication in the subgroups of all three assignments, which can be explained by differences in the individual students' communication about regulative aspects.

6.3 The In-service Course

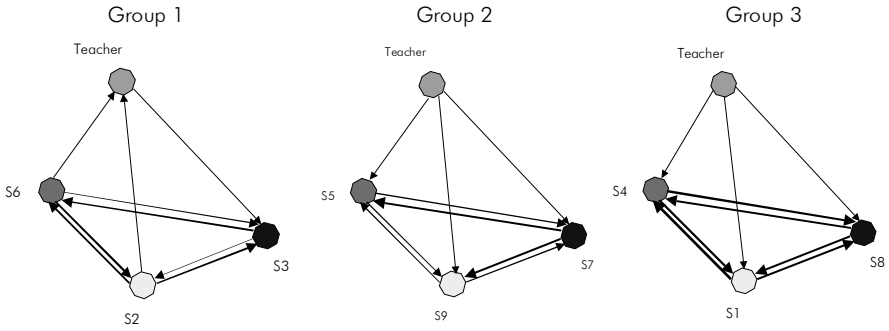
During this course, the student teachers worked on one assignment. The online assignment was presented to them as an optional alternative to an individual assignment. The assignment was pre-structured and included role-taking and built-in controversy. Students had to write a story including their own teaching experiences.

6.3.1 Perspective 1: Frequency of Participation

The number of notes and documents sent and received by the students are totalled for each subgroup. Figure 6.11 visualises the In-service group's participation. It shows the three subgroups had equally distributed participation patterns, which means the students were involved in the online discussion at more or less similar frequency. The amount of notes sent by the students (outdegree) differs between groups ($KW = 6.60$; $df = 2$; $p = .04$)[10]. The group of students sent between 40 and 70 notes and documents. In most cases the students addressed their notes and documents to all group members. There was no variation between the three subgroups in relation to the amount of notes received (indegree). The groups received between 75 and 100 notes and documents.

The participation patterns also show low teacher participation. In fact, the teacher sent few notes, and received notes from one group only.

Figure 6.11. Participation patterns of the In-service groups.



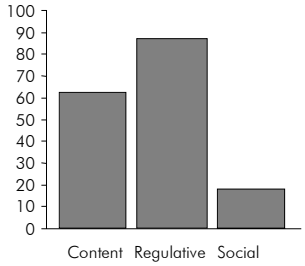
6.3.2 Perspective 2: Nature of the Communication

In the HTM and BITEP courses, regulative communication dominated the students' communication. The online assignment for the In-service groups has been designed so as to stimulate content discussion and decrease the dominance of the regulative communication by pre-structuring the assignment.

The distribution of all notes over the categories task related content, regulative and social communication, diverge from an equal distribution ($\chi^2 = 44.0$; $df = 2$; $p \leq .001$). Students still concentrated on regulative matters (see Figure 6.12), but the percentage of notes with task related content remarks is considerably higher than in both other courses (63%).

[10] Due to the low number of notes, the teacher is not included in the Kruskal-Wallis test.

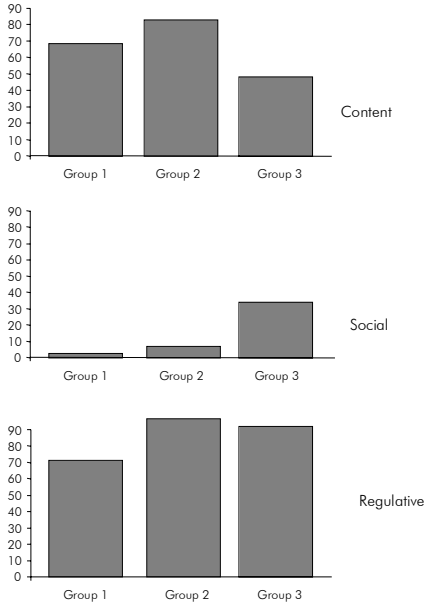
Figure 6.12. Number of notes categorized in task related content, regulative and social communication of the In-service course (in %).



Similar to the HTM students, the In-service students had very little communication about social matters. They concentrated in the social communication on extended forms of greetings, questions about personal circumstances such as holidays and well-being, and witticisms.

Besides the distribution of the nature of the notes for the entire course group, we studied the differences between the three subgroups, which vary in their attention for the task related content ($\chi^2 = 9.1$; $df = 2$; $p \leq .05$) and social matters ($\chi^2 = 39.0$; $df = 2$; $p \leq .001$). Figure 6.13 visualises how subgroups differ. One subgroup focused relatively much on social matters. The same group has sent fewer notes with task related content than did the other subgroups.

Figure 6.13. Nature of notes (content, social, regulative) for each In-service subgroup (in %).



Furthermore, analysis on student level shows the student teachers differ significantly with respect to all three types of communication: the task related content ($\chi^2 = 45.7$; $df = 8$; $p \leq .001$), the regulative ($\chi^2 = 16.2$; $df = 8$; $p \leq .05$) and the social communication ($\chi^2 = 182.6$; $df = 8$; $p \leq .001$). In contrast to the students of the other two courses, the In-service students also differ in frequency of usage of regulative remarks.

6.3.3 Perspective 3: Interaction Patterns

The number and character of threads together shape a group's interaction patterns. Table 6.11 shows the interaction patterns of the groups. The students posted 108 threaded notes in the Bulletin Board, which covers 97% of all notes, only 3% of notes being isolated ones.

Table 6.11
Interaction of In-service subgroups

	Threads (*N*)	Top-level notes (%)	Responses (%)	Isolated notes (%)	Notes in BB (*N*)	Thread length *M* (*SD*)
Group 1	6	19	75	6	32	5.2 (2.5)
Group 2	6	21	75	4	28	4.7 (1.9)
Group 3	11	22	78	0	51	4.7 (3.0)
All groups	23	21	77	3	111	4.8 (2.5)

Note. Teachers' notes (< 5) not included.

The subgroups created a total of 23 threads, their length ranging from 2 to 11 notes, the mean length being 4.8. Averagely, the threads consisted of a top-level note plus four responses. The subgroups do not differ significantly with respect to mean thread length.

6.3.4 Perspective 4: Level of Information Exchange

The task related content remarks of the students are scored on a 5-point Likert scale measuring the level of information exchange, ranging from surface to deep level. The mean score of the In-service groups figures just above the middle of the scale of information exchange (see Table 6.12).

In almost 50% of the notes students communicated on a deep level (categories 4 and 5), which is considerably more than the students of the HTM and BITEP groups did, and meets our expectations of the student teachers increasingly focusing on content in this assignment. In 30% of the notes the students used a surface (categories 1 and 2) level of information exchange. The subgroups do not differ significant on their mean score on the level of information exchange.

Table 6.12
Level of information exchange by In-service subgroup

	M	*SD*	Deep level notes (%)	*N*
Group 1	2.8	1.2	31	26
Group 2	3.4	1.4	54	24
Group 3	3.6	1.3	56	27
Total	3.3	1.3	47	77

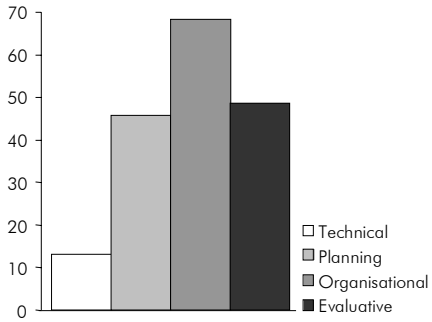
Next to the differences between subgroups, we analysed whether students differed with respect to the level of information exchange. The students significantly varied quite strongly ($F = 3.4$; $df = 8, 86$; $p = .003$; $f = .62$). Analysing students' individual scores, we noticed that in two groups, one member predominantly used a deep level of information exchange. Apparently, other group members have not been stimulated to adopt a deeper level of information exchange, following their group mate as an example.

6.3.5 Perspective 5: Regulative Communication

Regulative communication is measured in terms of communication on technical, planning, organisational and evaluative issues. Although we still wanted to have the students regulate their own collaborative process, we opted for a highly pre-structured assignment, leaving less responsibility to the students. We expected the In-service students to communicate less about aspects of planning and evaluation of the collaborative process, assuming they would also use organisational communication to organise their communication. One of the conditions for the students to participate was that they disposed of suitable hardware and a well functioning Internet connection. Therefore, we assumed that communication on technical aspects would be limited to groupware usage.

Although the In-service assignment was more structured than those of the other courses, Figure 6.14 shows students still communicated much about planning and evaluative issues. Studying the content of the communications, it appears that the openness of the type of task and the distant role of the teacher caused insecurity about the performance of the task. Agreements about the time schedule and the distribution of roles were also aspects of the task generating this kind of regulative communication. In almost 50% of the regulative notes, the communication has been focused on planning issues. The subgroups vary significantly ($\chi^2 = 7.1$; $df = 2$; $p \leq .05$), ranging from 30% to 50%. Besides varying between subgroups, the students differ in their communication about planning issues ($\chi^2 = 99.5$; $df = 8$; $p \leq .001$).

Figure 6.14. Frequencies of the regulative categories in all notes of the In-service course (in % of all regulative communication).



Evaluative remarks and questions were also produced in about half of the regulative notes sent. The subgroups communicated about evaluative issues at more or less the same frequency and do not differ significantly. Next to the variation between groups, we analysed the variation between individual students, finding they vary significantly in the use of evaluative remarks ($\chi^2 = 77.3$; $df = 8$; $p \leq .001$).

In almost 70% of the regulative notes, students used organisational remarks to arrange the online communication, and this is considerably more than the students of the HTM and BITEP courses did. This high number might be explained by the structure of the assignment. The students had to work partly in a file exchange server and partly in a bulletin board, and relate and refer the content of the documents and notes. Subgroups do not differ significantly, but the students vary in their usage of organizational remarks to structure the online communication ($\chi^2 = 44.6$; $df = 8$; $p \leq .001$).

As expected, and borne out by Figure 6.14, students produced very little communication about technical problems. Communication about technical aspects consisted mainly of remarks on groupware usage. The subgroups vary significantly ($\chi^2 = 24.9$; $df = 2$; $p \leq .001$) in their communication about technical issues. Two groups in particular show very little communication on technical issues (less than 5% of their notes), but the third group did experience technical problems, which were discussed in almost 25% of the notes of this group. Despite the requirements for participation, one of its students had difficult access to the hardware and the Internet, which caused some problems and delays in the work of this group. This above explains why we did find variation between the individual students in their communication about technical issues ($\chi^2 = 109.9$; $df = 8$; $p \leq .001$).

In the In-service assignment, students mostly communicated about organising their online communication, and hardly about technical aspects. However, there were individual differences between students, which were more or less ad random divided among the three subgroups.

6.4 Summary and Conclusions

Overall, we may conclude the creation of good conditions for online collaborative work in the In-service course (the third course in this design research) positively influenced the collaborative process. Of all groups, in fact, collaboration was the most intensive in the In-service groups. They concentrated more on task content, interacted more in discussion threads, and used a higher level of information exchange. They were less troubled by and focused on technical issues, and communicated about planning and evaluation. They arranged their organisational communication to take place at more or less the same rate as the students of the other two courses.

The following sections present a summary and our conclusions in relation to all three courses for each perspective separately.

6.4.1 Perspective 1: Frequency of Participation

Designing the courses, we aimed at discussions with an equal input of all group members. Generally, the subgroups of all three courses show equally distributed patterns, i.e the students contributed similarly to the discussion. There were some exceptions, though. In two HTM groups and one BITEP group, one student took on a dominant position in the collaborative process, sending much more notes and documents in comparison to their group members. However, this did not result in free rider behaviour by the other group members. In the TIE assignment of the BITEP course, the role of the English student teacher responsible for linguistic aspects constituted a less valued position in the collective work on the task, which resulted in less communication from the students with this role. The frequency of sending notes and documents was relatively intensive during work on the BITEP Research assignment and the In-service assignment. The students of all three courses have consistently sent their messages and documents to all group members, regardless of how active the group members had been. In general, participation of the teacher educators was low. Only the teachers of the Research assignment of the BITEP course participated more frequently.

6.4.2 Perspective 2: Nature of Communication

Within Perspective 2, we studied the nature of the communication, which has been characterised as task related content, regulative and social communication. As one of the aims of the HTM and BITEP online assignments was to have the students regulate their collaborative processes themselves, we expected to find an emphasis on regulative matters. And indeed, in almost all notes, regulative issues were discussed. Communication about task content was limited to 44% of all notes in the HTM course, and to 32% of all notes in the BITEP course.

The In-service online assignment was specifically designed to stimulate content discussion and decrease regulative communication, by structuring the assignment with prescribed activities and roles, and by means of built-in controversy. However, the In-service students still concentrated on regulative matters, but the percentage of notes with task related remarks is considerably higher than in both other courses.

The HTM and In-service students communicated very little about social issues. In both courses, the students met each other F2F, which may have affected the number of notes with social remarks. In the BITEP course environment, a separate forum for social communication did not prevent students from communicating about social matters in their group areas. In general, the BITEP students knew each other very well, were located all over the world and were dependent on online communication to stay in contact during an exciting period in their lives.

The general conclusions about the nature of the communication should be seen only against the backdrop of the differences between both subgroups and individual students, with respect to the communication about task related content and social matters.

6.4.3 Perspective 3: Interaction Patterns

The interaction patterns are characterised by the number and the structure of the threads. By means of the design of the courses, we tried to stimulate students to discuss their tasks and to work with threads to structure their communication. Over time, this became increasingly successful: the HTM course starts off with 50% of notes included in threads, the BITEP course raised the figure to 75%, and the In-service course almost reached 100%. All in all, discussion threads appear to be quite short (on average three to four notes).

6.4.4 Perspective 4: Level of Information Exchange

Within Perspective 4 we analysed the level of information exchange, noticing an increase in the level of information exchange from the HTM course to the In-service course. In 50% of notes with task related content, the HTM students communicated on surface level, in 25% on a deep level. The BITEP students also spent 50% of their notes communicating on a surface level, but the number of deep level notes increased to 30%. On the other hand, the In-service students dedicated 50% of their notes to deep level communication, and in only 30% of their notes surface level information was exchanged.

Although individual students vary significantly, the HTM and In-service subgroups do not differ as to their levels of information exchange, which indicates that, generally, students with a particular level of information exchange in their communication were randomly divided among the subgroups. It also suggests

that the subgroups included both students using a deep level of information exchange and students using a surface level of information exchange. On course level, the BITEP subgroups differ significant as to their levels of information exchange. However, there are no significant differences between subgroups during each assignment, neither are there on student level.

6.4.5 Perspective 5: Regulative Communication

Regulative communication is an important part of the student teachers' communications. As the aim of the HTM and BITEP assignments was to have students organise and plan the assignments themselves, and make them responsible for their own collaborative process, we expected a large part of regulative communication to address matters of planning and evaluation. Around 50% of their notes included remarks related to planning or evaluation. The In-service course shows that, even with a more highly structured task, the students still used this kind of communication.

We also expected to find communication focusing on organizing the communication ('organizational communication') in many of the students' notes. Indeed, this kind of communication to structure and clarify documents and texts is used in 50% to 70% of the notes.

We imagined the student teachers' would communicate about technical problems at the start of each course, but that this would decrease progressively through the courses. This notwithstanding, we assumed communication about technical problems would be limited as we supported the students with hardware and software, and technical assistance was available throughout all courses. Considering the levels of students' command of ICT, we expected most problems in the HTM course. Over time, during each of the three courses, the percentage of notes with communication on technical aspects indeed decreased progressively. As expected, the students faced more technical problems in the HTM course than in the BITEP and In-service courses. Unsurprisingly, the In-service course shows very little technical communication, as one of the preconditions for participating in this assignment was that students have access to both hardware and the Internet.

The subgroups and the individual student teachers of all three courses varied significantly with respect to most types of regulative communication. Noticeably, the Research groups, all three guided by different teacher educators. did not differ in their use of regulative communication. Further research will be required to study individual student behaviour in relation to usage of communication regulating the group process, as we assume group processes to play an important role besides task instruction.

Chapter 7: Task Instruction

This chapter provides information to answer research question 3: *"In what way are elements of the task instruction related to the student teachers' CSCL process?"*. The task instruction is one of the design clusters and consists of the task itself and the group composition.

In Chapter 6, we reported on the collaboration of the student teachers in the subgroups. In this chapter on the relation between the students' collaboration and the task instruction, we will present the results of the analysis of the collaboration for each assignment in each of the three courses. Three or four subgroups worked on each assignment. The data of the subgroups are analysed together for each assignment and are compared to the data on the subgroups while working on the other assignments of each course. The assignment of the In-service course is described in relation to the assignments of the two other courses. We used the five perspectives of our multi-perspective method of analysis to describe the collaboration on task level. The results are presented in Sections 7.2 through 7.6. In Section 7.7, the relation between the level of information exchange and the regulative communication has been analysed. Then a cross-course analysis is performed, using the results of Sections 7.2 through 7.7, and results from the analysis of the interviews and questionnaires on topics related to the task instruction (7.8). Appendix E3 includes an overview of the students' statements from the interviews and Appendix D1 presents the scores on the related questionnaire items for all three courses. We start this chapter with a short description of the different tasks. A summary of the whole chapter can be found in 7.9.

7.1 Introduction of the Different Tasks

This section presents a brief description of the different tasks. A detailed description can be found in Chapter 3.

In the HTM course, the students worked collaboratively on four assignments, in three of which in heterogeneous groups (based on type of teacher training programme) of three or four students, and in the last assignments they worked in homogeneous groups of three or four. The first assignment was a debating type of task, the other ones focused on the creation of a shared product, based on literature and classroom experiences. All assignments were open-ended tasks,

with the students responsible for the regulation (like planning, organizing and evaluating) of their own work process. The first two assignments had a moderate pre-imposed structure, with clues for handling the task and some time limits given. The other two assignments had a low pre-imposed structure. The teacher created the groups, and students were assessed on the basis of their presentations and reflections in their portfolios on their end products and their collaborative process.

In the BITEP course, the students worked in subgroups on three different assignments. The TIE (Teaching in English) assignment focused on giving comments on products of group members. It was an open-ended type of assignment. Students were responsible for regulating their own work process. The TIE assignment had a high pre-imposed structure, including role-taking. The groups were created by the teacher, and were assessed on the students' reflection on the assignment in their portfolio. The TOC (Teacher outside the Classroom) and the Research assignment focused on the creation of a shared product, which was mainly based on research activities. Students could decide themselves what subject to choose and, for the Research assignment, whether or not they would use the groupware as a communication platform. The assignments were open-ended, and had a low pre-imposed structure without role-taking. The students were assessed on the basis of a F2F presentation of the end product, or a written report, plus the description thereof and reflections on all this in their portfolios. Students composed their own groups.

The In-service students received one assignment during their course. The aim was to create optimal circumstances for students to work in a CSCL assignment. Highly motivated students were recruited to work on a task that was given a pre-imposed structure, including built-in controversy, aiming at intensive dialogue. The assignment focused on commonly writing an end product. The exchange of teaching' experiences and beliefs with fellow students was a key element of the task. Participation occurred voluntarily and the online assignment was presented as an alternative to a regular assignment. The students created the groups themselves. The outcomes and collaboration was discussed in a conversation with the teacher and other group members.

In this chapter, we will present to what extent the following aspects of the task instruction (see also Table 3.4, in Chapter 3) have influenced the students' collaboration:

- the use of various types of tasks;
- the use of different degrees of structure of the tasks, including role-taking;
- compulsory and voluntary participation;
- the period of time available for an assignment;
- the assessment of assignments;

- the combination of F2F and online communication;
- the use of various types of groups.

7.2 Perspective 1: Frequency of Participation

In this section, we examine the frequency of participation of the subgroups on task level. Table 7.1 provides an overview of the number of notes and documents sent and received in the various assignments.

Table 7.1
Number of notes and documents sent (outdegree) and received (indegree), by task

Course	Task	Groups (*N*)	Students (*N*)	Outdegree	Indegree
HTM	1 (he)	4	15	24	64
	2 (he)	4	15	68	174
	3 (he)	4	15	113	329
	4 (ho)	4	15	51	143
BITEP	TIE	7	17	200	391
	Research	3	10	202	459
	TOC	5	17	114	223
In-service		3	9	163	261

Note. he = heterogeneous groups, ho = homogeneous groups.

There is a significant difference in the number of notes and documents sent ($\chi^2 = 65.4$; $df = 3$; $p \leq .001$) and received ($\chi^2 = 208.7$; $df = 3$; $p \leq .001$) by the students working on each of the HTM tasks. They sent and received the least notes and documents during Assignment 1, which probably has little to do with the task itself, but with the fact that the students only just started working in the CSCL environment, had to get used to it and overcome technical difficulties (see Chapter 8). Most notes and documents are sent during Assignment 3, but we should note that the period of time available for this assignment was double that of the other assignments.

The participation frequencies of the homogeneous groups during assignment 4, vary from those of the heterogeneous groups during Assignments 2 and 3. Table 7.1 shows that the participation patterns of the homogeneous groups were less intensive than those of the heterogeneous groups.

The BITEP students, while working on the different tasks, vary significantly as to their numbers of notes and documents sent ($\chi^2 = 6.4$; $df = 2$; $p \leq .04$) and received ($\chi^2 = 7.2$; $df = 2$; $p \leq .03$). In particular, the subgroups working on the Research assignment determine the variation between the BITEP tasks. The 10 students working on the Research assignment sent and received considerably more notes and documents than the 17 students of the other two assignments.

Table 7.1 shows that, compared to the in- and outdegrees of the HTM and BITEP students working on each of their tasks, the students of the In-service groups participated frequently, considering the number of students working on the tasks. In comparison to for instance the students working on the HTM tasks (N = 15), the In-service students (N = 9) participated considerably more. Only the three BITEP Research groups together sent and consequently received more notes.

7.3 Perspective 2: Nature of Communication

This section reports on our analysis of the nature of the communication of students working on the different tasks. Table 7.2 shows the percentages of notes including task related content, regulative, and social communication, on task level, for all three courses.

Table 7.2
Nature of the notes on task level (in % of total number of notes sent)

Course	Task	Content	Regulative	Social
HTM	1 (he)	88	68	0
	2 (he)	49	88	4
	3 (he)	32	90	14
	4 (ho)	33	88	18
	All	45	86	10
BITEP	TIE	33	97	43
	Research	30	97	30
	TOC	35	97	43
	All	33	97	39
In-service		63	87	18

Note. he = heterogeneous groups, ho = homogeneous groups.

The HTM students while working on each of the tasks vary significantly as to the number of notes with task related content ($\chi^2 = 40.7$; $df = 3$; $p \leq .001$) and social communication ($\chi^2 = 23.6$; $df = 3$; $p \leq .001$). As the course progressed the students communicated more about social issues, and less about task related content. There could be a relation between communication on task related content and social communication, in that increasing communication on social matters decreases communication on task related content, and vice versa. The focus on content in Assignment 1 could also be explained by the type of task (debating type of task), while the other assignments focussed on creating a shared end product. The HTM students did not or at best barely knew each other at the start

of the course. This could be an explanation for the absence of social communication during Assignment 1.

As to the different BITEP tasks, Table 7.2 shows that regulative communication can be found in almost all notes of all tasks. The percentages of notes with social and task related content communication are considerably lower. The students working on each of the BITEP tasks do not vary significantly in the nature of their communication.

Table 7.2 shows that the In-service students communicated more about task related content than the students of the HTM and BITEP course ($\chi^2 = 9.7$; $df = 2$; $p < .01$). This indicates that the design elements we deployed to increase interaction on task content among group members during this assignment, such as a high pre-imposed structure including built-in controversy, a good technical situation as a precondition for participation, and participation on a voluntary basis, did indeed help.

7.4 Perspective 3: Interaction patterns

Table 7.3 brings together the information on the interaction patterns of the subgroups on task level. During the various HTM tasks, the students interacted almost in the same patterns. Although the students created more threads in Assignments 2 and 3, they do not differ significantly from the other HTM assignments as to the percentage of threaded notes of the total number of notes sent to the Bulletin Board. Neither do the students of each task vary significantly as to mean thread length.

Comparing the BITEP tasks, Table 7.3 shows that the TIE and Research assignments have almost identical interaction patterns. The students created the lowest number of threads in the TOC area ($N = 19$). Some threads in the TOC area include many responses, while most threads are comparable in length to those in the other areas. This explains the combination of a rather small number of threads ($N = 19$) and a high percentage of the total number of notes in threads in the Bulletin Board (80%). Why the groups created such long threads in the TOC assignment is hard to explain. Comparing mean thread lengths, the students working on each of the BITEP tasks do not vary significantly.

Table 7.3 shows the In-service students interacted most intensively. Only 2.7% of their notes are not responded to. The In-service students made longer threads ($M = 4.8$; $SD = 2.5$) than the HTM ($M = 2.9$; $SD = 1.3$) and BITEP ($M = 3.4$; $SD = 2.1$) students ($F = 6.9$; $df = 2, 145$; $p < .001$). This result, together with their relatively high frequency of participation, indicates the In-service students have acted more as 'a group'. This is possibly explained by the task, which more than the others tasks induced groups to collaborate (students had to work to-

gether creating a story, in a high pre-imposed structure including built-in controversy).

Table 7.3
Interaction of the task groups (teachers' notes included)

Course	Task	Threads (*N*)	Notes in threads (*N*) (%)	Top-level notes (*N*) (%)	Responses (*N*) (%)	Isolated notes (*N*) (%)	Notes in BB (*N*)	Thread length (*M*) (*SD*)
HTM	1 (he)	6	54	21	32	46	28	3.0 (1.1)
	2 (he)	11	52	20	32	48	56	2.6 (1.0)
	3 (he)	14	57	18	38	44	76	3.1 (1.7)
	4 (ho)	6	47	17	31	53	36	2.8 (.4)
BITEP	TIE	32	79	24	55	22	134	3.3 (1.9)
	Research	37	74	24	50	27	155	3.1 (1.6)
	TOC	19	84	21	64	16	94	4.2 (3.1)
In-service		23	98	21	77	3	111	4.8 (2.5)

Note. he = heterogeneous groups, ho = homogeneous groups.

7.5 Perspective 4: Level of Information Exchange

Table 7.4 shows the level of information exchange on task level for all three courses, scored on a scale ranging from surface to deep level of information exchange.

The level of information exchange during the four HTM assignments varied significantly ($F = 3.6$; $df = 3, 76$; $p = .02$; $f = .39$). The level of information exchange of the students during work on Assignment 1 differs from the figures on the other three assignments of the HTM course. Assignment 1 stimulated the students to communicate more about the task on a deep level. The mean level of information exchange during the other three assignments was lower. Moreover, in Assignments 3 and 4, less than 20% of notes had the students engaged in deep level communication, a considerably lower figure than during Assignment 1. Assignment 1, being a debating task, could be considered as stimulating students to exchange information more deeply than the other assignments, in which the students were supposed to create a product together.

Table 7.4 also shows the level of information exchange of the students working on each of the BITEP tasks. The students working on each task vary significantly ($F = 8.0$; $df = 2, 125$; $p < .001$; $f = .37$). The TIE assignment stimulated the students to exchange information on a relatively deep level.

Table 7.4
Level of information exchange by task group

Course	Task	*M*	*SD*	Notes scored deep level[1] (%)	*N*
HTM	1 (he)	3.3	1.0	41	22
	2 (he)	2.5	1.3	25	24
	3 (he)	2.8	1.2	13	23
	4 (ho)	2.4	1.3	18	11
	All	2.6	1.2	25	80
BITEP	TIE	3.3	1.4	48	56
	Research	2.5	1.1	25	40
	TOC	2.3	1.1	16	32
	All	2.8	1.3	33	128
In-service		3.3	1.3	47	77

Note. he = heterogeneous groups, ho = homogeneous groups.
[1] Scores 1 and 2 on the scale represent a surface level, scores 4 and 5 on the scale represent a deep level.

Examination of the students' notes gave reason to think that the students of English were, at least to some extent, responsible for the relatively high score on the level of information exchange. In order to check our assumption, we divided the TIE students into two groups: group 1 the students in English, group 2 all other, subject oriented, students. A *t*-test confirms the students in English indeed presented their task related content on a deeper level than the subject oriented students did ($t = 2.7$; $df = 124$; $p = .01$). Their role in the TIE assignment, providing feedback on the language use of the group members, without being responsible for designing a lesson plan themselves, seems to have stimulated them to respond on a deep level.

The In-service students exchanged information on a deeper level than the HTM and BITEP students ($F = 5.6$; $df = 2, 284$; $p = .004$; $f = .78$). The differences in the mean level of information exchange between the In-service students and the HTM and BITEP students are quite strong, as we found a large effect size. Moreover, in a relatively high percentage of notes the In-service students communicated on a deep level.

7.6 Perspective 5: Regulative Communication

The regulative communication was categorised in communication about planning, evaluation, organization and technique. Overall, the students predominantly communicated about matters of planning and evaluation, and used organ-

izational remarks to structure their online communication. Additionally, the HTM students focused on technical issues in their communication (see Table 7.5).

Table 7.5
Frequency of the regulative communication in notes, on task level (in % of total number of regulative notes for each task)

Course	Task	Technical	Planning	Organisational	Evaluative
HTM	1 (he)	35	12	41	29
	2 (he)	40	47	42	40
	3 (he)	32	44	56	29
	4 (ho)	28	76	41	52
	All	33	47	48	36
BITEP	TIE	27	55	60	48
	Research	13	63	52	51
	TOC	13	72	31	61
	All	19	62	50	52
In-service		13	46	68	49

Note. he = heterogeneous groups, ho = homogeneous groups.

The HTM student teachers differ significantly as to the frequency of communication on planning ($\chi^2 = 46.2$; $df = 3$; $p \leq .001$) and evaluative issues ($\chi^2 = 9.3$; $df = 3$; $p \leq .05$), working on each of the four assignments. While working on each of the three assignments of the heterogeneous groups, the students also vary significantly ($\chi^2 = 22.0$; $df = 2$; $p \leq .001$) in the frequency of communication on planning issues, but they do not differ significantly as to the use of evaluative issues in their communication. The different use of the communication about planning issues can be explained by the deviant score of Assignment 1. During Assignment 1, the students discussed less about planning issues than in the other assignments. As mentioned earlier, this task was quite different in nature (being a debating task with clear objectives) from the other assignments (focused on creating a shared product). During Assignment 4, the students communicated much more about planning issues than during all other assignments. The students working in the homogeneous groups in Assignment 4, differ significantly as to the amount of communication about planning aspects from the students of the heterogeneous groups ($\chi^2 = 10.4$; $df = 1$; $p \leq .01$), but there is no significant difference in the use of evaluative issues.

The students working on each of the BITEP tasks differ significantly as to the percentage of notes with communication about technical issues ($\chi^2 = 7.7$; $df = 2$; $p \leq .05$). The BITEP students communicated most about technical issues during the TIE assignment (see Table 7.5), which can be explained by the fact that they only started working in the CSCL environment with the TIE assignment, facing initial technical problems and not being familiar with the environment. The stu-

dents working on each of the BITEP tasks also differ significantly as to the use of organizational communication ($\chi^2 = 9.6$; $df = 2$; $p \leq .01$). During the TOC assignment, the students discussed what had to be done, barely producing interim products, which would have required organizational communication to point group members to find files including these products and new versions of files, or to structure files. This may be one of the reasons for the relatively low percentage of organizational communication during the TOC assignment.

In Table 7.5 we can read the In-service students communicated less about technical issues ($\chi^2 = 9.7$; $df = 2$; $p \leq .05$) than the HTM and BITEP students. It would seem that the conditions for entering the CSCL course (students had to be experienced ICT users and were required to have easy access to hardware and the Internet) reduced the number of technical problems. The In-service students did not use the other types of regulative communication different from the HTM and BITEP students.

7.7 Relation between Perspectives 4 and 5

In this section we will present the relation between the students' use of regulative communication and the level of information exchange. Various assignments were aimed at having the collaborative process regulated by the student teachers, and at having them discuss matters of content. It may well turn out that these two aims conflicted. As Table 7.6 shows, the more student teachers communicated about planning issues, the lower the level of information exchange in their notes. Note however that the relation we found is quite weak ($r_s = -.26$). Probably, students used notes to communicate about planning issues, distracting their attention from issues of task related content, which they also shared with their peers in the same note. Albeit, once more, a rather weak relation ($r_s = .26$), Table 7.6 also shows that the level of information exchange was higher in notes with organizational communication, than in notes without organizational communication. A random sample survey of notes showing a deep level of information exchange also containing organizational communication showed that these notes were generally longer. This may have increased the need for the students to structure and order the communication on the content.

Table 7.6
Correlation between level of information processing and presence of regulative remarks in notes (N = 242)

	Technical		Planning		Organisation		Evaluative	
	r_s	p	r_s	p	r_s	p	r_s	p
Level of information exchange	-.09	.2	**-.26**	**≤ .001**	**.26**	**≤ .001**	.1	.12

We conclude that the aims to let student teachers regulate their own collaboration and create a meaningful discussion on content have not conflicted, although it may be that the student teachers' attention to planning aspects distracted them from the content.

7.8 Cross-Course Analysis

In this section we try to identify aspects of the task instruction that have affected the participation, the nature of communication, the interaction patterns, the level of information exchange and use of regulative communication. As already described in section 4.4, this has been done in a cross-course analysis, in which we selected topics related to the task instruction from the interview summaries and compared these with the relevant questionnaire results, which were also used to complement the interview summaries. Subsequently, we tried to relate the relevant outcomes of the interviews and questionnaires to our conclusions on the students' collaboration working on the different tasks, and the student teachers' and teacher educators' evaluation of the collaboration. The following sections discuss these relations. Appendix D1 presents the descriptive statistics on the questionnaire data and Appendix E3 consists of the summarized interview statements of the students.

Although being one of the design elements in this research, we do not report on the assessment procedures. The student teachers were not assessed on their work during the three courses of this research. They were asked in their portfolios to report on products, such as lesson plans, reports or F2F presentations, and on the collaboration. As the portfolios were assessed at the end of their teacher training, the assessment procedure was not addressed at the interviews with the student teachers and teacher educators. Therefore, there is insufficient information to report on the role of the assessment of the tasks.

7.8.1 Task Subject Related Motivation

We think that motivation for the subject of the task can help students to participate more intensively. In Table 7.7, we studied possible relations between the task subject related motivation of the students with the participation and the content related perspectives of our method of analysis.

Motivation of the students for the subject of an assignment did positively influence student teachers' participation and interaction, as Table 7.7 suggests. The relation between students' motivation for the task subject and the content of the communication is ambiguous, however. The In-service students' motivation for the subject of the task seems to have influenced the nature of the content and the

level of information exchange. These students considered the assignment challenging and a good way to exchange experiences. Using a story as a metaphor offered the In-service students' opportunity to reflect on, and exchange personal problems, within a fictional story. In one HTM assignment and one BITEP assignment, the students were not motivated for the subject of the task but did show a deeper level of information exchange than during the other assignments. Other variables than motivation for the task subject are responsible for the relatively deep level of information exchange in these two assignments.

Table 7.7
Task subject motivation in relation to participation and communication on content

Course	Students' opinion	Participation/Interaction	Communication on content
HTM	Most positive about Assignment 3: best fitted their concerns.	Relatively intensive participation during Assignment 3.	
	Negative about Assignment 1: too theoretical, not related to daily practice.		Relative focus on content and deep level of information exchange.
BITEP	TOC assignment: not interesting, not important and not appropriate to work on from different countries.	Little participation during TOC assignments.	
	TIE assignment: no learning effects, and artificial.	Little participation during TIE.	Relatively deep level of information exchange.
	TIE assignment: useless.		
	Research assignment: important and useful.	Intensive participation during Research assignment.	
In-service	Liked the subject, assignment was creative, challenging and good way to exchange experiences in a safe way with group members who respected each other's knowledge.	Intensive participation and interaction.	Relative focus on content and deeper level of information exchange.

7.8.2 Type of task

The tasks of the three courses varied in type of task. We distinguish several aspects of the type of task: the degree of shared responsibility, the learning objectives of an assignment, and the instructional method (see Chapter 2).

Degree of Shared Responsibility in the Task

The degree of shared responsibility refers to the degree to which an assignment prompts one to conceive it as constituting an individual or a group responsibility. According to the student teachers, a low degree of group responsibility negatively

influenced the participation. The TIE assignment of the BITEP course was the only assignment in which group members had to produce an individual end product. Task specialisation had been part of the design. In the interviews and the questionnaire, the students indicated they did not feel shared responsibility for the end products of the group, as a consequence of having produced an individual end product. Consequently, they did not often consult group members.

> "You do not really work collaboratively. You just react to something. You don't have to come up with a shared product. You, yourself are responsible for the end product. With TOC or Research assignments you need to come up with a shared product. TIE is more easy. You don't have to agree with everything. You don't have to communicate back and forth because you get feedback and decide for yourself what to do with it."

The students' statements give reason to think that their participation and interaction was influenced by a low degree of shared responsibility, which, however, did not prevent the BITEP students exchange information on a deeper level during the TIE assignments than during the other assignments.

Although task specialisation was not included in the HTM assignments, we know from the interviews that HTM Assignments 2, 3 and 4 stimulated the students to divide tasks. Overall, the participation and interaction of the HTM students was relatively low. Probably it was precisely this task division which, similarly to the TIE assignment, negatively influenced the participation and interaction.

The BITEP Research assignment and the In-service assignment both required a shared end product. We know from the literature that in most cases a shared end product increases the degree of responsibility and positive interdependence, resulting in more discussion. We think the requirement of creating a shared end product, together with a motivation for the task subject, stimulated and compelled the students to collaborate and discuss ideas and materials, resulting in a more intensive participation pattern. In the In-service group it also explains a relatively high number of threads.

All in all, we have reasons to think a feeling of shared responsibility helped the students to work together on the task at hand, resulting in more intensive participation and interaction patterns. We did not find a relation between the degree of shared responsibility and the students' focus on content or the level of information exchange.

Learning Objectives of an Assignment

The learning objectives of an assignment relate both to subject related and to ability objectives. In this section we will discuss the relation between the different learning objectives of the assignments in this study and the students' participation and interaction, as well as their content related communication.

During the interviews the student teachers expressed a preference for assignments related to daily classroom practice, which was the first concern of most student teachers. During these assignments, such as the TIE and In-service assignments, the students showed the deepest level of information exchange. There may be a relation between the students' preference and the level of information exchange they showed, as we think these types of assignments, closely related to the classroom practice, stimulated students to become involved in the content. When these types of assignments also focused on the exchange of information and reflection on their own experiences, they were even more positively valued. In the assignments focused on exchange of information, the students participated relatively more. Providing group members with feedback on individual products, as was the case in the TIE assignment, was called 'artificial', and therefore, according to the students, resulted in less participation.

Concerning the regulative communication, unclear learning objectives of the assignment generated specific evaluative communication about the learning aims of the assignment and the work students had done for this assignment. From the interviews we know that Assignment 2 of the HTM course created unclear expectations, and in the students' online communications we read students were unsure as to the meaning of the assignment and what exactly they had to do.

Summarizing, assignments aimed at the exchange of information, had the students participate relatively more. Assignments oriented at classroom experiences may have induced information exchange on a relatively deep level.

Instructional Method

During the courses various instructional methods are used. In this section we discuss the relation between the instructional method, more specifically the method of collaboration, and students' communication about the task related content.

The HTM task groups varied significantly in the nature of their communication. During Assignment 1, a debating task, groups discussed considerably more about the task related content, and at a relatively deep level of information exchange. The task stimulated the students to put forward their own opinions and discuss them. Debating stimulated interdependence: students needed each other to accomplish the assignment. We assume such assignments require less planning than for instance an assignment in which groups together have to generate a series of lessons, which would explain the low frequency of planning communication during Assignment 1.

The In-service assignment compares to HTM Assignment 1 in that both stimulated debate. The In-service assignment was characterised by built-in controversy and had the students focus on task related content. We think that, besides the instructional method itself, the positive attitude of the In-service students as to the

instructional method of the assignment was an important factor. When interviewed, they mentioned it had been a fun and an amusing alternative to the original assignment. The inclusion of a debate on learning experiences compelled and helped them to reflect on their teaching behaviour, and to communicate at a relatively high level of information exchange.

The students do not agree on the suitability of writing assignments for online collaboration. Besides debating, the In-service students also had to write a shared end product. One of the students mentioned the In-service assignment was suitable for online collaboration:

> "F2F, we would have taken notes of each other's feedback and include these at a later point in time".

In contrast, the HTM students thought writing assignments stimulated them to divide tasks into sub-tasks.

> "When the end product of online cooperation is a writing product, you might expect group members to work together. It is about collecting information, summarize it, put it into a document, and upload it to the Web. You can not do this another way than dividing the task into pieces and divide these among the group members".

The HTM teacher mentioned some of the writing assignments were easy to divide among the group members, but thinks the students mistakenly integrated their individually written parts into one end product without discussion. This brings us to the thought that writing assignments are suitable for online usage when embedded in a structure in which students depend on each other's work to perform their parts of the task, which guarantees positive interdependence and promotive interaction.

Summarily, an instructional method based on debate stimulated interdependence as students needed each other to accomplish the task. Built-in controversy even reinforces such effects. The assignments with this kind of instructional method had the students focus relatively more on content and generated a deeper level of information exchange. An instructional method based on writing products was valued positively by the students only when group members depended on each other's interim products in order for them to finalize their own ones.

7.8.3 Structure of the Task

For the BITEP and In-service courses, we hypothesised that a strong pre-imposed structure might help students to take up the tasks and work on content at a regular pace, keeping them on track. For the BITEP course, we designed one assignment with (TIE) and two without pre-imposed structure (TOC and Research). The

Research groups showed a more intensive participation pattern than the TIE and TOC groups. The three assignments show no differences in the frequency of communication on content, and only in the TIE assignment did the students show a deeper level of information exchange. The students indicated in the interviews they had not been interested in completing the TIE assignment, and considered it time consuming. This could mean that the pre-imposed structure helped them to discuss content, thus compensating the negative effects of their lack of motivation. Students confirm this conclusion, explicitly mentioning the pre-imposed structure helped them to discuss content.

The students were not always positive about the pre-imposed structure of the TIE assignment. They clearly did not appreciate the role definition. Both the subject teachers and the English teachers adjudged the role of the teacher of English as being very negative.

> "I mean the comments of Mary [student teacher of English] was valuable, but I do not have the feeling that I needed her to improve my lesson. Because I know the level of my pupils. I know exactly what I have to explain to them and what not, what the school find important, what I have to do linguistically speaking. I know all this, Mary not. That Mary have studied English has no surplus value for me."

This negative attitude did not prevent the students of English from exchanging information at a deeper level than their group members (see 7.5).

When compared to the other groups, we think the pre-imposed structure with built-in controversies stimulated the In-service students to discuss the content on a deep level of information exchange, and resulted in an interactive way of communication with group members responding to others. However, a pre-imposed structure by itself does not seem enough to create maximum positive interdependence. According to the teacher, a complete interdependence, in which group members not only need each other to arrive at an end product, but also need each other from a professional point of view is still missing in this kind of assignment.

> "I miss, for instance the theoretical input. They should evaluate together what did we learn so far, can we use this information and knowledge, and when not, what do we still have to learn and what can we learn form the theory".

The pre-imposed structure of the In-service assignment was quite detailed. However, the In-service students still employed regulative communication to plan and evaluate their work. The teacher mentioned the structure offered sufficient freedom to the students.

> "I thought the structure with changing learning elements of other group members was good. Of course it was enforced; we wanted to provoke the discussion. There is nothing wrong with that. There was still a lot of freedom in the assignment for the students."

In both the BITEP and In-service courses, the description of the pre-imposed structure, including role descriptions, generated some confusion at the outset, which, according to the students, resulted in delays in the collaborative work early into the assignment.

In sum, when students lack motivation a pre-imposed structure may help them to carry out the assignment. A pre-imposed structure with built-in controversies generated the best results, although these students were motivated intrinsically and did not experience many constraints from their environment. Even though the pre-imposed structure of the In-service assignment was quite detailed, it offered sufficient freedom to the students to organise their own learning and collaborative process. A clear description of a pre-imposed structure, including role-taking, is necessary to avoid delays in the work of collaborative groups.

7.8.4 Compulsory and Voluntary Participation

We assumed that a voluntary participation in the assignments would bring about intrinsic motivation to work on the assignment, and as a consequence expected to find a higher frequency of participation and a focus on the task related content.

In the BITEP course, we varied the conditions for participation. In the TIE assignment, CSCL was compulsory, whereas the students were free to choose the electronic learning environment for a working platform in the other two assignments, although there was some pressure from the training institute to work online on the TOC assignment. Compared to the other two BITEP assignments, the student teachers participated more in the Research assignment and we think this may have been caused by the fact that participation in the Research assignment was voluntary, ensuring we had students motivated to perform part of this assignment online. According to the teacher of the In-service course, which also included a voluntary online assignment, the voluntary character of the assignment has been a strong determining factor for the success of the collaboration.

> "I do not know what would have happened when we had forced students to participate, because students must be able to appreciate such a creative kind of assignment."

So, to a certain extent the voluntary character of an assignment ensures motivated students, which may assist in increasing students' participation.

Considering the differences in scores of the Research and In-service groups on the nature of the communication and level of information exchange, there seems

to be no relation between presence or absence of voluntary participation in an assignment and the content of the communication. However, accepting the words of the In-service teacher, the In-service students would have scored less on all perspectives if we had obligated students to work on the assignment.

7.8.5 Scheduling within Teacher Training Programme

In this section we analyse how the scheduling of the courses in the teacher training programme influenced students' collaboration. Progressing through the HTM course, the HTM students' attention for the task related content of the assignments reduced. Simultaneously, the level of information exchange decreased as well. During the interviews many HTM students mentioned that in the last assignment they were 'fed up at the end of the course, and distracted by other obligations of the teacher training programme, resulting in less content related discussion and work'. In their view them, having to schedule the assignment within other requirements of the teacher training programme affected their participation and their focus on task related content. The In-service students confirmed that the scheduling of the course within the teacher-training programme can influence students' concentration on the task itself or on particular aspects. The In-service students mentioned they were less motivated to work on the assignment at the end of the course, as they had to finalise the teacher-training programme and present the institute with their final portfolio. Thus, scheduling usage of a CSCL environment in teacher training, one should consider the other parts of the teacher training programme as these may compete for students' time and attention. Obviously, this also holds true in regular course programmes but we assume this is even more so when online and F2F course are scheduled parallelly, because it is easier to withdraw from an online course.

7.8.6 Time Available for Assignment

During the courses, we differentiated in the length of time available to work on the assignments. In the HTM course, it varied between two weeks (Assignments 1, 2 and 4) and four weeks (Assignment 3). The BITEP assignments and the In-service assignment had considerably longer period of time available (10 to 14 weeks). Generally, the participation in the BITEP and In-service groups was higher than in the HTM groups. During the interviews, the HTM students and teacher suggested a relation between time available for an assignment and the participation degree of a group. They think the time for each assignment was too short to generate intensive participation and interaction. Online discussion took them more time than expected, due to it's a-synchronous character, and some students could only access the groupware in the weekend, due to their activities in the week. When interviewed, students indicated that the time available for the as-

signments had been too short to respond to each other. Only a few BITEP students thought the period of 14 weeks for their assignments slowed down the collaborative process as their involvement decreased in time, both in terms of participation and contribution to content discussion. A short period of time available does not mean the students are less focussed per se on the content of the communication. For instance, despite the fact that according to the HTM students, participation in Assignment 1 was difficult due to the limited amount of time available, that did not deflect the students from a relative focus on the content.

All in all, a period of time of two to four weeks was too short for many of the students to participate and interact as they otherwise would, and could, have done. A period of 10 to 14 weeks seems more appropriate. We did not find a relation between the duration of an assignment and the students' communication on the content.

7.8.7 Combining F2F and Online Teaching

According to some students, the combination of F2F and online education decreased their participation and interaction. When interviewed the HTM students mentioned they had also discussed the content of Assignment 4 F2F, which had been one of the reasons for their limited participation in this assignment in homogeneous groups. Moreover, the interaction patterns of the homogeneous HTM groups are characterised by a limited number of threads. The In-service students also mentioned they discussed aspects of their assignment at F2F meetings of other courses, indicating that online participation would have been more frequent if they had not also met F2F.

Blended learning is recommended in many studies, as a way to personalize collaboration and stimulate the involvement of students in the group, but also because F2F and online communication each are useful in supporting particular aspects of the learning process and a combination of both may reinforce the learning process. Our results show blended learning may also obstruct online collaboration in cases not aimed at teambuilding and with no F2F meetings complementing the online collaboration. In such cases the students were inclined to discuss the content of the assignment F2F, as they simply preferred this way of communication and thought it would be "more easy to talk things trough quickly". When this occurs discussions on task content become fragmented. In Chapter 2 we discussed the virtues of CSCL, many of them related to the importance of text mediation as an effective means for stimulating elaborated and reflective discussions, and for making the students' learning process visible. Due to the lack of verbal communication, students are forced to explain and elaborate their ideas, arguments and knowledge. Writing also provides them with time to reflect on others, on the discussion and on their own argumentation, rereading

and re-evaluating the discussions and products. This will be less so or absent when parts of the discussion take place F2F. Moreover, when parts of the learning process are done F2F, teachers' monitoring possibilities decrease.

7.8.8 Group Composition

In the HTM course we used heterogeneous and homogeneous groups of students who differed in the type of teacher training programme (Pre-service, BITEP, In-service, Specialty). Purpose of the heterogeneous groups was that group members could learn from each other's experiences and knowledge. Homogeneous groups were required for Assignment 4, due to its content. The use of homogeneous or heterogeneous groups did not create many differences in collaborative behaviour except for the use of regulative communication, more particularly communication on planning and evaluative issues. During Assignment 4, the HTM students communicated relatively more about planning and evaluative issues. This seems strange at least, as we know from the interviews that these group members, enrolled in the same type of training programme, met each other weekly in other courses and discussed the assignment at these F2F meetings, whereas the group members of the heterogeneous groups did not meet F2F. The students mentioned they discussed task related content offline, because of which the relative share of online notes with regulative communication increased.

Although the group composition barely influenced the observed collaboration of the students, the student' and teacher' perceptions diverge from our observations. The students experienced the online collaboration during Assignment 4 as more positive, while being negative about working in heterogeneous groups. Interview statements on the use of heterogeneous groups referred to group members having different workloads, different teaching experiences and teaching situations, all of which created different needs and eventually incoherent end products. Also, group members did not know each other and, in contrast with the homogeneous groups, barely met F2F. According to the students, all this resulted in 'useless' collaboration and a lack of group feeling. Only five students, four of which constituting one group, were positive about working in a heterogeneous group, as it allowed them to benefit from each other's experiences. From the teacher's perspective, the students did not benefit from each other in the heterogeneous groups.

> "They all have the same subject, they all want a teaching profession. That characterises their personality and aims in live and their affinity etc. But it seemed like if the one student came from Mars and the other one from Venus. How they looked at each other and associated. The group consisted of eight students with a teaching job and eight without. That seemed perfect from a collaborative learning perspective. They all could bring in different

> things. But, they did not think that they could learn from each other. They thought the others were scary. They did not see what we saw."

In the students' perception, the group composition was the main reason why the collaborative process in many cases had not been satisfactory. It was difficult for them to anticipate the advantages of the sharing of experiences and knowledge with student teachers of various teaching backgrounds. Probably, this is caused by the fact that most student teachers are dealing with their daily classroom hassles, and feel supported by students in a similar situation. For example, Pre-service student teachers find themselves at the very beginning of their teaching career and need to learn the basics of pedagogy, such as the preparation of a lesson, whereas In-service student teachers have to deal with actual classroom management issues.

The group members of the In-service course had different subjects of teaching. In their view, the differences in subject background plus having to work in small groups and the personal atmosphere, made the collaboration effective.

> "I liked the different colours. Otherwise, it would have been too subject oriented, with a lot of subject oriented tricks and tips. It is about the teaching profession, about the teaching experiences. And these experiences are alike, whether or not you teach religious education or English."

Summarizing, using homogeneous and heterogeneous group compositions based on the type of training programme barely influenced the collaborative processes, but was a very influencing factor in both the students' and the teacher's perceptions. The students were very negative about working in a heterogeneous group, and the teacher was disappointed in the students' attitude. According to the In-service students on the other hand, being involved with students from different backgrounds of teaching subject worked well within the framework of the particular assignment.

7.8.9 Personalisation

Analysing the interview data, it became clear that all students considered personalisation essential to the collaborative work in groups. In this section we examine the relation between personalisation and the collaborative process.

Several times during his interview, one of the teacher educators pointed out that their not being familiar with each other had restricted the students in collaborating. This teacher had been surprised at the need of the students to work with people they knew. Students' interview statements on personalisation focused on a need for social coherence, enabling one to develop a feeling of responsibility for the work in the group and for the end product, increasing the participation and involvement. Personalisation also induces the need to know each other, and the

directly linked need to feel free to be critical in the face of one's peers when discussing the content and regulation of the assignment.

> "Yes, that was a big difference [between the heterogeneous and homogeneous groups]. You know each other. That is why you feel responsible. It sounds nasty, but you do feel more responsible for each other. You also kept someone up to the mark, more easily."

When interviewed, all In-service students explicitly mentioned the fact they knew each other made it easier to provide and receive feedback on teaching experiences, beliefs and problems.

Despite students' perceptions of the importance of personalisation, it did not always yield in a different collaborative process. As we already indicated, whether homogeneous (group members knowing each other very well) or heterogeneous (group members not knowing each other very well), groups did not differ much in their collaborative behaviour in the CSCL environment of the HTM course. Several HTM students mentioned a lack of teambuilding activities, but these do not always seem to be required when other aspects, such as the type of task, are well designed to stimulate discussion on content. We refer in this respect to the HTM Assignment 1 during which the students focused on task related content and used a satisfactory level of information exchange, barely knowing each other. On the other hand, personalisation may have resulted in more social communication. The HTM students for example, communicated increasingly about social matters online as the course progressed. At the start of the course the students did not know each other. By the time of Assignment 3, contact between students had become more personalised, also because of F2F evaluations of the group process, which may well have resulted in more social communication. The BITEP students were well acquainted and communicated intensively in their 'Social Talk' folder. Of course, the fact that these students were located abroad stimulated their need to communicate.

Although personalisation does not seem to have had a large effect on the collaborative process, it does lead to more social communication instead of discussion on task related content. We assume personalisation is an important factor of the group composition which should be taken into account, considering its effect on the students' perceptions of the collaborative process. Students considered a social structure in which group members know each other more stimulating.

7.9 Summary and Conclusions

In this chapter we described both the collaboration on the various assignments and the relation between the task instruction and the student teachers' collaboration.

In the HTM course, the students differed in their participation pattern working on each of the tasks. In their work in the homogeneous groups, the students participated less than in the heterogeneous groups. The teacher and students were not satisfied with the participation throughout the HTM course. In the BITEP course, the students participated much more in the Research assignment than in both other assignments. Overall, the In-service groups participated quite intensively compared to the HTM and BITEP groups. The In-service groups also show more interaction than the HTM and BITEP groups.

Throughout the In-service course the students were more focused on the content and used a deeper level of information exchange than did the HTM and BITEP students during their tasks, although the HTM and BITEP groups also varied in the level of information exchange between the different assignments. Progressing through the HTM course, the students communicated more about social issues and less about task related content.

The use of regulative communication varied along the different assignments. In general, the amount of communication about planning and evaluation was quite comparable in all assignments. The difference found between the four assignments of the HTM course is explained by the absence of communication about planning during the first assignment of this course. In the BITEP course the students varied over the three assignments as to their communication about technical issues and organisational communication. During the first assignment of this course the students experienced some technical problems and this resulted in more communication on technical matters.

Various aspects of the task instruction influenced the collaboration of the groups. The results of the analysis of the relation between the task instruction and the students' collaboration are summarized in Table 7.8. We included those results that in our opinion are important to designing CSCL environments in teacher training. They are further worked into design principles in Chapter 10. Below, we discuss the most remarkable results concerning the relation between task instruction and the collaborative process.

First, in the interviews both student teachers and teacher educators discussed the task instruction more than they did the other design clusters and the design context. Discussing the impact of the task instruction on their collaborative process, the students and teachers paid most attention to the subject related motivation, the instructional method, the learning objects and the degree of shared responsibility of the task.

Second, the assignments with high pre-imposed structures resulted in a students' performance of the task at a satisfactory level, meaning that they participated and interacted, and were just as focussed on content as during other assignments. During the assignments with a high pre-imposed structure the students even showed the deepest level of information exchange. We conclude that a pre-

imposed structure can be very important in situations in which students have to work with CSCL assignments they are not intrinsically motivated for.

Third, we varied the time available for completion of the assignments. The results show that in online environments in which student teachers collaboratively work on tasks, rules other than in F2F situations apply. While F2F collaborative assignments can even take a couple of hours, we conclude that in a-synchronous online environments student teachers need a significantly longer period of time (around 10 to 14 weeks).

The fourth remarkable result was that, contrary to our expectations, the design aspects concerning group composition and personalisation had a minor role in the collaborative process itself, but they were determining factors in the students' level of satisfaction. Designing CSCL environments, we recommend one pay attention to these design aspects, as we can expect more effort from student teachers in the long run when they have a positive feeling towards their collaborative process.

Finally, a remarkable result in our study into the task instruction is the consequences of the blended learning we designed. Combining F2F and online education can decrease participation, this in contrast with many researches recommending a combination of F2F and online education. The decreased participation has been mentioned discussing assignments in which the F2F meetings focussed on other parts of the programme, and teambuilding has not been the purpose, the latter being often the reason in other studies for recommending the alternation of F2F and online education. This brings us to conclude that, when students are inclined to discuss the content of the assignment F2F, preferring this way of communication, and a combination of F2F meetings and online education is not used each for supporting particular aspects of the learning process, it may also obstruct the online collaboration. Discussion on task content then becomes fragmented. When parts of the discussion take place F2F, text mediation will be reduced as an effective means to stimulate elaborated and reflective discussions, turning the students' learning process less visible.

Table 7.8
Summary of results related to the task instruction, organised by design element and the five perspectives of CSCL analysis

	Participation	Nature of communication	Interaction	Level of information exchange	Regulative communication
Subject related motivation	Fitting concerns of students increased motivation and stimulated participation.	Challenging and creative task form interested students in task and may have helped students focus on content.	Fitting concerns of students increased motivation and stimulated interaction.	Challenging and creative task form, interested students in task and may have helped students focus on content.	
Degree of shared responsibility	Task specialisation resulted in task division and individual work on content, and less discussion. Shared end product increased positive interdependence, resulting in more participation.		Task specialisation resulted in task division and individual work on content, and less discussions. Shared end product increased positive interdependence resulting in more interaction.		
Objectives of an assignment	Tasks aimed at feedback on individual products were not considered useful by students, resulting in less participation. Exchange of information on own teaching experiences was considered useful, which increased participation.		Tasks aimed at feedback on individual products were not considered useful by students, resulting in less interaction. Exchange of information on own teaching experiences was considered useful, which increased participation.	Assignment on own teaching experiences probably stimulated students to use a deep level of information exchange.	Unclear learning objectives created evaluative communication.

Table 7.8 (continued)

	Participation	Nature of communication	Interaction	Level of information exchange	Regulative communication
Instructional method	Debate with built-in controversy creates interdependency and resulted in more participation. Writing product tasks without positive interdependency decreased participation	Debate with built-in controversy creates interdependency and may have resulted in a focus on task content.	Tasks aiming at writing products without positive interdependency decreased interaction.	Debate with built-in controversy creates interdependency and may have resulted in a focus on task content.	In debate type of task students showed less communication on planning.
Structure of the task	Unclear description of pre-imposed structure and role definitions created delay in the start of the assignments. Pre-imposed structure helped unmotivated students to carry out task. Pre-imposed structure with built-in controversy may have stimulated students to participate.		Pre-imposed structure helped unmotivated students to carry out task. Pre-imposed structure with built-in controversy stimulated students to interact.	Pre-imposed structure helped unmotivated students to discuss content on deep level. Pre-imposed structure with built-in controversy may have stimulated students to discuss on a deep level.	
Compulsory or voluntary participation	Voluntary participation ensured motivated students, stimulating participation.		Voluntary participation helped to motivate student to interact.		
Scheduling		According to students scheduling of task in competition with other (demanding, or F2F) parts of the teacher training programme decreased students attention to content.		According to students, scheduling the task in competition with other (demanding, or F2F) parts of the teacher training programme decreased students attention to content resulting in less deep level of information exchange.	

Table 7.8 (continued)

	Participation	Nature of communication	Interaction	Level of information exchange	Regulative communication
Time available for assignment	Tasks less than four weeks offered students insufficient time to participate. Tasks of 10 to 14 weeks gave students sufficient opportunity to participate.		Tasks of 10 to 14 weeks gave students sufficient opportunity to participate.		
Combining F2F and Online	When group members were well acquainted and F2F meetings were not intertwined with the online collaboration, F2F meetings obstructed the online participation.				
Group composition	Only in students' perception did heterogeneous groups based on type of teacher training programme influence their participation.		Only in students' perceptions did heterogeneous groups based on type of teacher training programme influence their interaction.		Use of heterogeneous groups based on type of teaching programme increased communication on planning and evaluative issues.
Personalisation	Only in students' perceptions did personalisation influence their participation.	Personalisation increased social communication.	Only in students' perceptions did personalisation influence their interaction.		

Chapter 8: Online Environment and Design Context

This chapter provides information to answer research question 4: *"In what way are elements of the online environment related to the student teachers' CSCL process?"*, and research question 5: *'In what way are elements of the design context related to the student teachers' CSCL process?'*. For this purpose we related student teachers' and teacher educators' evaluation of the online environment and design context (in questionnaires and interviews) to our conclusions with respect to student teachers' collaboration from Chapters 6 and 7. Appendix D1 includes an overview of the scores on the related questionnaire items and Appendix E3 summarizes the statements from the interviews.

The online environment includes the hardware and software used, and the electronic teaching materials. Section 8.1.1 includes a short description of the design features related to the online environment. In 8.1.2 and further, we present the results of the analysis of the students' and teachers' opinions as to the influence of the *online environment* on the students' collaboration. Section 8.2 presents the opinions of students and teachers as to the influence of the *design context* on their collaborative processes. The design context comprises aspects influencing the collaborative learning in the electronic environment, but which were not or barely under control in designing the three courses. It includes the technical situation student teachers had to work in and their ICT skills, individual student behaviour, their attitudes to online collaboration, their personal contexts, and their teaching contexts. A summary of this chapter is provided in 8.3.

8.1 Online Environment

8.1.1 Description of the Online Environment

Chapter 3 described the online environment of the courses in detail. This section presents the main elements.

In the HTM course, the students and teacher worked with the groupware programs BSCW© and Webboard™, both included in a website. While BSCW© was used for the collaborative work on the assignments, Webboard™ served as social discussion forum. The website included information on the course and the as-

signments, and offered manuals on groupware usage and collaboration. BSCW© offered the students a bulletin board and file exchange possibilities. The technical assistant created group areas within both functionalities.

During the BITEP and In-service courses, students and teachers had WebCT at their disposal. In WebCT they could use a bulletin board, a file exchange server and a chat facility. Additionally, we included information on the course and assignments, as well as technical manuals and manuals on collaboration. Group areas were created in the bulletin board and file exchange server, prior to the course. For the benefit of the BITEP course, a separate social discussion area was created. The In-service students did not dispose of a social area.

In this section, we will present to what extend the following aspects of the online environment influenced students' collaboration:

- the functionalities of the groupware used;
- the usability of the groupware used;
- the use of a (separate) social forum.

8.1.2 Groupware: Discussion Area and File Exchange

Overall, the students were satisfied about the usability and functionality of the groupware used. The programmes were suitable for discussion and collaborative work. Yet, several HTM students mentioned BSCW© as being unorganised and confusing, referring to its structure as 'a box-in-box'. However, they did not report the groupware as obstructive to their collaboration. The online communication of both students and teachers clearly shows they had to get used to the groupware. From the outset, communication about technical issues was relatively frequent in the HTM course.

On the other hand, the BITEP and In-service students referred to WebCT as an easy to use programme, and a clear system with an attractive layout.

> "I find WebCT really good. I said several times to myself: Jesus, what a good system this is [..] It is a clear system and a successful system".

However, some of the students thought the file exchange server of WebCT was confusing.

We analysed whether or not there was a relation between the usability of the functionalities and the student teachers' opinions of their collaboration. We found no correlation between the answers to questionnaire items on usability and students' opinion of the collaboration. With one exception, as the more BITEP students experienced problems with the file exchange server, the less satisfied they were about their collaboration ($r = -.67$; $p = .01$).

During the interviews we discussed the various functionalities of the groupware with the students and teachers. Despite the fact that a considerable part of the

notes in the HTM and BITEP courses had not been responded to and threads appeared to be quite short, the students experienced the thread structure, and the options to mark notes in the discussion area as convenient. The teachers were satisfied about the possibility to create different forums, which made the bulletin board clear and enabled them to select what messages and forums to read.

> "I liked it that there were separate areas, that is clear. It is like you are going to sit comfortably in a corner, and in that corner you work and in that corner the people whisper, and make fun. You can almost see it as a school" [the teacher].

Groupware developers should take into account that online collaboration triggers a new way of communication. This organizational communication refers to the kind of communication students use to regulate communication between group members. The students used this kind of communication frequently (see Chapter 6 for a more detailed description). Online collaboration might demand greater time investment resulting from organizational communication, which is not needed in F2F collaboration. WebCT notifies users on the homepage of the course when a new message is uploaded, but this was not sufficient. It was still difficult to find new materials and students missed notification for files.

In general the students were satisfied about the functionality and the usability of BSCW© and WebCT, although some HTM students were critical about the structure of BSCW©. Considering the opinions about the discussion options and file exchange possibilities, we conclude they played a minor role in the students' collaboration.

8.1.3 Social Area

The experts we consulted in this research, mentioned a course site should include a separate social area, which we designed in the HTM and BITEP courses. In order to vary, we did not include a social area in the In-service course. The BITEP bulletin board included a social area for the students' off task communication. The WebCT log files show this area was frequently used and very long discussion threads were produced. More than half of the student group made it very clear they appreciated the social function of the digital learning environment: the exchange of experiences kept the group together.

> "Nice to go there every day, just to see how everything is in other parts of the world"

> "I like Social Talk very much because you stay in contact with people and this is important also because you could exchange your experiences"

We think there was a need among students to communicate socially, because group members knew each other very well before work in the CSCL environment started, physically separating them for a number of months.

The HTM social area was not used. Only very few messages were sent to Webboard™, the programme used for social communication. Discussing the social area as a functionality of a CSCL environment during the interviews, the HTM students mentioned they did not feel any need to use it as they did not know the other members of their group and met other students of IVLOS teacher training programmes in F2F meetings and preferred socializing with these peers.

The absence of a separate social area in the CSCL environment of the In-service course did not result in much social communication in the areas created for working on the assignments.

All in all, the BITEP students were physically separated, knew each other well, and felt the need to socialize, whereas the HTM and In-service students found other ways to socialize, for instance in F2F meetings at the teacher training institute. We conclude this means a social area is not needed when participants have another suitable way for socializing.

8.1.4 Chat Facility

Although the use of the chat facility was not referred to in the assignments, WebCT did offer such a facility and the BITEP students did use it quite frequently. According to some, a chat facility can be useful when discussing concrete problems and to get a quick view of group members' opinions. However, the students experienced the chat facility to be too chaotic and fast, demanding agreements and rules on communication. The HTM students had no complaints about a chat facility not being available to them. The In-service students mentioned it might have been useful to discuss the possibilities of a chat facility during the training session, in order to be able to use it while working on the assignment.

8.1.5 Private Mail

WebCT also offered a private mail option and the BITEP and In-service students and teachers could use it whenever they wanted. Most BITEP students used this private mail option and were satisfied. To them, it was a convenient and quick way to send other students and the teacher a private mail. The teacher used it for individual guidance and was aware that messages by private mail had high priority. In contrast, some In-service students mentioned they used their own e-mail applications, as they checked this medium almost daily.

Although not discussed as such with the students and teachers, we think the BITEP CSCL environment was their home base, as the only link to the teacher-training institute while abroad. When interviewed, BITEP students mentioned they

appreciated the social function. To the HTM and In-service students, the CSCL environments were 'merely' facilities for carrying out the assignments. For the latter, 'additional' functionalities such as private mail were less needed.

8.1.6 Lay Out

We assumed an attractive layout of the CSCL environment would help create a positive feeling about working in the CSCL environment. The HTM students were less satisfied ($M = 3.2$; $SD = 1.1$; $N = 15$) about the BSCW© lay-out than BITEP ($M = 4.1$; $SD = .8$; $N = 17$) and In-service ($M = 4.0$; $SD = .7$; $N = 9$) students were about the WebCT lay-out. Analysing In-service and HTM questionnaire data, we found no correlation between students' opinions of their collaboration and of the CSCL environment lay-out. Only for the BITEP students we found that the more students experienced the website lay-out as attractive, the more positive they were about their collaborative work during the TIE assignment ($r = .62$; $p \leq .01$). Curiosity and the novelty of working online with WebCT may provide reasons why we found this correlation for the students only while working on the TIE assignment and not for the same students in the other BITEP assignments.

8.2 Design Context

The design context comprises elements influencing students' collaborative learning, not or barely under control in designing the three courses. Chapter 3 describes the design context for each course. In this section we present to what extent the following elements of the design context had an effect on the student teachers' collaboration:

- the technical situation of the students;
- the students' ICT skills;
- the educational context;
- the location of the students;
- the personal circumstances of the students;
- the students' characteristics.

8.2.1 Technical Situation

We expected hardware and access problems to influence the collaborative process. Over half of the HTM students experienced technical problems, such as a failing computer, no Internet connection, not working modem and incompatibility of MacIntosh Apple computers with the Internet software. This is reflected in their communication about technical issues. In more than 30% of the notes the HTM students addressed technical issues, which percentage even passed 40% in three

groups. According to all students, technical trouble hampered and frustrated the collaboration. Most technical problems of the HTM students were solved in a few weeks. Most of the more severe problems occurred during assignment 1, one of its aims being to get students acquainted with the technique. The students would have liked to have a two-week period to get used to the technical circumstances. The technical problems of the BITEP students concerned Internet connections or difficulties with the groupware. These kinds of problems were solved in a few weeks, before the start of the TOC and Research assignments. The technical situation of the In-service students was satisfactory. Only one of the In-service students did not have access at home and had to work at his practical training school, but analysis of the collaborative behaviour of this group shows this group did not diverge from the other two groups.

Analysis of the electronic and interview data revealed that only very few students with technical problems dominated their group with communication about technical problems. Still, we say that a poor technical situation interferes with effective collaboration. Some HTM groups experienced delays in the start of their assignments due to group members' technical problems. The In-service students, experiencing very little trouble, generated the most intensive participation patterns and most threads. We found that technical trouble did not change the nature of the collaborative process. It did not influence the nature of the communication, the level of information exchange, or the other regulative skills.

8.2.2 Students' ICT Skills

The BITEP and In-service students were experienced ICT users, disposing of technical skills for working with word processors, Internet and email applications. The HTM students were less experienced, some even lacking basic technical skills. The students of all three courses had to get used to working with groupware.

The HTM students faced most technical problems. Students with less ICT skills (based on the questionnaire scores on the item relating to ICT experience), mentioned in the interviews they needed more time to get used to the groupware and they experienced more difficulties in dealing with technical problems. The participation patterns of the groups show that less skilled students communicated less than their skilled peers, and an important part of their communication related to technical issues. On the other hand, very skilled students often became dominant in the group communication.

We expected to find a relation between the level of ICT skills and students' opinions of the collaboration; less skilled students expected to be more negative. However, none of the courses shows such a correlation. Possibly, technical difficulties presented themselves to the students primarily at the start of the courses,

diminishing progressively through the courses, decreasingly influencing students' collaboration.

Summarily, the less skilled ICT users experienced more difficulties in working with the groupware and hardware, resulting in (temporary) less participation and interaction. These students did not differ from their peers in their opinions of the collaborative process.

8.2.3 Students' Attitude to Online Collaboration

When interviewed, the HTM and BITEP students stated various reasons for their preference of F2F collaborative work in general. The main reasons are the unsuitability of online communication for discussion purposes, the lack of personal and verbal communication online, and the inertness of the discussions.

> "It is like a question and answer game with one to seven days in between."

According to the teachers, the negative attitude towards online collaboration prevented the students from investing time and effort in accomplishing the assignments. The HTM students also experienced CSCL as difficult, and were therefore inclined to divide tasks. The In-service students on the other hand, were all positive towards CSCL. They were motivated to work online, which may have helped them to generate a collaborative process better in all perspectives when compared to the HTM and BITEP groups (see Chapter 6 and 7).

In addition, several students stated in the interviews it was difficult to be personal in their online communication. It was difficult for many students to appeal to group members to take up their tasks, or to be critical in their feedback, especially when group members did not know each other very well. The BITEP and In-service groups behaved more personal and showed more evaluative communication than did the HTM groups. We think a personal atmosphere in the group, generating a safe and friendly area for communication, may have helped these students in creating an evaluative atmosphere.

8.2.4 Educational Context

Situations at the practical training school influenced the students' perceptions of their collaborative work. For instance, due to their being located in England, the TIE assignment on second language learning seemed less applicable to some students' situations. According to these, this was the reason why they had been less engaged in the TIE assignment. However, the TIE groups' participation frequencies show these students were still involved at similar frequencies.

8.2.5 Location

In the BITEP group, the location of the students played a specific role in the collaborative process. Not only did being located in countries like Guyana cause difficulties in getting access to computers, but the collaboration was also hampered by the time differences between the countries where BITEP students were situated.

Absence of F2F contact increased the level of participation and the share of social communication. This is illustrated by the enormous amount of notes in the BITEP social area, by one of the Research groups focusing on social communication (all group members being located separately), and by the dominant amount of contributions to the communication by group members located away from the other group members.

8.2.6 Personal Circumstances

According to the students, personal circumstances such as illness, family situations, and especially students' busy life schedule (study and work in combination with social activities) influenced the individual students' behaviour in the collaborative process. This has generated frustration among group members. We compared the participation, interaction and communication on content of the groups including one or more members with a busy time schedule (according to themselves), or including one or more members ill for a long time, with groups not including members affected by personal circumstances. Contrary to the students' feeling, our observations of the online communication do not provide clear indication that personal circumstances influenced the groups' collaborative behaviour in the CSCL environment.

8.2.7 Individual Student Behaviour

Various aspects connected to the individual student play a role in learning situations. Differences in cognition create different learning results. Although we did not study the students' cognitive levels, we assume differences in cognition may have caused variation in the levels of information exchange of the individual students. The personal relation between group members is another aspect creating differences in group behaviour in collaborative learning activities. People do or do not get along and this influences the working relationship. According to members of one HTM group, a troubled relationship between two group members disturbed their collaboration, resulting in less participation, less focus on content and limited feedback on each other's work. In this group, mutuality was low. Analysis of this group' electronic communication indeed shows they partici-

pated less than the other heterogeneous groups and were less focused on the content.

Another aspect of the individual students' behaviour connected to learning in a CSCL environment was the students' motivation to work online, and to collaborate with others. Within the context of this study, we distinguish three types of student behaviour related to students' motivation to collaborate and work online on the assignments. This distinction is made primarily on the basis of the outcomes of the students' and teachers' interviews, but whenever possible we related the types of conduct to the observed collaboration.

The first group consists of intrinsically motivated students, focused on long-term knowledge building. When interviewed, they stated a good personal contact with group members and motivation to learn collaboratively, as their reasons for working actively. These students are also characterised by a strong feeling of responsibility for the collaborative process and the end product of an assignment. All four students of one HTM groups mentioned this feeling of responsibility as an important reason for this group participating, interacting and focusing on content much more than the other HTM groups. Several students of the other HTM groups confirmed this during the interviews. The In-service students too indicated they had been motivated to collaborate online. In our view, this has assisted them in working well, as they scored higher on all perspectives when compared to the students of the other two courses.

The second group are extrinsically motivated students, focused on learning for extrinsic rewards and gratification. They stated in the interviews time pressure (e.g. having to finalize an assignment during the time abroad), a pre-imposed structure and their sense of duty as reasons for working actively. One student described this as resulting in a 'business way' of collaboration. Such opinions were mainly expressed in discussing the TIE assignment of the BITEP course. Although the BITEP students favoured the Research assignment, they communicated on a deeper level of information exchange during the TIE assignment. From the interviews we know the students thought the TIE assignment to be important and although they did not really like it, and considered it an obligation, they did finish it.

The third group consists of students not motivated at all, as they admitted they were not motivated to work online and/or to collaborate with others, as illustrated by interview statements such as:

> "Yes, I should have contacted the teacher, because my computer was not working, but I did not feel like it and was not interested. I prefer to work off-line".

An important part of the students of the HTM group belonged to this third group. Especially the lack of motivation of students to learn from and with others, to-

gether with a lack of motivation for the CSCL tasks, hampered the group process, according to students and teacher. The teacher explicitly mentioned the differences between students' motivation to work online and/or to collaborate with others, as the main factor influencing students' collaborative behaviour and creating differences between groups.

8.3 Summary and Conclusions

Table 8.1 summarizes the results of the analysis of the relation of the online environment and the design context with students' collaboration. We included those results which in our opinion are important to designing CSCL environments in teacher training. They are further processed into design principles in Chapter 10. We will comment briefly on the most remarkable results in this section.

Generally the students were satisfied with the functionalities and usability of the groupware, although some HTM students were critical as to the structure of BSCW©. The students were also satisfied with the groupware lay-out. The HTM and In-service students were quite indifferent towards the availability of 'additional' functionalities such as a social area, a chat facility or private mail. The BITEP students valued these additional functionalities more. To them, the CSCL environment was their main way of communication with each other. Analysing the interviews and questionnaires, we had the impression that the groupware used has played only a minor role in the students' collaboration.

As in many other courses, the technical problems the students experienced disturbed some of the students' participation and created annoyance and frustration among most. However, the technical problems of the students involved did not change the nature of the collaborative process, which includes the nature of the communication.

Comparable to the analysis of the task instruction, in analysing the design context, we noticed that the students' perception of the importance of some of the design context elements differed from our observations of their online communication. For example, in their perception personal circumstances were an important influencing factor. Our observations of the online communication do not support their view.

The students' motivation to collaborate online on the assignments seems to be related to their collaborative behaviour. Mainly based on the students' and teachers' statements in the interviews, we distinguished three types of students with regard to their motivation and collaborative behaviour: intrinsically motivated students, extrinsically motivated students, and students not motivated at all.

Table 8.1
Summary of results related to the online environment and design context, organised by design element and the five perspectives of CSCL analysis

	Participation	Nature of communication	Interaction	Level of information exchange	Regulative communication
Technical situation of students	Bad technical situation interfered with effective collaboration, causing delays in students' work.		Poor technical situation hampered students in getting involved in discussions.		Technical problems generated communication on technical issues.
ICT skills of students	In students' perception the less skilled communicated less than their peers. Very skilled students became dominant in sending notes and documents in the groups.		In students' perceptions, the less skilled communicated less than their peers.		Less skilled students communicated more about technical issues.
Groupware: Bulletin Board and File exchange server			Students and teachers thought thread structure convenient, but threads appeared quite short and many notes were not responded to.		'Organizational communication' is important in CSCL; Students missed notification when information was uploaded; Unclear groupware structure generated communication on technical issues.
Social area		Social area only seemed needed omitting any other suitable way of socialization.			

Table 8.1 (continued)

	Participation	Nature of communication	Interaction	Level of information exchange	Regulative communication
Chat facility		Chat facility was thought useful to discuss concrete problems and get quick view of group members opinions.			
Private mail		When groupware was only way to communicate with group members and peers, additional functionalities such as private mail were welcome to students and teachers.			
Students attitude towards online collaboration	Negative attitude to online collaboration (compared to F2F collaboration) decreased participation. Intrinsic motivation seemed to stimulate participation. Students not motivated to work collaboratively were stimulated to participate by extrinsic incentives, such as a pre-imposed structure.	Intrinsic motivation seemed to stimulate students focus on content. Students not motivated to work collaboratively on task were stimulated to focus on content by extrinsic incentives, such as a pre-imposed structure.	Intrinsic motivation seemed to stimulate interaction. Students not motivated to work collaboratively on task were stimulated to interact by extrinsic incentives, such as a pre-imposed structure.	Intrinsic motivation seemed to positively influenced the level of information exchange. Students not motivated to work collaboratively on task were stimulated to focus on content by extrinsic incentives, such as a sense of duty.	Organisational communication demanded time investment not required when collaborating F2F. Personalisation, resulting in personal atmosphere stimulated evaluative communication.

Chapter 9: Teachers' Guidance

This chapter provides an answer to research question 6: *"In what way are elements of the teachers' guidance related to the student teachers' CSCL process?"*. To that end, we analysed the teachers' guidance of the students' online collaboration, relating the results to both the students' and teachers' opinions of the teachers' guidance. Appendix D1 presents an overview of the scores on related questionnaire items, Appendix E3 summarizes the interview statements.

The teachers' guidance consists of the teachers' interventions during the course, and the technical training and assistance. As we did not want to change the teacher educators' routines, we barely prescribed the way of guiding the students. A few agreements were made with the teacher educators, as described in Section 9.1. The information about the teachers' interventions in the students' communication is presented using the perspectives from our multi-perspective method for analysing electronic communication, and then particularly the perspectives of the participation, the nature of the communication and the interaction, as described in Sections 9.2, 9.3, and 9.4 respectively. These sections also provide students' and teachers' opinions from the questionnaires and interviews. All this information is also related to our observations of the student teachers' communication (see Chapter 6 and 7). In contrast with the statements on the task instruction, the students barely related the teachers' guidance to their own collaborative behaviour. Consequently, we could hardly use their statements on the teachers' guidance as explanation for their behaviour. Moreover, due to a limited role of the teachers in our research, we did not dispose of sufficient data to analyse the content of the teachers' notes in more detail, as was done within Perspectives 4 and 5 of our analysis method for the students' notes. Students' opinions of the technical training and technical assistance can be found in 9.5. Finally, Section 9.6 summarizes the chapter.

9.1 Main Elements of Teachers' Guidance

This section presents the main elements of the teachers' guidance, which were described in detail in Chapter 3.

Five experienced teacher educators were involved in our research. Both in the HTM and In-service courses, one teacher educator was responsible for guiding

the student teachers. The BITEP course involved three teacher educators, one whom exclusively responsible for the TIE assignment. The same teacher educator and two others were responsible for guidance in the Research assignment (each teacher guiding one group) and one of the students was appointed student co-ordinator to guide his peers through the TOC assignment. The HTM teacher educator guided his students online and also offline in F2F meetings with the whole course group and at individual meetings. With regard to subject matter, he was supported by an expert, who could be consulted by the students while working on their assignments. A technical assistant was responsible for technical support of the students during all three courses. Besides offering students assistance when running into problems, the technical assistant moderated the site, assigning groups and permitting access.

Our research involved existing courses of a teacher training programme which were adapted to CSCL learning. CSCL research provides little information on the implementation of teacher educators' guiding strategies in CSCL environments. We did not want to prescribe in detail when and how to intervene, as it would have meant having to interfere substantially in the teachers' routines. We discussed with the teacher educators how they were to use their own collaborative learning guiding routines, and to decide themselves how to adapt their routines to a CSCL environment. We discussed guidelines fitting the personal way of teaching. With the teacher educators concerned, we decided the HTM teacher and the BITEP TIE assignment teacher should focus, besides on content of the assignments, on the process of collaboration. Beforehand, we planned a kick-off meeting and various in-between F2F evaluations for the HTM course in order to create a group feeling, as these students did not know each other at the start of the course. We did not make agreements with the HTM teacher educator as to how he should intervene in students' task related content discussions. We did neither discuss specific agreements as to the BITEP teacher educators' way of intervening.

We decided with the In-service teacher that he would intervene at least twice, once at the beginning of the assignment to confirm the students as to whether or not they were on the right track, and once at the end as a way of concluding students' work on the task.

The teacher educators did not receive training on online guidance, as we knew little about the guidance of student teachers in a CSCL environment and because we did not want to interfere too much in the existent teacher educators' routines of guiding student teachers' collaborative learning. Technical training for the teacher educators was not required, as they were sufficiently experienced technically.

At the start of each course, students received technical training from the technical assistant and their teacher educator. For the BITEP and In-service courses,

this also included training on collaborative work. The assignments were introduced and some online collaborative skills, such as turn taking, or providing feedback, were trained.

In this chapter, we will consider to what extent the following aspects of the teachers' guidance have influenced students' collaboration:

- frequency of teacher interventions;
- content of teacher interventions;
- type of interventions;
- usage of interim evaluation of collaborative group process;
- usage of a kick-off meeting in a group of students not familiar with each other;
- training of CSCL;
- technical training;
- technical assistance.

9.2 Perspective 1: Frequency of Participation

This section describes the frequency of the teacher educators' interventions, in combination with the students' and teachers' opinions on the frequency of intervening.

The HTM teacher only wrote a small number of interventions in the heterogeneous groups (11 notes in assignments 1, 2 and 3), and hardly any in the homogeneous groups (3 notes during assignment 4). During assignments 1, 2 and 3, all groups at least received one note from the teacher including feedback on work done. The teacher provided most of his intensive feedback to the groups that worked less.

Table 9.1 presents the BITEP teacher educators' involvement, demonstrating how the TIE teacher barely communicated online. The TOC student co-ordinator had a negligible role, just sending a note to some of the groups reminding them to start working on the assignment or prepare their presentation. The Research teacher educators were far more involved in the online communication than all other teacher educators. In fact, of two groups (R1 and R2), of all group members it was the teacher that sent the largest amount of notes. As mentioned in Chapter 6, the number of student notes in the Research assignment was high as well. This could indicate a relation between the frequency of the teachers' notes and the students' participation.

The In-service teacher too had a minor role in the collaborative groups, sending six notes, equally divided over the three groups. He did not meet the agreements made on the moments of him providing feedback. The collaboration of the In-service students was the most intensive and equally distributed in comparison

to the HTM and BITEP groups, demonstrating that satisfactory collaboration can go hand in hand with a passive role of the teacher educator. It would seem that compensation is found in other elements of the CSCL environment, such as task instruction.

Table 9.1
Participation patterns of the BITEP groups and the teachers' involvement

Group	Outdegree groups	Indegree groups	Teachers' notes (*N*)
TIE 1	5	10	0
TIE 2	31	48	0
TIE 3	36	81	2
TIE 4	38	62	1
TIE 5	48	91	2
TIE 6	19	46	1
TIE 7	25	53	0
TIE total			6
R1	36	50	10
R2	45	100	15
R3	112	300	9
Research total			34
TOC 1	20	39	1
TOC 2	37	74	1
TOC 3	24	47	0
TOC 4	24	48	0
TOC 5	9	15	1
TOC total			3
Total BITEP course	509	1064	43

Considering all three courses, the teacher educators show limited intervention in students' collaboration, except for the teachers of the Research assignment in the BITEP course. Analysis of the frequency of teacher educator communication with the groups shows a positive relation between the teacher educators' and the students' participation in the Research assignment. We did not find significant correlations between the number of teacher interventions and the students' communication on the content of the task. The results of the In-service course show that a passive role of the teacher educator can go hand in hand with well functioning collaboration.

The students differed in their opinions of the frequency of the interventions. Some thought it sufficient, mentioning there was no need for more guidance. The feeling that the teacher educator was available when needed, had been comforting enough. They were not convinced that more interventions would have been

helpful. Others would have liked to have seen more interventions, gaining motivation from the teacher's feedback, which could have added more value to the students' discussions.

> "I would have liked to receive feedback from the teacher educator who has a professional point of view. It is something different compared to technical assistance. It sure had deepened the collaborative process and increased the learning outcomes."

Remarkably, the students working on the Research assignment, which was actively guided, explicitly mentioned they were satisfied with their guidance, showing indifference with regard to the guidance in the other two BITEP assignments.

In retrospect, all three teachers favoured a more active role, yet within the boundaries of their teaching time. For instance, according to one of the teacher educators, he should have made some interventions when he noticed the students becoming less critical towards their peers. Such interviews could then have functioned as a model of various forms of feedback. In his view, students are more active when the teacher leads by example. Teacher interventions should be well planned and organized, preventing teachers from having to waste time in searching, reading and responding to endless amount of notes. To monitor students' work, the teachers indicated they had to invest quite a considerable amount of time to obtain a view of the threaded discussion.

9.3 Perspective 2: Nature of Communication

In this section, we analyse the nature of the notes of the teachers, which overall shows a similar picture as the student notes: a focus on regulative communication (around 90%), with around 40% of notes containing issues related to task content, and relatively limited social communication.

The HTM teacher's online feedback focused on the collaboration process (for instance indicating how to structure the group area or stimulating students to start working) and the content of the students' work. At the outset, he decided to take a passive role, assuming the students would be intrinsically motivated to work actively. As the course progressed, by the time it had become clear not all groups were working as had been intended, he became more active, especially at the F2F meetings, also providing students with time to evaluate, plan and organize their collaborative process. According to the HTM students, all F2F evaluations of the collaborative process had stimulated the process. However, these evaluations did not result in more attention to task related content. On the contrary, their attention for the content decreased, but the students communicated considerably

more about social issues (see Table 7.2). This provides us with indications that these evaluative moments helped groups to create a group feeling.

The BITEP teacher educators' interventions focused on regulative issues. The teacher of the TIE groups, also the co-ordinating teacher of the BITEP group, communicated socially with his students as well. The Research teachers (see Table 9.2) were more focused on content related feedback than the teacher educator of the TIE assignment.

Table 9.2
Nature of teachers' interventions in the Research assignment of the BITEP course (in number of interventions)

Group	Content interventions	Regulative interventions	Social interventions	Total number of notes
R1	6	10	1	10
R2	6	15	3	15
R3	4	8	4	9
Total Research	16	33	8	34

We tested whether the Research teachers differed in their feedback, and what had been the influence of their interventions in students' collaborative behaviour, as this task was the only one in which different teachers guided subgroups. They did differ significantly as to the percentage of notes with task related content ($\chi^2 = 6.1$; $df = 2$; $p \leq .05$) and social feedback ($\chi^2 = 19.5$; $df = 2$; $p \leq .001$). The students in the Research subgroups did not vary in the nature of their communication, the level of information exchange and regulative communication. So, we did not find a relation between the content of the teachers' interventions and the students' collaboration.

The In-service teacher also focused on regulative aspects in his communication with the students. The teacher has also provided feedback on the process of collaboration. However, when interviewed he mentioned that group members' stimulating and critical remarks focused on the group process were more effective in getting the students to work than were his own interventions. This is in line with Cohen (1994) who argues that intra-group reflection on group processing is more effective than supervision.

Due to the limited number of teacher educators' notes we were unable to analyse the content of these notes in more detail. To obtain a view of the types of feedback from the teachers, we developed a system, described in Chapter 4, measuring the presence of direction in teacher educators' notes. Analysing the level of direction, we considered the teacher educators of all three courses as one group. The teacher educators were directive in just over half of their notes. They were directive in their interventions on both the content and the collaborative

process. Content analysis of the notes shows the students were directed in a certain direction to deal with the task content, or were stimulated to provide each other with content related feedback. The direction in the collaborative process was focused on stimulating groups to plan and organise their work and stimulating individual students to start working.

In general, the HTM students and students working on the Research assignments during the BITEP course were satisfied about the content of the interventions. They found the teachers enthusiastic, active, helpful, and professional, monitoring students' process and work. The HTM teacher educator focused on the process of collaboration. According to some students, this resulted in a lack of attention for the content of the course during both the F2F meetings and in the online communication.

> "Looking back, I know I have learned less from these assignments doing them in this way. Much time has been invested in problems with the computer, discussing how we should tackle the assignments and the evaluation of the collaborative process. I regretted this".

The students also mentioned that the teacher educator should have focused more on creating a personalised atmosphere in the small groups during the kick-off meeting of the HTM course. According to the students this would have increased their motivation to participate and work on the task. Some of the HTM students would have liked to have seen the teacher addressing students who did not work enough. In their opinion this could have stimulated those students to become more involved in the collaborative process.

The students working on the TIE and TOC assignments of the BITEP course and the In-service students were quite indifferent as to the content of the teacher educators' interventions, many mentioning the teachers' role had been "ok", or "I did not expect anything", others not even discussing the role of the teacher.

When interviewed, the teacher educators mentioned several interesting points about the content of their interventions:

- When group members do not know each other, F2F teambuilding activities in the collaborative groups are required.
- It is difficult to provide feedback in writing, due to the limited way of interaction (absence of non-verbal behaviour easily leading to wrong interpretations).
- Stimulating and critical remarks from group members are more effective in getting group members going, than such remarks from the teacher.
- It is difficult for a teacher to address students online, reminding them of their obligations (a F2F meeting is more confronting: "looking in someone's eyes").
- Online guidance is more complicated than regular guidance as the teacher has a limited view of what students are actually doing during their learning activities. This makes it difficult to supervise the collaboration.

9.4 Perspective 3: Interaction Pattern

In this section, we will study the position of the teacher educators in the interaction patterns of the collaborative groups. Table 9.3 presents the interaction patterns for each course, including the teacher educators' and student teachers' communication. For the BITEP course, the information is provided on task level as far as concerns the TIE and TOC assignments, as different teachers guided the students during each assignment. And because three teachers were involved in the Research assignment, the table also provides the interaction pattern of each Research subgroup.

The teachers had different roles in the interaction patterns. The HTM teacher interacted quite isolated, as most of his notes were isolated ones. He took no real part in the discussion, apart from initiating 11% of all threads in the HTM course.

Table 9.3
Interaction patterns including teachers' and students' interaction

Groups/ Teacher educators	Notes in threads (*N*)	Top-level notes (*N*)	Responses (*N*)	Isolated notes (*N*)	Notes in Bulletin Board (*N*)
HTM students	105	33	72	77	182
Teacher educator HTM	5	4	1	9	14
TIE students	101	31	73	29	134
Teacher educator TIE	5	1	4	1	6
R1 students	25	7	18	4	29
Teacher educator R1	9	2	7	1	10
R2 students	34	11	23	8	42
Teacher educator R2	9	6	3	6	15
R3 students	55	19	36	29	84
Teacher educator R3	7	3	4	2	9
TOC students	80	18	62	14	94
Student coordinator TOC	1	0	1	2	3
In-service students	108	23	85	3	111
Teacher educator In-service	4	1	3	2	6

Compared to the HTM teacher, the BITEP teachers were more involved in threads, thus sharing in the discussions. The teachers of the TIE and Research assignments[1] do not vary significantly in this aspect. In 14% of all threads, the teachers have been the initiator. The Research assignment had 30% of the threads started by a teacher educator. The Research teachers vary significantly as

[1] The Student Co-ordinator was left out due to his limited number of interventions.

to their percentages of top-level notes ($\chi^2 = 8.5$; $df = 2$; $p \leq .05$), isolated notes ($\chi^2 = 17.5$; $df = 2$; $p \leq .001$) and responses ($\chi^2 = 25.8$; $df = 2$; $p \leq .001$). Table 9.3 shows how the teachers differ.

The teacher of Research group 1 frequently involved himself in discussions, most of the time responding to one or more group members. The teacher of Research group 2, on the other hand, shows a relatively low response percentage, but has sent more top-level notes than the other two teachers of the Research assignments. This means that this teacher probably attempted to initiate discussions and stimulate the group members to work. Compared to the other Research teachers, the teacher of Research group 3 had a smaller role in the communication. Research group 3 discussed less in comparison to the other Research groups, the percentage of isolated notes of the total number of notes in the Bulletin Board being much higher. The data on the Research groups indicate a relation between an interactive teacher role and more subgroup interaction. Qualitative sequence analysis, which had no part in our research, is required to analyse who stimulated whom to interact in the threads.

The In-service teacher barely communicated at all, initiating only one discussion.

We studied the relation between the teacher educators' directive notes and the interaction patterns. More than two-thirds of the top-level notes (71%) were directive in nature. From the isolated notes, 36% was directive. This indicates a positive relation between directive notes of the teacher educator and students' responses. Analysing the electronic communication of the teachers and students, we noticed that the directive notes the teachers sent at the start of the assignment generated relative quick response of the students and started discussions.

When interviewed, the students did not discuss the role of the teachers in the interaction patterns of their groups.

9.5 Technical Training and Assistance

The technical training and assistance are parts of the teachers' guidance not reflected in the online teachers' interventions discussed in the previous sections. This section describes students' and teachers' opinions of the technical training and technical assistance, when possible, related to the collaboration of the groups.

9.5.1 Technical Training of the Student Teachers

Overall, the students were very positive about the training, which was more or less the same for all three courses. In all three courses the students received a

technical training. In the BITEP and In-service courses this has been combined with an explanation of the assignments. In the HTM course this explanation has been done at the F2F meetings. The training sessions of the three courses were sufficient to work on the tasks without problems, according to most students. This leads us to conclude that the combination of technical information, demonstration and training, with an explanation of the assignments' content, worked well. Still, the student teachers and teacher educators did mention some points of attention.

First, both students and teachers mentioned that for those students with less ICT skills, the level and pace of the training had been too high. The students mentioned the less ICT-skilled students encountered problems with hardware and software. In the online communication we noticed that this has generated communication about technical problems, mostly with uploading documents.

> "I thought I uploaded the file, but now it is lost again."

> "This is the third time I'm trying to send this note."

Second, from the interviews we know that, during the training, the BITEP teacher educator emphasized the importance of the TIE assignment, creating extrinsic motivation of the students, who indeed felt obligated to work for the assignment:

> "They acted as if this was the assignment of the year, but in fact both the content and the guidance were disappointing."

The teachers' attitude during the assignment instruction influenced the students' collaboration, resulting in a students' attitude to perform well, as many students indicated. In our view, this may have resulted in a deeper level of information exchange during the TIE assignment than during the other BITEP assignments.

One of the teachers advised us in training also to spend time on the perceived difficulties of the task. This would have made it more clear to the BITEP students, for example, that the purpose of TIE assignment was to have them working together on lessons without a clear vision of each others' lessons' context. This shortage of information of each other's context was an important reason why the students did not like the TIE assignment.

9.5.2 Technical Assistance

Overall, the students thought the technical assistance sufficient for collaborating online, as it was performed with dedication, quickly and helpfully. It was used most intensively during the HTM course, the HTM students being less skilled, and experiencing most problems in accessing the CSCL environment. We think they

were inclined to ask for technical assistance after having received a modem and an Internet connection from the institute. The BITEP students were required to arrange for their access and computers themselves abroad and could not call on technical assistance for this part. They did not complain about this situation. Technical assistance was barely needed during the In-service course, one of the entrance conditions for which had been disposal of suitable hardware and a well-working Internet connection.

9.6 Summary and Conclusions

The teachers of all three courses took a passive role, leaving performance, planning and organisation of the task to the students, the teacher educators of the Research assignment of the BITEP course being the exception. Both passive and active roles of the teacher educators came paired with active students. In one assignment, in which the teacher educator had an active role, the student teachers showed a relatively high level of participation and interaction. In another one, in which the teacher educator showed a low frequency of interventions, student teachers still were relatively active. The students mentioned they appreciated the active role of the teacher educators in the Research assignment. Due to the limited total number of interventions in all three courses, it is difficult to decide as to the most effective frequency. Looking back, all three teachers favoured a more active role, assuming students tend to be more active if the teachers are active themselves.

As regards the nature of the teacher communication, the teachers focused on regulative communication. The content of the teachers' feedback seems to have had very little influence on the collaboration of the subgroups of student teachers. The HTM teacher focused on evaluating the process of collaboration. The student teachers were positive about the use of evaluative moments during F2F meetings, although eventually it only assisted the collaborative process of one group. These evaluations may be the reason why the HTM students showed progressively more social communication through the course.

The teacher educators were directive in just over 50% of their notes. Students were directed both in their work on task content and the regulation of their collaboration.

In general, the students were satisfied with the frequency and content of the interventions, although some mentioned a more active role of the teachers might have helped and motivated them. During the interviews, the students were quite clear that in their view the teachers had a minor role. However, this did not affect their collaborative process. The students did not consider the teachers' role as an important influencing factor.

Both the training session before the start of the courses, and the technical assistance were judged quite positively.

The teachers involved in our research were new to guiding students in CSCL environments and experienced online guidance as more complicated than regular guidance. They were of the opinion that it was difficult for them to supervise students' work, and provide feedback in writing. Moreover, one of the teachers mentioned that stimulating and critical remarks from group members were more effective in getting group members going, than such remarks from the teacher, as is often the case in other learning settings too. It may prove more effective to invest time in stimulating students to provide each other with feedback on content and process, instead of increasing the number of teachers' interventions. Van den Berg (2003) describes the possibilities of peer feedback in Higher Education.

Table 9.4 summarizes the results of the analysis of the relation between the teacher educators' guidance and the students' collaboration. We included those results which in our opinion are important in designing CSCL environments in teacher training. They are further worked out into design principles in Chapter 10.

Table 9.4
Summary of results related to teachers' guidance, organised by design elements and the five perspectives of CSCL analysis

	Participation	Nature of communication	Interaction	Level of information exchange	Regulative communication
Frequency of interventions	Passive teacher role did go paired with intensive and equally divided participation of groups. Active teacher role showed positive relation with student participation.		Interactive role of teacher relates to student interaction.		
Content of interventions	Directive notes relate positively to student responses. Directive notes at start of the assignment generated relatively quick response. Students who did not know each other at the start would have liked to have seen more teambuilding activities in the subgroups, as it would have stimulated their participation.	Evaluative moments with students (F2F) (conversations, exercises) induced social communication and group feeling and can be used as teambuilding activities. Students who did not know each other at the start would have liked to have seen more teambuilding activities in the subgroups, as it would have stimulated their participation.	Directive notes relate positively to students responses. Directive notes at start of the assignment generated relatively quick response.		

Table 9.4 (continued)

	Participation	Nature of communication	Interaction	Level of information exchange	Regulative communication
Technical training	Emphasis on particular assignment in training created an atmosphere of importance of the assignment, stimulating students to work on the assignment. Technical training as designed sufficient for ICT-skilled students to work with a CSCL environment including this type of assignment.			Emphasis on particular assignment in training created an atmosphere of importance of the assignment, stimulating students to show a high level of information exchange.	Level and pace of technical training was not adjusted to less ICT skilled students, generating communication on technical issues.
Technical assistance	Quick, helpful and dedicated assistance was appreciated and helped students in staying involved in the collaboration.				

Chapter 10: Design Principles and Discussion

In this chapter, we summarise the main findings of our research and present design principles for a CSCL environment in teacher training. In the first section (10.1), we outline the research problem and the design of the study. Sections 10.2 through 10.6 summarize the main results of the research for each of the research questions. The findings from the analysis of the relation between the student teachers' collaboration and the clusters of design elements are translated into design principles in Sections 10.4, 10.5, and 10.6, each of which related to one of the clusters: task instruction, online environment, and teacher's guidance. The design principles related to the design context are included in Section 10.5. All design principles we mention result from the interpretation of the research findings based on the evaluation of our designs, and the confrontation of these findings with the theory on CSCL and collaborative learning, and views on CSCL in teacher training. Section 10.7 presents an example of the application of the design principles in the design of a CSCL environment for teacher training. In Section 10.8, we provide some comments on the research design and suggestions for future research. Considerations on the data analysis are discussed in 10.9, which also results in suggestions for further research.

10.1 The Research Problem and Design

The study was focussed on identifying and describing principles for an effective design of a CSCL environment in teacher training. Collaborative learning and learning by interaction are important ways in supporting the learning process of both the student teachers and their students. Facilitating the communication and collaboration between student teachers, CSCL may enhance such learning by interaction. Using CSCL in teacher training contributes to bridging the gap between teacher training and the teaching profession, as beginning teachers have been graduating without proper schooling in the (pedagogical) use of ICT (Kirschner & Selinger, 2003). Moreover, CSCL applications may support the collaboration and interaction between a diverse group of student teachers, increas-

ing the flexibility of teacher training programmes which are faced with a more and more diverse intake of student teachers.

This research concentrated on the design of effective CSCL environments. In addition to a literature study, consultation of experts in CSCL in teacher training generated information on designing CSCL in teacher training. Three CSCL environments were designed, implemented and evaluated in three different existing courses. In the first course, on History Teaching Methods (HTM), the CSCL environment was designed based on the results of the literature study and the expert consultation. The CSCL environments of the second course, the bilingual international teacher training programme or BITEP course, and third course (the In-service course) were designed using the (preliminary) evaluation results of the preceding designs. In the In-service course, task instruction was an essential factor in the design and our evaluation. In all three courses, groupware was used to facilitate the student teachers' collaboration.

In our research, the design of CSCL environments in teacher training concentrated on three clusters of design elements: *the task instruction, the online environment and the teachers' guidance*. The cluster of the task instruction refers to the task itself and the group composition. In the three designs we varied the type and structure of the task, students' role-taking, the combination of F2F and online activities (blended learning), and the group composition. The second cluster of design elements, the online environment, relates to the functionalities of the groupware used, the usability of this groupware and the electronic teaching materials. The third cluster of design elements, the teachers' guidance, refers to the instruction and communication by teacher educators' during the online tasks and the training of the student teachers in the use of the CSCL environment and performance of the tasks. In addition to these clusters of design elements, we identified context elements that do influence collaborative learning in electronic environments, but which were not designed to that end. We summarized these aspects in the concept of *the design context*.

The search for principles for an effective design of a CSCL environment in teacher training was specified into six research questions:

1. How do student teachers and teacher educators evaluate the student teachers' collaboration in the CSCL environments designed within the framework of this research?
2. How can the communication in the CSCL environments be characterised in terms of participation, interaction and content?
3. In what way are elements of the task instruction related to the student teachers' CSCL process?
4. In what way are elements of the online environment related to the student teachers' CSCL process?
5. In what way are elements of the design context related to the student teachers' CSCL process?

6. In what way are elements of the teachers' guidance related to the student teachers' CSCL process?

The answers to these six research questions together provided us with information which is translated into design principles.

Our research involved 36 student teachers and 5 teacher educators of the IVLOS Institute of Education of Utrecht University. Data on the student teachers' and teacher educators' evaluation of the student teachers' collaborative process, and on the three clusters of design elements and the design context were gathered with the help of a questionnaire for all student teachers, and individual interviews with all student teachers and three of five teacher educators. The quality of the questionnaire, the interview and the coding scheme which was used to summarize the data of the interviews, was satisfactory. Data on the student teachers' collaboration (in terms of participation, interaction, and content of the communication) were gathered from the electronic communication. To analyse these data, we developed a multi-perspective method of analysis, which includes several instruments also with satisfactory quality.

10.2 Students' and Teachers' Evaluation of the Collaboration and the CSCL Environment

The first research question to be answered was: *"How do student teachers and teacher educators evaluate the student teachers' collaboration in the CSCL environments designed within the framework of this research?"*. The student teachers' and teacher educators' evaluation is described in Chapter 5.

Student teachers' opinions of the collaborative process varied quite strongly, around one-third satisfied, being positive about the group feeling, atmosphere and feeling of responsibility. They also positively evaluated the regular feedback about progress, the quality of the feedback of group members, and the pace at which feedback was provided to one another. The planning and task division these students had made in their groups worked well and stimulated the collaborative process.

The other students evaluated the frequency and the content of the notes quite negatively. The students in these groups worked individually, assembling their work at the end of the task period without discussing their results. These students were negative about the CSCL due to the technical problems they had to face, a lack of social cohesion and responsibility in the group, a lack of planning and organizational activities in their groups, the disappointing quality of comments, and personal circumstances such as sickness or a busy working and private life. The lack of responses of group members was an important reason for the students' negative attitude. The student teachers of the HTM course were quite

negative as to the collaboration in both the homogeneous groups (members of the same type of teacher training programme) and heterogeneous groups (members of different types of teacher training programmes), although they did mention preferring the homogeneous groups. They also mentioned an additional reason for their disappointment about the collaboration, in that the F2F meetings, in which time had been allocated to attune the work on the tasks and the online collaboration was evaluated, did not result in an improvement of their collaboration, with the exception of one group.

Many students of the HTM and BITEP courses mentioned various reasons for favouring F2F collaborative work to online collaborative work, such as the unsuitability of online communication for purposes of discussion, the inertness of the discussion and the lack of personal and non-verbal communication. This is also found by Van der Veen (2001), who suggests in his study that students preferred to work F2F, allowing for more easy communication. Lehtinen and others (1999) argue that a lack of non-verbal communication can turn the group process difficult when social, motivational, and emotional meanings, which in F2F communication are mediated by different verbal and non-verbal acts of communication, have to be communicated in groupware with its limited repertoire of modalities. The virtues of CSCL (storing, archiving, re-evaluating, editing and rewriting information, offering time to reflect on one's own communication and that of others) were not recognized by the students. These students' attitudes influenced the collaboration. During the interviews the students expressed their reluctance to invest time and effort in CSCL. All such above observations are in line with findings of other research into CSCL in teacher training. Such research indicates that a lack of motivation of student teachers was one of the main reasons for limited interaction and well-supported reasoning in the CSCL environments that were studied (Angeli et al., 2003; Brett et al., 1999).

Two teacher educators were satisfied with the collaboration of their students. The other one was disappointed about the limited interaction, discussion, and collaboration on products, but he was pleased about the fact that the students had now experienced CSCL as an instructional teaching method.

10.3 Student Teachers' Participation, Interaction and Communication

To answer research question 2: "*How can the communication in the CSCL environments be characterised in terms of participation, interaction and content?*", the collaboration of the students of all three courses was studied by analysing their electronic communication (see Chapter 6). For this purpose, we used a method of analysis with five perspectives: the frequency of participation, the nature of the

communication, the interaction, the level of information exchange, and the use of regulative communication.

Each of the five perspectives was analysed separately. In the first perspective, the degree of participation as expressed in the frequency of notes and documents sent and received, differed between groups, ranging from sending 5 to 121 notes. In general, all three courses showed an equal distribution of notes and documents sent and received within the groups. In some groups one group member became dominant in sending notes and files. Overall, the students consistently sent their messages and documents to all group members, independent of how active the individual group members had been. The teacher educators of all three courses barely participated, except for the teachers involved in one of the BITEP assignments.

The nature of the communication, the second perspective, is expressed in task related, regulative and social content of the communication. In all three courses, the student teachers communicated in most notes about regulative issues. In addition, the In-service student teachers discussed task related content in about 60% of their notes, whereas the HTM and BITEP students did this in only one-third of their notes. Most of the HTM and In-service students barely communicated about social issues in their group. The fact that the students met each other F2F probably affected the number of notes with social remarks. The BITEP student teachers communicated more about social matters. A separate forum for communication of social matters issues in the course environment did not prevent the students from also communicating about social matters in their group areas. These students felt a strong need to remain in contact, as they knew each other well and found themselves located in different schools abroad.

In the design of the courses, we tried to stimulate students to work with threads as the structure for interaction (Perspective 3), as this may support knowledge building in groups. Over time this was increasingly successful, ranging from 50% of notes being threaded in the first course to almost 100% in the third course. The length of the treads was quite short (averagely three to four notes for all three courses).

In the fourth perspective, we measured the level of information exchange. There has been a development in the students' level of information exchange. In the first course in 25% of the notes information has been exchanged on a deep level, in the third course this was in 50% of the notes.

Perspective five had us further analyse regulative communication, as distinguished in four types: planning, evaluative, organizing, and technical communication. In general, one aim of the assignments was to have the students plan and organize their own collaboration. Around 50% of the students' notes included remarks related to planning and evaluation. Even in highly structured tasks, the students still used this kind of communication. Organizational communication, which refers to the communication the students used to regulate the online com-

munication (see Chapter 4), was used in 50% to 70% of notes to structure and clarify their documents and texts. Discussion about technical issues decreased over all three courses, from around one-third of the notes in the first course to below 10% in the third course. Also within each course, communication about technical issues decreased.

Taking the results of all five perspectives into consideration, we may conclude that the improvement of the design, especially the urge to increase the interaction on the content progressively through the three courses has influenced the collaborative process positively, as in the third course the collaborative process of the groups has been the most intensive and interactive. Additionally, during this course the students focussed relatively more on task content, also showing a deeper level of information exchange than the student teachers of the other two courses. In terms of the model of Salmon (2000), we conclude that, generally, the emphasis of the collaboration between the student teachers in the first course (HTM) occurred in the first two stages of this model (getting access and motivation to spend time, and socialisation). The HTM students also exchanged information (stage 3) on regulative matters and to a limited degree exchanged information on content. The students of the second course (BITEP) reached stage 3 in one ore more assignments, providing each other with content related information and feedback. However, in most cases this did not lead to discussions on content resulting in commonly generated conclusions on content. Some of the BITEP students and all students of the third course (In-service) reached this stage 4 of the collaborative creation of knowledge.

10.4 Task Instruction

The third research question refers to the cluster of design elements related to the task instruction: "*In what way are elements of the task instruction related to the student teachers' CSCL process?*". Student teachers' and teacher educators' evaluation of the task instruction was gathered by means of the student questionnaire and the interviews with both students and teachers. In Chapter 7, this information was related to the student teachers' collaborative behaviour in the various tasks, which is studied in terms of participation, interaction and content of the communication, using our multi-perspective method of analysis.

During the different tasks, the student teachers varied in degree of participation, nature of the communication and level of information exchange. Although there are differences between the student teachers' collaborative behaviour during various tasks within a course, the main difference is found between the student teachers' collaboration on the assignment of the In-service course and the students' collaboration in all other assignments. In the In-service course the student teachers showed a relative high degree of participation and interaction and,

showing a relatively deep level of information exchange, they were more focused on content. With respect to regulative communication, student teachers' communication about planning and evaluative issues was comparable during the different tasks, but they varied in the communication on technical issues and organisational communication.

The task instruction varied in several ways (see Chapter 3). Below, we discuss the relation between the task instruction and the student teachers´ collaboration, presenting related design principles, organized by design element.

10.4.1 Task Subject Related Motivation

In relation to the subject of the task, the students' motivation for the task influenced their participation. They indicated they were more motivated to work for tasks in line with their teaching concerns. In teacher training programmes generally the importance of concern-based training is recognized, which means the students are motivated for tasks oriented at their teaching practice and relating to their own teaching experiences, as described for instance in a study by Admiraal, Lockhorst, Korthagen, Veen, and Wubbels (1996) on the use of an email list in teacher training. Such subjects increase the chance of having intrinsically motivated students, and, in reference to Slavin (1995), of enhancing the probability of successful collaboration between student teachers. Lave and Wenger (1991) argue that the learning process evolves more naturally and easily when learning is connected to the professional practice. Therefore, the following design principle is relevant.

1 In order to increase participation in CSCL, use tasks focused on student teachers' own teaching practice.

10.4.2 Type of Task

The student teachers' motivation for the task can even be made stronger when the task focuses on the exchange of information about the student teachers' own teaching experiences. Concerning the types of learning objectives of an assignment, this study shows that objectives differently influenced students' participation in the collaborative groups. The students involved in this research considered the tasks aimed at the exchange of experiences useful, whereas an assignment in which the students were required to provide feedback on group members' products was seen as less meaningful, resulting in less participation. In this latter type of tasks, students had to provide group members with feedback on products without receiving feedback in return. Van den Berg (2003) found in her study on peer assessment in university teaching that non-mutual feedback is more difficult to organise as students do not feel they are receiving something in return. This

may be the reason why the student teachers in our research preferred to exchange information. During the assignments on learning experiences in the classroom, the students also exchanged information on a deeper level.

2 In order to stimulate participation and a deeper level of content discussion, use tasks aimed at exchange of information and discussion of own teaching experiences.

According to Cohen, (1994) challenging tasks motivate students to work on the content of the task and generate positive interdependence. As mentioned under the previous design principles, having intrinsically motivated students increases the chances of successful collaboration. The students of the In-service course labelled their task challenging and creative. They were required to write a fictional story about a teacher, including three of their own teaching experiences. One of these experiences had to be rewritten on instigation of the group members. Quite literally in this assignment, student teachers' reflections and interactions were linked, which, in Chapter 2, we indicated as one of the virtues of CSCL. Both the story writing and the mandatory discussion of personal teaching experiences stimulated reciprocal exchange, and both were referred to as challenging and creative, motivating the In-service students for the task. This means that:

3 In order to enhance the participation and the students' focus on content, use challenging and creative tasks in CSCL.

Our tasks differed as to the expected end products. Some tasks, such as the TIE assignment of the BITEP course, required an individual end product, which resulted in a lack of shared responsibility and positive interdependence. During other tasks, students divided the task, compiling their work at the end without thorough discussion. The students indicated they had worked individually, which decreased group participation and interaction. The analysis of the online communication shows this individual way of working did not result in different communication about task related content. As an assignment in which students created a shared end product, the In-service assignment had students writing parts of one product with information from written parts of group members and the group discussions. In this assignment, students were virtually forced to participate and interact, otherwise finding themselves left without input to carry out their part of the story. This highly stimulated positive interdependence and promotive interaction.

4 In order to stimulate participation, use tasks that require shared end-products, giving no room for simply compiling individual subproducts at the end, without thorough discussion.

In our research, the student teachers participated and interacted more intensively, focussed more on task related content, and communicated on a relatively deeper level of information exchange in tasks with an instructional method based on debate including built-in controversy. Such a task was the In-service assignment. In Chapter 2 we described the effects of such tasks as promoting reciprocal exchange, verbal interaction, exchange of points of view, elaborated reflections and re-evaluation of students' own position (Cohen, 1994). Aimeur and Frasson (1996) describe the positive effects of the use of 'learning by disturbing' in an experiment at the University of Montreal using a computer based intelligent tutoring system, in which a so-called 'troublemaker' interferes in the learning process with provoking statements. It challenged learners to argue, and it motivated them to be involved in the discussion. A comparable role was used in the In-service assignment, which had one of the group members forcing the others to change elements of his products (see Chapter 3 for a description of the assignment). The In-service students mentioned that the inclusion of learning experiences which had to be discussed, and the controversial roles of group members, forced and helped them to reflect on their teaching behaviour. The positive effects of built-in controversy lead us to the following design principle.

5 In order to stimulate the student teachers' participation, interaction on task related content and their level of discussion, use debating type of tasks with built-in controversy.

In relation to all design principles discussed above in teacher training, one could think of assignments including debate on classroom management problems.

The students varied in their evaluations of writing products as an instructional method in CSCL. Some thought it enticed them to divide tasks, as writing together on one product seemed difficult. This is in line with Veldhuis-Diermanse (2002), who also found that students were inclined to subdivide tasks when working on writing products. Other students thought the groupware an excellent medium for writing and rewriting products together. We think writing assignments are suitable for online usage when embedded in a structure in which the students depend on each other's work to carry out their parts of the task, as it guarantees positive interdependence and promotive interaction. Further research will be needed to study writing assignments in CSCL, especially in relation to one or more of the abovementioned design principles concerning the task.

10.4.3 Task Structure

We varied in the use of pre-imposed structure in the tasks. After noticing limited interaction during the CSCL assignments of the HTM course, we included assignments with relatively high pre-imposed structure in the BITEP and In-service courses, as advocated in the literature (e.g. Sorensen & Takle, 1999) and by our experts, in looking to remedy the limited interaction in CSCL. The results of the analysis of the electronic communication shows that, during tasks with a pre-imposed structure including built-in controversy, the students participated more and were more focused on content. When designing a course in which a CSCL environment is used, it seems important to estimate to what extent the student teachers will be motivated for the task, because a highly pre-imposed structure risks decreasing the motivation and even suppressing the online collaborative process of already intrinsically motivated students (Cohen, 1994). Although the In-service students were intrinsically motivated, the task instruction included a pre-imposed structure to organize the built-in controversy. However, following the advice of Ronteltap and Veen (2002), to find a balance between the task structuring and self-management of the learning process, we left the task structure open enough for the student teachers to plan and organise their collaboration. The online communication shows they indeed used regulative communication to plan and evaluate their collaboration. We would advise to determine the degree of task structuring also in relation with students' prior experience with working in a CSCL environment, as a strong structure may give experienced students the feeling of being restricted in their freedom of movement.

Our data on the use of a pre-imposed structure also showed that not intrinsically motivated students were stimulated to participate and focus on content in tasks with any pre-imposed structure, even without built-in controversy. This was the case in the TIE assignment, for which the students were not really motivated. Some of the TIE students explicitly mentioned the structure had assisted them in discussing the content. All this brings us to the following design principle:

6 In order to stimulate participation, interaction and discussions on content, use a pre-imposed structure with built-in controversy. When the teacher/designer anticipates the students lack motivation for the task, a pre-imposed structure without built-in controversy also assists students in performing the task.

Role-taking is seen in this research as part of the task structure. In line with the literature we studied, our results on role-taking are ambiguous. It did increase the level of information exchange, but it decreased the level of participation. During the TIE assignment of the BITEP course, the students with the role of providing group members' lesson plans with linguistic feedback, performed learning activi-

ties on a deeper level of information exchange as compared to the other students of this assignment, even though some of the students were quite critical towards the aspect of role-taking. However, their degree of participation was lower.

Except for the role of the leader, we did not find any of the roles Singley and others (1999) identified in collaborative learning. There were groups in which a leader role developed by one member taking on responsibility for planning and task division, and for keeping members on track. This role showed characteristics of 'The Planner' and 'The Communicator' roles as defined by Strijbos and others (2004) (see Chapter 2). The students of these groups appreciated this role-taking, which brings us to the following design principle.

7 In order to help students collaborate, task instruction should include organizational role-taking, particularly the role of a group leader to divide the task, plan activities, and feeling responsible for the work of the group.

One of the most important reasons for some of the student teachers' negative evaluation of the collaboration was the lack of (regular) response of group members. Regular communication is needed to keep a group 'alive', and motivates group members to work on the task, and to work together. This means that student teachers should respond to each other regularly, remaining in contact even when work is not progressing. In a study of Sorensen and Takle (1999) requirements on the frequency of sending and responding provided the students with the idea of 'presence' and 'shared space'. One of the CSCL experts we consulted also recommended us to use a strict schedule of deliverance of contributions to the online discussions.

8 In order to stimulate participation and to keep a CSCL group 'alive', stimulate students to communicate regularly, for instance by including clues in the task instruction for an effective frequency for responding.

Depending on the students' experience in working in CSCL environments, the level of task structure, and the perceived motivation of the students, such clues can differ in character, from suggestions on 'netiquette' in the online collaboration (e.g. 'let group members hear from you even you did not work on the task') to scheduling the frequency of participation (e.g. 'contribute to the online discussion at least three times a week').

10.4.4 Compulsory or Voluntary Participation

The degree of participation was higher in assignments with voluntary participation, as in the In-service assignment and the Research assignment of the BITEP course. One might expect student teachers participating in these assignments to

be intrinsically motivated. From the interviews we know these students indeed were motivated to work on the task and to collaborate online. According to one of the teachers, the students' collaboration would have been less successful had the assignment been compulsory.

9 Intrinsic motivated student teachers increase the participation in CSCL. Voluntary participation in assignments is a way to involve motivated student teachers in CSCL.

No doubt, in many cases student teachers have no choice whether to participate in a course or not, because several parts of the training are mandatory. Freedom of choice in programme parts or assignments in a course could yield a semblance of voluntary participation.

10.4.5 Period of Time Available for Assignment

With respect of the period of time available for assignments, the student teachers indicated that assignments of two to four weeks are too short for collaborative online work. In teacher training, part of the student population consists of students with a part-time teaching job and/or a busy family life. This could mean they can only contact groupware during the weekend. In general, the student teachers said that online discussion took them more time due to its a-synchronous character. This is in line with the statements of our experts, and Ellis and Bruckman (1999), Heilesen, Cudrio Thomsen, and Cheesman (2002), and Veldhuis-Diermanse (2002), who also found that online tasks generally take more time than F2F ones, due to the amount of time needed for the interaction in a-synchronous media. Our research shows 10 to 14 weeks to be an effective period of time for a CSCL assignment.

10 In order to establish a constructive discussion on the task, CSCL assignments should have a duration of 10-14 weeks, which for our student teachers proved to be an effective period of time for responding to each other and bringing the assignment to a successful end.

10.4.6 Blended Learning

Getting group members acquainted is often the reason in other research for recommending alternated F2F and online education (Cheesman & Heilesen, 1999; Veldhuis-Diermanse, 2002). The combination of F2F and online communication can also be useful when either supports particular aspects of the learning process and as a combination reinforcing the learning process. We found that in assignments in which F2F meetings were not planned for teambuilding or complementary to the online collaboration, students were inclined to discuss the content of

the assignment F2F as they simply preferred this way of communication and thought it easier and more expeditious to discuss F2F. According to the students, the combination of F2F and online education decreased the participation and the interaction in the online discussions. This result is in contradiction with Veldhuis-Diermanse (2002, p. 160), who recommends: "Organise regularly (once a week) a face-to-face meeting: experience shows that communications in a CSCL-system is more natural and easy when students meet each other regularly. Besides, students feel more compelled to participate in the system when they sometimes see fellow-students in real life". Having students discuss content F2F creates a risk of the discussions on task content becoming fragmented. In Chapter 2 we indicated the importance of text mediation as an effective means to stimulate elaborated and reflective discussions, turning the students' learning process visible. This will be less so, or even completely missed with parts of the discussion taking place F2F. Moreover, when parts of the learning process are done F2F, the teachers' monitoring possibilities decrease. All that brings us to formulate a next design principle:

11 If teambuilding or a complementing combination of F2F and online education are not aimed for, blended learning (here the combination of F2F and online learning) may decrease students' participation in CSCL and the learning effects of the students' online discussions.

10.4.7 Scheduling within Teacher Training Programme

According to the student teachers of two of the courses, other parts of the teacher training programmes, which were perceived to be more important, such as the portfolio assessment, competed for the students' time and attention, which resulted in less participation and attention to the content of the online discussions. Obviously, this principle holds true in every course programme, but we assume it is even more applicable when online and F2F courses are scheduled parallelly. It is easier and safer to withdraw from an online course, as in F2F collaboration group members can address their group members more easily, reminding them of their duties. When scheduled alongside F2F courses requiring much attention of the student teachers, action should be undertaken to keep the students involved in the CSCL course. A related design principle is:

12 In order to prevent decreased students' participation and attention to task content, do not schedule the CSCL assignment parallel to F2F courses or parts of the teacher training programmes requiring much attention of the student teachers. If parallel scheduling is unavoidable, take extra actions to keep students involved.

10.4.8 Group Composition

Unexpectedly, the design aspects concerning group composition seemed to play only a minor role in the collaborative process. In the HTM assignments, the aim was to create collaborative situations in which student teachers with different teaching experiences and from different types of training programmes (Pre-service, In-service, BITEP and Specialties) learned from each other. The literature had provided us with arguments for using compositional heterogeneity, the rationale being that different viewpoints and experiences originating from the different backgrounds of group members might trigger interaction (Dillenbourg et al., 1995; Veldhuis-Diermanse, 2002) and stimulate positive interdependence. However, we found no differences in communication which could be attributed to group composition, apart from the fact that the groups with students from the same training programme showed less participation. In the students' perception however, group composition was an important factor. According to them, differences between teaching experiences of group members created different needs, resulting in incoherent end products as each group member worked from his own learning aim. This is in line with studies indicating that heterogeneous groups reduce interaction due to an absence of ties between group members (Heilesen, Cudrio Thomsen, & Cheesman, 2002). This leads us to the following design principle:

13 Use groups with student teachers with similar teaching backgrounds and experiences.

Another factor of group composition to be taken into account is the role of personalisation in CSCL. Almost all student teachers considered a social structure in which group members already know each other, as more stimulating. They consider ´social coherence´ essential to safe surroundings for providing and receiving feedback, which is also observed in other research, e.g. Kirschner, Jochems, and others (2003). Social coherence results in more promotive interaction. The students perceived personalisation (e.g. knowing each other, valuing each other's contributions and mutual trust) as a precondition for social coherence. This is in line with Kirschner, Jochems and others (p. 27), who stress the importance of "building of a 'social space' between group members, in which beliefs, values, roles, and opinions can be shared or at least be known and respected". However, there were no differences in the communication which could be attributed to this aspect of group composition. Still, considering the students' perception on the role of personalisation in CSCL, and other studies, we formulate two design principles:

14 Use groups in which members know each other well, as this is experienced by student teachers as stimulating the collaborative process.

15 In a situation in which students do not know each other, at the start include F2F meetings for teambuilding activities as student teachers prefer to work with group members they know.

10.5 Online Environment and Design Context

This section presents an answer to research question 4: *"In what way are elements of the online environment related to the student teachers' CSCL process?"*, and research question 5: *"In what way are elements of the design context related to the student teachers' CSCL process?"*. Describing the analysis procedure and results in Chapter 8, here we summarize the results and formulate relating design principles, organized by design element.

10.5.1 Functionalities of the Online Environment

In our research we used BSCW© and WebCT, rather basic groupware including a Bulletin Board, a file exchange server, an option to provide course information, and an option for creating group areas. In general, the student teachers and teacher educators were satisfied with the functionalities of both programmes. In the type of courses and assignments we studied in our research, and using the groupware in small groups, this kind of groupware was sufficient for supporting the collaborative process of the student teachers, who did appreciate the basic nature. In Chapter 2 we indicated that several presenters at various CSCL conferences have studied the development of all kinds of technical tools for supporting the interaction in CSCL. We also indicated that several other researchers found that the amount and nature of the collaboration has less to do with the technical environment and more to do with the task (see for instance Baker, and others, 2003; Kanselaar and others, 2000; Veen, 2001). Often, more advanced functionalities are not used by students when not really needed to perform the task, as was the case in our research. BSCW for instance included a facility to connect the discussion directly to the content, as recommended by the experts, but the students did not use it.

16 Use groupware with only those functionalities that are needed to perform the CSCL task at hand, keeping groupware usage simple.

The literature (see for instance Kreijns, 2004; Reffay & Chanier, 2003) stresses the importance of social interaction for creating a CSCL community with high

positive interdependence, promotive interaction and group processing. It creates a group feeling and an atmosphere of trust and respect for each other's opinions. The experts consulted in this research indicated that a CSCL environment should include a social area where students can meet socially online. We paid specific attention in our research to the use of a social area in the groupware. We found that students meeting peers at F2F meetings, whether or not related to the course, nor necessarily group mates, did not feel a need for online socialization. Overall, the students were quite indifferent as to the availability of such an additional functionality, as they also were with respect to the availability of functionalities like a chat room or a private mail option. The students of the BITEP course were the exception to the rule. The BITEP student teachers were located abroad for some months and not able to have F2F contact with most other course participants. These students, who knew each other well, considered the CSCL environment their home base - an umbilical cord with the teacher training institute and their peers. It was their environment to work in and communicate from, and because of this the additional functionalities of the groupware were valued. The following design principle is related to this, but may well be applicable only in situations in which students know each other.

17 When there is no F2F contact between student teachers and teacher educators for a longer period of time (e.g. during teaching practice periods or in virtual teacher training programmes), the CSCL-ware should include more functionalities (such as a chat facility, a private mail option and a social area) than in other online training situations.

According to the BITEP students, a chat room can be useful when discussing practical problems or for brainstorming sessions, provided agreements and rules on communication are adhered to. We recommend prior technical training in the use of a chat facility, as well as training on how to work and behave in a chat facility.

18 A chat facility can be used in CSCL environments to discuss practical problems or to get a quick view on group members' opinions.

10.5.2 Usability of the Online Environment

In relation to the usability of the groupware, some of the students were critical with respect to the structure of BSCW© and the WebCT files exchange server. The unclear structure generated communication about technical issues, such as notes and files mysteriously disappearing. Still, according to the student teachers, this had little impact on their collaboration. The impact of the groupware's user-friendliness was less than expected. The student teachers criticized one aspect of

the user-friendliness of both BSCW© and WebCT, though, missing an effective notification of files and notes to support the organizational communication, i.e. communication related to co-ordinating the collaboration - needed specifically as the non-verbal behaviour to organize group communication (e.g. presenting documents, gesturing for attention) is impossible. Organizational communication is a way of communication triggered by CSCL, and not found in F2F collaborative communication. One could think of some sort of alarm functionality by email to update users when notes or documents are added or adjusted, and where to find these. There are already virtual environments, like BSCW© version 4.1.4 and Community Zero™, in which the participants regularly receive updates of all changes in the environment. Many students preferred to receive notification of changes in the CSCL environment by email, as they daily check the mailbox.

19 CSCL environments need functionalities to support the organization of the online communication, such as notification of all changes in the environment or automatically sent email with information on changes or notifying the addressee that particular actions are needed.

Threads are an often used way to organize discussions in groupware, keeping them conveniently arranged and effective. The BSCW© and WebCT discussion areas offer threads as a structure for the discussions. The student teachers experienced the thread structure as convenient. However, in two courses a considerable part of the notes was not responded to and overall the threads appeared to be quite short. These results are in line with other studies on CSCL (see for instance Arnseth et al., 2001; Lipponen, 2001; Muukkonen et al., 1999). We realise that effective use of threads cannot be taken for granted in CSCL environments and should be stimulated.

20 To effectuate threaded discussions in CSCL environments, thread usage should be stimulated, for instance by training students in using threads.

In the future, with new generations of learners with other communication strategies and habits (such as described by Lindstrom, 2003; Veen, 2000), a threaded structure may become outdated. Such learners may possibly not be helped with threads, more used as they may be to communicate in short lines, generating knowledge in non-linear ways, scanning information and hopping from one bit of information to the other.

10.5.3 The Design Context

In the student teachers' perception, some of the design context factors, such as their busy daily schedule or the situation at their practical training school, were

important influencing factors. However, their online communication shows no evidence for this, as those who indicated having been busy or experiencing problems at school did not behave differently from the other students in the collaboration. Only the location abroad of the students of the BITEP course influenced the participation of some of the students. Difficult access to computers and time differences between locations complicated the synchronous collaboration.

The student teachers were responsible for their own computer and Internet access. Only during the first course were students provided with a modem and an Internet account. In general, there were only minor problems with hardware and software. Technical problems with hardware, access to the Internet and the groupware sometimes frustrated students, but only very few students dominated their group by communicating much about technical problems. Problems were solved relatively quickly consulting the technical assistant and the IVLOS helpdesk. When problems were more severe, students found other ways for their communication (e.g. using computers from friends, or libraries). Still, we would like to stress that a good technical situation of the student teachers stimulates their participation and helps keeping the students focused on the content of the task.

21 In order to stimulate a well-functioning CSCL process, the student teachers need a good technical situation (well-functioning hardware, groupware and access to the Internet), preferably at home.

In Chapter 8 we have indicated that the ICT skills of the student teachers influenced the participation and interaction of the students in the collaboration. Less ICT-skilled students (inexperienced in the use of MS Windows®, MS Word®, the Internet and email applications) ran into difficulties when working with the groupware and hardware, resulting in low participation and interaction. Training could have helped these students. ICT skilled group members however, became dominant in their groups, sending much more notes and documents than their group members. When an equally divided participation in collaborative groups is one of the requirements for the collaboration of student teachers, as was the case in the courses in this research, the course designer should take into account that, in small groups, those who are highly skilled in ICT become dominant in sending notes and documents. Bringing such skilled students together in one group or personally addressing their behaviour during the course, may avoid such overbearing behaviour. This brings us to the next design principle, a part of which is further unfolded in the next section, in a second design principle related to teachers' guidance.

22 In CSCL, the designer should take the ICT skills of the students into account and act accordingly, by training less ICT skilled students (see 10.6.3), addressing the dominance of ICT skilled students, and composing groups of only ICT skilled students to prevent them becoming dominant in groups with less ICT skilled students.

10.6 Teachers' Guidance

In Chapter 9 we described the teacher educators' communication, related it to the student teachers' communication and the students and teachers evaluations of the teacher educators' role. This resulted in an answer to research question 6: "*In what way are elements of the teachers' guidance related to the student teachers' CSCL process?*". The main findings and related design principles are presented here, organized by design element.

In the design of the courses we did not want to interfere substantially in the teacher educators' established personal ways of teaching, as other research advises to remain close to the teachers' daily guiding routines (Veen, 1994; Veldhuis-Diermanse, 2002). The teachers of all three courses took a passive role, leaving the planning and organisation of the task to the students. In one of the assignments of the BITEP course, the teacher educators took a more active role, sending much more notes than their colleagues. In general, the student teachers were quite clear that in their view the teachers had a minor role, and did not largely influence their collaborative process.

10.6.1 Frequency of Interventions

The relation between the frequency of the teacher educators' interventions and the students' collaboration is ambiguous. First, there were assignments in which the teacher educators had a passive role, showing a low frequency of intervening, and the student teachers being relatively active. For instance, the In-service course had the teacher educator merely sending a total of six notes, the students participating and interacting actively, focused on content and showing a relative deep level of information exchange. Second, there were assignments with passive teacher educators and students also showing relatively limited participation, as in some of the HTM assignments. Third, during the only assignment in which the teacher educators had an active role (in two of the three groups even sending more notes than the individual group members did), the groups of student teachers also showed a relative high level of participation and more interaction in discussion threads. Moreover, the student teachers indicated that this active role of the teachers motivated them to collaborate. Ronteltap and Van der Veen (2002), reporting on an evaluation of the use of e-learning environments, found

corresponding results on the motivational effects on students. This ambiguity makes it difficult to say what would be the most effective frequency for teacher educators' interventions. In line with Bernheim Brush and others (2002), our research shows the friction in the choice between the passive teacher leaving the process to the students, and the active teacher, responding and stimulating but restricting the students' freedom to develop their own collaboration. Still, two design principles can be formulated.

23 In order to increase the student teachers' participation and interaction in CSCL, an active role of the teacher educator may be of assistance.

24 In order to have student teachers participate, interact, and focus on the content of a CSCL assignment, an active role of the teacher educator is not required, provided a teacher educator' passive role is compensated by other design elements, such as elements of the task instruction, or elements ensuring intrinsically motivated students.

10.6.2 Content of the Interventions

In relation to the content of the teacher educators' interventions, we distinguished three types of functions of the online teacher, mainly based on the work of Paulsen (1995) and Salmon (2000). In the 'organizational' type, guidance is focused on structuring the communication. In the 'social and regulative' type, the teacher stimulates the collaborative process of the students, and in the 'intellectual' type, interventions are made on the content of the students' work. Overall, the teachers' interventions in our research focused on regulative issues, stimulating the collaboration and the work on the task (social/regulative function). Less attention was given to the content of the students work (intellectual function), nor did the teacher educators structure the communication (organizational function). With specific attention we studied the teacher educators' interventions in the Research assignment, which was the only assignment in which each group was guided by a different teacher educator. Although the content of the interventions differed, this did not cause significant differences in the collaboration of the students.

Besides studying the nature of the teachers' communication, we also analysed the degree of direction in the teacher educators' notes. In about 50% of their notes, they directed students towards the content of the task or to the collaborative process. The students were directed in a certain direction to deal with the task content, or were stimulated to provide each other with content related feedback. The direction towards the collaborative process was focused on stimulating groups to plan and organise their work and stimulating individual students to start working. Analysis of the students and teachers' electronic communication showed

that the teacher educators' notes, including directive communication sent at the start of the assignment, did stimulate student teachers to participate in the discussion and (re)start online discussions. This is expressed in the next design principle.

25 In order to stimulate students to participate in and (re)start discussions, the teacher educator should send notes including directive communication in the beginning of the assignment period.

One teacher particularly focused on evaluation of the students' collaborative process, organising F2F meetings in which the groups evaluated their collaboration process, in order to stimulate intra-group reflection (group processing) and to increase the individual accountability of the student teachers. In the perception of some students, this stimulated group feeling and promoted teambuilding. The electronic data however, showed that these evaluative meetings stimulated social communication but did not stimulate communication on task related content. The use of evaluative F2F meetings to improve the collaboration in terms of increasing task related content discussion was not effective. This finding deviates from statements by Cohen (1994) on the importance of students' reflection on the group process and individual roles, and Veldhuis-Diermanse (2002), who recommends to evaluate the progress of a course, as interim evaluating helps students keeping focused on the task.

26 In order to get participants acquainted with each other do use evaluative F2F meetings. Do not use evaluative F2F meetings for increasing the students' communication on task content, but use other means, such as particular types of tasks.

10.6.3 Training and Technical Assistance

We considered the training and technical assistance parts of the teachers' guidance. The three-hour training session administered by the technical assistant and teacher educator consisted of technical training on the use of the groupware and training on the collaboration needed during the assignments. We assumed the student teachers to be familiar with the use of MS Windows®, MS Word®, email, and accessing the Internet. Overall, the students were very positive about the training, which was more or less the same for all three courses. All ICT experienced and some of the less experienced student teachers were sufficiently trained to collaborate on the assignments without problems.

27 In order to have ICT skilled student teachers work in a CSCL environment, a short training session focused on developing the students' technical skills and the performance of the assignment is sufficient.

We noticed that the less skilled students were responsible for most of the communication about technical issues in the groups and occasionally participated less than the other students. According to both the ICT skilled and the less ICT skilled students, the technical problems of the less skilled distracted from the content of the task. Extra training on the basics of computer usage may prove a meaningful addition to the regular training.

Part of the training session was oriented at the assignments, which were explained and the students were trained in performing the assignments by working on a small mock version. Those assignments that were explained and practiced were the most important ones in the students' perception, as the students' interview statements showed. Students became extrinsically motivated. For example, the TIE assignment of the BITEP course was explained and practiced quite intensively at the training session. Therefore, according to the BITEP students, they felt stimulated to work on the assignment and perform well. In our view, this may have been the reason why the students exchanged information on a relatively deep level in this assignment, for which, initially, they were not motivated.

28 In order to increase students' participation in a CSCL task, the task should be explained and practiced in a training session prior to the course.

As indicated by the student teachers, the technical assistance, which consisted of the institute's helpdesk and a technical assistant available by email and phone and in some cases even visiting students with technical problems at home, was sufficient to guarantee online collaboration. This leads us to the following design principle.

29 In order to support participation of the students, quick, helpful and dedicated technical assistance, for instance by phone, email or even house calls, should be available during the entire course.

However, this design principle is of a very temporary character, as one might expect the hardware situation at home and the ICT skills of student teachers to improve in the coming years. As a consequence, technical assistance will become a less important factor.

10.7 Design Principles: An Example of Usage

This section describes design elements for a CSCL environment in a hypothetical teacher training course, using our design principles. Prior to the presentation of the example, we will discuss some aspects of the deployability of our design principles in other contexts.

As often in design research, we used small samples, e.g. three courses from the same teacher training institute, with a limited amount of respondents. In such cases, Van den Akker (1999, p. 12) suggests one should use "analytical forms of generalisation: readers need to be supported to make their own attempts to explore the potential transfer of the research findings to their own context". Such analytical forms of generalization are used in our research, providing a clear theoretical argumentation for our designs, a clear description of the evaluative process and implementation context, and as Van den Akker (1999, p. 12) argues, by "thick description of the process-in-context, the ecological validity of the findings might be secured". A 'thick description' provides designers of CSCL the possibility of translating the design principles into their own context. Specific aspects in relation to the generalization of this research are the technological developments and the maturation of the ideas on usage of CSCL in learning and training. This makes our research a product of its time.

Figure 10.1 (see p. 218) provides an example of the application of our design principles for designing a CSCL environment in another teacher training context, not in completely arbitrary sequence. After an inventory of the design context, we suggest designers develop the task(s) as a first design activity, this in consideration of the relevance of the task instruction in the design of CSCL in teacher training. Upon the arrangement of the task, the design of the online environment and the teachers' guidance can be developed.

10.8 Considerations on the Research Design and Suggestions for Future Research

10.8.1 The Friction between Action and Guided Learning

The CSCL environments we studied in our research were designed from a constructivist point of view. Social constructivism has induced new ideas about learning. In these new ways of learning the learner has increasing control of his own learning process. Simons and others (2000a) refer to action learning, in which the learner determines the goals of the learning according to his needs, in which learning is self-organized and self-planned, and in which the learner determines his own ways of self-testing. However, although in the IVLOS teacher training programme student teachers increasingly control their own learning process and programme, guided learning has taken an important share in the pedagogical orientation at the three courses of this study. It was the teacher educators who determined the task, the learning environment and the way of guidance. In some of the assignments, although the teacher provided the task, action learning was stimulated as the students themselves could determine their subjects, the learning activities and their collaborative process.

Figure 10.1 *Example of the use of the design principles in designing a course in teacher training.*

Figure 10.1 (Continued)

It would be interesting to study to what extent the results of this study can be transferred to educational situations in teacher training programmes more directed to action learning. In our opinion, using action learning as learning strategy in teacher training, usage of a CSCL environment will have an important role dependent on the field of study, the students involved and whether or not learning takes place completely online. To be able to study the design principles of a CSCL environment in which student teachers are more trained according to the principles of action learning, experimental studies have to be developed in which parts of the teacher training programme are transferred to training situations that are based on this kind of learning. Such research may provide information on future usage of CSCL environments in teacher training programmes in which action learning has a role.

10.8.2 The Role of a Social Atmosphere

Many CSCL studies refer to the importance of social interaction in distance learning (for example Coa & Greer, 2003; Haythornthwaite, 1999; Kirschner, Jochems, & Kreijns, 2003; Kreijns, 2004; Lehtinen et al., 1999). Social interaction creates a social atmosphere, in which each other's values and beliefs are respected, and which is safe allowing one to be critical to each other without disturbing the atmosphere. A good social atmosphere supports the cognitive processes. A socially safe and open surrounding is even more important in teacher training, as students learn and work under exciting and vulnerable circumstances. One of the student teachers participating in our research explicitly mentioned group members accepted each other's feedback and felt free to discuss, sometimes even painful, personal experiences and problems, precisely because of the safe (read social) environment.

According to Kirschner, Jochems and others (2003), social off-task communication has an important role to play in the creation of such a social atmosphere. In our research we did not find a relation between the students' online social off-task communication and their content related communication. Moreover, after teambuilding activities to improve the collaborative process of the students, the social communication increased while communication about task content decreased.

The data of the interviews led us to understand that in this research all kinds of other aspects may have influenced the social atmosphere. According to the student teachers interviewed, knowing each other has been the essential condition for the existence of a social space. In CSCL environments used in a training programme in which the learners also meet each other F2F, this seems more important than the presence of social affordances used to stimulate the social interaction such as described by Kreijns (2004) in his study of the use a CSCL environment at the Open University in The Netherlands (see Chapter 2). The student

teachers and teacher educators mentioned also the motivation of the group members to work on the task and to collaborate, the student teachers' feeling of responsibility towards the other group members and the tasks, personal relationships, and explicit or implicit role division directly or indirectly influenced the collaboration on the task.

We support the relevance of further research into the means for stimulating a social atmosphere in CSCL situations and the influence of the social atmosphere on the students' interaction on content.

10.8.3 Teachers' Role Underexposed

In Chapter 2 we observed there is little information on teachers' guidance in CSCL. Teachers and designers are searching for the aspects of their guiding routines that work well in CSCL environments, and for new guiding principles that should be developed. Our research too, only generated limited information as to the teacher educators' role. This was inherent in our choice for not interfering with the teacher educators' existent guiding routines. Most of the teacher educators involved adopted a passive role, which left us with only a limited amount of data about frequency and content of teacher educators' interventions.

Studying the role of the teacher educator will require evaluation of courses in which the teacher educators communicate more. The question is whether we should use quasi-experimental research methods providing the teacher educator with guidelines on how to guide student teachers. Heilesen and others (2002, p. 642) argue: "the free choice of teaching methods has no future in this kind of online teaching". Maybe we should challenge teacher educators to take on other roles, using particular CSCL tools and tasks and organizing the student teachers' learning process. If teacher educators are prepared to co-operate, such experiments are useful for acquiring ideas on the frequency and content of effective and efficient teaching interventions.

However, such research would be in contradiction with the kind of research that implicates the importance of staying close to the daily routines of the teacher educator (Veen, 1994; Veldhuis-Diermanse, 2002). A possibility for keeping close to the teacher educators' guiding routines would be to start a longitudinal research which includes training the teacher educators in guiding student teachers during various courses, and aimed at identifying effective and efficient guidance interventions. The teacher educators we interviewed in this research were all new to guiding student teachers in a CSCL environment, and received no training. They experienced the online guidance as complicated. However, even after their first experience, they mentioned alternatives to their own role, such as a focus on monitoring and a more active role intervening at a higher frequency. In such a longitudinal research, the teacher educators' own professional development, and their findings become object of study.

10.9 Considerations on Data Analysis and Suggestions for Future Research

In this study a combination of qualitative and quantitative analysis was carried out. Interviews provided qualitative data which were analysed by content analysis. The other data (provided by questionnaires and online communication) were analysed quantitatively. Particularly for the online communication, our analysis gives no more than a rather limited view of the student teachers' collaboration. Further qualitative content analysis might have provided us with more information on the design principles. Such research ought to be focused on communication characteristics, such as the kind of phrasing used, how students query to their group mates, and the tone of the notes. An example of such research is the question as to what triggered students to react to top-level notes and pass over isolated notes. We did not find any significant variation between both types of notes on the five perspectives of our method of analysis, which increases the need for content analysis. This could generate evidence for design principles to be used for stimulating interaction, directing student teachers to write particular kinds of notes. Initially, such more detailed content analysis was not the aim of our research. However, in consideration of our research findings, it would seem interesting to include such content analysis in further research.

Sequential analysis offers another interesting possibility for further content analysis. Stahl (2002a) refers to the fragmentary research methods which in many cases discard collaborative learning in CSCL, reducing everything to data for statistics. In our research too, analyses occurred on individual student level, analysing each note separately from other notes. If we want to have a better view of the consequences of the collaboration for student teachers' behaviour, it seems useful in future research to include interaction and content related sequential analysis, and analysis of patterns in the communication.

Another limitation of our data analysis concerns the various levels of analyses used. We analysed the student teachers' communication on course, task, subgroup and student levels. This means that the data are nested. Variance in one level can be explained by characteristics on another level. To overcome this problem we should have used multi-level techniques. For the purpose of this study, single-level analyses were sufficient, as we only aimed to have a first insight in the variations in the student teachers' collaboration, and possible design elements. We used supplementary information of the questionnaires and interviews with student teachers and teacher educators to support or refute relationships between variations found in the student teachers' collaborative behaviour and the possible design elements. In future studies, multi-level analyses can be used to test various hypotheses and develop a model of explaining variables at various levels.

Epilogue

I would like to end this dissertation with a few reflections on the merits of the results of this study for the design of CSCL environments, the usefulness of CSCL in teacher training, and the relevance of the results of this research in the long term, considering the changes I foresee in schools and teacher training. In doing so, I allow myself the freedom to venture beyond the boundaries of our research.

In Chapter 2 is indicated that the development of technical tools is one of the main themes of CSCL research, and the development of such tools is often seen as solution to the main problem of CSCL: the limited amount and poor quality of the interaction. This study indicates that, obviously, the functionalities and usability of a CSCL environment should be in line with the assignments and skills of the target group, however this does not guarantee that CSCL will be successful. This research has shown that task instruction is an important element in the design of CSCL environments. Design considerations with regard to using task instruction in order to increase content related interaction such as type of task, usage of a preimposed structure with built-in controversy, and voluntary participation, resulted in a high degree of student teacher participation and a focus of students on content.

This study has also shown that a teacher role limited in online moderating and guiding does not appear to influence the collaboration negatively. Collaboration between student teachers does not necessarily suffer from a passive role of the teacher educator, which is characterized by a limited number of interventions. Regular F2F meetings evaluating the group process with the teacher educator do have a social value for student teachers but do not lead to content related benefits. From these results we may conclude that CSCL offers an opportunity to save teacher educators' time, which can then be allocated to other training activities requiring an active role of the teacher educator.

At this moment in time, ICT is used in Higher Education as a support tool for existing ways of learning, to improve the quality of the training, and as a way to change and stimulate new ways of learning and teaching focusing on learning in social interaction with others. In this context, organisers of regular teacher training programmes and teacher educators can use the design principles issuing from our research when deciding to facilitate parts of their programme by means of CSCL environments.

Besides generating answers, our research also raises questions. In this research many design variables which influence student teachers' CSCL are identified and described, but further research is needed to determine how exactly these

design variables influence the CSCL. For instance, this research made it clear that the task structure influenced the CSCL process of the student teachers in the various courses, both in relation to their participation and communication on the content of the task. However, the data are insufficient to agree on how exactly and in relation to which circumstances task structure influences the CSCL process. One may raise questions as to for instance the influence of individual student teacher behaviour, or how various levels of previous CSCL experience of student teachers influences their work on differently structured tasks. Additional research into the design variables is needed to answer such kinds of questions.

Reflecting on the value of this study to teacher training in the long run, I will first discuss the relevance of CSCL as a learning strategy in teacher training. I consider teacher training pre-eminently a place for CSCL. From a constructivist point of view, learning is important both in the teacher training programme and in the educational sector it prepares its student teachers for. Learning in interaction is common in most Dutch teacher training institutions. Student teachers learn together with their peers, and communicate intensively with teacher educators and teachers in schools. The training of student teachers has changed in such a way that student teachers reflect on their experiences, linking theory and practice, and learn in interaction with others (Melief & Tigchelaar, 2001). Moreover, so-called horizontal learning (Galesloot, 1994), i.e. the creation of communities of practice in which colleagues at school evaluate and develop the practice of learning and teaching, is more and more commonly found.

I think it is critical that student teachers are prepared for using pedagogical principles of learning in interaction with the inclusion of ICT usage, as technology provides opportunities for learning and for ways of communication that cannot be achieved in traditional learning settings. The use of technology is all the more crucial for teacher training, because there appears to be a gap between teacher training and the professional teaching practice. The Inspectorate of Education in the Netherlands indicated this gap by stating that, currently, beginning teachers are graduating without proper schooling in the (pedagogical) uses of ICT (Inspectie van het Onderwijs, 2002).

Besides the fact that CSCL can facilitate learning in interaction, usage of CSCL can support the flexibility of teacher training, an aspect which has lately become more and more important due to an increasing diversity of student teachers. Students with very different backgrounds are entering the programme, varying from those who have just obtained their master's degree to students who have already been working in education for a long time but who are now aiming to get a university degree. The current group of student teachers also vary in age and type of family life, which makes it difficult to reach all these students with one type of programme. For many students it is impossible to attend the training insti-

tute regularly, which makes F2F interaction and collaboration between students difficult. Yet, our research shows how a diverse group of student teachers can still be serviced using a CSCL environment.

Following this line of thought, I would like to discuss the use of CSCL in training so-called 'newly-arrived school immigrant entrants', i.e. students from other fields of professional life and new to the field of education. These students start teaching immediately and are trained along the way, mostly at the school where they work. CSCL seems a useful option for training such students, as learning in interaction with peers, reflecting, and exchanging experiences also are important aspects of the training for these students as well. CSCL also seems useful for the professional development of teachers. Continued training is often hampered by logistical problems, as it is difficult for teachers, with their busy timetables, to attend meetings. Distance learning could solve such problems, as teachers can be trained in the workplace. Additional advantages are that the training of the teachers can be more directly related to their actual work in the school and the classroom, and collaboration with colleagues outside their school will be stimulated.

I will end this epilogue with a view of future use of CSCL in teacher training and, related, the relevance of the results of our research in the long term. I think teacher training will change as there will be, and already are, changes in education reflecting in teacher training. Schools will change because of developments in society. In the corporate sector, major changes can be recognized owing to the use of information technology, not only in the production process, but also in the way staff are trained. Nowadays, life-long learning and training on the shop floor are common in many corporations.

Except that society, the market of the schools, is changing, the supply in the schools is changing too. New generations of youngsters are and will be entering our schools. At home, kids have their own computer in their rooms, spending hours on the Internet, on gaming and on communicating with friends, and potential friends. These kids are used to controlling their own learning processes, learning in various ways, using all kinds of learning resources and working with different learning partners. They enjoy being confronted with authentic materials and complex situations, just as they are also used to in playing computer games. In most schools learning is organized in a way not connected to the students' perception of their environment. As a consequence they are not interested.

Schools will change into institutes where the learning needs of the students are central. There already are schools which have responded to the new generation of learners, such as the UniC schools in The Netherlands, with students learning in big halls, working with teachers on various subjects according to the interests of the learners. These schools lifted the existing timeslots and the compulsory

sequences of subjects, attempting to redesign day-to-day practice within the constraints of a national curriculum and existent traditional learning materials.

ICT enables such new ways of schooling in which more individual, customized learning paths will be central. Learning in interaction with others (peers, experts) will become increasingly important, and I anticipate an important role for CSCL. As there will simply be individual learning paths, ICT is required to create collaboration possibilities for the learners, who will find their own collaborative partners both within and without their educational context. In a flexible way, CSCL groups will have to be created, independent of time and place, and supported by usable technologies.

Presently, developments in education and the redesign of teacher training, with a large role for the uses of ICT, are important issues on the European agenda. Technology develops fast and in just a couple of years the present groupware will be followed by other types of software such as Learning Support Systems focusing on collaboration rather than administration as current Learning Management Systems do. However, it is the European Commission's concern that the educational institutions, and those for teacher training in particular, seem to lag behind and are thus training tomorrow's teachers for yesterday's schools. It is worrying that for too many teacher trainers, schools seem to be institutions where classrooms, fixed curricula of traditional subject matters, and traditional bell ringing will continue to exist. Fortunately, there are forces working towards tomorrow's schooling. Pioneering schools are emerging and will hopefully inspire and influence those sceptic about educational change. I think they are right in doing so, and teacher training institutes will redesign their programmes in the future, preparing student teachers for their role in the new schools and modelling new ways of learning. The student teachers will also force teacher training institutes to change. The new generation of kids will become students, who will become student teachers. Moreover, as we can already see, learning at the workplace of the school will more and more become the rule. Stijnen (2003) refers to virtual learning communities to support the professional development of student teachers, as it offers the possibility of learning at the workplace, while at the same time being involved in a learning community in which communication is concern based, reflective, and in which collaboration with peers is focused on the exchange of experiences in a wider context. CSCL seems to be a valuable learning method. In such a learning community, learning becomes even more strongly a process in the hands of the student, constructing his own tasks, in consultation with teacher educators, and himself choosing the technologies to be applied. When teacher training changes into this direction, the design principles we formulated in this research will probably no longer hold water. I shall not be the one to regret this.

Appendices

Appendix A1: Keywords Literature Search

Type of study	Keywords	In combination with
Literature	Learning environment, Student teachers, Teacher training, Pedagogy, Teaching method, Educational theory, Tele learning, Tele teaching, Telementoring, Teaching strategies, Educational program, Multimedia learning, Electronic skills, Instructional design and Curriculum design.	
	Collaborative learning, Learning in groups, Learning groups, Co-operative learning, Student interaction, Collaborative writing, Peer mentoring and Peer tutoring.	Teaching, Teacher, Teachers' role, Teacher training
	Telematics, Internet, WWW, Computer, Computer mediated communication, Online, Virtual study, Virtual learning, Email, Electronic learning, Digital learning, Group learning environments, Groupware, Learning environment and Computer conferencing.	Collaborative learning
	Computer supported collaborative learning, CSCL	Teacher training
Internet	Online learning, Online course, Telematic learning environment, Learning environment, Virtual course, Virtual teaching, Virtual learning, Digital learning, Group learning environments, Groupware, Computer Conferencing, Open and Flexible learning, Telematics, Computer Mediated Communication, Telecommunications, Multimedia learning, Web teaching World Wide Web, Internet, Distance Education, and Distance Learning.	Teacher education, Teacher training, Co-operative learning, and Collaborative learning.
	Co-operative learning, Collaborative learning, Group learning, and Peer mentoring.	Online, Teacher training, Teacher education, World Wide Web.
	Computer supported collaborative learning, CSCL	Teacher training

Appendix A2: List of Relevant Journals

Action in teacher education
Australian Educational Researcher

Behaviour and information technology
Behaviour research methods, instruments and computers
British Journal of Educational Technology

Communication Education
Computer Assisted Language Learning
Computers in Education
Computers in Human Behaviour

Education at a Distance
Educational Media International
Educational psychologist
Educational Researcher
Educational Technology
Educational Technology Research and Development

HyperNexus

Instructional Technology
Instructor
Interactive learning environments
International Journal of Educational Research
International journal of human computer studies
Internet Research

Journal of artificial intelligence in education
Journal of computer assisted language learning
Journal of computer assisted learning
Journal of Computers in Mathematics and Science Teaching
Journal of computing in childhood education
Journal of computing in teacher education
Journal of educational computing research
Journal of educational Computing Research
Journal of Educational multimedia and hypermedia
Journal of Teacher Education
Journal of technology and teacher education

Learning and leading with technology

Machine mediated learning

Public Health Nursing

Roeper Review

Social Studies

Teaching exceptional children
TeachTrends
Technological Horizons in Education
Telematics and Informatics
The American Journal of Distance Education

Appendix B1: Expert Interview Scheme

After a short introduction about the interview procedure and the way of reporting the interview results, the questions beneath will be asked.

1. Your work at your institute.

2. Your experiences (successes and problems) working with telematics in teacher training. Illustration with examples.

3. Your pedagogical views towards learning and teaching in telematic learning environments (TLE's).

4. The role of the teacher in the TLE in which students have to work collaboratively.

5. Changes in the learning environment of the student, comparing the telematic learning environment with the regular learning environment.

6. Suggestions for us about the design of our TLE (process and product).

7. URL's of examples of 'best practices' of relevant TLE's on the WEB (maybe we have time to have a short look at them).

8. Names of other experts on TLE's and collaborative learning of students who could be of interest to me to interview.

Literature suggestions.

Appendix C1: Assignments of the HTM Course[1]

Opdracht 1: Commissie de Wit

Doel: Kennis en standpuntbepaling ten aanzien van het advies van de commissie de Wit over de toekomst van het geschiedenis onderwijs.
Bronnen: Stencil met krantenartikelen (wordt uitgedeeld), Informatie over commissie de Wit (wordt uitgedeeld), Online bronnen in de TLO (in de library), Geschiedenis methoden, Cursusopzet in de website, Handleidingen Online Werkomgeving, Netiquette en collaboratief groepsgedrag in de website.
Planning: wk 35-36.
Organisatie: Heterogene groepen naar type student.

Intro

De commissie de Wit adviseert over de toekomst van het geschiedenis onderwijs. 'Terug naar een chronologisch overzicht met een minimumpakket aan historische kennis, of blijven we bij een thematische ordening met aandacht voor vaardigheden'?

Opdracht

Formuleer samen met je groepsleden een discussiepunt over het advies van de commissie de Wit. Zet dit discussiepunt in de werkruimte over de commissie de Wit in de algemene werkruimte. Stuur het discussiepunt ook naar de docenten (zij printen alle discussiepunten uit en nemen deze mee naar de bijeenkomst van 13-9-1999).

Om tot een gezamenlijk discussiepunt te komen, dient ieder groepslid een voorstel voor een discussiepunt te doen. Beargumenteer je keuze vanuit de bronnen. Zet deze in de discussieruimte van jullie groep. Bediscussieer daarna welk discussiepunt jullie uiteindelijk als groep in de gehele cursusgroep willen brengen met argumenten erbij voor jullie keuze. Gebruik hiervoor de discussiemogelijkheden in de werkruimte van jullie groep. Lees vooraf de handleidingen over groepsgedrag, de online werkomgeving, en netiquette.

In de bijeenkomst van 13-9-1999 worden de discussiepunten besproken. Denk eraan dat je het discussiepunt van de eigen groep moet kunnen verdedigen. Lees ook voor de bijeenkomst van 13-9-1999 de discussiepunten van de andere groepen.

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[1] Originaly, the assignments were presented in the website in HTML, having an attractive lay-out.

Opdracht 2: Doelen, Werkvormen en Evaluatievormen

Doel: Kennis vergaren over het opstellen van doelen en criteria aanleggen voor goede doelen in het geschiedenis onderwijs.
Bronnen: Lesgeven en zelfstandig leren van Geerligs & van der Veen, Examenprogramma's Geschiedenis VWO, Geschiedenis op school 1 & 2 van Dalhuisen, Toebes & Verhagen, Geschiedenis, een vakvertaling van Dalhuisen en Walhain, Website van PVMO (kerndoelen en eindtermen), Experts, en zelf zoeken op het Internet en/of de bibliotheek.
Planning: wk 37 en 38, wk 38: 20-9-1999 Samenvatting eerste fase naar de docent, wk 38: 23-9-1999 Criterialijsten op het Net.
Organisatie: Deze opdracht wordt in vier groepen (dezelfde samenstelling als bij opdracht 1) uitgevoerd. Eén groep zoekt informatie over doelen, twee groepen zoeken informatie over werkvormen en één groep over evaluatievormen.

Opdracht

Verzamel informatie over het opstellen van doelen, het gebruik van werkvormen en evaluatievormen met het oog op lesvoorbereiding in het geschiedenis onderwijs. Maak uiteindelijk een criterialijst voor goede doelen en geschikte werkvormen en evaluatievormen voor gebruik in het geschiedenis onderwijs. Beargumenteer jullie keuze voor de inhoud van de criterialijst. Gebruik hierbij de aangegeven bronnen en zoek zelf nieuwe bronnen op het Internet. (Als je geschikte bronnen vindt, zet deze dan in de Algemene Werkruimte onder het kopje bronnen!). Kijk ook goed naar de kerndoelen en eindtermen van het vak geschiedenis. Bekijk en becommentarieer uiteindelijk de criterialijsten van de andere groepen.

De opdracht nog eens in stappen:

- Vat de informatie die jullie na de eerste fase van informatie verzameling hebben kort samen en stuur deze voor feedback toe aan de docent. De docent geeft jullie op 22-9-1999 feedback op jullie materiaal.
- Maak vervolgens de criterialijst en plaats deze in de gezamenlijke ruimte van de hele cursusgroep onder 'opdracht 2', zodat andere groepen hier kennis van kunnen nemen en gebruik maken bij opdracht 3. De criterialijst moet uiterlijk 23-9-1999 in de Algemene Werkruimte staan!
- Bekijk vervolgens de criterialijsten van de andere groepen. Geef aan in hoeverre jullie criteria aansluiten bij de criterialijsten van de andere groepen. Schrijf een reactie hierover aan de andere groepen en zet deze bij jullie eigen criterialijst erbij.

Tips

Spreek bij de start van de opdracht de te volgen procedure in je groepje met elkaar af. Een voorstel voor een procedure kan zijn dat eerst ieder groepslid zijn kennis vanuit zijn of haar ervaringen inbrengt in de discussie. Vervolgens halen jullie informatie uit de bronnen

erbij. Daarna maak je de criterialijst op basis van de uitwisseling van ervaringen en de informatie uit de bronnen. Een eigen procedure vaststellen mag ook.

Voor feedback op jullie werk en discussie kunnen jullie je wenden tot de docent, maar vergeet ook niet dat jullie een expert kunnen raadplegen via de TLO. Vraag de expert eens om zijn mening over jullie werk!

Denk eraan dat de opzet van deze opdrachten om met heterogene groepen te werken niet voor niets is gekozen. Wissel ervaringen, inzichten en ideeën uit, bevraag elkaar, help elkaar, daag elkaar uit, leg elkaar uit. Juist omdat jullie uit verschillende groepen komen kunnen jullie gezamenlijk tot interessant(ere?) eindproducten komen.

Opdracht 3: Maken van een lessenserie

Doel: Leren ontwerpen en voorbereiden van lessen.
Bronnen: Lesgeven en zelfstandig leren van Geerligs & van der Veen, Geschiedenis op school 1 & 2 van Dalhuisen, Toebes & Verhagen, Geschiedenis, een vakvertaling van Dalhuisen en Walhain, experts, en zelf zoeken op het Internet en/of de bibliotheek
Planning: wk 41, 42 en 43 (inclusief herfstvakantie).
Organisatie: Groepsopdracht (zelfde groepen als in opdracht 1 en 2).

Opdracht

Maak een lessenserie over één van de beide inhoudelijk, door de groep uitgekozen, thema's. Dit kan je met jouw groep doen door een geschiedenis methode als uitgangspunt te nemen en daar materiaal bij te maken (omvang 8 à 12 lessen) of door helemaal zelf het thema uit te werken in 3 à 4 lessen. Maak hierbij ook gebruik van het materiaal in de databank (dat hoeft dus niet alleen het materiaal te zijn van de eigen groepsleden). Geef in een toelichting bij jullie lessen aan waarom jullie hebben gekozen om met bepaald materiaal uit de databank te werken (zo wordt automatisch het werk dat iedereen in de individuele opdracht heeft gedaan van feedback voorzien). Het materiaal zet je als groepsproduct in de Algemene Werkruimte onder 'Lessenseries". Het materiaal kan dus de vorm hebben van Word files of Webpagina's met daaraan gelinked AV of ICT materiaal die jullie groep in de lessenserie heeft opgenomen. Uiteindelijke worden de lessenseries gepresenteerd in de bijeenkomst van 1 november 1999 door de groepen zelf. Bereid dit dus met je groep voor!

De lessenserie moet de volgende onderdelen bevatten:
- lesplannen volgens het DA-model;
- variatie aan werkvormen;
- evaluatievorm;
- AV- of ICT-gebruik;
- studieplanner voor leerlingen.

Let op:
Zet tussenproducten op het Net! Zo kunnen je groepsleden en de docenten je van feedback voorzien. Gebruik elkaars ideeën, ervaringen en kennis zodat de lessenserie uiteindelijk echt een gezamenlijk product wordt.

Opdracht 4: Onderwijsprogramma's

Doel: Informatie verzamelen en vergelijken van verschillende onderwijsprogramma's (Nederlands, Internationaal, tweetalig en Brits).
Bronnen: Reader, SLO (website en materiaal), OCenW (website en periodiek De Uitleg), websites educatieve uitgeverijen, website KPC, website Cito, Experts, zelf bronnen zoeken op het Internet.
Planning: wk 46, 47 en 48, wk 48: 29 november 1999: verslag in de TLO, wk 49: 6 december 1999: vergelijking programma's in de TLO.
Organisatie: Groepsopdracht (nieuwe groepen: homogeen naar type student).

Opdracht
In deze opdracht verzamelen de verschillende groepen informatie over de onderwijsprogramma's van Nederland, Groot-Brittannië, het Internationale programma en het tweetalig programma. In een verslag karakteriseren de groepen de onderwijssystemen en beschrijven de geschiedenis programma's. Deze verslagen worden in de Online Werkomgeving gezet en door de leden van de andere groepen gelezen. Ieder groepje maakt tenslotte een vergelijking van het door zijn of haar groep beschreven onderwijsprogramma met de andere beschreven onderwijsprogramma's.

De opdracht nog eens in stappen:
- Karakteriseer het gehele onderwijssysteem globaal.
- Beschrijf het programma voor geschiedenis op onderwerp en doelen en illustreer met lesmateriaal.
- De groepen die werken aan het onderwijsprogramma van Nederland beschrijven tevens de ontstaansgeschiedenis (wanner ingevoerd, wat zijn de doelen/ uitgangspunten) van de programma's (Basisvorming en Tweede Fase).
- Maak met je groep een *overzichtelijk* verslag en plaats dit in de Algemene werkruimte van de TLO. Dit verslag moet uiterlijk 29 november 1999 in de Online Werkomgeving staan.
- Lees de verslagen van de andere groepen en formuleer met je groep een opvallend verschil tussen het programma dat jouw groep heeft bestudeerd en de andere beschreven programma's. Plaats dit als reactie achter je eigen verslag in de Algemene Werkruimte, of plaats achter elk verslag een reactie.
- Op de bijeenkomst van 6 december 1999 worden de verslagen en reacties besproken. De vier groepen worden gemixed tot vier andere groepen (uit elke groep een lid).

De verschillen die zijn geconstateerd, worden in deze nieuwe groepen besproken. Ten slotte zal ieder in deze groepen moeten aangeven waar hij of zij als geschiedenisdocent graag in zou willen werken.

Appendix C2: Teaching in English Assignment of the BITEP Course[2]

Short outline of the assignment

Language plays an important role in your lessons. Both in Bilingual and International Classes it is very important that you are aware of the language you use and what means there are to ensure utmost clarity and transparency. At bilingual and international schools subject teachers and language teacher therefore should co-operate and make use each other's qualities. As we have seen in the Teaching in English module, language is inter-twined with the subject itself. During the course we practised various techniques that aim at clarifying texts.

In this assignment you will design, revise and actually give a lesson with the help of others.

You as a subject teacher (ST-1) will work on this lesson together with a fellow subject teacher (ST-2) and a teacher of English (ST-E). The lesson, which has to include a short text, will be revised and improved in such a way that it makes good teaching material both from a content based and from a language perspective.

Improvements and revisions will be made on the basis of suggestions by a teacher of English and by a fellow subject teacher. The whole process will take about 10 weeks and you will work together using telematics with students who are doing their internship elsewhere. Subject teachers will each prepare a lesson and comment upon the other subject lesson, whereas the teacher of English will give his comments on the linguistic aspects. Subject teachers will produce a lesson that could serve as a good sample of a 'good' lesson. Subject teachers will reflect on their work and the process of revising, students of English will reflect on their role as linguistic advisers.

Goals

As the three students in each workgroup have different tasks, it is clear that the aims of the assignment will be different.

Everybody:

- obtaining practical skills in making lessons transparent and structured;
- obtaining practical skills in telematic group work and making use of WebCT.

Subject teachers will learn how to

- design and revise a lesson;
- describe the given lesson and reflect on the content and the language level.

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[2] Originaly, the assignments were presented in the website in HTML, having an attractive lay-out.

Teacher of English will learn how to

- use and apply their linguistic knowledge with respect to subject lessons.

Assignment Schedule

Week 2, Jan 10: All get familiar with the task and form working groups
In this week (on Wednesday January 12) you will be informed about the task and receive instruction on how to use WebCT.

Instruction on the task:

- Aims as mentioned above will be discussed.
- Working groups consist of three persons: 2 subject teachers and one teacher of English. As a subject teacher within a group you perform two roles. You are subject teacher one (ST-1) who is responsible for making and performing the lesson, at the same time you also subject teacher two (ST-2) who has to give advice and suggestions with respect to the content of the lesson of ST-1.
- The teacher of English only gives his reaction as far as the linguistic aspects are concerned. Due to the fact that we have 4 teachers of English and 12 subject teachers, teachers of English will have to function in two groups.
- For this assignment it is necessary that everyone in the group sticks to his task and more important to the deadlines. Careful planning is required, as some of the tasks cannot be done overnight but require careful preparation. Please do note that although every group-member has its own responsibility, the final responsibility lies with the subject teacher one.
- During this assignment your instructors of the Teaching in English module will read your proceedings, but will not interfere as far as the content of your work is concerned. Of course you can direct very specific questions or problems at them.
- At the end of the twelve-week period the complete product will be assessed. This has to be sufficient.
- For all correspondence about this assignment you have to use WebCT.

Week 3, Jan 24: All go abroad
You will use this week for travelling and get familiar with your new environment.
It is important that in the beginning you make sure that find out where you can use a computer with an internet provider.

Week 4, Jan 31: All have first week of school-practice
In this week you will experience your first teaching practice abroad. All check the schedule for the weeks to come and see if they will be available during the weeks that tasks are required. If not, e.g. because there is a school-holiday, notify your fellow member as soon

as possible. In cases of delay subject teachers-1 are responsible for setting up a new scheme.

Week 6/7, Feb 7: Subject teacher-1 finds a topic for lesson and makes a lesson plan plus analyses; teachers of English write essay on the role of the English teacher in bilingual and international schools

Subject teachers-1 discuss the assignment and it objectives with their mentors. The idea is that you will give the lesson in weeks 11 or 12. The best thing would be to pick a class from the lower levels, as your fellow English student will also have to understand. This requires planning, and maybe some diplomacy to discuss this with your mentor. If it is not possible to give your lesson in week's 11/12 subject teachers-1 come up with a new scheme.

The lesson you are about to give may in fact be a lesson that is part of a 'regular' series. You may also use the book or other materials that your pupils use. However, in this lesson you will also make use of some 'authentic' material. Your extra material doesn't have to be longer than one page, but it should be above the level of your pupils. You can find materials in subject-magazines, university books or e.g. the internet.

Make analyses of the text your are going to use in which you indicate what will probably difficult for your pupils. This analysis has to include content matters as well as linguistic aspects (difficult structure, redundancy, vocabulary, etc.).

Make a detailed lesson plan in which you pay explicit attention to the various means there are to make sure your lesson is very clear and transparent from a language point of view. (body language, gestures, corrective feedback, synonyms, etc,etc.)

If you want to use any other material like PowerPoint, slides, video, etc. make sure there is a way to get it on the web, otherwise it will be too hard for your fellow members to judge.

Do not forget to point out to your fellow group-members what the level of your students is.

Formulate specific questions for both your fellow subject group-member and your 'English' group-member.

Teachers of English write essay (1000 words) in which they address the following questions:

- What do you know about the role of teachers of English at bilingual schools?
- What was the role of teachers of English at your first internship school and compare this to what you see at your present school?
- Do you see any possibilities to improve the situation?
- What tasks would you like to perform and which would you dislike?

Week 8, Feb 21: Subject teacher-1 plus teacher of English put their materials on the web

Subject teachers-1 put their material on the web in such a way that is clear to the fellow students what the lesson will be like. Teachers of English put their article on the web.

Week 9, Feb 28: Teacher of English and Subject teacher 2 put reactions on the board
Subject teachers-2 and Teachers of English formulate their reactions. This means they decide for themselves whether they agree with analyses as far as the difficult issues are concerned and come up with alternatives, suggestions, etc. They also comment on the lesson as a whole.

Week 10, March 6: Subject teacher-1 reacts and directs more questions
In this week the subject-teachers-1 react to the comments given by the fellow group-members. If necessary they can direct new questions and comments.

Week 11/12, March 13: Subject teacher-1 applies suggestions and gives lesson
In this week the subject teacher finalises his lesson plan and gives the lesson. As the results will have to be evaluated, the lessons should be observed. For this a video of audio-recorder is best be used. If it is not possible to obtain any of these ask one of your fellow students of your mentor.

Week 13, March 27: Subject teacher-1 puts revised lesson plus a reflection of the actual lesson on the web
In this week subject teachers-1 put their final version of the lesson on the web. Furthermore they write a reflection/evaluation.

For this they use the standard IVLOS questions for debriefing lessons and reflect in particular on the language aspect. For the latter the following questions are to be addressed:

- How did the pupils react towards the text-material and the 'simplified' version?
- Did you use any oral clarifying techniques? If not, why not?
- If yes, were you satisfied with this and what can you say about the students' reactions?
- Was the lesson any different from your regular lessons?

Week 14, April 3: Subject teacher-2 and Teacher of English react on revised lesson
Subject teacher-2 and teacher of English react on the final product and give comment on the evaluation/reflection by the subject-teacher.

Week 15, April 10: All reflect on their role(s) (set questions directed towards the process)
Everybody reflects on his or her own role during the process?

- How would you rate your own role in the past ten weeks?
- Which aspects you are satisfied about?
- Which are you displeased with?
- What is your opinion about this way of co-operating?

Appendix C3: Assignment In-service Course[3]

Dossieropdracht: Het Onderwijsverhaal

Korte omschrijving opdracht: Dio's maken in groepen een onderwijsverhaal over een goed functionerende docent (autobiografisch, al of niet met fictie) waarin ze reflecties op hun eigen ontwikkeling als docent gedurende het afgelopen jaar verwerken. De opdracht wordt online en samenwerkend uitgevoerd.
De opdracht moet afgerond zijn in week 18.
Doel: Reflectie op het eigen functioneren als docent.
Reflectie op de eigen ontwikkeling als docent gedurende het afgelopen jaar.
Uitwisselen van ervaringen en opvattingen ten aanzien van het docentschap met mede-dio's.
Werkwijze: Je werkt in groepen van drie of vier personen aan de opdracht. Hiervoor wordt het programma WebCT gebruikt. WebCT is te bereiken via Internet. Jullie krijgen allemaal een inlognaam en een password. In WebCT hebben de groepen vervolgens een eigen ruimte om in te werken. In de technische training leren jullie met WebCT te werken.
Alle communicatie moet online plaatsvinden zodat deze inzichtelijk wordt gemaakt voor de docent en je medegroepsleden. Check tenminste 3x per week of er berichten en/of documenten zijn geplaatst.
Het verhaal mag geschreven worden m.b.v. een tekstverwerker (bijvoorbeeld WORD), maar mag ook als een HTML pagina (webpagina) worden gemaakt. Dat betekent dat het verhaal ook een a-linaire structuur kan krijgen en dat de lezers er dus op hun eigen manier doorheen kunnen. Ook kunnen dan foto's en video- en audio fragmenten worden opgenomen.

Beschrijving opdracht: Iedere groep maakt gezamenlijk een verhaal over een in hun ogen goed functionerende docent. In dit verhaal dienen door dio's autobiografische elementen te worden verwerkt. Dus eigen ervaringen, leermomenten, ontwikkeling en onderwijsopvattingen moeten voor de docent en de andere groepsleden terug te vinden zijn in het verhaal. De lezer van het verhaal moet in staat zijn zich een beeld te vormen van de dio's ontwikkeling als docent (stiel-leren). Het verhaal mag geheel autobiografisch zijn, maar mag ook fictie-elementen bevatten.
De opdracht bestaat uit de volgende stappen (zie ook visualisatie opdracht op blz. 244):

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[3] Originaly, the assignments were presented in the website in HTML, having an attractive lay-out.

Stap 1: Bepalen van context, structuur en planning
De groepsleden bepalen aan het begin van de opdracht samen de context van het verhaal (bijvoorbeeld speelt zich af op een Nederlandse school, of in de ruimte) en de structuur van het verhaal (beginnend bij de bejaarde docent terugkijkend op zijn leven, of de eerste dag van de docent in een school). Maak ook een planning wie wanneer wat aanlevert. Beschrijf in een document de context, structuur en de planning en zet dit document in de groepsruimte onder "Student Presentations".

Stap 2: Groepslid 1 schrijft eerste deel verhaal
Groepslid 1 start het verhaal en schrijft een eerste paragraaf (tenminste één A4). In de paragraaf moeten tenminste 3 autobiografische elementen (eigen ervaringen, leermomenten, ontwikkeling en onderwijsopvattingen) worden verwerkt. De autobiografische elementen moeten dus in het verhaal terug te vinden zijn. (Bijvoorbeeld groepslid 1 heeft tijdens zijn lessen moeite gehad met een niet gemotiveerde leerling en reflecteert hierop. In het verhaal verwerkt groepslid 1 een situatie die hier op lijkt en beschrijft in het verhaal erbij hoe de docent volgens groepslid 1 zou moeten handelen). Wanneer groepslid 1 klaar is zet hij/zij het eerste deel van het verhaal in de groepsruimte onder "Student Presentations".

Stap 3: Groepslid 1 schrijft toelichting op autobiografische elementen
De drie autobiografische elementen moeten in een apart document (file of e-mail) worden aangegeven en toegelicht. Groepslid 1 zet zijn of haar toelichting in de groepsruimte op het Bulletin Board.

Stap 4: Voorstel tot wijziging van groepslid 2 en discussie
De andere groepsleden lezen de documenten en reageren in het Bulletin Board (doe dit door middel van een reply op het bericht van groepslid 1 met zijn of haar toelichting). Groepslid 2 doet vervolgens een voorstel om het door groepslid 1 geschreven deel van het verhaal op één van de 3 elementen te wijzigen. Deze wijziging moet betrekking hebben op het gedrag van de docent of de interactie die de docent heeft met collega's en/of leerlingen. Groepslid 2 doet dus in het Bulletin Board een voorstel voor wijziging. Dit voorstel moet in de groep worden bediscussieerd. Dus hier doet ook groepslid 1 aan mee, maar groepsleden 3 en evt. 4 geven ook een reactie. Iedereen mag tegenvoorstellen doen, of weer aanpassingen in het voorstel. De voorstellen voor wijziging en de reacties moeten blijk geven van doordachte argumentatie. Pas als iedereen het eens is met de verandering wordt het verhaal door groepslid 1 aangepast.

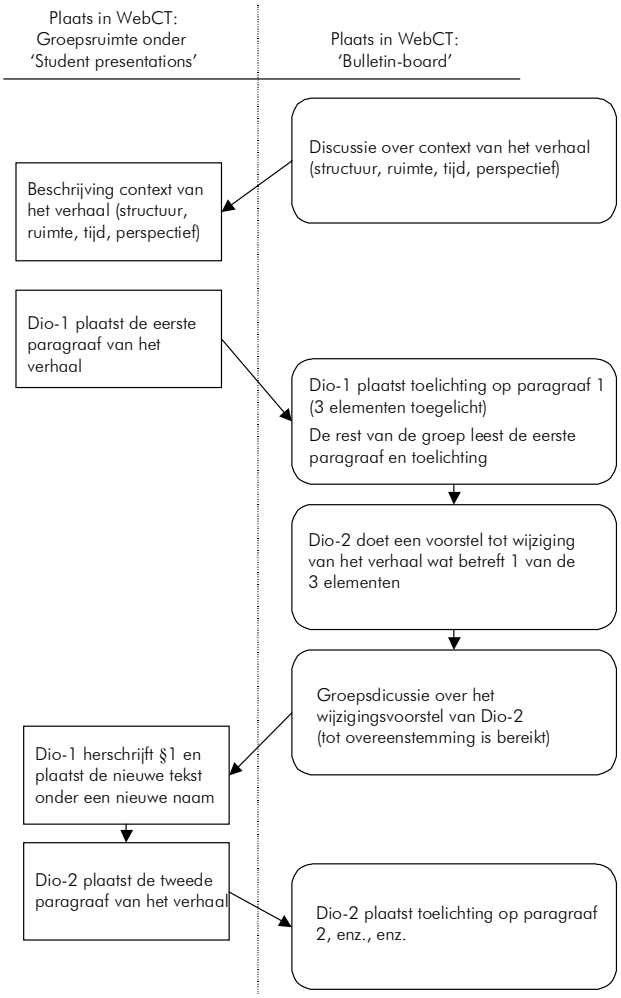
Stap 5: Aanpassing van het verhaal
Groepslid 1 past zijn/haar deel aan op basis van de discussie uit stap 4 en plaatst het aangepaste verhaal onder een ander naam in de groepsruimte onder "Student Presentations".

De docent zal in ieder geval na de eerste bijdrage van groepslid 1 feedback geven om de groepen een idee te geven of ze op de goede manier bezig zijn met de opdracht.

Stap 6: Groepslid 2 schrijft volgende gedeelte verhaal en volgende stappen
Daarna gaat groepslid 2 aan de slag met het volgende deel van het verhaal. Groepslid 2 schrijft ook weer een toelichting op zijn of haar drie autobiografische elementen en plaatst dit document in het Bulletin Board. Start hiervoor een nieuwe discussiethread. Nu is groepslid 3 verplicht te reageren met een voorstel voor wijziging. Enz.
De procedure herhaalt zich vervolgens zo vaak dat in ieder geval elk groepslid twee keer een deel van het verhaal heeft geschreven en twee keer een voorstel voor de verhaalverandering heeft gemaakt. Dus er worden ten minste twee volledige rondes per groep 'gespeeld'.
Uiteraard is elke groep vrij om meer elementen uit het verhaal te bediscussiëren tijdens 'de rit'.
Probeer het verhaal zo te maken dat iedereen zich in het verhaal kan vinden. Zorg dat in de discussie duidelijk wordt wat je argumenten (onderbouw de discussie met eigen leerervaringen) zijn, zodat de docent behalve in het verhaal ook uit de discussie jouw leermomenten, opvattingen en reflecties op je eigen ontwikkeling kan halen.

Laatste stap: Mail de docent
Mail de docent wanneer de definitieve versie van het verhaal klaar is.

Visualisatie-opdracht



Appendix D1: Items Questionnaire with Descriptive Statistics

	HTM			BITEP			In-service		
Description	*M*	*SD*	*N*	*M*	*SD*	*N*	*M*	*SD*	*N*
Collaboration									
Satisfaction about number of notes	2.5	1.1	15	3.0	1.3	16	3.8	1.0	9
Satisfaction about content notes	3.2	.9	15	3.2	1.2	16	3.9	.8	9
Satisfaction about number of responses	2.3	1.0	15	3.1	1.3	16	3.6	1.0	9
Satisfaction content responses	2.8	0.8	15	2.9	1.1	16	4.3	0.7	9
Felt responsible for the quality of the lesson of my peers				2.5	1.0	17			
Sufficient exchange				3.5	2.0	17	4.0	1.0	9
Learned to collaborate with colleagues	2.9	1.0	15						
Online collaboration TIE assignment positive experience				2.6	1.1	16			
Enjoyed collaboration on the TOC assignment				2.8	.8	17			
Online collaboration on Research assignment useful				4.1	.7	10			
Experienced collaboration as positive							4.4	.5	9
Outcomes									
Satisfaction with the quality of the group end products	3.3	.8	15	2.8	1.2	17	3.7	.9	9
Possible to exchange experiences and views on teaching with peers							4.0	.7	9
Assignment provided more insight in my learning process than offline assignments							2.8	.7	9
I learned a lot by exchanging and sharing my experiences and learning with peers							3.4	1.0	9
Online collaboration helped to reflect on my professional growth							3.4	.9	9
Online collaboration helped to reflect on my functioning as a teacher							3.6	1.2	9
Task Instruction									
The assignments were clear	3.6	.7	15	2.8	.8	17	3.7	.7	9
Opinion of the level of the assignments	3.3	.6	15	3.1	.5	17	3.4	.5	9
The assignment was interesting	2.7	.6	15	1.8	.8	17	4.1	.8	9
The structure of the online work was clear	2.6	.8	15	3.0	.9	17	3.9	1.1	9
Heterogeneous groups useful	2.2	1.7	15						
Homogeneous groups useful	4.0	1.0	15						
Group members should create their own groups	3.6	1.2	15	2.8	1.0	17	4.2	1.6	9
The role taking was clear				1.9	1.0.	17	4.4	1.9	9
TIE: Group composition with student English and other subject teacher was useful				2.6	1.1	15			
The assignment offered sufficient possibilities to reflect on my teaching performances							4.1	.9	9

(continued)

	HTM			BITEP			In-service		
Description	*M*	*SD*	*N*	*M*	*SD*	*N*	*M*	*SD*	*N*
The online assignment needed a bigger time investment than the original assignment							2.1	.6	8
Online environment									
Searching and reading notes and documents in groupware was easy	3.4	1.1	15						
Uploading notes in groupware was easy	3.3	1.3	15						
Uploading documents in groupware was easy	3.0	1.2	15						
Responding to notes and documents in groupware was easy	3.3	1.3	15						
Searching and reading notes in webboard was easy	3.3	1.2	15						
Website had attractive lay-out	3.2	1.1	15	4.1	.8	17	4.0	.7	9
Website had clear structure	2.7	1.2	15	4.1	.7	17	4.2	.7	9
Searching and reading notes in Bulletin Board was easy				4.8	.4	16	4.1	1.1	9
Searching and reading documents in the File exchange server was easy				3.7	.9	17	3.6	1.0	9
Uploading notes in the Bulletin Board was easy				4.7	.5	17	4.1	.9	9
Uploading documents in the File exchange server was easy				3.4	1.0	17	3.4	1.3	9
Responding to notes in the Bulletin Board was easy				4.7	.6	17	4.4	.5	9
The groupware is easy to use				4.0	.7	17	4.1	.6	9
Design context									
How much ICT experience did you have before the start of the course	2.9	1.4	15	3.7	1.0	17	3.3	1.2	9
Teachers' guidance									
Satisfaction about frequency interventions	3.3	.7	15				3.1	.8	9
Satisfaction about content of online feedback	3.3	.6	14				3.0	1.0	9
Evaluations of online cooperation during F2F meetings have stimulated cooperation	3.0	1.2	15						
Guidance of teacher during F2F meetings stimulated the online cooperation	4.7	.6	15						
Satisfaction about frequency interventions TIE				3.0	.6	14			
More content related interventions would have been helpful (TIE)				2.8	.9	15			
Satisfaction frequency of interventions research assignment				3.3	1.1	16			
Satisfaction about content of online feedback research assignment				3.3	1.0	16			
Technical training sufficient				4.6	.8	17	4.0	1.3	9
The technical assistance was not sufficient							1.9	1.3	9

Note. On a five-point Likert type of scale with 1= *not at all* or *I do not agree*, and 5 = *completely* or *I do agree completely*.

Appendix E1: Interview Scheme for Students[4]

Centrale interviewvragen

Kun je aangeven wat je groep heeft gedaan tijdens het maken van de *[5]opdracht?
Wat was jouw rol in het werk van de groep?

Checklist

- Wat voor berichten en bestanden zijn er ingebracht bij de * opdracht en welke heb jij ingebracht?
  - frequentie;
  - reacties op elkaar en zelf inbrengen van (hulp)vragen dan wel reacties;
  - voldoende discussie;
  - redenen om berichten wel of niet in te brengen;
  - formulering opdracht;
  - andere vormen van communicatie (vergelijking in kwantiteit en kwaliteit);
  - F2F contact over opdracht (waarom/wanneer, noodzaak).

- Welke leereffecten heeft de online samenwerking aan de * opdracht voor jou gehad?
  - bruikbaarheid/zinvolheid van reacties;
  - samenwerking positief dan wel negatief ervaren.

- Was er bij * opdracht sprake van een (bewuste of onbewuste) rolverdeling?
  - aard rolverdeling (rol beschreven in opdracht, rol uiteindelijk in groep);
  - eigen rol;
  - tevredenheid rolverdeling;
  - invloed op samenwerking.

- Op welke wijze heeft de samenstelling van de groep de samenwerking bij de * opdracht beïnvloed?
  - aard samenstelling (verschillende vakken).
  - sociale samenstelling
  - tevredenheid samenstelling (sprake van een team)

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4 The checklist differed for each course. Some of the parts have been specifically geared to the relevant course. All assignments of the HTM and BITEP courses are discussed during the interviews, although the TIE assignment of the BITEP course was the main subject of discussion.

5 The * stands for the name of the relevant assignment.

- Opdrachten
  - aansturing samenwerking
  - inhoudelijke uitdaging
  - duidelijk
  - zwaarte

- Begeleiding (online en offline)
  - begeleiding bij/sturing van de samenwerking
  - sturing van inhoud
  - kwaliteit van de begeleiding
  - omvang begeleiding

- Website
  - het Bulletin Board (bruikbaarheid en invloed op samenwerking)
  - de File exchange server (bruikbaarheid en invloed op samenwerking)
  - de Chat mogelijkheid (gebruikt bij samenwerking groep, zinvolheid)
  - de Private mail (gebruikt bij samenwerking groep, zinvolheid)
  - het sociale discussie platform (gebruikt bij samenwerking, zinvolheid)

- Techniek
  - de technische randvoorwaarden
  - gebruikersvriendelijkheid (website, het Bulletin Board en de Student Presentations)
  - ervaringen met ICT
  - invloed techniek in loop van samenwerking

⇨ De volgende onderwerpen komen na de bespreking van de * opdracht aan de orde:

- Opbrengst
  - kwaliteit onderwijs
  - in vergelijking met oorspronkelijke opdracht (wanneer van toepassing)
  - in verhouding tot tijdsinvestering

- Relevantie online samenwerking i.v.m. tijdsaspect (woon/werksituatie)

⇨ Wil je nog iets toevoegen aan het interview, iets wat we nog niet besproken hebben maar volgens jou wel van belang is om mee te nemen in de evaluatie van het online samenwerking aan de * opdracht?

Appendix E2: Interview Scheme for Teachers

1. Hoe is de online samenwerking van de studenten verlopen?

2. Wat zijn volgens jou de opbrengsten van de online samenwerking voor het leerproces van de studenten geweest?

3. Op welke wijze heb je de studenten begeleid in de online samenwerking?

4. Ben je achteraf gezien tevreden over de taakinstructies die de studenten hebben gekregen?

5. Ben je tevreden over het ontwerp van de CSCL-omgeving?

6. Welke redenen zijn er om online samenwerkend leren te integreren in de lerarenopleiding?

7. Wil je nog iets toevoegen aan het interview, iets wat we nog niet besproken hebben maar volgens jou wel van belang is om mee te nemen in de evaluatie van de online samenwerking in deze cursus?

Appendix E3: Statements from the Interviews

HTM Course

Subject	Statement
Collaborative process	• Structuring the work, planning each assignment, dividing the task, feeling responsibility, reacting, and having a good atmosphere all stimulates the collaborative process
	• Working in heterogeneous groups is positive experience as one can use each others' experiences
	• Preference to work in homogeneous groups as group members knew each other, worked from within the same teaching perspective and were in the same training situation
	• Collaboration has been negative due to the assembling of individual products without discussion, technical problems, bad atmosphere in the group, and sickness of group members
	• F2F interim evaluation of the collaborative process in each group is good
Task instruction	
Type of task	• Assignments to much focused on theoretical aspects instead of the educational practice
	• Not motivated to execute theoretical online assignments
	• Assignment 3 nice assignment, because it joined the educational practice
	• First discussion assignment was not suitable to discuss online as one had to read a lot of information and than provide an opinion in the groupware.
	• Second assignment not suitable, because during this assignment they had to collect information from books.
	• Second assignment was very suitable as the exchange of experiences and information was the focus. Needed to express the information quite well for group mates and online collaboration provides time to do this.
	• Assignments stimulated to divide the task in sub tasks; writing texts using resources. Not indicated in assignments that discussions were aimed for.
	• Interdependence should have been better integrated in the assignment; group members should have been dependent from each other to come to end product
	• To work online stimulates
	• To work online does not stimulate
	• Assignments were clear
Structure of assignment	• Openness assignment positive as one could organise the tasks themselves
	• Openness assignment negative due to lack of clues how to proceed
Planning	• Due to (strict) deadlines of assignments less discussion as reacting to each other takes time online
	• Series of assignments lacks balance in structure
	• Better to start with practice oriented assignments
	• Start with teambuilding, other wise discussion assignments such as Assignment 1, will not yield elaborated discussion
	• Start working with the computer two weeks before the first assignment
Task support	• Technical circumstances at home influence the collaborative work. Provide good services such as hardware
Group composition	• Heterogeneous groups have made collaboration difficult

Subject	Statement
Social structure of group	• Homogeneous groups are better to work collaboratively on tasks
	• In heterogeneous groups one can learn from each others' experiences, and help each other
	• Group coherence is essential for collaboration and should be created before the start of the cooperative work
	• More important than type of group, is if group members can get along
	• Not knowing each other had negative influence on collaboration
Online environment	
Online versus F2F	• Personalisation low online which discourages the collaboration and feeling of responsibility for the end product is low
	• Communication online difficult due to absence of non verbal communication
	• Discussion is inert: one has to wait for response and contribution to take time as groupware must be started etc. F2F discussion is faster, more intensive, and documents are easier to use as resources.
	• Online discussion difficult for people with difficulties in writing their view down.
	• Online collaboration is expensive
	• Online collaboration is difficult for computer nitwit
	• Technical aspects of online learning hamper the collaboration
	• Online is time and place independent learning
	• Online discussion offers possibility to take time to think and reflect on the discussion and to verbalize preciously.
	• Discussion information and documents are directly stored into computer
	• Online collaboration makes it more efficient as it forces to make appointments and storage of information
Usability of groupware	• Unclear tree structure (box in box)
	• Structure made by teachers was confusing
	• Groupware difficult to use for students without ICT experience
	• Work of other groups was easy to study
Functionality: General	• BSCW useful
Functionality: Bulletin Board	• Suitable to react actively and intensively to each other
Functionality: Social Café	• Exchange of classroom experiences positive
	• Not functional: no need for social contact and other exchange possibilities were available
Functionality: Website	• The expert was useful: good comments
	• To little responses of the expert
	• Resources (specially the links) were useful
	• Manuals (specially the technical) were useful
	• Course information not useful
Design context	
Technical situation	• Lack of computer at home made collaborative work difficult (no time and place independency) and hampered and generated problems in the collaborative work
Teachers' guidance	
Content of interventions online	• Teacher followed collaboration frequently, which has been positive
	• Teacher has helicopter view
	• Feedback has been useful, stimulating, and encouraging
	• Students, who did not enough work, were not stimulated or punished
	• To little team training

Subject	Statement
Content of interventions offline	• Focussed on process of collaboration
	• Evaluation motivated to work collaboratively online
	• Time to organize the collaboration for each assignment has been useful
	• Explanation of assignments during F2F meetings has been clear and useful
Technical training	• Training sufficient, specially in combination with manuals
	• Level and pace of training adjusted to the more experienced student; in-experienced students felt the need for a more basic course first
Technical assistance	• Much time and energy has been spend on technical assistance
	• Problems with provider influenced collaborative work negatively
	• Information before start of the course, unclear

BITEP course

Subject	Statement
Collaborative process	• Collaboration has been good because the comments on the lesson and the exchange of different ideas has been useful
	• Including questions for group members in notes stimulates the feedback
	• Collaboration has been les good due to the limited role of the student in English, the quality of the group members' comments, technical problems and the lack of motivation of group members to work online.
	• The TIE assignment has been an individual oriented task
	• Too busy to work on the TOC assignment
	• Collaboration on Research assignment has been fruitful
	• Strong sense of group feeling during Research assignment
Task instruction	
Type of task	• Assignments concerning exchange of experiences are suitable for online work
	• Phase of brainstorming not suitable for online work
	• Assignments needing collaboration are suitable for online work
	• Different type of task create different forms of communication
	• Important assignment and thus motivated to work on it
	• TIE: commenting was difficult because they missed school context and non verbal communication
	• Some positive aspects of TIE assignment: o interesting to receive comments from within two area's (subject and language); o sharing experiences with lesson plans; o working on lesson plan; o using language techniques as non native speaker; o giving feedback to someone's lesson is good exercise; o being able to exchange feedback while you are at a distance.
	• Research assignment is important assignment in teacher training programme
Structure of assignment	• Pre-imposed structure clear
	• Pre-imposed structure too detailed
	• TOC: task description unclear
Planning	• TIE: task was time consuming
	• TIE: task was difficult to plan
	• Spacing of assignment over 15 weeks offered time to send and react notes
	• Spacing of assignment over 15 weeks created low commitment

Subject	Statement
Role taking	• TIE competed for attention with other tasks and activities
	• Comments of student in English less useful than those of the subject student
	• Role taking unevenly divided
	• Role description unclear
Online environment	
F2F versus online collaboration	• Personal contact is needed elaborating problems in groups
	• Exchange of experiences is more agreeable F2F
	• Context aspects of problems, such as the TIE assignment, are easier to judge
	• Conversation easier F2F with more interaction, because online action and reaction take long time
	• Misses non verbal communication on line
	• Difficult to express yourself; feedback often straightforward
	• Difficult to point out someone's responsibilities and negligence working online
	• In F2F conversation one has to take his or her responsibilities
	• In F2F conversation it is easier to catch on opinions of others
	• In F2F conversations group members reach problem definition easier
	• In F2F conversations it is easier to get down to business
	• Working with computer for long hours is uncomfortable
Functionality: Bulletin Board	• Tree diagram (thread structure) very convenient
	• Labelling of new messages handy
	• When number of messages is high, Bulletin Board inconveniently arranged
Functionality: Social Forum	• Very satisfied: exchange of experiences keeps group together
Functionality: Students Presentation Area	• Unclear and difficult to use
	• Difficult to see how to arrange the document
	• One has to go deep into the functionality to find documents
	• Options for editing html pages were confusing and distracting
Functionality: Chat	• Useful, workable and enjoyable (6 students)
	• Chat members must prepare session by orientation on topic of discussion and reading of materials beforehand
	• Difficult because it becomes chaotic quickly, specially when the group has more than four members
	• Chat conversations mix easily and are fast
	• Clear appointments have to be made setting communications rules and planning
	• Not user-friendly because technical problems and no save and print options offered
Design context	
Motivation	• Intrinsic motivated students: good personal contact with group members and motivation to learn cooperatively
	• Extrinsic motivated students: time pressure and sense of duty
Busyness of students	• To busy during the school practice period to work on the assignments or to communicate (75%of the students)
	• Busyness due to: daily hassles at school, the fact that they had to deal with a complete new situation, and travel time needed to go to the university to work with a computer
Location of students	• Technical and educational context in Guyana hampered the collaboration
	• Time differences created problems
	• Students located in English speaking countries experienced difficulties with the TIE assignment

Subject	Statement
Personal circumstances	• Students located in The Netherlands no need for social exchange of experiences as family and friends are nearby
	• Holidays
	• Access to information
	• Time spent abroad
Educational context	• Planning of assignments by IVLOS (pressure on research assignment while abroad, and ample time for TOC assignment back home)
	• Planning difficulties concerning TIE lesson at school
	• Teaching abroad stimulated students to work on language issues
	• Schools did not have TOC related activities
	• Research topic did not fit in activities of school
Characteristics of students: level of English	• TIE assignment less useful for English high level student
	• English high level students offered head start in online communication
Teachers' guidance	
Frequency interventions TIE	• Did not receive any guidance during TIE
	• Did not feel any need for guidance during TIE
	• Should have been more guidance because this motivates
Frequency interventions TOC	• Did not receive any guidance during TOC
	• Did not feel any need for guidance during TIE
Frequency interventions research assignment	• Satisfied about frequency
	•
Content of interventions of research assignment	• Satisfied about content
Technical training	• Manual too technical
	• Due to overload information during training role taking assignment still unclear while abroad
Technical assistance	• Satisfied about fastness and helpfulness
	• Did not need technical assistance

In-service course

Subject	Statement
Collaborative process	• There has been a positive atmosphere in the groups and this stimulated the collaboration
	• Strict planning, including task division helps the collaborative process
	• Role taking, using the role of an organizer, can be useful in collaborative work
	• Regular feedback motivates
	• There has been no real discussion due to the fact that group members agreed on their learning experiences and solutions to classroom problems
Task instruction	
Type of task	• Challenging task, offering a good and save way to exchange experiences
	• Freedom to choose what learning elements to incorporate, forcing them to reflect
	• Learning effects: reflection on their teaching, help with teaching problems, and final evaluation of their teaching behaviour
	• No learning effects
	• Modelling of online collaborative learning, useful for own teaching practice
	• Fun and playful alternative
	• Reason why assignment was difficult: inclusion of learning elements that fits the storyline, number of learning elements and inclusion of problematic learning situations in story about well-functioning teacher
Structure of assignment	• Pre-imposed structure too detailed

Subject	Statement
Role taking	• Role description unclear
	• Workload of roles unequally divided
	• Increasing the importance of roles 2 and 3 stimulates the content discussion
Planning	• Assignment correctly scheduled: when students are fed up with writing diaries and more time to evaluate and reflect on their teaching as a whole
	• Should have been scheduled (also) at the beginning of the course when discussing teaching experiences with others is even more important
	• Online assignment costs less time than original assignment and forces to work on regular pace
	• Assignment costs more time due to technical problems
Online environment	
Online versus F2F	• Like to work with computers; Online collaboration is fun
	• Hardly off task communication. WebCT work is more business like
	• Online work is time and place indenpdent
	• Suitability of online learning increases when F2F contact decreases
	• The discussion is qualitative spoken higher level, which makes the online collaboration at the end quicker.
	• Writing assignment such as this one, is very suitable for online work
	• Programme was fine, and when there would have been no F2F contact it would have been used even more intensive
	• A-synchronous communication less interaction; you have to wait for a response
	• Computer is not personal
	• Feel like discussing in public, phone is more safe
General	• WebCT is fine
	• Separate areas for discussion and file exchange is convenient
	• Well structured, specially because of the visualisation
	• Once you know how it works, it is easy
	• Difficult without ICT experience
Bulletin Board	• Worked well, and well structured
	• Different group areas sometimes confusing
File exchange server	• Confusing button labels
	• Not clear due to much buttons that are not used
Functionality: General	• WebCT sufficient possibilities to discuss online
	• WebCT to complicated for the assignment, not necessary possibilities
	• Also use of email, as this is checked everyday
Functionality: Chat	• More suitable for discussion, but not used
	• Not suitable for discussion because difficult to realise
Functionality: Assignments	• Not necessary to incorporate in WebCT
Functionality: Calendar	• Not used, but could have been useful
Design context	
Busyness of students	• Due to time pressure less discussions about content
	• Time pressure due to lack of experience with hardware and software
	• Time pressure due to school obligations
Personal circumstances	• Holidays, heavy workload and lack of experience with software caused delays in group work, i.e. feedback came late
Educational context	• Weekly F2F contact created situation to talk about assignment offline
	• Assessment planned well at end of programme when students had lot of teaching experience
	• Limited discussion at end of assignment because students were at the end of their training programme and just wanted to finish this
Characteristics of students	• Different working styles influence collaboration
	• The talent for writing influenced the collaboration; those motivated to write stories or with mother language background found writing part of assignment more easy.

Subject	Statement
Teachers' guidance	
Frequency interventions	• Needed feedback at the end of the assignment on the end products
	• Not necessary to provide more feedback; it was nice to work just with peers
	• When needed, the teacher would have provided feedback
	• Should have been clear when feedback was expected
	• Disappointed about frequency of feedback; teacher could have provided feedback from a professional point of view
Content of interventions	• Groups received notes that they were well on their way
	• Would have been nice if teacher had collected all stories and distributed them among all groups
Technical training	• Sufficient, both technical as explanation to the assignment
	• Not sufficient
	• Training and manual necessary to carry out assignment
	• Too short
	• Manual not difficult and not motivating
	• Manual should be provided before the technical training
Technical assistance	• Good

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Samenvatting

Aanleiding en probleemstelling

Leren in interactie en samenwerking met anderen is belangrijk in de opleiding van aanstaande docenten. Computer ondersteund samenwerkend leren (CSCL) levert een bijdrage aan het gezamenlijk construeren van kennis met medestudenten, gebruikmakend van technologieën die de interactie en samenwerking ondersteunen, waarbij men niet afhankelijk is van 'face-to-face' (F2F) contact. Hierbij gaan reflectie en interactie samen, wordt de toegang tot authentiek leermateriaal vergroot en worden mogelijkheden geboden tot een meer gelijkwaardige discussie zonder onderscheid des persoons (Warschauer, 1997; Watabe et al., 1995, Nicaise & Barnes, 1996). Door CSCL als onderwijsvorm in te zetten in de opleiding van leraren kan CSCL ook een bijdrage leveren aan het overbruggen van de kloof tussen de competenties van de afgestudeerde docent-in-opleiding (dio) en de competenties die nodig zijn om ICT op een didactisch verantwoorde wijze in te zetten in de klas (Inspectie van het Onderwijs, 2002; Kirschner & Selinger, 2003). Mede door de groeiende diversiteit in de studenten van de lerarenopleidingen is de interactie en samenwerking soms moeilijk te realiseren. CSCL maakt tijd en plaats onafhankelijk samenwerken mogelijk.

Dit onderzoek richt zich op de identificatie en de beschrijving van ontwerpprincipes voor een CSCL-omgeving waarin dio's samen leren. Hiertoe zijn drie CSCL-omgevingen ontworpen en in drie bestaande onderwijsonderdelen van de IVLOS lerarenopleiding van de Universiteit Utrecht (vanaf nu te noemen cursussen) geïmplementeerd en geëvalueerd. In deze studie wordt de implementatie van de drie CSCL-omgevingen beschreven en de kenmerken van de omgevingen geëvalueerd. Tevens wordt een relatie gelegd tussen de gebruikte ontwerpen en de waargenomen samenwerking.

CSCL in theorie

Een sociaal-constructivistische visie ligt ten grondslag aan onze ontwerpen. Centraal in de ontwerpen staat de lerende (de dio) die kennis construeert in interactie met anderen (mede dio's en opleiders), en wordt geleid in zijn leerproces door zijn eigen motivatie. De voor dit proces relevante kennis is aanwezig bij dio's en opleiders; door interactie wordt een leergemeenschap gecreëerd waarin naast kennis, ook normen en waarden worden gedeeld (Lave & Wenger, 1991). Dit

gebeurt binnen de context van het opleidingsinstituut en de opleidingsschool, die een authentieke omgeving vormen die rijk is aan informatie en waar de dio betekenisvolle ervaringen opdoet en kennis functioneel toepasbaar is (Kirschner, 2000). Binnen deze context waarin de student zich kennis eigen moet maken, ondersteunen en stimuleren zowel de technologie als de opleiders de gemeenschappelijke kennisconstructie. In dit onderzoek richten wij ons op het *proces van interactie* dat nodig is om kennis te construeren, en de condities die nodig zijn om die interactie te bewerkstelligen. Daarbij is gekozen voor een ontwerponderzoek waarbij alle aspecten worden bestudeerd die de interactie in de CSCL-omgeving mogelijk beïnvloeden.

Ten behoeve van het promotie-onderzoek is behalve literatuur met betrekking tot CSCL ook literatuur over samenwerkend leren bestudeerd. Het werk van Johnson & Johnson (1994) en Slavin (1995) heeft een centrale rol gespeeld bij het ontwerp van de CSCL-omgevingen. Dit heeft geleid tot zes premissen voor samenwerkend leren: 'positive interdependence', 'individual accountability', 'promotive interaction', 'group processing', 'development of collaborative skills' en 'motivation'.

Uit de literatuur is een drietal clusters van ontwerpelementen gedestilleerd: de taakinstructie, de online omgeving en de begeleidingsprocessen. De taakinstructie heeft betrekking op het type taak, meer specifiek de mate van zelfverantwoordelijkheid, de werkvorm en de doelen van de taak, en de taakstructuur, de taakorganisatie en de groepssamenstelling. Tot de online-omgeving behoren de functionaliteiten van het softwareprogramma dat wordt gebruikt, de gebruikersvriendelijkheid uitgedrukt in de navigatie en de structuur van de omgeving, en de elektronische leermaterialen. Tot het cluster 'begeleidingsprocessen' behoren de interventies van de docent en de training en technische ondersteuning van de studenten. Tevens is uit de bestudering van de literatuur duidelijk geworden dat een nauwkeurig beschreven 'ontwerpcontext' van de CSCL-omgeving nodig is, omdat deze invloed heeft op het samenwerkingsproces, en conclusies ten aanzien van de ontwerpelementen kan beïnvloeden (Lehtinen et al., 1999).

Op basis van onze literatuurstudie zijn zes onderzoeksvragen geformuleerd:

1. Hoe evalueren dio's en opleiders de CSCL omgevingen die zijn ontworpen?
2. Hoe kan de samenwerking in de CSCL omgevingen worden gekarakteriseerd in termen van deelname, interactie en inhoud?
3. Op welke manier is de taakinstructie gerelateerd aan het CSCL proces van de dio's?
4. Op welke manier is de online omgeving gerelateerd aan het CSCL proces van de dio's?
5. Op welke manier is de ontwerpcontext gerelateerd aan het CSCL proces van de dio's?

6. Op welke manier zijn de begeleidingsprocessen gerelateerd aan het CSCL proces van de dio's?

CSCL ontwerpen in de lerarenopleiding

In dit onderzoek zijn achtereenvolgens drie ontwerpen van CSCL-omgevingen ontwikkeld, geïmplementeerd en geëvalueerd. Deze ontwerpen zijn gebruikt in een cursus Vakdidactiek Geschiedenis, tijdens de stage in het buitenland van dio's van de internationale lerarenopleiding, en tijdens de cursus Algemene Didactiek in het programma voor de In-service studenten. De CSCL-omgevingen zijn ontworpen op basis van bevindingen uit de literatuurstudie, de consultatie van drie experts op het gebied van CSCL in Hoger Onderwijs die zijn geïnterviewd om aanvullende informatie op de literatuur te krijgen, en resultaten van eerdere ontwerpen. De ontwerpen verschillen in de operationalisatie van de drie clusters van ontwerpelementen en de ontwerpcontext. Voor wat betreft de taakinstructie verschillen ze in het type taak, de mate van structurering, het gebruik van rollen, de beoordeling, de beschikbare tijd voor een opdracht, de al dan niet vrijwillige deelname en de mate van 'blended learning' (hier bedoelt als de combinatie van F2F en online leren). Wat betreft de online omgeving zijn verschillende groupware-omgevingen gebruikt. In de eerste cursus stond BSCW de dio's ter beschikking en in de tweede en derde cursus WebCT. De functionaliteiten van deze programma's verschillen niet veel, wel de interface en gebruikersvriendelijkheid. Er zijn weinig ontwerpinterventies gepleegd in de begeleiding van de dio's door de opleiders aangezien eerder onderzoek heeft uitgewezen dat het moeilijk voor docenten is om bestaande begeleidingsroutines te veranderen (Veen, 1994; Veldhuis-Diermanse, 2002). In de drie bestudeerde cursussen werkten studenten in groepjes van drie of vier aan één of meer online opdrachten die varieerden in lengte van 2 tot 15 weken. De opdrachten waren gericht op het maken van gezamenlijke producten of het geven van feedback aan groepsleden op individuele producten. De opdrachten werden geheel online uitgevoerd met uitzondering van presentaties van de resultaten in de gehele groep. Gedurende twee cursussen zagen de dio's elkaar ook F2F. Ze hadden een elektronische leeromgeving tot hun beschikking waarvan de belangrijkste functionaliteiten voor interactie het discussiebord en een optie om bestanden uit te wisselen waren.

Methode

In dit ontwerponderzoek hebben in totaal 36 dio's en vijf opleiders van het IVLOS geparticipeerd. De respondenten vertegenwoordigden verschillende vakgebieden en de verschillende opleidingsprogramma's: Pre-service, internationale lerarenopleiding, In-service, en het 'op maat' programma.

Om antwoord te kunnen geven op onze onderzoeksvragen zijn data verzameld door middel van vragenlijsten en interviews met dio's, interviews met drie

opleiders, en het bewaren van de elektronische communicatie van de studenten en opleiders. De vragenlijsten en de individuele interviews hadden tot doel inzicht te krijgen in de mening van de studenten en de opleiders ten aanzien van de samenwerking in de groepen, het individuele studentgedrag en de relatie tussen de ontwerpelementen en de samenwerking. De data voortkomend uit de interviews en vragenlijsten zijn geanalyseerd door middel van inhoudsanalyse (de interviews, waarvoor een codeersysteem is ontwikkeld), en beschrijvende statistiek (vragenlijsten). De kwaliteit van het codeersysteem, de interviewafname en het maken van de samenvattingen is gecontroleerd door middel van interbeoordelaarsovereenkomst en het meten van de interne validiteit van de interviewprocedure. De elektronische communicatie is geanalyseerd om zicht te krijgen op de samenwerking in de groepen. Hiertoe is een methode ontwikkeld waarbij vanuit vijf perspectieven de samenwerking wordt geanalyseerd: de participatie, de aard van de communicatie, de interactie, het niveau van informatie-uitwisseling en de regulatieve communicatie. De kwaliteit van de instrumenten behorende bij deze methode is nagegaan door middel van het meten van de interbeoordelaarsovereenkomst. Om significante verschillen in de samenwerking van de groepen te achterhalen, is gebruik gemaakt van Sociale Netwerk Analyse, non-parametrische variantie analyses en *t*-toetsen van verschil in gemiddelden. De informatie van de interviewsamenvattingen en de beschrijvende statistiek van de items van de vragenlijsten is uiteindelijk in verband gebracht met de samenwerking van de dio's, gebruikmakend van 'content-analytical summary tables' (Miles & Huberman, 1994).

Evaluatie van studenten en opleiders

Eenderde van de dio's was tevreden met de samenwerking in hun groepen. Zij oordeelden positief over het gezamenlijke gevoel van verantwoordelijkheid om het product te maken en samen te werken met de groepsleden, het regelmatig reageren op groepsleden en de positieve atmosfeer in de groep. Tevens waren deze studenten tevreden over de inhoud van de gegeven feedback door hun groepsleden. De planning en de taakverdeling in deze groepen werkten volgens hen goed. De andere dio's waren kritischer ten aanzien van de samenwerking in de groepen. Als redenen voor hun ontevredenheid gaven zij aan dat in de betreffende groepen een verantwoordelijkheidsgevoel en teamspirit ontbrak, individueel werd gewerkt en individuele tussenproducten aan het einde van de opdrachtperiode zonder discussie over de inhoud aan elkaar werden geplakt tot een onsamenhangend eindproduct. Ook noemden ze technische problemen die de samenwerking verstoorden, het ontbreken van een planning en taakverdeling, en een druk werk- en privé leven als storende factoren. Het gebrek aan respons van groepsleden werd echter als belangrijkste oorzaak genoemd voor hun negatieve oordeel over de samenwerking.

Twee geïnterviewde opleiders toonden zich tevreden over de samenwerking van de dio's. Een derde geïnterviewde opleider was ontevreden over de interactie, discussie en samenwerking door de dio's aan producten, maar was wel tevreden over het feit dat de dio's ervaring hadden opgedaan met CSCL als werkvorm.

Samenwerking

De samenwerking is geanalyseerd op participatie, interactie, en op de inhoud. De groepen varieerden in hun participatie voor wat betreft het aantal verzonden berichten (5 tot 121 berichten). Binnen de groepen was de participatie over het algemeen gelijk verdeeld. De opleiders hebben nauwelijks geparticipeerd in de online communicatie van de groepen, met uitzondering van de betrokken opleiders van één van de opdrachten. In het ontwerp van de CSCL-omgevingen is geprobeerd dio's te stimuleren gebruik te maken van discussiedraden als manier om de communicatie te structureren. Gedurende het onderzoek was dit in toenemende mate succesvol. In de eerste CSCL-omgeving is de helft van de berichten in een discussiedraad verstuurd, terwijl dit in de laatste CSCL-omgeving bijna altijd gebeurde. Over het algemeen bestonden de discussiedraden uit drie of vier berichten.

De inhoud van de communicatie in de groepen was sterk gericht op regulatieve aspecten van de samenwerking. Bij de meeste opdrachten was één van de doelen dat de dio's zelf verantwoordelijk waren voor de planning, organisatie en evaluatie van de taken. Opvallend was dat in ruim de helft van de berichten met regulatieve communicatie deze was gericht op de organisatie van de online communicatie. Dit was nodig omdat non-verbale communicatie zoals voorkomend in F2F samenwerkingssituaties (bijvoorbeeld gebaren om aandacht te trekken, iets aan iemand geven) niet mogelijk was. Communicatie over technische aspecten, zoals technische problemen en gebruik van de groupware, varieerde van rond de 30% tijdens de eerste CSCL-omgeving, naar 20% tijdens de tweede en minder dan 10% tijdens de laatste omgeving.

In 30% van de berichten in de eerste twee cursussen is gecommuniceerd over taakgerelateerde inhoud, terwijl dit in de laatste cursus 60% was. In sommige groepjes was de communicatie over de inhoud oppervlakkig van aard, terwijl andere groepjes op een redelijk diep niveau de inhoud van de taak bediscussieerden door te argumenteren, problemen en voorgestelde oplossingen te analyseren, ideeën en oplossingen te bieden en eerder opgedane kennis en ervaringen te gebruiken. Ook hier zien we een positieve ontwikkeling; in de eerste CSCL-omgeving werd een kwart van de berichten op een diep niveau uitgewisseld, terwijl dit in de derde CSCL-omgeving de helft van de berichten betrof.

Tijdens twee van de drie cursussen heeft weinig niet-taakgerelateerde communicatie plaatsgevonden. De dio's van de internationale lerarenopleiding (de tweede cursus) hebben relatief veel sociaal gecommuniceerd.

Taakinstructie

De analyse van de relatie tussen de taakinstructie en de samenwerking van de studenten tijdens de verschillende opdrachten laat zien dat verschillende elementen van de taakinstructie de samenwerking hebben beïnvloed. Taken gericht op discussie met een structuur van ingebouwde controversen en het creëren van een gezamenlijk gedragen eindproduct verhoogden de positieve afhankelijkheid tussen de studenten en resulteerden in meer participatie en meer communicatie over de taakinhoud. Een sterk gestructureerde opdracht heeft dio's, die niet gemotiveerd waren om aan een taak te werken, geholpen de taak uit te voeren. De dio's waren over het algemeen het meest gemotiveerd om samen te werken aan taken die aansloten bij hun concerns.

Een opvallend resultaat van dit onderzoek betreft het naast elkaar inzetten van F2F en online activiteiten. Hoewel 'blended learning' vaak wordt aangeraden in de literatuur omdat dit de samenwerking stimuleert en een groepsgevoel creëert, blijkt uit dit onderzoek dat het ook verstorend kan werken. In ons onderzoek vond de online interactie in geschreven vorm plaats waardoor de studenten meer tijd hadden te reflecteren op de discussie en hun eigen argumentatie en de discussie te herlezen. Tijdens F2F bijeenkomsten besprak een aantal dio's delen van de CSCL taken. Wanneer dit gebeurde, werd de online discussie over de taakinhoud gefragmenteerd, werden mogelijkheden tot reflectie gemist en werd het leerproces van de studenten, ook voor henzelf, minder zichtbaar.

In tegenstelling tot onze verwachtingen heeft de groepssamenstelling weinig invloed gehad op de samenwerking. Zo heeft het heterogeen dan wel homogeen samenstellen van de groepen op basis van de onderwijservaringen van de dio's geen verschillen in samenwerking teweeggebracht. Echter in de percepties van de dio's heeft de groepssamenstelling wel een grote rol gespeeld. Met name de mate waarin de groepsleden elkaar kenden was volgens de dio's van invloed op de samenwerking.

Online omgeving

Over het algemeen waren de meeste studenten tevreden over de technische omgevingen BSCW© en WebCT. Niet alle onderdelen van de technische omgevingen werden echter voldoende beheerst. Hoewel de studenten de optie te communiceren via discussiedraden positief waardeerden, blijkt uit het onderzoek dat zij er wel moeite mee hadden. Training in het gebruik van discussiedraden had de discussie mogelijk effectiever gemaakt. Voor het maken van de opdrachten waren een platform voor de uitwisseling van bestanden en een discussieplatform

nodig. Additioneel hadden de studenten de beschikking over een chatmogelijkheid, een persoonlijke postbus en een forum waarin kon worden gecommuniceerd over niet-taakgerelateerde inhouden. In het bijzonder is het aanbieden van een separate sociale omgeving een aandachtspunt in de ontwerpen geweest. Hoewel de literatuur en de door ons geconsulteerde experts het aanbieden van een optie voor sociale communicatie aanraadden, bleek dat dio's die elkaar of andere mededio's regelmatig F2F zagen geen gebruik maakten van het discussieforum voor sociale interactie. De groep met studenten die elkaar niet F2F zagen, heeft het discussieforum voor niet-taakgerelateerde communicatie daarentegen veelvuldig gebruikt.

De interviews en antwoorden op de vragenlijsten geven aanleiding om aan te nemen dat de technische omgeving een beperkte rol invloed heeft gehad op de samenwerking.

Begeleiding door opleiders

In de begeleiding door de opleiders zijn twee typen rollen waargenomen wat betreft de frequentie van de interventies. Opleiders hebben een passieve rol getoond, dat wil zeggen weinig geparticipeerd in de groepen, en dit ging samen met zowel relatief actieve als passieve studenten. Zolang echter andere ontwerpelementen zoals de taakinstructie, de samenwerking ondersteunden en stimuleerden, had een passieve rol geen negatieve invloed op de samenwerking. Andere opleiders waren actief, in twee groepen hebben zij zelfs het grootste aantal berichten verzonden. Deze actieve rol ging samen met actieve studenten. De dio's gaven aan deze actieve rol te waarderen. Op basis van ons onderzoek is het moeilijk aan te geven wat de meest effectieve frequentie van interventies van de opleiders moet zijn.

In hun interventies waren de opleiders vooral gericht op regulatieve aspecten van de samenwerking. De opleiders vonden het lastig de dio's online te supervisieren en van feedback te voorzien in online teksten. De inhoud van de interventies heeft weinig invloed gehad op de samenwerking van de dio's. Tussentijdse F2F evaluaties, gericht op de verbetering van het samenwerkingsproces, hebben geleid tot meer sociale communicatie in de groepen, maar niet tot meer taakgerichte communicatie.

Over het algemeen waren de dio's tevreden met de frequentie en de inhoud van de interventies van de opleiders, en hebben zij aangegeven dat wat hen betreft de opleiders een beperkte rol hebben gehad in de samenwerking.

Ontwerpcontext

Twee aspecten uit de ontwerpcontext hebben de samenwerking beïnvloed. Door technische problemen heeft een klein aantal dio's voor kortere of langere tijd niet

kunnen deelnemen aan de online interactie, maar dit heeft geen invloed gehad op de inhoud van de communicatie van de groepen.

De houding van de dio ten aanzien van online samenwerken is in dit onderzoek als aspect van de ontwerpcontext beschouwd. Het onderzoek geeft indicaties dat de motivatie van dio's om online samen te werken aan opdrachten is gerelateerd aan hun samenwerkingsgedrag. Op basis van de interviews met dio's en opleiders onderscheiden we drie typen studenten waarmee rekening kan worden gehouden bij het ontwerp van CSCL. De intrinsiek gemotiveerde studenten toonden de relatief grootste participatie, meeste interactie en een relatieve focus op de inhoud van de taak. Aspecten zoals tijdsdruk, verantwoordelijkheidsgevoel en een sterk gestructureerde opdracht, hebben extrinsiek gemotiveerde studenten geholpen de opdrachten uit te voeren. Volgens de ongemotiveerde studenten belemmerde een gebrek aan motivatie om online van en met anderen te leren, de samenwerking in de groepen.

Conclusies

Op basis van de analyse van de relatie tussen de ontwerpelementen en de ontwerpcontext enerzijds, en de samenwerking tussen de dio's anderzijds, zijn er conclusies getrokken ten aanzien van het gewenste ontwerp van CSCL-omgevingen voor de lerarenopleiding, concreet gemaakt in 29 ontwerpprincipes. We bespreken hier kort de belangrijkste.

Veel onderzoek is gericht op de ontwikkeling van technische tools als oplossing voor de vaak gebrekkige hoeveelheid en kwaliteit van de interactie. Dit onderzoek laat zien dat de taakinstructie in CSCL-omgevingen ook een belangrijke factor is. Het type taak, het gebruik van structurering met ingebouwde controversen en vrijwillige deelname resulteerden in een relatief hoge participatie van de dio's en een focus op de inhoud van de taak. De resultaten van dit onderzoek geven aanleiding om in CSCL-omgevingen in de lerarenopleiding een technische omgeving te gebruiken met relatief eenvoudige, standaard functionaliteiten die voldoende zijn om de CSCL-taak uit te voeren.

Evenals in ander onderzoek, toont dit onderzoek aan dat het 'levend houden' van de groep in CSCL belangrijk is in het samenwerkingproces. Studenten moeten het gevoel hebben in een groep te functioneren, en de aanwezigheid van andere groepsleden 'te voelen'. Om dit bereiken moeten studenten worden gestimuleerd regelmatig met groepsleden te communiceren. Dit kan bijvoorbeeld door het geven van aanwijzingen omtrent de frequentie van reageren. Daarbij is ook gebleken dat dio's, die vaak een druk werk- en privéleven hebben, een bepaalde tijdsperiode nodig hebben om te interacteren met groepsleden. Dit onderzoek wijst uit dat opdrachten van 10 tot 14 weken de dio's voldoende tijd geven om te participeren en te discussiëren over de inhoud van de taken.

In het onderzoek is de rol van de opleiders in de samenwerking zeer beperkt geweest. We hebben gezien dat de samenwerking van dio's niet hoeft te lijden onder een passieve rol van de opleider. Tevens bleken F2F-evaluatie-bijeenkomsten gericht op de verbetering van het samenwerkingsproces niet te leiden tot meer communicatie over de taakinhoud. We concluderen op basis van deze resultaten dat door het inzetten van CSCL, begeleidingstijd kan worden bespaard, welke ingezet kan worden tijdens andere onderdelen van de opleiding die intensieve begeleiding vragen. Nader onderzoek is nodig, mede ook vanwege de beperkte hoeveelheid data in dit onderzoek omtrent de begeleiding door de opleiders.

'Blended learning' is alleen zinvol wanneer F2F-bijeenkomsten nodig zijn voor teambuilding of als aanvulling op de online opdrachten. In andere gevallen heeft 'blended learning' een negatieve invloed op de participatie van de studenten en de leereffecten van de online discussies. F2F-evaluatieve momenten om communicatie van studenten over de taakinhoud te stimuleren, leiden bovendien niet tot meer communicatie over de taakinhoud. Om deze communicatie te realiseren kunnen beter andere middelen zoals bepaalde type taken worden ingezet.

Dit onderzoek toont aan dat bepaalde aspecten uit de context van het ontwerp effect hebben op de samenwerking. Met name de motivatie van de dio's om aan de CSCL-taken te werken heeft de samenwerking beïnvloed. De motivatie van dio's is niet altijd rechtstreeks te beïnvloeden door de ontwerper, maar kan worden gestimuleerd door bijvoorbeeld het aanbieden van creatieve taken die aansluiten bij de ervaringen en concerns van de dio, door studenten vrijwillig te laten participeren, en door een groepssamenstelling waarin de groepsleden elkaar kennen en onderwijservaringen kunnen delen. Wanneer een docent of ontwerper een gebrek aan motivatie bij zijn studenten verwacht, helpt een gestructureerde taak de studenten om de taak uit te voeren.

Bij het onderzoek kunnen enkele kanttekeningen worden gemaakt. Allereerst heeft de studie plaatsgevonden in een bestaande opleidingssituatie waardoor geen volledige controle over de ontwerpvariabelen mogelijk was. Ten tweede kan in vervolgonderzoek gebruik worden gemaakt van meer kwalitatieve inhoudsanalyse, opdat zicht kan worden verkregen op de karakteristieken van de communicatie van de dio's, zoals de manier waarop vragen worden gesteld of de 'toon' van de berichten. Sequentie analyse kan meer inzicht verschaffen in de consequenties van de samenwerking voor het individuele studentgedrag. Ten derde is er de vraag in hoeverre de resultaten van dit onderzoek te generaliseren zijn naar andere opleidingen. Door nauwkeurige beschrijving van theorie, implementatie-context en evaluatieve activiteiten hebben ontwerpers de mogelijkheid de resultaten van dit onderzoek te vertalen naar de eigen context.

Curriculum Vitae

Ditte Lockhorst was born on March 21, 1965 in The Hague. After Montessori primary school, she went to the 'Haags Montessori Lyceum', and became a Montessorian all the way. After her graduation in 1983, she started her studies Human Geography at Utrecht University. Specialising in Geography for Education, she completed her study in 1989.

After her study she has worked for various education supporting organisations in multi-disciplinary design teams to develop multi-media and participated in research on the use of ICT in secondary education. At the same time she has co-operated on the development of a new Geographic textbook for secondary education. She is employed as educational consultant at IVLOS, the Institute of Education of the Utrecht University since 1991. She has been involved in many national and international projects related to the use of ICT in secondary education and the use of electronic learning environments in teacher training, such as the European T3 and REFLECT projects. She has been co-operating author in various publications related to these projects. Moreover, in the period from 1993 to 1997, she was responsible for the training of student teachers on the use of ICT in the classroom. She started her PhD research in 1998, during which she kept on being involved in projects related to electronic learning environments and digital portfolios in teacher training.

Since finishing her PhD, she is involved in a European project on 'Learning at the workplace and ICT in SME's', and works for the Ruud de Moor Centre of the Open University in the Netherlands.