LEARNING TOGETHER: A POSITIVE EXPERIENCE

The effect of reflection on group processes in an asynchronous computer-supported collaborative learning environment

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Silvia Dewiyanti
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CONTENTS

CHAPTER 1 - General introduction

Although learning is an individual matter, contemporary approaches to learning suggest that learning should be facilitated by other people; for example other learners or experts. A constructivist view of learning emphasises the provision of support for learners as they build on and modify their existing mental models (Dalgarno, 2001). It has been suggested that the support of a group of learners with a common learning objective produces an effective learning process and the best learning outcomes (Jonassen, Mayes, & McAleese, 1993; Moallem, 2003). Thus, encouraging more collaboration among students has become an important feature of learning today.

One pedagogical method that is used to facilitate interaction among learners is collaborative learning. This method involves two or more participating learners to exchange their ideas, experiences and resources, then elaborate and refine these in order to co-construct knowledge (Veerman, 2000; Veldhuis-Diermanse, 2001). Collaboration involves the construction of meaning through interaction with others and can be characterised by a joint commitment to a shared goal (Littleton & Häkkinen, 1999).

There has been a focus in the literature of the benefits on collaborative learning (Koschmans, 1996; Roschelle & Teasley, 1995; Scardamalia & Bereiter, 1994; O'Malley, 1995; Dillenbourg, 1999). Research shows that collaborative learning is useful to stimulate critical thinking and active learning. This is another reason to recommend collaborative learning for distance learners.

Also in higher education the collaborative learning principle becomes an important part of the learning process because learners need to learn together with their peers through debate and discussion, through understanding other points of view and articulating their own, and through explaining and receiving explanations of concepts and ideas (Hiltz, 1997). Besides, interactions with other peer students promote friendship and emotional support, which is important to foster a sound group climate.

The fast development in information and communication technologies makes it possible to learn together with others regardless of time and space via Computer-Supported Collaborative Learning (CSCL). According to Koschman (1996), CSCL is built on social constructivist and socio-cultural perspectives of learning and focuses on the use of technology as a mediating tool within the collaborative methods of instruction. A CSCL environment can be synchronous, which means that discussion is held in real time, or asynchronous where students are free to read and to write their responses when it is most convenient to them.

In asynchronous CSCL environments learners collaborate through activities such as exchanging information and raising questions of each other as well as reading and responding to others' comments. Although collaborative

learning in CSCL environments differs with collaborative learning in a face-to-face environment in some aspects, however, the aim of collaborative learning in both types of learning environments remains the same, namely acquisition of domain knowledge and collaborative skills (Kaye, 1992). A productive collaboration demands students to pay attention not only to gain domain knowledge or skills, but also to demonstrate certain skills with respect to communication and collaboration in order to be able to complete a task.

This research focuses on the use of asynchronous CSCL environments as medium to facilitate campus-based and distance education students to collaborate and reach their learning goals. Especially in distance education the use of asynchronous CSCL environments seems profitable because of several reasons. First, asynchronity is worthwhile because it can facilitate distance education students who are dispersed geographically. Second, asynchronous CSCL environments offer time and pace flexibility for distance learners in placing their responses. Third, it offers useful ways of organising the discussion in threads.

Asynchronous CSCL environments seem to be most common and most useful for distance education (Williams, 2002). In distance education, the learners are separated from their peer students and teacher. They do not or irregularly attend face-to-face lectures and interaction with other learners with whom they might pursue joint learning and mutual support is limited or completely absent. However, via asynchronous CSCL environments, collaborative learning can be applied to distance education.

Nowadays, more and more higher education institutes implement CSCL environments to facilitate collaboration among their students. These learning environments free learners of the requirement to share physical space and communicate synchronously (Harasim, 2001). Besides CSCL can provide a less competitive situation and promote a more equal participation as compared to face-to-face collaboration (Harasim, 1989).

In practice, applying an asynchronous CSCL environment is not simply assigning students in groups and asking them to use the environment to facilitate their collaboration. The use of this medium should be accompanied with specific instructions to create a powerful and safe learning environment. Specific instructions might be needed in order to structure collaboration among students through assigning roles (Strijbos, 2004), providing scripted cooperation (O'Donnel & Dansereau, 1992), providing social affordance devices (Kreijns, 2003), using computer-based external representations (Van Bruggen, 2003) or stimulating reflection (Johnson, Johnson, Stanne & Garibaldi, 1990). Those specific instructions aim to help learners to reach a productive collaboration. In this research the effect of reflection on the regulation of group processes will be investigated.

The importance of the regulation of group processes

Collaborative learning is a learner-centred approach that encourages students to be more responsible for their own learning process. One concern in collaborative learning is that the group members are expected to be able to take responsibility in regulating the group process in order to maintain a productive collaborative learning. One reason to pay attention to the regulation of group processes is the fact that an asynchronous CSCL environment facilitates only delayed responses from group members (Abrami & Bures, 1996; McConnell, 1994). Another reason is that interaction among group members in an asynchronous CSCL environment lacks information we normally receive in face-to-face collaboration like body gestures. Therefore, the chance of misunderstanding among group members is considerably. In addition, in distance education, group members might be unfamiliar with each other. This unfamiliarity might hinder distance learners to interact with their peer learners. Thus, based on these drawbacks, regulatory activities in an asynchronous CSCL environment could be more difficult than in a face-to-face context. Therefore, collaboration in a CSCL environment needs to be regulated well.

From a theoretical point of view, a well-regulated group process is assumed to enhance effectiviteness and efficiency e.g. in the sense of a better learning outcome. One way to keep or to maintain a well-regulated group process is through reflecting on a group session (Johnson & Johnson, 1994). Reflection can be described as members actions that are helpful or unhelpful in order to make decisions about what actions must be taken in order to reach the group's goals. However, it is still not fully understood how groups might benefit from reflective activities (Webb & Palinscar, 1996). Only few researches are done to examine the importance of the regulation of group processes during group work (e.g. Yager, Johnson, Johnson & Snider, 1996; Ulicsak, 2004; Kyza, Golan, Reiser, & Edelson, 2002). Furthermore, no research is conducted in campus-based and distance education that considers the importance of regulating group processes and how to stimulate students to regulate group processes during collaborative learning.

The aims of this research

The aims of this thesis are, firstly, to reveal how group members regulate group processes while using an asynchronous CSCL environment, and secondly, to investigate whether reflection can be promoted in order to stimulate group members to regulate group processes, to increase knowledge co-construction, and to foster affective learning activities. Four studies are presented in which the way students regulate their group processes are observed and in which the effect of reflection on group processes are studied.

So, the main research questions are: (1) How do campus-based and distance education students collaborate in an asynchronous CSCL environment and how do they experience collaborative learning? And (2) What is the effect

of reflection on the regulation of group processes, knowledge co-construction and affective learning activities.

The relevance of this research, especially for the Open University of the Netherlands (OUNL) and distance education institutes, is that it aims to provide guidelines for improving the design of education with CSCL. Furthermore, students in the OUNL come with various level of knowledge, ranging from novices to beginning experts (Van Bruggen, 2003). The use of collaborative learning method is useful for them because it offers entry points for all knowledge levels (Scardamelia & Bereiter, 1994). Finally, studies in this thesis promote the use asynchronous CSCL environments to facilitate collaborative learning in the OUNL.

Context of this research

This research is conducted primarily in a distance education context. However, the context is also widened to higher educational institutes where CSCL environments are embedded in face-to-face education to facilitate collaborative activities. There are several considerations in widening our context. First, ICT has come to play an important role in higher educational institutes. Currently a lot of traditional universities apply CSCL environments to facilitate their learning program (Bullen, 1998; Bures, Abrami, & Amundsen, 2000; Jung, Choi, Lim, & Leem, 2002). Secondly, the use of asynchronous CSCL environments is considered to have additional benefits for the learning process because it promotes student's reponsibility for their own learning and equality in participation. Thirdly, it encourages the use of reflection rather than spontaneous thinking and suggested to increase critical thinking and active learning (Abrami & Bures, 1996). Fourthly, collaboration with peer students in an asynchronous CSCL environment facilitates the acquisition of complex cognitive skills. Working together with others requires students to deal with coordination and integration of separate skills in order to accomplish a task (van Merriënboer, Clark, & de Croock, 2002). Finally, collaborative learning that is facilitated by an asynchronous CSCL environment promotes metacognitive processes. These processes include the activities of planning, monitoring and selection of strategies that are needed when students work together to proceed a task (Brown, 2002).

Approach

Our approach in answering the research questions is divided into four steps.

First, a literature study was done to outline the theoretical starting point. The foci were on the importance of collaborative learning particularly in distance education, interactions in the asynchronous CSCL environment, and the use of reflection for maintaining positive interactions. From the literature guidelines for practical use of reflection in asynchronous CSCL environment were formulated.

Second, an explorative study was executed to get an idea how distance students experience collaborative learning in asynchronous CSCL environments. Learning in collaboration with peers, especially in a CSCL environment, is not predictable, and does not necessarily occur simply by assigning a number of students in a group (Johnson et al., 1994; Roschelle & Teasley, 1995; Slavin, 1995). According to McGrath (1991), there are three functions that a group should fulfill at the same time: (1) working on the common task together, (2) maintaining the communication and interaction among group members, and (3) helping individual members when necessary. Practically, being a member of a group means to adjust with other group members ways of work and behaviour, to respect others, to communicate individual intentions, and to contribute ideas and suggestions. This circumstance makes it essential in collaborative learning to regulate group processes, to communicate different perspectives in order to reach a common perspective as well as to create relaxed groups' atmospheres. A well regulated group process is more than a well coordinated group process. In this research the term 'regulation' is used instead of 'coordination' because regulating group processes is more than coordinating task activities within a group. It not only involves planning and dividing task activities but also includes orienting the task, determining the group's goal, and monitoring group members' participation as well as the execution of the group's plans. Further, commonly learners are assigned in small groups in which other group members may influence their attitudes and opinions. In this situation, learners should take advantage of other learners presence in order to improve their individual ability to absorb or to gain new skills and knowledge through certain learning activities such as asking, arguing, and explaining. The value of learning in collaboration with peers is shown through the knowledge co-construction process. Moreover, group members should maintain their group's atmosphere. The way students' collaborate is influenced by the group's atmosphere, for example, a supportive group atmosphere helps learners to become real members of the community. Lack of such a feeling will lead to group members who are likely to be anxious, defensive, and unwilling to involve in the group (Wegerif, 1998). So, in this explorative study, five research questions were addressed: (1) how do distance students experience collaborative learning in asynchronous CSCL environments?, (2) are distance students satisfied with collaborative learning in asynchronous CSCL environments?, (3) do individual and course characteristics influence students' experiences with collaborative learning?, (4) which aspects within collaborative learning do influence students' satisfaction?, and (5) how do students actually collaborate in an asynchronous CSCL environment?

Third, an experimental study in a laboratorium setting where the situation was strictly under controlled, was conducted in order to investigate the effect of reflection as a tool for fostering effective and efficient collaborative

learning. In literature, reflection is introduced by Johnson et al. (1994) as an important element to foster group effectiveness. Reflection functions to review how well group members are functioning and how to improve their work processes. Various researchers stress the importance of reflection in learning processes (e.g. Dillenbourg & Self, 1995; Bull, Dimitrova & Brna, 2002; Boud, Keogh & Walker, 1996). Although there is a lot of research in the collaborative learning area, however, research on reflection in a collaborative learning session receives only small attention. Most of these were conducted in a face-to-face context (e.g. Johnson, Johnson, Stanne, & Garibaldi, 1990; Yager et al., 1996) and very few research has been conducted in a CSCL environment (e.g. Ulicsak, 2004). In this experimental study, our interest was to investigate the effect of reflection on group processes in an asynchronous CSCL environment on the regulation of group processes, on knowledge co-construction, and on students' experiences with collaborative learning.

The final phase of the research was to determine the effect of reflection in field studies. Two field studies that involved students from a distance learning institute as well as from a campus-based institute were conducted. An empirical study that involved distance education learners was conducted to investigate the effect of reflection on the regulation of group processes, on knowledge co-construction, on students' experiences with collaborative learning, and on affective learning activities. The second field study was more explorative and involved students from a campus-based institute. As mentioned before, currently, not only distance education applies CSCL environments but also campus-based higher education. In this explorative study, students from a campus-based institute used an asynchronous CSCL environment to facilitate their collaboration. Several instructional settings that emphasised reflecting on group process were applied in the asynchronous CSCL environment. The main interest was to explore whether asynchronous collaborative learning is a feasible learning method for students in campus-based higher education.

Structure of the thesis

This thesis focuses on the use of reflection to stimulate a positive collaboration process in an asynchronous CSCL environment. The first chapter provides a general overview of the background of the research. The rest of the thesis is organised as follows.

In Chapter 2, a theoretical framework of embedding reflection in an asynchronous CSCL environment is presented. It is discussed how reflection can stimulate students' awareness of maintaining positive interactions during collaborative learning. In addition, theory-based guidelines for embedding reflection in asynchronous CSCL environments are formulated.

Chapter 3 reports an explorative study that was carried out to gain response from distance students on their experiences with collaborative

learning in asynchronous CSCL environments. Moreover, this study attempts to identify crucial aspects concerning the collaborative learning.

Then, in Chapter 4 an experimental study is presented. This was conducted in a laboratorium setting and examined the effect of reflection on the regulation of group processes, on knowledge co-construction, and on collaborative learning experiences.

An experimental field study is reported in Chapter 5. This study is a follow up of the study in the Chapter 4. The study was conducted in the real setting and involved distance learners. Additionally, the effect of reflection on affective learning activities is examined.

Chapter 6 presents two studies that explored how higher education students experienced asynchronous collaborative learning that was facilitated by a CSCL environment. Both studies observed whether asynchronous collaborative learning was a feasible learning method for student in a campus-based higher education institute. Issues on participation, interaction, and students' experience while using an asynchronous CSCL environment to facilitate collaborative learning were discussed.

The final chapter summarises the research questions and findings of all studies, followed by critics and argumentations related to the methodology and the theory. Implications for practice and directions for future research will conclude the chapter.

CHAPTER 2 - Reflection on group processes: A tool to maintain positive interaction in an asynchronous computer-supported collaborative learning environment

Abstract

The modern perspective on learning stresses the importance of active learning and the social dimension of learning. This perspective emphasises interaction among learners and experts to learn from other points of view, to verbalise their thoughts, to argue ideas and finally to come up with the best solution. The purpose of this chapter is to discuss how reflection can stimulate students' awareness of maintaining positive interactions during collaborative learning, and to generate theory-based guidelines in embedding reflection in asynchronous computer-supported collaborative learning (CSCL) environments. First, the necessary conditions to start interaction among learners are described. Second, the interaction in asynchronous CSCL environments is discussed. Third, the use of reflection on group processes as a tool to maintain positive interaction is elaborated. Finally, theory-based guidelines for embedding reflection in asynchronous CSCL environments are presented.

In place of traditional learning, a new perspective is arising on the concept of learning. While traditional learning focused on the transferability of knowledge, the new concept of learning aims at learning outcomes that include skills on learning, thinking, and collaboration (Simons, van der Linden, & Duffy, 2003). This new learning concept emphasises the social interaction with other learners and experts as an important element of learning processes.

Social interaction with other learners or experts in order to promote learning can be facilitated through collaborative learning. Collaborative learning is a pedagogical method that promotes interaction among learners. Accordingly, learning requires a situation in which two or more participating learners exchange ideas, experiences and information, then elaborate and refine them in order to co-construct knowledge (Veerman, 2000; Veldhuis-Diermanse, 2002). Further, collaborative learning has social, cognitive and affective benefits since learners are encouraged to see others' points of view, to verbalise their thoughts, to argue the ideas and to achieve the best solution (Harasim, Hiltz, Teles, & Turoff, 2001; Johnson & Johnson, 1994). So, working together while accomplishing a task is seen as a characteristic of a powerful learning environment, aiming at the active construction of knowledge (van Merriënboer & Paas, 2003).

During the last decade the growth of technology has enabled interaction among learners to escape the restrictions of time and place by using computer-

supported collaborative learning (CSCL) environments. The availability in such environments of communication tools, such as chatting, e-mail and discussion groups, have provided opportunities for learners to communicate and interact with each other without limitation of time and place. Moreover, CSCL environments can be categorised as: synchronous or asynchronous.

A synchronous CSCL environment allows learners to communicate at the same time from different places whereas an asynchronous CSCL environment supports communication both from different places and at different times. So, the main difference between asynchronous and synchronous CSCL environments lies in time independence. An asynchronous CSCL environment permits learners in any geographic location and at different times to work collaboratively. Moreover, learners can take advantage of the asynchronous CSCL environment in that it allows the use of thoughtful rather than spontaneous thinking, removes interruption, and stimulates less assertive students to contribute their opinion (Abrami & Bures, 1996; Hsi & Hoadley, 1997).

On the other hand, there are disadvantages when collaborating in asynchronous CSCL environments, such as a lack of gesture actions, an increase of lurkers, the difficulty of keeping track of each other's work and controlling turn-taking. However, these disadvantages can be seen as challenges. When asynchronous on-line collaboration is used, designers and developers of CSCL environments can try to minimise the disadvantages by decreasing group size, requesting joint products, providing specific instructions, and providing the conditions in order to start interaction among group members.

Taking these aspects into account, educational practitioners may expect a positive influence on the collaboration process. This is important because researchers found that in real practice, the expected positive interaction in collaborative learning does not always happen. Some experts (e.g. Solomon, 1992; Johnson & Johnson, 1994) argue that a true collaboration where students pool together their abilities and generate new knowledge is rather rare. For this reason, positive interactions during collaborative learning must be triggered (Dillenbourg, 1999). Thus, one essential question in the CSCL research area is how positive interactions can be triggered and be maintained.

This chapter aims to promote reflection as a tool to maintain positive interactions in collaborative learning in an asynchronous CSCL context. Firstly, the necessary conditions to start interaction in asynchronous CSCL environments are elaborated. Next, two types of interactions in the collaboration process are discussed. Then, previous research about the importance of reflection to maintain positive interactions in an asynchronous CSCL environment is reviewed. Finally, theory-based guidelines to facilitate reflection on group processes in asynchronous CSCL environments are proposed.

The necessary conditions to stimulate interactions in asynchronous CSCL environments

An asynchronous CSCL environment should be an open, safe and trustable learning environment that allows equal opportunities for learners to participate as well as to engage collaboratively without limitation on knowledge levels (Scardamalia & Bereiter, 1994), to express ideas and arguments without fear of being penalised or ridiculed (Rowntree, 1992), and to practise critical reflection, conflict negotiation, and consensus building (Rinehart, 1999). Thus, in this learning environment productive collaboration is expected to occur. Collaboration is considered to be productive when all learners participate actively, review the ideas, add information, elaborate their own ideas and propose new ideas (Hsi et al., 1997).

Collaborative learning that is applied in an asynchronous CSCL context involves different communication and interaction as compared to the face-to-face learning context. However, the goal of collaborative learning remains the same in both contexts: domain knowledge and group skills acquisition (Kaye, 1992). Domain knowledge acquisition, often called knowledge co-construction, is the result of interaction and negotiation with other group members to come to a mutual agreement as to the interpretation of what is to be learned (van der Linden, Erkens, Schmidt, & Renshaw, 2000). Group skills acquisition is the result of social interaction with other group members in organising their group in order to reach the group goals.

Several researchers (e.g. Hooper, 1992; Johnson & Johnson, 1994; Kagan, 1994) have warned that simply assigning students in groups and requiring them to engage in collaborative learning will not automatically produce positive interactions or outcomes. Based on literatures (Brandon & Hollingshead, 1999; Johnson, et al., 1994; Webb & Palinscar, 1996), we proposed three necessary conditions in the asynchronous CSCL context, namely group size, a group task and teacher involvement.

The size of a group may have an effect on group members' sense of personal responsibility for contributing their efforts to accomplish the group's goal or so-called individual accountability. The appropriate size of a group is relative and depends on the activity to be pursued and the length of time the group will stay together. Larger groups require more time to become effective and cohesive, but they have the advantage of formalising the communication among their members, because group members can learn more through different perspectives and points of view. Hence, breaking large numbers of students into small groups (less than five members) is recommended for an asynchronous CSCL environment because relatively small groups enable group members to participate more equally (Rovai, 2000; Tolmie & Boyle, 2000).

A group task that stimulates group members to work collaboratively and to produce a joint product increases positive interdependence in which group members are linked with each other in such a way that when working

individually the group's goal cannot be reached. This type of task cannot be solved individually, since it can only be completed when group members work together and share their resources such as information, feedback, skills or alternative solutions (Cohen, 1994). Further, the task should stimulate group members to generate various opinions, discussions and creative group decisions. An example of this type of task is a case study that is situated in a real-life context and enables learner to think as an expert, because it can stimulate group members to collaborate.

The involvement of the teacher in the beginning of a collaboration process may encourage promotive interaction among group members as well as foster the use of the group skills. Teacher involvement may be intense in the beginning of collaboration process to encourage group members to participate as well as to give examples of interpersonal and group skills. However, the intensity has to be reduced as group sessions proceed.

In the next section, the interaction during the collaboration process in asynchronous CSCL environment is discussed.

Interaction and expected outcomes from the collaboration process in asynchronous CSCL environments

In asynchronous CSCL environments two types of interaction occur in parallel, namely (1) interaction to gain domain knowledge or skills and (2) interaction to build and to maintain the group. Both types of interaction are of great importance in collaborative learning. It is crucial to balance between these two types of interaction because participants in collaborative learning should reach consensus about the representation of the task as well as about the way the task is to be dealt with (van der Linden et al., 2000). Thus, it is important to know about the essential aspects of both types of interaction that contribute to a positive development of group processes, namely on the one hand cognitive restructuring, verbalising, and conceptual conflict resolution, and on the other hand regulation, constructive participation, and social and emotional support. These aspects will be discussed in greater details.

Cognitive restructuring, verbalising, and conceptual conflict resolution are related aspects of the interaction to gain domain knowledge or skills (McConnell, 1994; van der Linden et al., 2000). These aspects are often seen as one process of co-construction of knowledge. Cognitive restructuring is characterised by sharing different perspectives, verbalising by making one's idea explicit, whereas communicating one's own knowledge and conceptual conflict resolution become visible by exchanging arguments. Activities related to these aspects include questioning, arguing, reasoning, explaining (King, Staffieri, & Adelgais, 1998; Veerman, 2000; Webb & Farivar, 1994). These activities are thought to be mechanisms that can stimulate learning. Through participating in these activities, students are encouraged to recognise individual misconception, recognise multiple viewpoints, seek new information, resolve

disagreements, re-conceptualise and reorganise information, all of which lead to the construction of new knowledge (Webb et al., 1996). Particularly in asynchronous CSCL environments, group members should have skills to identify when they need help, when other members need help, when to argue, when to ask for explanation, and how to give a good explanation. Without those skills, collaboration is less effective.

In contrast to the first type of interaction, the second type of interaction, which is related to building and maintaining the group, is often neglected. Most research has focused on the benefits of collaborative learning on individual learning performances rather than on increasing individual awareness of group processes. In fact, learners need more structure and guidance in coordinating their group activities (Oliver & Omari, 2001). The important aspects of interaction to build and to maintain the group are regulation, constructive participation, and social and emotional support.

Collaborative learning is one approach to active learning. One of the important components of active learning is self-regulation (Brown, 2002). Regulation in collaborative learning refers to the management of group activities in attaining the group goals, for example by creating a clear working procedure and monitoring group members' involvement in completing the task. Ideally, in collaborative learning group members will support each other to reach the group goals. Therefore, in asynchronous CSCL environments, the regulation dimension moves from individual self-regulation (i.e. monitoring individual ideas) to group regulation (i.e. monitoring the ideas of others and weaving the ideas of all group members into a more integrated framework for their work). Since collaborative learning emphasises the pooling efforts among group members, activities such as orienting on the goal of the task, making a plan before the group starts to work, preparing strategies to carry out the task, and monitoring the group working procedure as well as the progress of the group, are crucial to developing effective group processes.

Constructive participation, which refers to the interaction and contribution of group members in completing the task and in coordinating activities within the group, is often used as a significant indicator of successful collaborative learning (Johnson et al., 1984; Roschelle & Teasley, 1995). In collaborative learning, group members are expected to contribute equally. However, equal participation is not always smooth. Group members might loaf, lurk or bully other members, dominate conversation, be overly aggressive or acquiescent. These behaviours hinder effective collaborative learning. As a consequence of this, it is important to motivate or to remind group members to take part in group processes.

Social and emotional support is particularly important for students who are participating in an asynchronous CSCL environment. Mutual respect and trust among group members should be maintained for a successful collaboration. Thus, maintaining a safe and harmonious group climate is one

aspect to encourage students to interact positively. Social and emotional support makes learners feel a member of the group community.

In sum, these aspects from both types of interaction will influence the results of collaborative learning that can be seen through (1) gaining new knowledge and new skills and (2) learners' appreciation of collaborative work instead of frustration and dislike. The main expected results of collaborative learning are obviously gaining new domain knowledge and new skills. New domain knowledge is either obtained or co-constructed through active interaction with other learners. However, learners' appreciation of collaborative work often relates to satisfaction and joyful experience with collaborative learning, which are indicators that positive interaction occurred in the collaborative learning.

In the next section, the use of reflection to maintain positive interaction in asynchronous CSCL environments will be discussed. The goal, the subject, the format, and the leader of reflection, including previous research on reflection, will be elaborated in detail.

Reflection to enhance group members' awareness of maintaining positive interaction in collaborative learning

In the literature reflection is defined as the mental process of trying to structure or restructure an experience, a problem or existing knowledge or insight (Wubbels & Korthagen, 1990). In the CSCL context, this definition can be interpreted as a joint process between group members of trying to structure or restructure an experience, a problem or existing knowledge or insight within a group. There are several reasons to promote reflection during collaborative learning. First, reflection could stimulate all group members to become involved in discussing what group members already know and what missing information they have to gather in order to solve the problem and to decide what actions should be taken to improve the collaboration process in order to reach the learning objectives (Flynn & Kelin, 2001). Second, reflection functions to stimulate group members' awareness of active monitoring and regulating their group processes. Collaborative learning requires group members to keep track of each other's work while carrying out their own work and to provide each other with feedback in order to attain the group goals (Gerosa, Fuks, & Lucena, 2003). Third, reflection upon the effectiveness of the collaboration process has great value in keeping the focus on the original intent of the task (Beaudin, 1999), to avoid errors in the completion of the task (Carey & Kacmar, 1997), and to determine the next actions within the group. Fourth, reflection allows group members to plan their activities prior to proceeding with a task, to make the assessment and adjustment while they are working, and to make revisions afterwards (Naidu & Oliver, 1999).

Current research shows that reflection can have a positive effect on learning achievement (Yager, Johnson, Johnson, & Snider, 1996) as well as on

problem solving success (Johnson, Johnson, Stanne, & Garibaldi, 1990). For example, Yager et al. (1996) examined the effects of discussing group processes on individual achievement. Secondary school students were randomly assigned to one of three conditions: (1) cooperative with reflection, (2) cooperative without reflection and (3) individual. In the cooperative conditions, students were assigned to groups of four members. In the individual condition students were instructed to work independently. Groups in the cooperative condition without reflection were instructed to collect and organise their materials at the end of a session. Groups in the cooperative condition with reflection were asked to analyse and discuss any problem the group had in working together, to comment on the positive behaviours of group members, and to set goals for working collaboratively during the next session. From their study, Yager et al. (1985) found that students in the cooperative conditions outperformed students in the individual condition. Their research also indicated that discussing group processes increases both individual achievement and group productivity.

In another study, Johnson et al. (1989) investigated the effects of different forms of reflecting and discussing group processes on individual achievement. Students from the last year of the secondary school were randomly assigned to one of four conditions: individual, cooperative without reflection, cooperative with teacher-led reflection, and cooperative with teacher- and student-led reflection. Students in the cooperative conditions were working in small groups of three members. Students who were working in the individual condition were instructed to work independently. Cooperative groups without reflection were simply asked to work as a group to maximise the success of all members. Cooperative groups with teacher-led reflection were instructed by the teacher (1) to summarise the information and the ideas of all group members, (2) to encourage active oral participation of all members, and (3) to check for agreement among members each time a decision was made. The teacher observed the small groups in action and provided feedback to all students. Cooperative groups with both teacher- and student-led reflection got the same instructions as the cooperative groups with teacher-led reflection, but in the former group students discussed their performance and use of the teacher-led targeted skills within their small groups. The finding in this study revealed that students in the cooperative learning conditions outperformed students in the individual condition. Further, the combination of student- and teacher-led reflection resulted in more progress than did either teacher-led reflection alone or no reflection.

Both studies indicated that reflecting on group processes increased individual achievement and group productivity. However, both studies were conducted in a face-to-face context at the secondary school level where teachers usually monitor collaborative settings very closely and the given task is highly structured. In a CSCL context, particularly at a higher education level, the tasks require more student independence and the monitoring of the quality of

students' interaction is rather limited or even hardly possible as is the case in distance education.

To summarise so far, the three necessary conditions previously mentioned, the important aspects from both types of interaction, the expected collaborative learning outcomes, and the role of reflection in asynchronous CSCL environments can be pictured in a model.

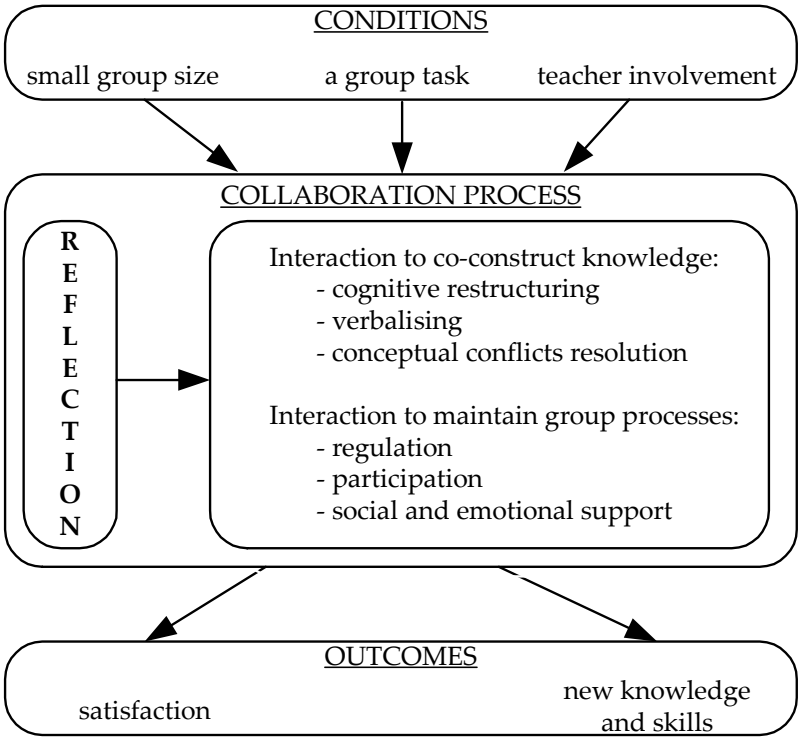

Figure 1. Conditions, aspects and expected outcomes from collaborative learning in an asynchronous CSCL environment.

As can be seen in this model reflection plays an important role during collaborative learning. The next issue is how to embed reflection in an asynchronous CSCL environment. In the next section guidelines will be formulated in order to accomplish this.

Guidelines for embedding reflection in an asynchronous CSCL environment

Much has been written about guidelines for effective group working either in face-to-face or in CSCL contexts (e.g. Hooper, 1992; Veldhuis-Diermanse, 2002). However, the existing CSCL literature does not pay much attention to the importance of reflection on group processes and even lacks from concrete instructional guidelines to promote reflection into practical use. Table 1 displays instructional guidelines about embedding reflection as a component for supporting effective collaborative learning in asynchronous CSCL environments.

Table 1
Guidelines for embedding reflection in an asynchronous CSCL environment for maintaining group processes

Element of reflection	Guidelines
Goal	• Inform the group members about the importance and the aims of reflection.
Subject	• Identify and determine the target skills and the expected attitudes that should be mastered during collaborative learning, namely: o in the regulation of group processes, o in the acquisition of knowledge, and o in social interaction and communication.
Format	• Use a clear, specific and encouraging format; • Select a familiar or an appropriate form in the task, for example by using questions, statements, or sentence-starters; • Recommend group members to refer to positive and effective behaviour during reflection.
Leader	• Give group members the opportunity to lead reflection within their group;
Time	• Give group members the opportunity to reflect on group processes periodically during collaborative learning; • Select a natural moment to reflect, for instance: after certain learning activities are completed.

Goals of reflection. It is important to inform group members about the goals and the importance of reflection on group processes. Learners tend to neglect reflection if the reasons for doing this activity are unclear. As we have mentioned before the goals of reflection on group processes are to evaluate group members' behaviour in order to maintain positive interaction in collaborative learning.

Subject of reflection. Successful reflection is shown through improvement in using collaborative skills and attitudes. Thus, it is important to identify and to determine the target skills and the expected attitudes that should be mastered during the collaborative learning. From the literature (e.g. Pilkington & Walker, 2003) three factors appear to be the foundation for productive interaction in collaborative learning. These factors, which are also shown in Figure 1, are the acquisition of new knowledge, the regulation of group processes, and social interaction and communication. Within these factors, there are a number of skills and attitudes that need to be mastered. For this reason examples of either skills or attitudes or both for each factor are described in detail. The first factor is acquisition of new knowledge. The main goal of collaborative learning is gaining new domain knowledge or new skills through interactions with other group members. Thus, learners should take advantage of other learners' presence in order to improve their individual ability in mastering learning material. Certain skills, for instance resolving conceptual conflicts, verbalising, and sharing different perspectives, are valuable for

learning processes. Further, these skills are believed to function as a mechanism that stimulates knowledge co-construction. The second factor is the regulation of group processes. Group members are responsible for regulating their group processes from the very beginning of the collaboration. Thus, some regulatory skills, for instance orienting on the task, preparing a working plan and monitoring group working procedure and group progress, need to be acquired. Finally, adequate social and communicative skills are needed for productive collaboration. As we have mentioned earlier, an asynchronous CSCL environment is different from a face-to-face learning environment. Communication in asynchronous CSCL environments lacks gesture, which might lead to misinterpretation of the messages. Thus, learners should develop the necessary communicative skills and understand social attitudes in order to work effectively and to create positive interaction. These skills and attitudes are, for instance, presenting clear opinions, respecting other group members' perspectives and constructive participation.

Format of reflection. Prompting students to reflect on certain factors and at certain times is effective (Brown & Palinscar, 1989; Davis, 2003). Particularly in asynchronous CSCL environments, prompting is a sophisticated format to guide students to jointly reflect on group processes because of the variable and flexible format. For example, prompts can take the form of statements, questions, or sentence-starters to be responded to. The use of reflection prompts in asynchronous CSCL environments should meet criteria such as being clear, specific and encouraging. The prompts should be clear and explicitly request students to reflect on their group processes. Ambiguous prompts can cause difficulties for group members to interpret the prompts with the result that they might ignore all prompts (Davis, 2003). Then, the reflection prompts should enquire into specific aspects of group processes. Targeting specific aspects of group processes seems more helpful for group members than prompts that address broad aspects of collaborative learning (Davis, 2003). Finally, the reflection prompts should refer to positive and effective behaviour rather than negative and ineffective behaviour.

Leader of reflection. Reflection on group processes seems to have more impact when group members themselves lead the reflection. Although the combination between student- and teacher-led reflection seems ideal, there are at least two reasons why teacher involvement might inhibit this process. First, the teacher may dominate the collaboration process and restrain students from interacting with each other (Brandon & Hollingshead, 1999). Second, teacher-led reflection is time-intensive and asks a lot from the teacher because the teacher needs a certain competency to lead the reflection session and should follow the situation in each group (Veldhuis-Diermanse, 2002). In an asynchronous CSCL environment, there are several reasons to recommend that

group members themselves lead the reflection. Firstly, in collaborative learning the learning control shifts from the teacher to the student (Bruffee, 1995). Thus, students have a greater responsibility to monitor and to regulate their own group processes. Second, group members who involve directly in reflecting on group processes know better the strengths and the weaknesses of their group. Third, group members might benefit from learning reflective skills that also can be used to monitor and regulate their individual learning.

Time for reflection. Reflection should be repeated periodically. Typically, reflection is done after a series of learning activities is completed. However, if reflection aims at developing positive group processes, then reflection should be done throughout the collaboration process. Positive group processes that are indicated by active monitoring and regulating should occur from the very beginning of the collaboration process. Reflection in the beginning of the collaboration process functions to explore pre-knowledge or pre-experience of each group member and to establish the group's rules and regulations. During the collaboration process reflection is a moment for an open discussion on exploring knowledge and skill acquisition, working patterns and relationships between group members and to focus on group goals. Providing time for reflection helps group members to review what went well in their group and what could be improved. Reflection at the end of the collaboration process functions to evaluate the entire group performance and the goal reached, and to make a learning plan for the future.

In sum, this highlights the potential value of reflection on group processes to promote the group members' awareness of maintaining positive interactions in the collaborative learning. Further, it points to the issues that need to be carefully considered when promoting reflection on group processes in asynchronous CSCL environments. Reflection on group processes helps group members to analyse how the group is functioning, to monitor and regulate their group actively, to promote equality in participation, to sharpen the group goal, to keep focus on the objectives of the task, and finally to understand the intent of the task.

Conclusion

This chapter purposed to promote reflection on group processes as a tool to maintain positive interaction in collaborative learning in an asynchronous CSCL context. Firstly, the necessary conditions to start collaboration were discussed and followed by an elaboration of the two types of interaction in asynchronous CSCL environments. Further, the importance of reflection to maintain positive interaction in an asynchronous CSCL environment was discussed and finally theory-based guidelines for embedding reflection in an asynchronous CSCL environment were presented.

Effective collaborative learning requires positive interaction among the participants. Therefore, it is important to direct students from the very beginning of a collaborative learning to achieve effective and productive collaboration. First, the necessary conditions for triggering student interaction need to be set. These necessary conditions include: small group size, a group task, and teacher involvement. These necessary conditions in an asynchronous CSCL environment are expected to encourage group members to interact with each other more effectively and further to develop the group process and to maintain positive interaction. Taking part in collaborative learning should result in the improvement of one's learning performances which is shown through acquisition of new domain knowledge as well as new skills. In addition, participation in collaborative learning should result in students' appreciation of collaborative work instead of ending in frustration and dislike. Positive and enjoyable experiences as the result of interacting with other group members are indicators of successful collaborative learning.

Reflection can be used as a tool to encourage and to maintain positive interaction that leads to effective, efficient and pleasurable group work experiences, because reflection helps group members to articulate their ideas, their confusions and their problems so that group members are able to think over the solutions (Davis & Linn, 2000). However, reflection is relatively neglected in collaborative learning, even though it seems to be a crucial component. So far, no attempt has been made to help designers embed reflection prompts in asynchronous CSCL environments. Moreover, little attention has been paid to reflection on group processes that aims at stimulating the positive development of group processes. To this end, this chapter attempts to identify theory-based guidelines for embedding reflection on group processes in asynchronous CSCL environments. The next step is to investigate whether reflection on group processes will enhance productiveness of collaborative learning in an asynchronous CSCL environment.

CHAPTER 3 - Students' experiences with collaborative learning in asynchronous computer-supported collaborative learning environments*

Abstract

This chapter describes an explorative study carried out to gain responses from distance students on their experiences with collaborative learning in asynchronous computer-supported collaborative learning (CSCL) environments. In addition, this study also attempts to have a good grip of crucial aspects concerning collaborative learning. The study was undertaken among distance learners from the Open University of the Netherlands who were working in groups of four to eleven persons. During and after the course students' experiences with collaborative learning were measured and after the course also students' satisfaction with collaborative learning was assessed. The finding revealed that distance learners appreciate the opportunities to work collaboratively. They show positive experiences and are quite satisfied with collaborative learning. This study also explored individual as well as course characteristics that influenced aspects of collaborative learning, and also aspects of collaborative learning that influenced students' satisfaction. The findings suggested that a group product influences regulation of group processes and group cohesion influences students' satisfaction with collaborative learning.

Nowadays computer-supported collaborative learning (CSCL) environments are viewed as an important electronic learning medium for distance education. CSCL environments can be described as a context where the computer facilitates interactions among learners for the acquisition of knowledge, skills and attitudes (Dillenbourg, 1999; Kaye, 1992; Koschman, 1996). Working together while accomplishing a task is seen as a characteristic of a powerful learning environment, aiming at active construction of knowledge (Van Merriënboer & Paas, 2003). Through a process of interaction and negotiation students have an active and constructive role in the learning process.

Research in recent years has shown that CSCL environments have been used successfully to promote learning achievements in distance education. Harasim (1989) described the social, affective and cognitive benefits of collaborative group work for distance learners. From her study, she concluded

*based on: Dewiyanti, S., Brand-Gruwel, S., Jochems, W., & Broers, N. (in press). Students' experiences with collaborative learning in asynchronous computer supported collaborative learning environments. *Computers in Human Behavior.*

that collaborative learning promotes more active and more effective learning for distance education. Hiltz (1995) also reported that students in collaborative learning conditions had more constructive learning activities and attained higher grades than students in other conditions. These environments provide distance learners the opportunity to work together and to practice critical reflection, conflict negotiation, and consensus building as in face-to-face learning environments. Besides, students are encouraged to exchange ideas, to share perspectives and arguments, and to use previous knowledge or experience in order to decide on the best solution for the problem to be solved. So, the use of CSCL environments can both help to overcome physical isolation between students and teachers, and help to improve learning.

CSCL environments are often promoted as an open, safe, and trustable learning environment that allows equal opportunities for learners to participate without the limitation of knowledge levels (Scardamalia & Bereiter, 1994). These learning environments stimulate students to express their ideas and arguments without any feeling to be penalised or ridiculed (Rowntree, 1992). In a CSCL environment students have the opportunity to take over some control of their own learning and to be active learners who are not only absorbing information but also connecting previous knowledge and new information to gain a deeper level of understanding. The use of an asynchronous CSCL environment is recommended for distance education above a synchronous CSCL environment because it offers flexibility in time to read, to reflect and to compose the responses (Abrami & Bures, 1996).

Students' participation in collaborative learning is seen as the interaction and the contribution of group members when they are collaborating to solve a problem or to accomplish a task. Various elements in an asynchronous CSCL environment may influence students' participation. The important elements are course characteristics, individual characteristics, different aspects of collaborative learning and satisfaction.

Course characteristics. Group size, the type of product (individual or group product), and teacher involvement are considered to be essential characteristics of courses in CSCL environments. Figure 1 in chapter 2 describes these characteristics as conditions for positive interaction in the collaboration process. Group size influences students participation in collaboration substantially (Johnson & Johnson, 1994; Shaw, 1981). Collaborating in small groups makes it easier to stimulate non-active participants, promotes a higher sense of presence and engagement, and increases the individual contributions (Bates, 1995; Hammond, 2000; Kaye, 1992; Wegerif, 1998). Regarding the type of product, Cohen (1994) argued that the task assigned to a group determines how group members interact. Courses that encourage collaboration in general show that the students become more active participants in the learning process when the task requires a high level of collaboration. A high-level collaborative task, for example requesting a group product, requires group members not only to share

information or to determine how to divide their labours, but also to discuss how to proceed as a group. On the contrary, a task with low level of collaboration, for example, requesting submission of an individual report, lacks of group interdependency that might hinder group members to collaborate while accomplishing the task (Johnson et al., 1994). Distance students usually less depend on the teacher and have more freedom to structure their own learning. So, in distance education teacher involvement in collaborative learning is limited.

Individual characteristics. Individual characteristics such as students' ideas about collaborative learning and students' experience with the use of technology might inhibit or promote their participation in the collaborative learning processes (Kagan, 1994). For example, in CSCL environments students are required to communicate by using text-based communication tool. A lack of experience of using text-based communication might influence students participation in their groups (Ross, 1996; Zafeiriou, Nunes, & Ford, 2001).

Collaboration process. The process of collaboration itself is the heart of CSCL (see figure 1 in chapter 2). Collaboration refers to activities that are related to how the group is functioning in accomplishing a task. Within collaborative learning, the responsibility for learning shifts from the teacher to the group members (Bruffee, 1995). This provides an opportunity for the group members to regulate their collaboration process. As a group, they should plan the working process together and make sure that the process will be goal directed. In order to achieve the learning goals group members need to support each other. They should discuss the learning content in depth and maintain the ongoing collaboration process. Determining strategy, contributing ideas, handling internal conflicts, and monitoring group processes are important aspects within collaborative learning. Thus, in order to reach the learning goals all group members have the responsibility to participate in the collaboration process.

Satisfaction with collaborative learning. Students' satisfaction with collaborative learning is an outcome of the collaboration process and can be described as the degree to which a student feels a positive association with his or her own collaborative learning experiences. Students' satisfaction can have repercussions on how students work together, such as whether everyone does his/her part of the work, whether group members can work with each other, whether group members remain on the task (no fighting, no fooling around or too much chatting), and whether there is a good working atmosphere in the group (Gunawardena et al., 2001). Although several studies (Harasim, 2001; Hiltz, 1995) have reported the benefits of collaborative learning for distance learners, still there are many questions surrounded the implementation of collaborative learning in distance education. Little is known on students' experiences during the collaboration process in asynchronous CSCL environments. Understanding students' experiences is important because this

might help designers to provide specific instructions to enhance the quality of the learning process.

This chapter describes an explorative study carried out to gain responses from distance learners on how they experience collaborative learning in asynchronous CSCL environments and attempts to have a good grip of the described crucial aspects concerning collaborative learning. In the end, the findings of this study should provide practical implications for supporting effective learning in asynchronous CSCL environments.

The specific questions addressed in this study were as follows:

1. How do distance students experience collaborative learning in asynchronous CSCL environments?
2. Are distance students, who in general are unfamiliar to each other, satisfied with collaborative learning in asynchronous CSCL environments?
3. To what extent do the individual characteristics and the course characteristics influence students' experiences with collaborative learning?
4. What aspects with respect to collaboration do influence students' satisfaction?
5. How do students actually collaborate in an asynchronous CSCL-environment?

Method

Participants

Students from five distance learning courses of the Open University of the Netherlands volunteered for this study. Participants were asked to complete three surveys (before, during and after the course). Respondents at the first survey were 112 students (76 men and 36 women). Furthermore, 51 participants responded to the second survey (34 men and 17 women). Finally, 67 participants (47 men and 20 women) responded to the last survey. Table 1 summarises the numbers of participants for each course across the surveys.

Table 1
Number of participants for each course across the surveys

	Surveys		
Course	Before the course	During the course	After the course
Change management	30	13	13
Law	16	15	15
Informatics*	19	-	15
Management science	33	8	16
Environmental science	14	15	8

* Because of the short duration of the informatics course, the participants from this course only responsed at the first and the third survey.

Materials

Courses

All the courses required students to work in groups and to submit either a group product or an individual product. All the courses applied an asynchronous CSCL environment. The descriptions of the course characteristics are summarised in Table 2.

Table 2
Course characteristics

Course	Period	Group members	Type of product
Change management	25 weeks	3 - 4	Individual product
Law	24 weeks	4	Group product
Informatics	2 weeks	4	Group product
Management science	20 weeks	8-11	Individual product
Environmental science	17 weeks	4	Group product

Questionnaire on individual characteristics

The individual characteristics questionnaire consisted of five scales. The first scale assessed student's attitude towards collaboration (Attitude Towards Collaboration, 12 items, Cronbach's α = .87), e.g., "I find that it is interesting to work together in a group". The second scale gathered information about individual activities in a group (Group Activity, 6 items, Cronbach's α = .82), e.g., "I like to take the initiative". The third scale intended to get information on student's familiarity with text-based communication (Perceived Text-based Communication, 4 items, Cronbach's α = .86), e.g., "Discussion group is a pleasant way to communicate". The fourth scale aimed at gaining information on student's prior knowledge (Prior Knowledge, 4 items, Cronbach's α = .76), e.g.," I can explain to other students about this subject", and, the last scale assessed student's opinion on using Internet (Opinion on Using Internet, 5 items, Cronbach's α = .75), e.g., "Internet was a pleasant way to get information all over the world". The format of all items is a Likert-type scale, ranging from 1 (strongly disagree) to 5 (strongly agree).

Questionnaire on collaborative learning

Students' experiences with collaborative learning were assessed with six scales (23 items all in) developed for the purpose of the present study and three existing scales. The six scales were (a) Monitoring Working Procedure (8 items, Cronbach's α = .87) e.g., "I remind group members who do not work together properly", (b) Participation (5 items, Cronbach's α = .85), e.g. "All group members participate in discussions to reach a consensus", (c) Monitoring Group Progress (5 items, Cronbach's α = .83) e.g., "I have responsibility to maintain our plan", (d) Helping Each Other (3 items, Cronbach's α = .70), e.g., "I help other group members who have difficulty to understand the learning material" (e) Giving Feedback (2 items, Cronbach's α = .75) e.g., "I constantly gave

feedback to other group member works", and (f) Need to be Monitored (2 items, Cronbach's α = .68) e.g., "I feel pleasant if someone reminds me about the deadline". Then, three existing scales assessed Team Development, Intra-group Conflict and Task Strategy. The Team Development scale was adapted from Savicki, Kelley, & Lingenfelter (1996) to assess the degree of cohesion that was achieved while group members have been working together (11 items, Cronbach's α = .91), e.g., "All group members understand the group goals and were committed to them". The scale Intra-group Conflict consisted of seven items. Items in this scale were adapted from Saavedra, Early, & Van Dyne (1993) and measured the degree of conflicts in a group (7 items, Cronbach's α = .72), e.g., "There was a lot of tension among people in our group". The Task Strategy scale was adapted from Saavedra et al. (1993) and assessed the decisions and choices made by a group while completing the task (7 items, Cronbach's α = .81), e.g., "Our group developed a good strategy for doing the tasks". The format of all items was a Likert-type scale, ranging from 1 (strongly disagree) to 5 (strongly agree).

Questionnaire on satisfaction with collaborative learning

This questionnaire consisted of three scales that measured (a) Satisfaction with Group Members Attitudes (6 items, Cronbach's α = .86), e.g., "All group members can get along well", (b) Satisfaction with Learning in the Group (5 items, Cronbach's α = .87), e.g., "I learn a lot from other group members", and (c) Satisfaction with Group Working (4 items, Cronbach's α = .82), e.g., "I feel pleasant to work together in the group to solve a task". In addition students' satisfaction over their final product was measured with a single item "I am satisfied with the final product". The format of all items was a Likert-type scale, ranging from 1 (strongly disagree) to 5 (strongly agree).

Content analysis

Content analysis aimed to gain more detailed understanding of learners' activities during collaborative learning. Based on previous studies in analysing students' messages (Henri, 1992; van Boxtel, van der Linden, & Kanselaar, 2000; Veerman, 2000; Veldhuis-Diermanse, 2002), a coding scheme was developed to analyse students' messages. The coding scheme consisted of six functional dimensions and 19 specific categories (Table 3).

The Regulation dimension consists of contribution about coordinating activities of learners, e.g. "I propose that we should finish the draft within two weeks". The Consensus dimension consists approval expressions of an idea, e.g. "Yes, I agree" or "That is absolutely correct". The Conflict dimension indicates disagreement of learners activities, e.g. "I do not like the way you work". The Content dimension includes contributions about activities to gain domain knowledge, e.g. "I do not understand what you mean. Can you explain it?". The Social dimension contains emotional expressions and non-task information, e.g.

"You did a great work" or "I had a nice weekend". The Technology dimension describes expressions about the use of computer, e.g. "How can I attach a document".

Table 3
Coding scheme

Dimension	Category
Regulation	Orientation
	Plan
	Reflection
	Monitoring general
	Monitoring working procedure
	Monitoring working progress
	Monitoring participation
Consensus	Reach consensus
	Try to reach consensus
Conflict	Conflict
Content	Ask
	Explain
	Argue
	Product
	External resources
Social	Negative emotion
	Positive emotion
	Off task
Technology	Technology

In order to apply this coding scheme, each message was broken down into manageable items, so-called units, for subsequent allocation into relevant categories. Each unit was assigned only to one category. Because one message might contain more than one topic, the base unit of analysis was a topic within one message. When two continuous sentences dealt with the same topic, they were counted as one unit. And, when one sentence contained two topics, it was counted as two separate units.

Using this coding scheme, two raters independently segmented the messages and classified the units into the appropriate category. If a unit could not be categorised (e.g. ambiguous statements) then the rest category was used.

The coding of the messages was completed in two steps to establish a good reliability between the raters. In the beginning, ten postings transcripts were randomly selected and were coded independently by the two raters. Then the codes were compared to reach consensus on the use of the categories. This process allowed for the coding categories to be further refined and for the raters to discuss ambiguity or disagreement until consensus was reached. The first training session between two raters across all categories reached a Cohen's kappa value of .48. After an intensive training, Cohen's kappa reached value of .62. Then one rater coded the remaining messages.

Design and procedure

The surveys were administered in the period of six months (dependent on the courses starting dates and the duration of the courses involved). All surveys were distributed via e-mail, regular mail or at a face-to-face meeting. Participants were asked to complete the survey individually and to return them to the researcher via electronic mail or regular post. After one week a reminder was sent to the non-respondents.

Three surveys concerning individual characteristics, experiences and satisfaction with collaborative learning were administered before, during and after the course. Table 4 provides an overview of the different measurements and moments of survey administration.

Table 4
Design of the study

	Surveys		
Course	Before	During	After
Change management	O1	O2	O2+O3
Law	O1	O2	O2+O3+O4
Informatics	O1	-	O2+O3
Management science	O1	O2	O2+O3
Environmental science	O1	O2	O2+O3

O1 = Questionnaire on individual characteristics.
O2 = Questionnaire on collaborative learning.
O3 = Questionnaire on satisfaction with collaborative learning.
O4 = Content analysis of one of the five groups from the Law course.

The first survey administered before the courses started was intended to get information on students' characteristics. The second survey was designed to retrieve information on students' experiences with collaborative learning and was administered halfway the course. The third survey was designed to gain information on students' experiences with collaborative learning as well as on students' satisfaction with collaborative learning. This survey was administered after the course was completed. In addition, messages from one of five groups from the Law course was analysed as a sample to explore activities while students were working in the group.

Results

Individual characteristics

Before giving the results concerning the research questions, a closer look is taken at the characteristics of the students (the first survey). Means and standard deviations on the individual characteristics variables are presented in Table 5.

The means range from 3.32 to 4.03 indicating that students scored above midpoint on all the scales. There were no significant differences on the individual characteristics variables across courses. It appears that collaborative

learning was not a new learning method for them. Students indicated their familiarity with using Internet for gaining resources, although their experience with respect to communicating via a text-based medium were quite varied (indicated by the high standard deviation). The results show that students' prior knowledge also varies substantially. The influence of the individual characteristics on the aspects of collaborative learning will be discussed later on.

Table 5
Means and standard deviations of variables in individual characteristics

Variable	n	M	SD
Attitude towards collaboration	112	3.62	.49
Group activity	112	3.83	.57
Perceived text-based communication	110	3.46	.70
Prior knowledge	112	3.32	.86
Opinion on using Internet	112	4.03	.55

Note. Unit of analysis is the individual mean. The scale is ranging from 1 to 5, where 1= strongly disagree, and 5 = strongly agree (3 = neutral).

Not all students respond to our survey completely, 50 % students replied once, 25 % replied twice and 25% replied all the surveys. However, there were no significant differences between students who reply either once, twice or all surveys on the variables of individual characteristics (all *p*s > .05).

Students' experiences with collaborative learning

In order to analyse students' experiences with collaborative learning the group means were taken as the unit of analysis, because students worked in groups and interacted with each other. Table 6 provides the group means and standard deviations with respect to the students' experiences with collaborative learning during and after the course.

Table 6
Means and standard deviations of variables in collaborative learning

	During course			After course		
Variable	n	M	SD	n	M	SD
Monitoring working procedure	26	2.56	.86	32	2.87	.64
Participation	26	3.31	.85	32	3.29	.69
Monitoring group progress	25	2.33	.69	32	2.64	.63
Giving feedback	25	3.81	.73	32	3.97	.44
Helping each other	25	3.40	.76	32	3.39	.58
Need to be monitored	25	3.21	.64	31	3.31	.39
Team development	26	3.47	.59	32	3.39	.63
Task strategy	26	3.36	.73	32	3.37	.62
Intra-group conflict	26	2.18	.44	32	2.25	.49

Note. Unit of analysis is the group mean. The scale is ranging from 1 to 5, where 1= strongly disagree, and 5 = strongly agree (3 = neutral).

The means range from 2.18 to 3.81 during the course and from 2.25 to 3.97 after the course. No extreme scores were found. The lowest score during and after the course was on the variable Intra-group Conflict. This indicates that there have been no serious conflicts between group members while learning collaboratively. On almost all the other variables the mean is above the midpoint. It can be concluded that students have quite positive experience with collaborative learning.

Further analysis was conducted to examine whether the students' experiences with collaborative learning differed during and after the course. A paired sample *t* test was used to examine students' experiences with collaborative learning during the course as compared to after the course. However, only 23 groups had completed the questionnaires for the second and the third survey. Results reveal that the variable Monitoring Working Procedure reached statistically significance ($t(22) = -3.58$, $p = .002$) in the sense that students experienced monitoring working procedures during the course. So, students paid more attention on monitoring their working procedures in the second half of the course.

In addition, significant differences at a 10% level were found on the scales Giving Feedback ($t(22) = -1.92$, $p = .07$) and Need to be Monitored ($t(21) = -1.94$, $p = .07$). So, it seems that students gave more feedback to each other and that they needed more monitoring on group processes in the second half of the course.

Kruskal-Wallis analyses were used to compare across the five courses. This non-parametric analysis was used because, using groups as units of analysis, we had a rather small number of observations within each course. Results reveal that students in the five courses differed significantly on Monitoring Working Procedure ($\chi^2 = 17.93$, df = 3, $p < 0.001$), on Team Development ($\chi^2 = 8.05$, df = 3, $p < 0.05$), and on Intra-group Conflict ($\chi^2 = 14.23$, df = 3, $p < 0.01$) during the course. After the course a significant difference was found on Monitoring Working Procedure ($\chi^2 = 18.81$, df = 4, $p < 0.01$). When we take a closer look at the mean scores across the five courses, the Management Science course had the lowest means on these variables. This course employed the largest group size (see Table 2) and requested student to submit an individual product. Hence, group size and type of product might be important elements of asynchronous CSCL environments that influence the collaboration process.

Students' satisfaction with collaborative learning

Table 7 contains the group means and standard deviations on the satisfaction variables. The means range from 3.31 to 3.97. These results indicate that the average scores for all satisfaction variables are above the midpoint. This means that students in general were quite satisfied with learning collaboratively in an asynchronous CSCL environment.

Table 7
Means and standard deviations of variables in satisfaction with collaborative learning

Variable	N	M	SD
Satisfaction with other group members	32	3.52	.53
Satisfaction with learning in group	32	3.81	.66
Satisfaction with working in group	32	3.31	.31
Satisfaction with final product	32	3.97	.64

Note. Unit of analysis is the group mean. The scale ranges from 1 to 5, where 1= strongly disagree, and 5 = strongly agree (3 = neutral).

Individual and course characteristics that influence aspects of collaborative learning

In order to answer the questions concerning the influence of individual and course characteristics on aspects of collaborative learning and the influence of collaborative learning aspects on satisfaction, regression analyses were conducted. As the number of potential predictors in the regression equations would be very large in comparison to the number of observations, a factor analysis was conducted to reduce the number of variables to be used in the regression analysis.

Using principal axis factoring with oblique rotation, the five variables in individual characteristics produced a two factor solutions explaining 70 % of the total variance (see Table 8). Only variables with a factor loading greater than 0.4 are shown. Factor 1 was labelled as Perceived Technology and factor 2 as Attitude Towards Group Work.

Table 8
Factor loadings of variables in individual characteristics

	Factor	
Variable	1	2
Attitude towards collaboration	-	.429
Group activity	-	.782
Perceived text-based communication	.849	-
Prior knowledge	-	-
Opinion on using Internet	.522	-

We conducted two separate factor analyses on the collaborative learning variables respectively on the data during and after the course in order to see whether our variables in the second and the third survey have similar loading factor patterns. Many of the variables loaded on the same dimension; however few did not. In the second survey, one variable was loading below .40 on the appropriate dimension. In the third survey, all variables were loading above .40. Next, the variable Giving Feedback which had a weak loading was excluded and the factor analyses on each separate survey were re-run. A three-factor solution seems the best for both the data during and after the course. The pattern of loadings was relatively similar. Table 9 displays the results. Only variables with a factor loading greater than 0.4 are shown.

Table 9
Factor loadings of variables in collaborative learning

	Factor		
Variable	1	2	3
During the course			
Monitoring working procedure	.566	.676	.570
Participation	.864	-	.413
Monitoring group progress	-	.886	-
Helping each other	-	-	.464
Need to be monitored	-	-	.754
Team development	.957	-	.456
Task strategy	.871	-	-
Intra-group conflict	.628	-	-
After the course			
Monitoring working procedure	-	.937	-
Participation	.921	-	.467
Monitoring group progress	-	.837	-
Helping each other	-	-	.488
Need to be monitored	-	-	.412
Team development	.876	-	-
Task strategy	.804	-	.682
Intra-group conflict	.776	-	-

The second measurement (during the course) accounted for 72 % of the variance in the data and the third survey measurement (after the course) accounted for 79 % of the variance in the data. The first factor corresponds to group cohesion (COHES), factor two to the regulation of group processes (PROCESS) and factor three to group support (SUPPORT). These three factors were used as collaborative learning aspects for the regression analysis.

Regression analyses with attitude towards group work, perceived technology, group size and type of product as independent variables and the regulation of group processes, group cohesion and group support as dependent variables were conducted using the backward elimination method. These explorative analyses yielded only a single model where a significant proportion of variance in the dependent variable could be explained: the model containing the regulation of group processes (PROCESS) as dependent variable and type of product (PRODUCT – with values 0 in case of a group product and 1 in case of an individual product) as independent variable ($F(1,45) = 32.72$, $p < 0.001$, $R^2 = 0.422$). This ordinary least square (OLS) regression analysis ignores the fact that individuals were nested within study groups. A regression model that takes this nested structure into account is a multilevel model known as the random coefficient model. Using multilevel analysis to re-analyse the regression model we found with OLS regression yielded the following equation (with associated standard errors between brackets): PROCESS = 0.548 (0.146) – 1.248 (0.124) PRODUCT.

This finding suggests that requiring a group product tends to stimulate group members to regulate their group during collaborative learning.

Aspects of collaborative learning that influence satisfaction

A regression analysis of group cohesion (COHES), group support (SUPPORT) and the regulation of group processes (PROCESS) on satisfaction with other group members (SATOTHER) using the backward elimination method resulted in a regression model that retained group cohesion and group support as statistically significant predictors of satisfaction with other group members, $F(2,44) = 13.852$, $p < .001$, $R^2 = 0.386$. Again, OLS regression analysis ignores the fact that individual subjects were embedded within study groups, yielding dependency among scores. Using multilevel analysis to test the model we had found with OLS regression, we found a result quite similar to that which was obtained with ordinary regression analysis. The random intercept model that was returned by the multilevel analysis was (with SE's reported between brackets): SATOTHER = 3.63 (0.08) + 0.29 (0.08) COHES + 0.18 (.09) SUPPORT, showing both group cohesion and group support to be significant predictors of satisfaction with others.

Similarly, a regression analysis of group cohesion, group support and the regulation of group process on satisfaction with learning in group (SATLEARN) using the same backward elimination method yielded group cohesion and group support as statistically significant predictors of satisfaction with learning in group, $F(2,44) = 31.137$, $p < .001$, $R^2 = 0.586$. Multilevel analysis returned the following model: SATLEARN = 3.89 (0.08) + 0.39 (0.07) COHES + 0.17 (0.07) SUPPORT, showing both group cohesion and group support to be significant predictors of satisfaction with learning in group.

A third regression analysis of group cohesion, group support and the regulation of group process on satisfaction with working in group (SATGROUP) using backward elimination resulted in a regression model that retained group cohesion and the regulation of group processes as statistically significant predictors of satisfaction with working in a group, $F(2,44) = 10.134$, $p < .001$, $R^2 = 0.315$. Multilevel analysis returned the following model: SATWORK = 3.40 (0.05) + 0.22 (0.05) COHES – 0.13 (0.05) PROCESS, showing both group cohesion and the regulation of group processes to be significant predictors of satisfaction with working in group.

Finally, a regression analysis of group cohesion, group support and the regulation of group processes on satisfaction with final product (SATPROD) using the same backward elimination method resulted in a regression model that only retained group cohesion as statistically significant predictor of satisfaction with final product, $F(1,45) = 15.914$, $p < .001$, $R^2 = 0.261$. Multilevel analysis returned the following model: SATPROD = 3.96 (0.14) + 0.46 (0.10) COHES, showing only group cohesion to be a significant predictor of satisfaction with final product.

Together, these analyses suggest that group cohesion is an important aspect of collaborative learning that influences students' satisfaction with collaborative learning.

Students' activities when they collaborated in an asynchronous CSCL environment

Messages from one group from the Law course were analysed to get insight into how group members collaborated when they accomplished the task. The content analysis was divided into two parts: part one contains data gathered from beginning the course to survey 2 (period 1) and part two contains data collected from survey 2 to the end of the course (period 2).

In the first period, each group member was asked to complete the task individually. Then all group members had to comment on the work of the others and they had to take the comments on their own work into account. In the second period, group members were asked to prepare joint products. All group members had to collaborate to write, discuss and comment the products.

To arrive at a balanced comparison between the number of units occurring in a category during the first period and the number of times these units were mentioned during the second period, percentages of units are compared.

When the course ended, students' messages were obtained from the server. The transcript corpus consists of 393 messages containing over 1009 units. In average, each group member posted 98 messages. Table 10 shows frequency and percentage of dimensions posted by students during period 1 and period 2.

Table 10

Number and percentage of units in all dimensions posted by students during period 1 and period 2

Dimension	Period 1	Period 2
Regulation	60 (20)	158 (22)
Consensus	28 (10)	92 (13)
Conflict	4 (1)	8 (1)
Content	117 (40)	284 (39)
Social	20 (7)	37 (5)
Technology	14 (5)	40 (6)

Note. Values shown are numbers of units; percentages are in parentheses.

The overall amount of messages increased as the course progressed from 107 messages (293 units) during the first period to 286 messages (716 units) during the second period. However, the percentages of units of all dimensions remain quite stable over both periods of the course. This result might suggest that group members need some time to adjust themselves with working together to complete a task. In order to get more insight in the collaboration process, we analysed the six dimensions into detail: Regulation, Consensus, Conflict, Content, Social, and Technology. Table 11 gives an overview of the

number of units and the percentages of the different categories within the six dimensions.

Table 11
Number and percentage of units in dimensions: Regulation, Consensus, Conflict, Content, Social and Technology

Dimension Category	Period 1	Period 2
Regulation		
Orientation	8 (13)	4 (3)
Planning	12 (20)	28 (18)
Reflection	1 (2)	4 (3)
Monitoring general	1 (2)	2 (1)
Monitoring working procedure	28 (46)	105 (66)
Monitoring working progress	3 (5)	12 (7)
Monitoring participation	7 (12)	3 (2)
Consensus		
Reach consensus	22 (79)	65 (71)
Try to reach consensus	6 (21)	27 (29)
Conflict		
Conflict	4 (100)	8 (100)
Content		
Ask	18 (15)	49 (17)
Explain	32 (27)	103 (37)
Argue	27 (23)	49 (17)
Product	37 (32)	72 (25)
External resources	3 (3)	10 (4)
Social		
Negative emotion	0 (0)	2 (5)
Positive emotion	15 (75)	24 (65)
Off task	5 (25)	11 (30)
Technology		
Technology	14 (100)	40 (100)

Note. Values shown are numbers of units; percentages are in parentheses.

In the Regulation dimension Monitoring Working Procedure increased sharply from the first period (46%) to the second period (66%), Orientation declined from 13% in the period 1 to 3% in the period 2, followed by the Monitoring Participation category which also dropped dramatically from 12% during the first period to 2% in the second period. The increase of Monitoring Working Procedure indicates that group members paid more attention to monitor their working procedure during the second half of the course. Whereas the decline of Monitoring Participation might suggest that group members felt more responsibility for individual contribution after a period of time. A slight increase was found at Reflection, and Monitoring Working Progress, whereas Planning and Monitoring General remained almost the same throughout the course.

Within the Consensus dimension the percentages increased in the second period. Try to reach consensus rose from 19% in the first period to 27% in the

second period. Also in the Conflict dimension, the number of units inclined twice in the second period than in the first period. The results from both dimensions indicate that in the second period the group took more difference perspectives and opinions into considerations.

The results in the Content dimension were varied. For instance, Explaining increased from 27% to 37%, whereas Product decreased from 32% to 25%. Very slight increases were found on Ask and Share External Resources. These results imply that group members were more active in gaining knowledge domain in the second period than in the first period of the course.

In the Social dimension, the results show that students made several comments in the Off-task category and exhibited a very small portion of Negative Emotion. The highest percentage was reached by Positive Emotion. This result might indicate that students showed their positive feelings and encouraged each other during collaborative learning.

The last dimension is Technology. The percentage of this dimension remained stable during both periods. This stable percentage reflected the students' familiarity with communication via discussion group.

Discussion and conclusion

The aim of this study was to explore students' experiences and satisfaction with collaborative learning in asynchronous CSCL environments. In order to have a good grip of crucial aspects during collaborative learning, the influence of individual and course characteristics on aspects of collaborative learning and the influence of the aspects of collaborative learning on satisfaction was determined. Also, students' messages from one group were analysed to gain more insight in how group members collaborate while working on a task.

The first issue examined was students' experiences with collaborative learning as a result of participating in the courses with a collaborative learning method. In general students show quite positive experiences with working in a CSCL environment both during and after the course. Only on the variable Monitoring Working Procedure a significant difference was found between the first and the second half of the course. In the second half of the course students paid more attention to the procedures they had to follow to accomplish the task. It might indicate that group members' involvement in regulating group processes might take some time to occur and does not happen at the beginning of the collaboration automatically. Besides, this may be due to the fact that working procedures must be more efficient in the second half of the course, because it was not allowed to exceed the deadline for accomplishing the task. Moreover, the scores on variables in collaborative learning, namely Monitoring Working Procedure and Monitoring Group Progress, were lower than on the other variables both during and after the course. Students seemed not to pay much attention to monitor their collaboration process from the beginning.

Hence, scaffolding group members in regulating group processes from the beginning of their collaboration is suggested.

The second issue investigated was whether students were satisfied with working and learning in an asynchronous CSCL environment. Consistent with previous studies (Bures, Abrami, & Amundsen, 2000; Harasim, 2001), our results also indicate that students were in general satisfied with working and learning in an asynchronous CSCL environment. On all the satisfaction variables the students mean scores were above the midpoint of the scale. Distance learning is often promoted to give flexibility for learners to manage their individual learning. Collaborative learning, however, limits the flexibility of distance learners because it creates interdependence between the group members. However, despite the fact that distance learners have less freedom in an asynchronous CSCL environment, the results in this study show that students were quite pleased with learning this way.

The third issue examined whether individual and course characteristics influenced the collaboration process. It was expected that small-groups as well as a task which requires a group product would stimulate student involvement in collaborative learning. The result of the present study indicates that the type of product influences the regulation of group processes. This finding shows that a group product stimulates students to regulate their group processes because it involves all group members proceeding the task (Cohen, 1994; Johnson et al., 1994). Thus, requiring a group product not only enhances students to gain subject knowledge but also stimulates students to develop group skills such as orienting, planning and monitoring. Although, the result of this study does not support the expectation that small groups stimulate group processes more than large groups, there is an indication that participants from the course that used large groups (7 group members each group) scored lower on the experiences with collaborative learning than the participants from the other courses. So, there is some evidence to conclude that the use of small groups is recommendable above larger groups. In addition, other studies (Hammond, 2000; Kaye, 1992; Wegerif, 1998) also recommend using small groups rather than large groups.

The fourth issue examined aspects of collaborative learning, which influence students' satisfaction. The results reveal that group cohesion is an important aspect that influences students' satisfaction. This finding is congruent with the work of Johnson et al. (1994); they also underline the importance of group cohesion during collaboration to keep the group work together. Another finding is that the regulation of group processes has a negative influence on satisfaction with working in a group. This finding contradicts with the result from Gillies (2003). In his study he reported that unstructured group processes made students became less positive about their group experiences. A possible explanation for this finding that we should take into account is that the participants were different. Our participants were distance learners who are

adults and have to manage their time to study as well as their time to work Although our finding shows that the regulation of group processes influences negatively on satisfaction with working in a group, we argue that the regulation of group processes is needed during collaborative learning and is considered to be supportive in the learning process. Lack of the regulation of group processes may cause a group loss of control in achieving their goal.

The fifth issue examined the collaborative activities within one group. The group members' messages while completing a task were analysed. In general, most of the group communications discussed the learning content. Activities such as asking, arguing, explaining, and providing extra resources dominated more than regulatory activities such as planning, monitoring and reflecting. These findings are in line with other results of studies on collaborative learning in asynchronous CSCL environments (Veerman, 2000; Veldhuis-Diermanse, 2002). The technology and social dimension had the lowest percentage numbers throughout the course. It implied that students were quite familiar with communication via the computer and indicated that group members did not spend much time to comment on unrelated tasks. Although, these findings indicated that learning in an asynchronous CSCL-environment focused more at completing the task than on other activities (such as talking about social life). It is important to notice that we analysed only the messages from one group.

Two limitations of this study need to be acknowledged. One limitation of this study is the sample size. Not all participants responded to our questionnaires. The number of participants in the second and third survey was among other things reduced because of leaving the course and of time pressure. Another limitation of this study was that we focussed only partly on actual students behaviour. Due to these limitations, the results of this study should be interpreted with caution.

Finally, the results of this study have several important implications for practice. First, it is suggested to set tasks requiring a high level of collaboration; for instance tasks which require a group product. Second, the use of small groups instead of large groups is recommendable. Those two recommendations are necessary conditions to start interaction in the collaboration process. Third, in order to maintain group cohesion we might consider asking students to reflect on their group processes. Hence, all group members should have the opportunity to reflect on their group activities and on gained knowledge in order to improve their group performance. Fourth, the less experience of the regulation of group processes might be tackled by providing specific guidelines on how to regulate the group. Besides reflection on group processes can also be used to improve the regulation of group processes. Finally, it is recommended to use asynchronous CSCL environments as a medium to support collaborative learning form for distance education, because collaborative learning is seen as a didactical approach that stimulates 'new learning'.

CHAPTER 4 - Fostering students' positive interaction in a computer-supported collaborative learning environment through reflection*

Abstract

Little is known about the effect of reflection on group processes while higher education students work collaboratively in a Computer-Supported Collaborative Learning (CSCL) environment. The purpose of this study was to investigate the effect of reflection on (1) the regulation of group processes, (2) knowledge co-construction, and (3) student's experiences with collaborative learning while students were working collaboratively in small groups through discussion forums. The findings of this study revealed that reflection on group processes during collaborative learning (1) stimulated group members to orient on the task and to monitor actively their group working procedure as well as the group progress, (2) did not directly influence knowledge co-construction activities, and (3) reduced intra-group conflict and tended to promote team development as well as satisfaction with group processes.

In higher education students are often faced with working in groups. With a rapid increase of the information and communication technology (ICT), and computer-supported collaborative learning (CSCL) environments students can be stimulated to work collaboratively in an electronic way. However, not all students are accustomed to work in a CSCL environment. Working together in an electronic learning environment requires certain collaborative skills, in order to make sure that the process of collaboration is effective. The question is how students' collaborative skills, while working together in an electronic learning environment, can be fostered. Researches done in face to face settings (Johnson, Johnson, Stanne, & Garibaldi, 1990; Yager, Johnson, Johnson, & Snider, 1996) show that reflection can help students to become more aware of the important aspect of collaboration and can foster students' collaborative skills. This study aims at investigating the effect of reflection on group processes, more specific on (1) the regulation of group processes, (2) knowledge co-construction, and (3) collaborative learning experiences.

Currently, the attention of research on learning processes is given to active learning and the social dimension of learning (Simons, van der Linden, & Duffy, 2003). Learning is mentally active knowledge construction. Learners

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construct new understanding by connecting their prior knowledge and integrating it into their existing knowledge (Jonassen, Mayes, & McAleese, 1993). This process mostly occurs through interaction with other learners within a community where members offer suggestions, negotiate ideas and share experiences.

Collaborative learning is a pedagogical method that facilitates interaction among learners. This method creates a learning situation in which two or more participating learners exchange ideas, experiences and information, then elaborate and refine them in order to co-construct knowledge (Veerman, 2000; Veldhuis-Diermanse, 2002). In this learning situation learners are encouraged to verbalise their thoughts, to argue about the ideas of others and to collaborate in order to achieve group solutions to problems (Johnson & Johnson, 1994). In literature the term cooperative learning and collaborative learning is often used interchangeable. In this thesis, the term collaborative learning is used because our focus is on how group members share meanings about their work rather than how group members share the workload.

The main purpose of collaborative learning is to improve individual or group learning and performances through sharing knowledge. Working together to accomplish a task requires group members to express their thoughts, to react to other group members' ideas, and to reach a consensus. Moreover, group members persist in giving either supportive or alternate perspectives that lead to the restructuring of information and the integration of all ideas. Therefore, working together while accomplishing a task is seen as a characteristic of a powerful learning environment, aiming at the active construction of knowledge (van Merriënboer & Paas, 2003).

CSCL environments facilitate groups to work and to learn collaboratively without time and place restrictions. These learning environments take advantages of tools as e-mail, discussion forum, video conferencing and chat to support interaction and communication between individuals. Collaborating in CSCL environments might not be as convenient as collaborating in face-to-face settings because it suffers of affective, social and contextual cues (e.g., body gestures and tone). However, despite of these drawbacks, CSCL environments also offer additional benefits. First, students and a teacher are not necessarily present in the same location at the same time. Second, students are encouraged to be active learners, instead of being passive learners sitting in a classroom and receiving information from teachers. Third, the shift of learning control from teachers to learners encourages learners to become autonomous.

Group members interact in CSCL environments, and they are involved in sharing, linking and integrating ideas as well as managing and maintaining their activities. In the process of collaboration, group members are expected to organise their group to work together, to develop the full potentialities of the group, and to produce synergy from all group members' abilities. However, a smooth collaboration process does not always occur naturally. Negative

interactions could also happen; for example, some individual group members might work together for their own sake, might bully other group members or might dominate all group decisions. Hence, Dillenbourg (1999) describes collaborative learning as *"a situation in which particular forms of interaction among people are expected to occur, which would trigger learning mechanisms, but there is no guarantee that the expected interactions will actually occur"*(p. 7). To make sure that positive interaction occurs, Dillenbourg (1999) suggests monitoring and regulating the interactions during collaborative learning. Moreover, active monitoring and regulating in collaborative learning function to maintain existing positive interactions. Other researchers also indicate that regulatory activities during collaborative learning are crucial (Webb, Troper, & Fall, 1985), since the organisation and management of group members' ideas and activities are important for the group to work effectively and efficiently. For example, setting up clear work procedures, such as orienting a task, creating clear plans, monitoring and evaluating group performance and so on, stimulates participation and sharing of responsibilities between group members. The regulation of group processes seems to have an impact on students' appreciation of group work and students' activities in gaining domain knowledge or skills.

Reflection to facilitate active monitoring and regulating

Research in the collaborative learning area has shown the importance of learners reflecting on what they are doing and on how they can improve their performance (Johnson et al., 1994). In this study, reflection is defined as a joint process of group members in trying to structure or restructure an experience, a problem or existing knowledge or to get insight in how a group is functioning. Taking time periodically to reflect gives group members an opportunity to discuss their previous actions, behaviours and decisions, enabling them to improve their group processes later on. Literature suggests that reflection can be done in the beginning, during or after a learning process depending on the purpose of reflection. Reflection in the beginning of the learning process aims to explore students' expectation or interest of learning content. The purpose of reflection during the learning process is to evaluate and to improve the learning process, and reflection after the learning process aims to evaluate the whole learning process and to determine the needs of future learning. Our focus in this study is reflection on group processes in a collaborative learning session, because it can stimulate the group members' awareness of monitoring and regulating their interactions in collaborative learning.

A number of studies indicates that reflection on group processes enhances the group problem-solving success in a face-to-face setting (Johnson, et al., 1990; Yager, et al., 1996). For example, Yager et al. (1996) examined the effects of reflecting and discussing group processes on individual achievement. They found that students in the cooperative conditions outperformed students

in the individual condition. Further, their research also indicated that reflecting and discussing group processes increases individual achievement and group productivity.

However, our experience and that of others suggests that not all students know how to develop positive interaction within their group. Some of them must learn ways to help their group members (Wheelan & Lisk, 2000). The study of Oliver and Omari (2001) indicates that a lack of guidance on appropriate ways to work in groups or an unstructured process was highly likely to result in a decrease of students' appreciation of group work. Our previous study (Dewiyanti, Brand-Gruwel, & Jochems, 2003) also shows that students do not automatically monitor and regulate their group interactions. Students' experiences with collaborative learning from five different courses at a distance learning institution were explored. The study showed that students were not inclined to pay much attention to monitoring their group processes. Hence, it seems that students need guidance to learn how to regulate their group processes. Reflection is expected to trigger students to pay attention in an appropriate and effective way to regulate group processes. Through reflection, students can honestly express their opinion as well as their feelings about the group processes in order to improve it. Although, there is a possibility that reflection leads to the quarrel among group members because their expectations in collaborative learning are not the same. However, back to the main purpose of reflection, it aims to improve group processes. Improvement in group processes can occur if the group members give their constructive critics and clarify open opinions towards the group process.

As described above, reflection on group processes can trigger and maintain positive interactions in collaborative learning, which can be associated with well-regulated group processes, active knowledge construction, and positive experiences with collaborative learning. Despite the empirical support for the positive effects of reflection on group processes in individual as well as group performance, most of the studies were conducted in a face-to-face context. Little is known about the effect of reflection on group processes in the context of higher education, where students work collaboratively in a CSCL environment. Therefore, in this study three research questions were addressed:

1. *What is the effect of reflection on the regulation of group processes?*

As we have mentioned before reflection can facilitate group members to monitor and regulate group processes. Regulation and monitoring of group processes are needed so each group members knows about the goal of the task, the work progress, who is or is not working, what needs to be done, what the group results are, and so forth. In collaborative learning, regulation and monitoring of group processes are shown in activities such as orienting, planning, and monitoring working procedures and progress. So, we expect that reflection will have a positive influence on the regulation of group processes.

2. *What is the effect of reflection on knowledge co-construction?*
Regarding to content-related aspects, reflection can facilitate group members to construct knowledge. In knowledge co-construction processes, activities such as externalisation and elicitation of knowledge, and integrating different perspectives into one consensus are important. So, we expect that reflection will have a positive influence on knowledge co-construction activities.

3. *What is the effect of reflection on students' experiences with collaborative learning?*
Since reflection on group processes shows a positive effect on collaborative learning in general, it could be expected that students express their positive experiences with collaborative learning. Successful collaborative learning should result in students' appreciation of collaborative learning instead of frustration and dislike of collaborative learning. Positive and enjoyful experiences with collaborative learning are indications that positive interactions occurred in collaborative learning. Thus, we expect that reflection will contribute to a positive experience of students' collaborative learning.

Method

Participants
Participants were first-year Dutch students from a Teacher Training College for Primary Education in the Netherlands. Fifty-five students participated of whom 38 students in the first session, 50 students in the second session and 43 students in the third session. The incomplete data set for some students was due to technical problems, absence and sickness.

Materials

Computer-Supported Collaborative Learning Environment
Participants used MILE, special software for student teachers that has been developed by the Freudenthal Institute in the Netherlands. MILE is a multimedia learning environment that provides information and the possibility for natural interactions between teacher and pupils in an arithmetic classroom. Two important features of MILE are (1) a series of movies and (2) a discussion forum. The movies show the authentic daily practices of arithmetic teaching at primary schools in the Netherlands. It is called authentic because the movies are non-scripted and not edited. The discussion forum is for supporting asynchronous on-line communication among student teachers. The participants could either communicate or watch movies, but they could not do both at the same time.

Task
The tasks were adapted from the supplementary working book to the MILE software. Three tasks which required students to work in a group were selected. The first task requested students to watch five movie fragments of

approximately 20 minutes in total before they had to write their opinions about two statements. The second task asked students to watch three movie fragments of approximately 25 minutes in total and to arrange the movie fragments from the most interactive to the least interactive. The third task required students to watch four movie fragments of approximately 30 minutes in total and to identify important interactions between the teacher and the pupils.

Reflection

For the experimental condition three prompts, which encourage group members for reflection, were inserted in every task. Group members should encounter them before and during the process of collaboration. The first prompt was delivered before the collaborative learning started and was designed to raise awareness of the activities that allow group members to work effectively together and to stimulate them to consider their group activities carefully before they start to collaborate. This prompt comprises ways in communicating ideas in an electronic learning environment, e.g., "Every group member must contribute his/her own ideas", aspects in gaining domain knowledge, e.g., "Present your supporting perspectives if you agree with the other group members and also present your opposing perspectives if you do not agree with the other group members", and aspects in building and maintaining the group processes, e.g., "Try to make a plan to proceed with the task". The second and third prompt were delivered during the collaboration process. These prompts were designed to encourage students to reflect on aspects within the collaboration process. The second prompt focuses on aspects of building and maintaining group processes, e.g., "Did your group work according to your plan?" The third prompt focuses on aspects of gaining domain knowledge, e.g., "Do you always give your opinion?"

Questionnaire on individual characteristics

This instrument aimed to measure the characteristics of students, such as familiarity with group work, technology and learning content prior to the start of the experiment. It consisted of five scales. All scales had already been tested in a previous study (Dewiyanti et al., 2003) and the reliabilities ranged from .75 to .87. The first scale assessed student's attitudes towards collaboration (Attitude Towards Collaboration, 12 items), e.g., "I find that it is interesting to work together in a group". The second scale rated individual activities in a group (Group Activity, 6 items), e.g., "I like to take the initiative". The third scale tapped information on student's familiarity with text-based communication (Perceived Text-based Communication, 4 items), e.g., "The discussion group is a pleasant way to communicate". The fourth scale sought information on student's prior knowledge (Prior Knowledge, 4 items), e.g., "I can explain this subject to other students", and the last scale assessed the student's opinion on using Internet (Opinion on Using Internet, 5 items), e.g.,

"The Internet is a pleasant way to get information from all over the world". The format of all items was a Likert-type scale, ranging from 1 (strongly disagree) to 5 (strongly agree).

Content analysis

Content analysis was used to gain deeper insight into participants' interactions during collaborative learning. Two dimensions are measured, namely: Regulation on the one hand and Knowledge Co-construction on the other hand. Before the students' messages were categorised into the two dimensions, firstly, every message was segmented into manageable items, so-called units, for subsequent allocation into relevant categories within each dimension. The base unit of analysis was a topic within one message. One topic was one unit. The topic in one message could be more than one. Thus, it means one message might contain more than one unit. The number of sentences in one message had no relations with the number of either topics or units. When two or more successive sentences dealt with the same topic, they were counted as one unit and when one sentence contained two different topics, it was counted as two separate units. After segmenting messages into units, the units were assigned into the categories within the two dimensions. Each unit could only be categorised in one category within each dimension. Units that did not fit into the categories were coded as Other. Table 1 presents the coding scheme that consists of the two dimensions: Regulation and Knowledge Co-construction.

The Regulation dimension was adapted from our previous study (Dewiyanti et al., 2003). This dimension consisted of six categories to assess regulatory activities. The categories are orientation, planning, reflection, monitoring procedure, monitoring progress, and monitoring participation. The inter-rater reliability of this instrument had been tested in our previous study and a Cohen's Kappa of .62 was reported (Dewiyanti et al., 2003). Messages in this dimension include contributions about how learners regulate their collaborative activities.

The Knowledge Co-construction dimension was adapted from Weinberger (2002) and comprised five categories to measure knowledge co-construction. An inter-rater reliability of .81 was reported for this dimension (Weinberger, 2002). This dimension was used to assess knowledge co-construction that included five categories, namely externalisation, elicitation, quick consensus building, integration-oriented consensus building, and conflict-oriented consensus building. Messages in this dimension included all theoretical concepts and information related to the task.

Table 1
Coding scheme

Category	Description	Example
	Dimension 1: Regulation	
Orientation	Describing information about the task.	"We should watch the movie and then we give our opinion whether we agree with the statements on the page 2"
Planning	Remarks on determining a sequence of activities to complete the task.	"Shall we first watch the movies and then we tell each other our opinion?"
Reflection	Remarks on reviewing on what happened in group processes, on what they have done, and how they want to improve their group processes.	"I think that our communication is going well. We still have 45 minutes to complete the task. Everyone has already given his/her contributions. We must be careful in typing our answer in a good way. Now, go to the task number 4"
Monitoring procedure	Remarks on keeping clear working procedure, on moving to the next task.	"I agree with your answer, can we move to the next task now?"
Monitoring progress	Remarks on checking the progress of the group.	"How far are we now? We have only half an hour to complete the task"
Monitoring participation	Remarks on reminding group members to contribute his/her opinion or on reporting individual activities.	"Kevin, what is your answer? You should be the first" "I am going to watch the movies and then I will send my answer of the first question"
	Dimension 2: Knowledge co-construction	
Externalisation	A response to any other contribution of other group members or a new initiating message.	"I think that the order is the fragment 2, then 3, and then 1"
Elicitation	A statement that triggers a specific reaction from other group members.	"What do you mean with interaction in classroom?"
Quick consensus building	Agreement that is expressed by short sign of approvals or by literal repetition of what has been already been said.	"Ok, I agree with you"
Integration-oriented consensus building	The contributions of other group members are combined into one's own considerations.	"I found also less interaction between thee teacher and the pupils. Maybe the students work in pairs, but the fragment 2 shows more interactions"
Conflict-oriented consensus building	A statement that contains explicit rejection, modification or replacements, modification or critical endorsement.	"No, Montana explains how she get the answer"

Questionnaire on student's experiences with collaborative learning
This instrument was administered at the end of each experimental session and assessed how students experienced the collaborative learning processes in six existing scales. The scales were described as follows. Two of the six scales were constructed and tested in a previous study (Dewiyanti et al., 2003). These two scales included (1) Monitoring Working Procedure (8 items, Cronbach's α = .87) e.g., "I remind group members who do not work together properly" and (2) Participation (5 items Cronbach's α = .85), e.g." All group members participate in discussions to reach a consensus". Then, the other four scales were used to assess Team Development, Task Strategy, Intra-group Conflict, and Group Process Satisfaction. Team Development was adapted from Savicki, Kelley, & Lingenfelter (Savicki, Kelley, & Lingenfelter, 1996) to assess the degree of cohesion that was achieved while group members have been working together (11 items), e.g., "All group members understand the group goals and were committed to them". Task Strategy was adapted from Saavedra, Early, & Van Dyne (Saavedra, Early, & Van Dyne, 1993) and assessed the decisions and choices made by a group that performed the task (7 items), e.g., "Our group developed a good strategy for doing the tasks". The Intra-group Conflict consisted of seven items adapted from Saavedra et al. (Saavedra et al., 1993) and measured the degree of conflict in a group (7 items), e.g., "There was a lot of tension among people in our group". Group Process Satisfaction was adapted from Savicki et al. (1996), e.g. "I felt good that I could participate with my group in coming to a conclusion about the problem". The format of all items was a Likert-type scale, ranging from 1 (strongly disagree) to 5 (strongly agree).

Design and Procedure

The design of this study is presented in Table 2.

Table 2
Design of the study

Condition	Session 1			Session 2		Session 3	
Experimental	O1	X1 + P	O2 + O3	X2 + P	O2 + O3	X3 + P	O2 + O3
Control	O1	X1	O2 + O3	X2	O2 + O3	X3	O2 + O3

O1 = Questionnaire on individual characteristics.
O2 = Questionnaire on student's experiences with collaborative learning.
O3 = Content analysis.
X1 = The first task.
X2 = The second task.
X3 = The third task.
P = Reflection.

The experiment was carried out at the multimedia laboratory at the Open University of the Netherlands. Participants participated in three sessions over the school term. Two conditions were compared: in one condition participants were prompted to reflect (the experimental condition) and in the other students

were not prompted (the control condition). In total there were 14 groups of three to five participants. These groups had already existed before; thus, participants in the groups already knew each other. Seven groups were randomly assigned to the control condition and seven groups were assigned to the experimental condition.

All participants worked with MILE and completed in each session a 2-hour task that required a group report at the end. There was one computer available for each participant. Each computer was installed with MILE and had a headphone. The participants were arranged to be seated in such a way that they could communicate exclusively through the discussion forum.

The second session was conducted six weeks after the first session and the third session was carried out one week after the second session. In the first session participants were asked to fill out the individual characteristics questionnaire 10 minutes before the experiment started. Then they received the materials, started at the same time and studied the instructions by themselves. In the second and third sessions, participants received the task and started directly. Participants in the experimental condition were additionally prompted to reflect. At the end of each session all participants of both conditions filled out the questionnaire on their experiences with collaborative learning. The completed work and all materials were collected and written messages were stored on the server.

Data analysis

The participants' messages were analysed at the group level, to assess the nature of interactions of each group. Because participants worked in the same groups throughout the study, the group was used as the unit of analysis in the content analysis. However, like Webb & Farivar (1994) and Gillies (2003), our interest lies in investigating the effect of reflection on the individual's collaborative learning experiences. Hence, we analysed the collaborative learning experiences data at the individual level. For the variables that indicate significant differences, follow-up analyses using group scores as the unit of analysis were conducted to investigate the group effects.

Results

Individual characteristics

In order to determine whether there were differences between the conditions on experiences with technology, group work and learning content, the results on the individual characteristics questionnaire are compared. Table 3 presents the data of the individual characteristics of the participants (means and standard deviations) in the experimental and control condition.

The means range from 3.36 to 4.22 indicating that students were quite familiar with collaborative learning, with using a computer to communicate and with using Internet for accessing resources. No lack of either computer

experience or collaborative experience seemed to inhibit their participation in this experiment. *T*-tests yielded no significant differences between the experimental and control condition on the scales for individual characteristics.

Table 3
Means and standard deviations of variables in individual characteristics

Variable		Control n = 28	Experimental n = 27
Attitude towards collaboration	M	3.74	3.71
	SD	.39	.47
Group activity	M	3.58	3.84
	SD	.75	.56
Perceived text-based communication	M	3.45	3.36
	SD	.60	.55
Prior knowledge	M	4.22	4.18
	SD	.49	.33
Opinion on using Internet	M	4.18	4.10
	SD	.58	.47

Note. Unit of analysis is the individual mean. The scale ranges from 1 to 5, where 1= strongly disagree, and 5 = strongly agree (3 = neutral).

Content analysis

In order to answer the first two research questions, content analysis was conducted to measure Regulation of Group Processes and Knowledge Co-construction. First, the total numbers of units were checked in order to see if there was a difference between the control and experimental condition. Then, the units in regulation of group processes and in knowledge co-construction were analysed and are reported.

Number of units

The numbers of messages generated by the participants were 691 (an average of 31 messages per individual) in the first session, 924 (an average of 28 messages per individual) in the second session, and 560 (an average of 22 messages per individual) in the third session. Those messages were segmented into units. Table 4 presents the number of units in both conditions.

Table 4
Means and standard deviations of units across sessions (1 – 3)

Session		Control	Experimental
1	n	4	6
	M	105.75	119.17
	SD	35.49	36.81
2	n	7	7
	M	79.29	127.29
	SD	42.88	36.30
3	n	6	6
	M	76.33	92.33
	SD	41.33	37.79

Note. Unit of analysis is the group mean.

Because the numbers of members in each group varied from three to five participants, Mann-Whitney tests were applied to check the differences on the total number of units across the sessions. No significant differences were found between the experimental and control condition.

The regulation of group processes

The means and standard deviations of the units concerning the regulatory activities across the sessions are presented in Table 5.

Table 5
Means and standard deviations of units on the categories in the regulation dimension across sessions (1 – 3)

		Control			Experimental		
Category		1 n = 4	2 n = 7	3 n = 6	1 n = 6	2 n = 7	3 n = 6
Orientation *b	M	.50	.57	1.17	2.67	3.00	1.00
	SD	1.00	.54	2.04	2.06	2.94	1.27
Planning	M	2.50	1.71	.83	3.17	2.29	2.67
	SD	3.11	1.25	.98	2.64	1.89	4.63
Reflection* a, *b, *c	M	0	.14	.17	2.17	2.86	3.17
	SD	0	.38	.41	1.94	2.04	2.64
Monitor procedure*b	M	8.50	5.86	7.17	10.50	11.86	9.17
	SD	5.80	3.34	2.99	3.67	3.72	5.81
Monitor progress	M	2.50	1.00	1.83	.50	2.71	1.00
	SD	2.52	1.53	.98	.55	1.49	.63
Monitor participation	M	3.75	4.14	4.50	3.50	5.43	9.00
	SD	2.75	.90	2.58	2.07	2.51	7.12

Note. Unit of analysis is the group mean.
* $p < .05$.
[a] *significant at the first session.*
[b] *significant at the second session.*
[c] *significant at the third session.*

Mann-Whitney tests revealed significant differences on Reflection in the first session ($U = 12$, $p < .05$), in the second session ($U = 36$, $p < .05$), and in the third session ($U = 25$, $p < .05$). These results indicated that participants in the experimental condition followed our instructions to take time for reflection. Further, significant differences were also found in the second session on Orientation ($U = 35.50$, $p < .05$) and on Monitoring Procedure ($U = 34.00$, $p < .05$). Except for Reflection, no significant differences were found on the other variables either in the first session or in the third session.

Knowledge co-construction

Table 6 shows the means and standard deviations of units concerning knowledge co-construction activities across the sessions.

Table 6

Means and standard deviations of units on the categories in the knowledge co-construction dimension across sessions (1 – 3)

		Control			Experimental		
		1	2	3	1	2	3
Category		n = 4	n = 7	n = 6	n = 6	n = 7	n = 6
Externalisation	M	15.25	12.14	14.83	14.00	15.29	13.83
	SD	2.63	7.19	7.25	8.87	9.71	3.54
Elicitation	M	3.00	4.57	4.57	6.67	6.57	3.83
	SD	2.16	3.91	3.91	5.47	2.64	2.56
Quick consensus building	M	5.50	5.00	5.00	7.83	5.43	6.00
	SD	7.19	5.59	5.59	6.79	3.21	6.07
Integration-oriented consensus building	M	4.25	3.43	3.43	5.00	4.71	4.50
	SD	5.44	2.64	2.64	4.38	4.11	4.23
Conflict-oriented consensus building	M	1.75	3.29	3.29	5.83	4.29	2.50
	SD	.50	3.40	3.40	6.27	1.11	2.43

Note. Unit of analysis is the group mean.

The results implied that students in both conditions focused on externalising their ideas rather than integrating or arguing other ideas. With respect to categories in the Knowledge Co-construction dimension, Mann-Whitney tests did not yield any significant differences between the experimental and control condition in any of the three sessions. Although no significant differences were found, an inspection of the group means (see Table 6) suggests that participants from the groups in the experimental condition in the first and second sessions were more involved in Elicitation and Conflict-oriented Consensus Building.

Students' experiences with collaborative learning

In order to answer the last research question on how students experienced collaborative learning, data on the 'Questionnaire on student's experiences with collaborative learning' were analysed. Table 7 presents the means and standard deviations on the participants' experiences with collaborative learning across the three sessions.

Table 7
Means and standard deviations of variables in student's experiences with collaborative learning across sessions (1 – 3)

		Control			Experimental		
		1	2	3	1	2	3
Variable		n=16	n = 24	n = 21	n = 22	n = 26	n = 22
Monitoring working procedure	M	3.08	3.30	3.35	3.13	3.23	3.16
	SD	.49	.60	.65	.61	.51	.66
Participation	M	3.84	3.89	3.89	4.13	3.97	4.09
	SD	.56	.64	.85	.58	.63	.56
Team development[† a]	M	3.86	3.98	3.94	4.17	4.19	4.11
	SD	.52	.59	.83	.51	.39	.65
Task strategy	M	3.58	3.78	3.78	3.77	3.93	4.03
	SD	.61	.77	.79	.74	.43	.51
Intra-group conflict[* b, † c]	M	1.86	2.13	2.05	1.83	1.80	1.84
	SD	.59	.59	.62	.48	.33	.54
Group process satisfaction[† a]	M	3.95	4.09	4.07	4.28	4.23	4.17
	SD	.52	.79	.84	.51	.48	.58

Note. Unit of analysis is the individual mean. The scale ranges from 1 to 5, where 1= strongly disagree, and 5 = strongly agree (3 = neutral).
[†] $p < .10$.
[*] $p < .05$.
[a] *significant at the first session.*
[b] *significant at the second session.*
[c] *significant at the third session.*

The means range from 1.83 to 4.28 in the first session, from 1.80 to 4.23 in the second session, and from 1.84 to 4.17 in the third session. No extreme mean scores were found. The scores in the control condition varied more, indicated by high standard deviations, than the scores of the participants who were prompted to reflect.

Because the number of participants in the first session differs largely from the number of participants in the second and third sessions, the differences between the experimental and control condition after the first and second sessions were analysed by using *t*-tests. Finally, the effect of the third intervention was analysed using a MANOVA with a repeated measure for the participants who participated both in the second and third session.

The results of the *t*-tests after the first session revealed no significant differences on students' experiences with collaborative learning variables. Despite this result, there were trends on the variables Team Development ($t(36) = -1.78$, $p = .08$) and Group Process Satisfaction ($t(36) = -1.95$, $p = .06$).

The results of the *t*-test after the second session revealed a significant difference on the variable Intra-group Conflict ($t(35.21) = 2.33$, $p < .05$). No significant differences were found on the other variables. Follow-up analyses of group effects, with group scores as the unit of analysis, showed no significant effect. This result indicated that the group in which students participated made no difference.

MANOVAs using Condition x Session with a repeated measure on the last factor were applied for the student's experiences with collaborative learning variables. No significant effects were yielded either for Session or for the interaction Condition x Session. But, as can be seen in the Table 7, there is a trend for the variable Intra-group Conflict for Condition $F(1,45) = 4.05$, $p = 0.05$, $MSE = .91$. Although scores of the control condition decreased on this variable and scores of the experimental condition increased, the overall participants' scores of the experimental condition were lower than the participants' scores of the control condition.

Discussion and Conclusion

This study investigated effects of reflection on the regulation of group processes, on knowledge co-construction, and on students' experiences with collaborative learning while students were working collaboratively in small groups through discussion forums.

The results of this study indicate that participants who were prompted to reflect showed significantly more reflection activities during collaborative learning than participants who were not prompted to reflect. These findings imply that participants followed our instruction to reflect across the sessions. So, it can be concluded that students need specific guidelines about appropriate and effective group processes. Reflection does not happen spontaneous. Designing special moments into the instruction or the collaboration process are very valuable and can foster students' collaborative skills. Furthermore, content analysis showed differences between the experimental and control condition on Orientation and on Monitoring Procedure. Participants in the experimental condition oriented more on the task, and kept track of the ongoing process of collaboration. They also paid attention to equal participation and to the learning goals that had to be reached as well as to the product that had to be delivered. These findings provide evidence that reflection led group members to pay more attention to the group process while they were collaborating in a CSCL environment. So, providing a structured reflection related to the group processes seemed to influence students' behaviour. Further, these findings corroborates the theory that asking group members to reflect on how well their group functions results in achieving and maintaining effective working relationships within the group (Johnson & Johnson, 1994).

However, the results were less positive on the effect of reflection on knowledge co-construction. No significant differences were found on this variable. One could argue that participants from the experimental condition spent time discussing and reflecting on group processes. So they spent less time on the task itself, but they did not perform worse than the participants in the control condition. Because of the small sample size, significant differences were rather difficult to reach although there is a considerably rise in the number of messages with questions asked (Elicitation) and understanding other's

perspectives (Conflict-oriented Consensus) in the experimental condition. Several researchers argue that question asking and discussion are thought to be mechanisms that can stimulate collaborative knowledge construction (e.g. Dillenbourg, 1999; Veerman, 2000; Webb & Palinscar, 1996). However, the effects are only found in the first and second sessions. In contrast, there is a lower and surprisingly negative effect in the last session. One possible explanation of this finding is that the type of task and the available time influenced group members' interaction. The difficulty of the tasks increased across the sessions, whereas the time to complete the task remained the same. Thus, the task in the last session was the most difficult one. The participants tended to easily agree with each other's opinions and to avoid disagreement because of the limited time to complete and deliver the task on time. It could be that the decreased number of questions asked and discussion activities were because participants needed ample time to interact with each other.

The last issue was the effect of reflection on students' experiences with collaborative learning. The results indicate that reflection decreases the experienced intra-group conflict. This finding suggests that reflection may stimulate group members to have open discussions on various group members' perspectives and differences of group members' behaviours. Nonetheless, some students who were not prompted to reflect on group processes still obtained high scores on different variables experiences with collaborative learning. Even without either reflecting or discussing their group processes, they experienced collaborative learning positively.

A limitation of this study that needs to be acknowledged is the small sample size and the relatively short experimental sessions. Due to technical problems, the number of participants in the first session was lower than the number of participants in the second and the third sessions so repeated measures analyses could not be applied. Although, through the short experimental sessions some effects of reflection can be found. Having a longer collaborative learning is recommended because the effect of reflection might be stronger.

With this limitation in mind, the results of the present study suggest several practical implications for practitioners to promote reflection on group processes while students work collaboratively in a CSCL environment. Firstly, it is important to mention clearly the goal of collaborative learning and also the procedure of the collaboration process. Not all students are familiar with the procedure for effective collaborative learning. Secondly, this study suggests that reflection needs to be externally directed and the goals of reflection should be explicitly mentioned so that students understand the added value of doing so. In addition, it will be more beneficial if students write their reflection note because they can re-read it. One possibility is to work with portfolio's in which students can write their reflection paper together with their products in their portfolio. Thirdly, this study also provides concrete suggestions for stimulating

group members' awareness of group processes. These suggestions include employing small groups with less than five students, mentioning the purposes of reflection, providing clear instructions and time to reflect, and asking students to write a reflection report. Fourthly, we recommend giving more attention to stimulating activities on knowledge co-construction during collaborative learning because these activities are mechanisms that help students to master learning materials.

In conclusion, the findings of this study suggest that reflection on group processes during collaborative learning appears to raise students' attention and attitudes in maintaining their group processes. It may be argued that prompting students to reflect on group processes has the potential to improve students' awareness of group processes. Future research should focus on the effect of reflection on the students' learning performance in skill and knowledge acquisition when they learn collaboratively over a longer period of time.

CHAPTER 5 - Learning together in an asynchronous computer-supported collaborative learning environment: The effect of reflection on group processes in distance education*

Abstract

Learning together in a Computer-Supported Collaborative Learning (CSCL) environment is not always so productive as expected. In order to collaborate well students need not only collaborative skills but also the ability to regulate group processes. Research that is mainly done in face-to-face settings shows that reflection can foster positive interactions. This study examined the effect of reflection on the regulation of group processes, knowledge co-construction, affective learning activities, and students' experiences with collaborative learning in an asynchronous CSCL environment. Participants were 44 distance learners who enrolled in a Law course at the Open University of the Netherlands. They worked in small groups of four students to complete their assignments. In the experimental condition, participants were asked to write a short individual reflection report and to discuss their group processes. Data were gained from students' messages as well as taken from questionnaires administered before, during and after the course. Findings indicated that reflection influenced both students' regulatory activities, such as planning group activities and monitoring working procedure, as well as students' experiences with collaborative learning in team development and monitoring the participation.

With the rapid increase of information and communication technology, it has become common for distance education to introduce collaborative learning using Computer-Supported Collaborative Learning (CSCL) environments. Despite much enthusiasm about applying the collaborative learning method in distance education, research has shown that true and productive collaboration is difficult to achieve (Solomon, 1992; Hsi & Hoadley, 1997). One way to enhance productive collaboration is to allow period breaks to assess, evaluate and discuss the ongoing group processes. A number of studies (Johnson, Johnson, Stanne & Garibaldi, 1990; Yager, Johnson, Johnson & Snider, 1996) have shown substantial empirical evidence in favour of the positive effect of

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reflection in group sessions on individual achievement and group productivity. However, these studies were done in face-to-face settings. Only a few studies have reported on the process of collaboration in CSCL environments and little is known about the effect of reflection on this process. In this empirical study we aimed to examine the effect of reflection on (1) regulation of group processes, (2) knowledge co-construction, (3) affective learning activities, and (4) students' experiences with collaborative learning when an asynchronous CSCL environment was used to support collaborative learning for distance learners.

Learning is a complex process. It is assumed that the learning process is deepened through social interaction among learners and teacher instead of sheer interaction with learning objects (e.g. books) (Jonassen, Mayes & McAleese, 1993). Moreover, the focus of interest in learning has shifted from considering just the learning outcomes towards the quality of interactions that lead to the learning outcomes. Collaborative learning requires appreciation for the diversity of perspectives for improving learning and performance. In collaborative learning students learn to think critically and independently. The last two aspects mentioned are often considered as key elements of learning processes in higher education. Activities such as explaining one's own ideas and reasoning to support or to oppose someone else's perspectives are said to help students to construct their knowledge (Veerman, 2000).

In recent decades the use of collaborative small-group work in which students work together to solve problems or to complete projects has increased. In both face-to-face (traditional) and distance education interaction with peer students is viewed as important (Mc Connel, 1994; Slavin, 1995; Johnson & Johnson, 1994; Harasim, 1986). In groups of three to five individuals, students work together, share and clarify ideas. Through discussion, students can discover what they know, what they do not understand, and what they need to learn.

Distance education usually is oriented on individual learning because most distance learning programmes are designed for people who cannot participate in full-time learning programmes. Students on distance learning programmes mostly have a full-time job, spouse, children, financial obligations and relatively little free time (Rowntree, 1992). Therefore, distance learners spend most of their time studying on their own. However they appreciate an opportunity to discuss the subject of learning with other students by writing messages and responding to the messages of others (Dewiyanti, Brand-Gruwel & Jochems, 2003). With the rapid increase of information and communication technology, it has become common for distance education to introduce collaborative learning. Thus, it is not surprising that the collaborative learning method has become important in distance education. Most distance learning institutions apply an asynchronous CSCL environment to facilitate the

participation of individuals in a group activity without physically being in the same location and in the same time.

Collaboration that produces a fruitful and worthwhile learning experience in distance education is possible to achieve although it is quite hard. Collaborative learning in distance education is different from campus-based education. Physical, social, and contextual barriers, such as students' unfamiliarity with each other and the absence of gestures and tone, can inhibit interaction during the collaboration process.

Reflection is one way to foster productive collaborative learning. It entails assessing and evaluating the ongoing group processes. In this study we define reflection as a joint process between group members of trying to structure or restructure an experience, a problem or existing knowledge or insight within a group. Reflecting on and discussing group processes to analyse how well the group is functioning is one of the basic elements that can increase productive collaboration (Johnson et al., 1994; Hooper, 1992). However, this element has received little attention; the research is relatively limited. A number of studies (Johnson, Johnson, Stanne & Garibaldi, 1990; Yager, Johnson, Johnson & Snider, 1996; Dewiyanti, Brand-Gruwel & Jochems, 2004) have proved positive effects of reflection during a collaborative learning session. For example, our previous study (Dewiyanti et al., 2004) examined the effect of reflection and discussion of group processes in a CSCL environment. Results of this study indicated that students' attention in orienting the task and monitoring their working procedure increased. However, this study was conducted in the CSCL context in the laboratory situation and only involved a few sessions.

Relatively little research has been directed at other outcomes that may result from reflection during collaborative learning, for example affective behaviours and students' experiences with collaborative learning. An empirical study from O'Donnell, Danserau, Hall, and Rocklin (1987) provides some evidence that learning in groups increased the opportunities for observing, practicing, and acquiring social/affective skills. In another study, Gillies (2003) investigated how students' perceive their small-group learning experiences and how they change as a result of participating in cooperative learning groups. He reported that students show a sense of responsibility for each other and a willingness to work together to complete the task.

The aim of this study is to guide distance learners in how to keep the process of collaborative learning most effective and efficient by instructing them to reflect on the ongoing group processes. The specific research questions and hypotheses addressed in this study are the following:

(1) What is the effect of reflection on the regulation of group processes?

In collaborative learning, it is worth remembering that each participant has his/her own skills and capabilities. Hence, there is a need to integrate independent activities and to coordinate activities with others. Regulating group processes means integrating all group members' efforts, skills, and

knowledge in order to reach the group's goals. Monitoring and regulating the interactions within the group becomes important (Dillenbourg, 1999). Taking time for reflection will help students to know about the work progress of each group member, who is or is not working, what was done, what needs to be done, what the results are and so forth. Thus, we expect that students who reflected in a collaborative learning session would show more regulatory activities.

(2) What is the effect of reflection on knowledge co-construction?
In collaborative learning, knowledge can be built through a series of processes. The processes start with externalising individual prior knowledge and interpreting the perspectives in different ways, followed by arguing about existing perspectives and finally end by modifying and integrating various perspectives into a new perspective (Fischer, Bruhn, Gräsel, & Mandl, 2002). Thus, we expect that through reflection students would be stimulated to be more active on knowledge co-construction activities.

(3) What is the effect of reflection on affective learning activities?
Affective interaction between group members in a collaboration process shows feelings or empathy in order to maintain positive relationships with one another. This interaction is assumed to influence learning processes because it is related to the students' feelings during learning. This interaction can influence the learning process positively or negatively (Vermunt & Verloop, 1999). Thus, we expect that reflection during collaborative learning will stimulate students to show their affective learning activities and affect the group atmosphere positively.

(4) What is the effect of reflection on students' experiences with collaborative learning?
It is important to recognise how students experienced the collaboration process because this reflects to how students played their role as part of a team and how an asynchronous CSCL environment facilitated their learning. Reflection among group members may help groups to release their tension or dissatisfaction with the collaboration process. It can provide students with a better understanding of the challenges in collaborative learning in an asynchronous CSCL environment. Thus, we expect that reflection during collaborative learning will help students to experience collaborative learning more positively.

Method

Participants
A total of 44 students (22 male and 22 female) from the Faculty of Law at the Open University of the Netherlands participated in this experiment. The students followed the course "Legislation", a compulsory course to obtain a Law degree. The mean age of the participants was 44.71 years (SD = 9.59). All

students were working at a distance and living in the Netherlands, US, Aruba or Belgium.

Materials

Assignments

The course consisted of two assignments. The first assignment took a period of six weeks including three weeks for self-study. The aim of this first assignment was to get familiar with the documents that they had to prepare in the second assignment. In this first assignment participants from both conditions were asked to write their personal reaction with respect to the case of closing a sex selection clinic. The personal reaction was placed in the discussion group and other group members had to give feedback on this reaction. Based on the feedback from the other group members, each individual student had the opportunity to improve his or her reaction before submitting it to the coach.

The second assignment took a period of 14 weeks. The aim of this second assignment was to prepare documents for making an Act of Parliament with respect to the case. The groups in the control condition had a case about regulations for public demonstration in the Netherlands and the case of the groups in the experimental condition was about the educational system in the Netherlands. Each group who represented a political party in the Dutch Parliament was responsible for preparing and defending the draft act. They had to complete the steps that a draft act according to Dutch constitutional law has to pass in order to become an Act of Parliament (Van Haaren-Dresens, 2004).

Intervention

On the course website for the experimental condition, guidelines about how to collaborate effectively were embedded. These guidelines included three aspects of group processes: (1) norms to participate e.g., "Every group member must contribute his/her own ideas", (2) activities to understand learning materials "Present your supporting perspectives if you agree with the other group members and also present your opposing perspectives if you do not agree with the other group members", and (3) activities to regulate group processes in a CSCL environment e.g., "Try to make a plan to proceed with the task". At the end of each assignment participants in the experimental condition were asked to write an individual reflection paper in which they answered three questions: (1) did you follow the participation norms? (2) did you apply the suggested activities to understand learning materials?, and (3) did you regulate and monitor the group processes according to the guidelines? After writing the reflection papers, the students discussed these three questions in their group. So the individual reflection papers formed the starting point for the discussion.

Questionnaire on individual characteristics

One week before the course started the individual characteristics questionnaire was administered. This questionnaire aimed to measure the students' characteristics, such as familiarity with group work, technology and the learning content before the start of the course. The questionnaire consisted of five scales. All scales had already been tested in a previous study (Dewiyanti et al., 2003) and the reliabilities ranged from .75 to .87. The first scale assessed student's attitudes towards collaboration (Attitude Towards Collaboration, 12 items), e.g., "I find that it is interesting to work together in a group". The second scale rated active or passive orientation to group work (Group Activity, 6 items), e.g., "I like to take the initiative". The third scale tapped information on student's familiarity with text-based communication (Perceived Text-based Communication, 4 items), e.g., "The discussion group is a pleasant way to communicate". The fourth scale sought information on student's prior knowledge (Prior Knowledge, 4 items), e.g., "I can explain this subject to other students", and the last scale assessed student's opinion on using Internet (Opinion on Using Internet, 5 items), e.g., "The Internet is a pleasant way to get information from all over the world". The format of all items was a Likert-type scale, ranging from 1 (strongly disagree) to 5 (strongly agree).

Content analysis

Students' messages were analysed to gain deeper insight into participants' interactions during the collaborative learning sessions. Three dimensions were measured, namely: regulation, knowledge co-construction, and affective learning activities. Before the students' messages were categorised into the three dimensions, firstly, every message was segmented into manageable units, for subsequent allocation into relevant categories within each dimension. A unit was defined as a discernable topic in a message. So, one message could contain more than one topic, meaning that one message might contain more than one unit. The number of sentences in a message had no relations with the number of units. When two or more successive sentences dealt with the same topic, they were counted as one unit, and when one sentence contained two different topics, it was counted as two separate units. After segmenting messages into units, the units were assigned into the categories within the three dimensions. Each unit could only be categorised in one category within each dimension. Units that did not fit into the categories were coded as 'Other'. The three dimensions and the categories are described below.

Regulation. This dimension was measured to answer the first research question concerning students monitoring and regulating their group processes. The coding scheme used to measure regulation of group processes was adapted from our previous study (Dewiyanti et al., 2003). This dimension distinguished six categories: orientation, planning, reflection, monitoring procedure, monitoring progress, and monitoring participation.

Knowledge co-construction. This dimension was measured to answer the second research question concerning knowledge co-construction. The coding scheme used was adapted from Weinberger (2002). He reported a Cohen's Kappa of .81. The scheme included five categories, namely externalisation, elicitation, quick consensus building, integration-oriented consensus building, and conflict-oriented consensus building.

Affective learning activities. In order to answer the third research question the messages were analysed on the dimension 'affective learning activities'. The instrument from Veldhuis-Diermanse (2002) was used to measure three categories in this dimension. She reported a Cohen Kappa of .82. The three categories were affective motivation, affective asking and affective chatting.

The detailed description of each category in each dimension is explained in Table 1.

In this study the segmentation of messages was done according to the system introduced by Henri (1998). According to her the essential factor in segmenting the message is the meaning or the topic; this is what we have called the unit. In this study, the two raters segmented and categorised the units. We did not separate the segmentation process from the scoring process because segmentation depended on the coding categories. So, no inter-rater reliability was calculated for the segmentation of the messages.

Each dimension was originally represented by one instrument. In this study we combined those three into one instrument and tested the inter-rater reliability of the instrument according to the following procedures. First, a training session was provided to the second rater (first rater was the first author). After three hours' training, a moderate inter-rater reliability was reached. Second, 36 messages were randomly selected and the two raters independently segmented and coded the units into the categories within the three dimensions. A moderate inter-rater reliability was achieved (Cohen's Kappa = .59). Finally, the rest of the messages were segmented and coded by the first rater.

Questionnaire on student's experiences with collaborative learning

This questionnaire was administered at the end of each assignment and aimed to assess how students experienced the collaborative learning process. The questionnaire consisted of six scales. Two of the six scales had been constructed and tested in a previous study (Dewiyanti et al., 2003). These two scales included (1) Monitoring Working Procedure (8 items, Cronbach's α = .87) e.g., "I remind group members who do not work together properly", and (2) Participation (5 items Cronbach's α = .85), e.g. "All group members participate in discussions to reach a consensus". The other four scales were used to assess Team Development, Task Strategy, Intra-group Conflict, and Group Process Satisfaction.

Table 1
Coding scheme

Category	Description
	Dimension 1: Regulation
Orientation	A unit is coded as orientation if it contains (1) review on the task that should be proceeded, (2) the product that should be submitted, and (3) time or date to submit the product.
Planning	A unit is coded as plan if it contains (1) a sequence of activities to complete the task, (2) time schedule to be spent on every part of the task, and (3) task division among group members.
Reflection	A unit is coded as reflection if it contains the response of given intervention from the researcher.
Monitoring procedure	A unit is coded as monitoring procedure if it contains (1) remarks to move to the next activities/steps in completing the task, (2) remarks to reshape or to adjust the group's working procedures, and (3) remarks to keep the working procedure in order to complete the task.
Monitoring progress	A unit is coded as monitoring progress if it contains (1) a summarisation of what the group (not individual) has done or reached, (2) a reminder of deadline/time to submit a product.
Monitoring participation	A unit is coded as monitoring participation if it contains (1) a reminder to a group member to contribute to the group, (2) remarks on looking for non-active group members, (3) remarks on the availability of a group member to participate.
	Dimension 2: Knowledge co-construction
Externalisation	A unit is coded as externalisation if (1) it was the learner's first expression / opinion/product, (2) it was group product, (3) it was an explanation / information that was requested by other group members, and (4) it was a suggestion of something that the group members could do, (5) it was an additional information from external sources, for example from internet, newspapers or magazines.
Elicitation	A unit is coded as elicitation if (1) it aims to directly trigger a specific reaction from the learning partners, and (2) it is a question, order, or instruction to the group members to do something.
Quick consensus building	A unit is coded as quick consensus building if it shows (1) an accepting, (2) a short sign of approvals or (3) a literal repetition of what a group member has already said.
Integration-oriented consensus building	A unit is coded as integration-oriented consensus building if contributions of one or more group members are adopted into one's own considerations.
Conflict-oriented consensus building	A unit is coded as conflict-oriented consensus building if it shows explicit rejections of other group members' opinions or modification of other group members' perspectives.
	Dimension 3: Affective learning activities
Affective motivation	A unit is coded as affective motivation if it shows a general emotional reaction to the messages of other group members without directly reacting to the content of that note. The reaction can be positive, negative or neutral.
Affective asking	A unit is coded as affective asking if it shows a request for a general feedback, responses or opinions by other group members.
Affective chatting	A unit is coded as affective chatting if it shows a chat or social talk that is not relevant to the task.

Team Development was adapted from Savicki, Kelley, & Lingenfelter (1996) and aimed to assess the degree of cohesion that was achieved while group members have been working together (11 items), e.g., "All group members understand the group goals and were committed to them". Task Strategy was adapted from Saavedra, Early, & Van Dyne (1993) and assessed the decisions and choices made by a group that performed the task (7 items), e.g., "Our group developed a good strategy for doing the tasks". The Intra-group Conflict consisted of seven items adapted from Saavedra et al. (1993) and measured the degree of conflict in a group (7 items), e.g., "There was a lot of tension among people in our group". Group Process Satisfaction, which was only asked at the end of the course, was adapted from Savicki et al. (1996) and aimed at assessing the degree to which participants were satisfied with the group process during the whole course, e.g. "I felt good that I could participate with my group in coming to a conclusion about the problem". The format of all items was a Likert-type scale, ranging from 1 (strongly disagree) to 5 (strongly agree).

Design and Procedure

The design of this study is presented in the Table 2.

Table 2
Design of the study

Experimental	O1	G	X1 + R	O2, O3	X2 + R	O2, O3
Control	O1	-	X1	O2, O3	X2	O2, O3

O1 = Questionnaire on individual characteristics.
O2 = Content analysis.
O3 = Questionnaire on student's experiences with collaborative learning.
X1 = Assignment 1.
X1 + R = Assignment 1 with reflection.
X2 = Assignment 2.
X2 + R = Assignment 2 with reflection.
G = Guidelines for effective collaborative learning.

The course is delivered once a year and is designed according to three principles: deliver in an electronic learning environment, focus on collaborative learning, and train students in competencies (Van Haaren-Dresens, 2004). The course started in the first week of February and lasted 20 weeks. Twenty students participated in the control condition and 24 students in the experimental condition. The control condition comprised of five groups and the experimental condition of six groups. Because of the small number of participants each year, participants for the experimental and control condition were recruited from two different academic years.

Before enrolling to the course, students were informed that they are required to have a computer with an Internet connection. At the beginning of the course, the two coaches assigned participants into groups of four students.

During the course, the communication among students and between students and the coaches was facilitated through newsgroups. There was a general newsgroup that could be accessed by all participants. In addition, there was a restricted newsgroup for each of the groups of four students.

All participants were asked to complete the individual characteristics questionnaire one week before the course started. A face-to-face meeting with the coaches and the participants was arranged the day before the course officially began. In this meeting the first author informed the participants in both conditions generally about the research project. The participants of the experimental condition received guidelines on how to collaborate effectively. In addition, they were asked to reflect and to discuss their group processes after each assignment. Participants from both conditions were asked to complete the second questionnaire after each task was completed.

Data analysis

In this study, the participants' messages were analysed per group to assess the nature of interaction within each group. Thus, in the content analysis the group was used as the unit of analysis because participants worked in the same group throughout the study. In contrast, the data of the collaborative learning experiences were analysed per individual because our interest lies in examining the effect of reflection on individual's collaborative learning experiences (Webb & Farivar, 1994; Gillies, 2003).

For the qualitative data the non-parametric statistical analysis was applied because of the limited amount of data. The data analysis was divided into two parts, after the first assignment and after the second assignment, because we considered that assignment one used more cooperative learning than assignment two did. The analysis after the first assignment focused on the data gathered from the beginning of the course to the official submission date for the first assignment. The analysis after the second assignment focused on the data gathered from the official starting date of the second assignment to the end of the course. For the quantitative data, the parametric statistical analysis was applied. The data was also analysed into two parts as for the qualitative data. Additionally, the repeated measures analyses were applied to determine the differences between the measurements moments.

Results

Individual characteristics

In order to determine if there were differences between the participants in the experimental and control condition concerning individual characteristics on beforehand, the questionnaire on individual characteristics was administered. Table 3 presents the data of the individual characteristics of the participants (means and standard deviations) for the experimental and control condition.

Table 3
Means and standard deviations of variables in individual characteristics

Variable		Control n = 16	Experimental n = 23
Attitude towards collaboration	M	3.24	3.16
	SD	.14	.23
Group activity	M	3.77	3.74
	SD	.28	.49
Perceived text-based communication	M	3.53	3.74
	SD	.52	.55
Prior knowledge	M	3.43	3.87
	SD	.88	.59
Opinion on using Internet	M	4.13	3.97
	SD	.49	.64

Note. Unit of analysis is the individual mean. The scales ranges from 1 to 5, where 1 = strongly disagree and 5 = strongly agree (3 = neutral).

The means range from 3.16 to 4.13 indicating that participants scored above midpoint on all the variables. No lack of either computer experience or collaborative experience seemed to inhibit their participation in this experiment. No significant differences were found between the experimental and control condition on the individual characteristics variables. From this result, it can be assumed that generally participants in both conditions have the same characteristics.

Number of units

The number of messages posted and the number of units were checked for skewness.

After the first assignment, 382 messages (M_{group} = 76.40, SD_{group} = 23.65) were posted in the control condition and 542 messages (M_{group} = 90.50, SD_{group} = 27.66) in the experimental condition. The messages were segmented into 951 units (M_{group} = 190.20, SD_{group} = 39.63) for the control condition and 1405 units (M_{group} = 234.17, SD_{group} = 54.33) for the experimental condition.

After the second assignment, participants in the control condition posted 1891 messages (M_{group} = 378.20, SD_{group} = 121.41) and in the experimental condition 2021 messages (M_{group} = 336.83, SD_{group} = 119.17). The messages were segmented into 4223 units (M_{group} = 844.60, SD_{group} = 271.39) for the control condition and 4628 units (M_{group} = 771.33, SD_{group} = 188.37), for the experimental condition.

There were no significant differences between the conditions either on the mean number of messages or the mean number of units after both the first assignment and the second assignment. Thus, in the analysis of the messages no correction is necessary with respect to the number of units.

The regulation of group processes

In order to answer the question concerning students monitoring and regulating group processes, the participants' messages were analysed. Table 4 shows the means and standard deviations of units on the categories in the Regulation dimension.

Table 4

Means and standard deviations of units on the categories in the regulation dimension

		During assignment 1		During assignment 2	
		Control	Experimental	Control	Experimental
Category		n = 5	n = 6	n = 5	n = 6
Orientation	M	1.00	2.17	3.20	4.83
	SD	1.73	1.60	1.30	5.15
Planning*[a, *b]	M	2.20	8.00	7.60	21.17
	SD	2.68	5.02	3.78	12.23
Reflection*[a]	M	.00	2.83	.00	3.17
	SD	.00	1.94	.00	2.93
Monitoring procedure	M	3.80	4.00	53.80	75.83
	SD	3.56	2.09	19.45	21.72
Monitoring progress	M	.20	.50	5.80	8.17
	SD	.45	.55	2.17	3.66
Monitoring participation	M	2.00	.83	7.80	8.50
	SD	2.12	1.33	3.03	4.04

Note. Unit of analysis is the group mean.

*$p < .05$.

*[a] significant during assignment 1.

*[b] significant during assignment 2.

The hypothesis on the regulation of group processes predicted that the groups of students who received guidelines and reflected during collaborative learning would show more regulatory activities. The results of Mann-Whitney tests supported this hypothesis only for certain regulatory activities.

During the completion of the first assignment, Mann-Whitney analyses revealed significant differences regarding Plan (U = 4, Z = -2.02, $p < .05$) and Reflection (U = 2.50, Z = -2.50, $p < .05$). These results indicate that groups in the experimental condition followed our instructions to reflect on group processes after completing the first assignment. Furthermore, these groups planned their group activities more often than the groups in the control condition.

During the completion of the second assignment, Mann-Whitney analyses showed only a significant difference regarding to Plan (U = 2, Z = -2.39, $p < 05$). Trends are also found on Monitoring Procedure (U = 5, Z = -1.83, $p = .08$) and on Reflection (U = 5, Z = -2.12, $p = .08$).

Knowledge co-construction

To answer the question about the effect of reflection on knowledge co-construction the participants' messages were analysed. Table 5 presents means

and standard deviations of units on the categories in the knowledge co-construction dimension in the experimental and control condition.

Table 5
Means and standard deviations of units on the categories in the knowledge co-construction dimension

		During assignment 1		During assignment 2	
		Control	Experimental	Control	Experimental
Category		n = 5	n = 6	n = 5	n = 6
Externalisation	M	50.20	56.50	242.20	231.00
	SD	15.53	16.86	69.87	93.26
Elicitation	M	20.60	25.83	52.20	43.33
	SD	11.08	6.56	17.99	16.47
Quick consensus	M	12.00	21.33	22.40	27.16
	SD	8.34	21.13	14.71	25.32
Integration-oriented consensus building	M	7.60	10.50	17.60	16.17
	SD	2.70	7.15	8.59	8.23
Conflict-oriented consensus building	M	12.00	9.50	16.80	15.67
	SD	5.52	3.21	6.42	9.13

Note. Unit of analysis is the group mean.

It was hypothesised that the groups of students who reflected during collaboration would demonstrate more activities on knowledge co-construction. However, the results did not show any significant differences after either the first or second assignment. Thus, our hypothesis is not supported.

Affective learning activities

To determine the effect of reflection on students' affective learning activities, again the participants' messages were analysed. Table 6 displays means and standard deviations on the affective learning activities in the experimental and control condition after the first or second assignment.

Table 6
Means and standard deviations of units on the categories in the affective learning dimension

		During assignment 1		During assignment 2	
		Control	Experimental	Control	Experimental
Category		n = 5	n = 6	n = 5	n = 6
Affective motivation	M	12.60	20.17	92.20	50.83
	SD	8.33	10.66	38.00	18.90
Affective asking	M	3.80	4.17	37.60	20.53
	SD	4.27	3.25	20.53	7.63
Affective chatting	M	6.40	13.83	32.80	38.83
	SD	3.05	12.25	36.99	24.38

Note. Unit of analysis is the group mean.

The hypothesis on affective learning activities predicted that the groups of students who reflected on a collaborative learning session would demonstrate more affective learning activities. However, the results of the

Mann-Whitney tests did not reveal significant effects for affective learning activities after either the first assignment or the second assignment, and thus no evidence was found to support this hypothesis. However, there was a trend that groups of students in the control condition generated more Affective Motivation (U = 5, Z = -2.12, p = .08) after the completion of the second assignment.

Student's experiences with collaborative learning

The last hypothesis suggested that reflection would have a positive influence on student's experiences with collaborative learning. The data regarding student's experiences with collaborative learning (means and standard deviations) during and after the course are shown in the Table 7.

Table 7
Means and standard deviations of variables in student's experiences with collaborative learning

		After assignment 1		After assignment 2	
Variable		Control n = 15	Experimental n = 23	Control n = 15	Experimental n = 20
Monitoring working procedure*[a], **[b]	M	3.38	2.38	3.35	3.19
	SD	.64	.71	.45	.49
Participation*[c]	M	3.42	3.22	3.33	3.66
	SD	.47	.75	.52	.58
Team development**[b]	M	3.71	3.98	3.63	4.28
	SD	.70	.42	.70	.50
Task strategy**[b], ***[c]	M	3.69	3.65	3.54	4.23
	SD	.58	.51	.69	.41
Intra-group conflict*[a]	M	2.39	1.74	2.07	1.84
	SD	.61	.51	.73	.51
Group process satisfaction	M	-	-	3.94	4.27
	SD			.43	.52

Note. Unit of analysis is the individual mean. The scale ranges from 1 to 5, where 1 = strongly disagree and 5 = strongly agree (3 = neutral).
* $p < .05$.
** $p < .01$.
*** $p < .001$.
[a] significant after assignment 1.
[b] significant after assignment 2.
[c] significant for Condition X Time.

The t-test analyses after the first assignment revealed significant differences on Intra-group Conflict ($t(36) = 3.53$, $p < .01$) and on Monitoring Working Procedure ($t(36) = 4.40$, $p < .001$).

After the completion of the second assignment significant differences were found on Team Development ($t(33) = -3.20$, $p < .01$) and Task Strategy ($t(33) = -3.66$, $p < .01$). Further, there were trends on Group Process Satisfaction ($p = .06$) and on Participation ($p = .09$).

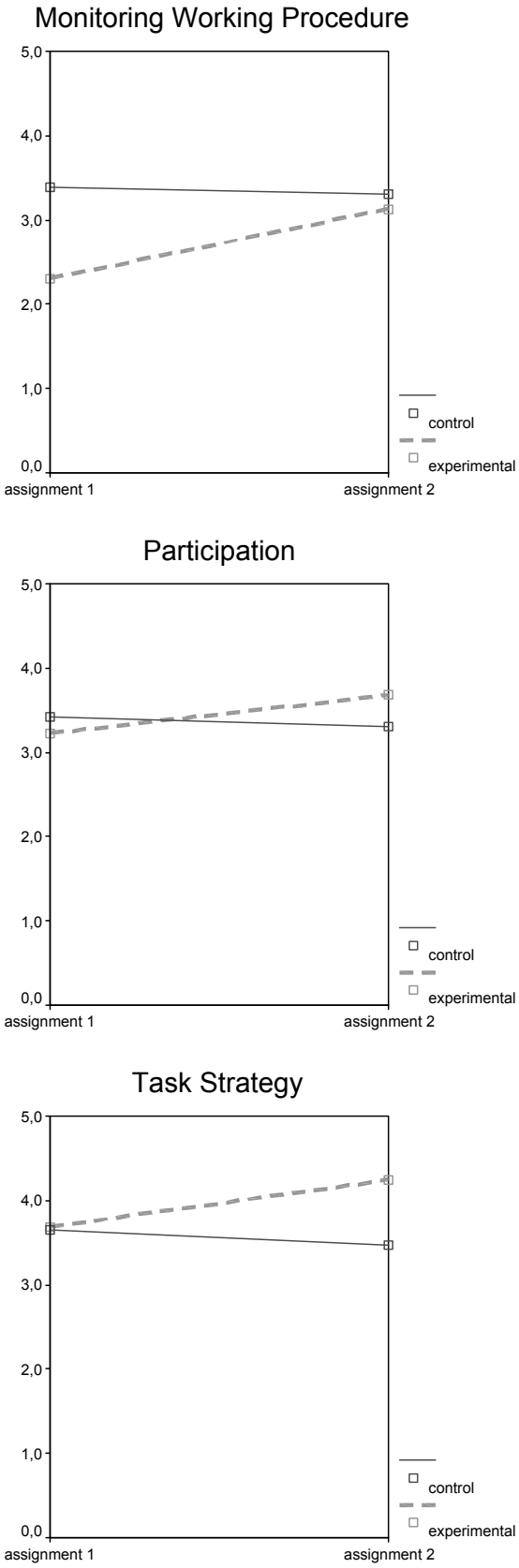

Figure 1. Students' experiences of the experimental and control condition on the variables Monitoring Working Procedure, Participation and Task Strategy.

To determine if there were significant changes in the students' experiences with collaborative learning for the experimental and control condition across time, we conducted a Condition x Time multivariate analyses of variance (MANOVAs) with a repeated measure on the last factor. Three variables were significant in the effect for Condition X Time: Monitoring Working Procedure, $F(1,32) = 14.98$, $MSE = .22$, $p < .01$, Participation $F(1,32) = 14.98$, $MSE = .22$, $p < .05$, Task Strategy $F(1,32) = 17.89$, $MSE = .12$, $p < .001$. Figure 1 gives an overview of the increase of these three variables in the experimental condition and the decrease in the control condition.

Discussion

The aim of the present study was to examine the effect of reflection when distance learners were collaborating in an asynchronous CSCL environment on four issues namely: the regulation of group processes, knowledge co-construction, affective learning activities, and students' experiences with collaborative learning. Before we elaborate on these four issues, first the characteristics of the sample are discussed. Findings showed that the distance learners in our sample were familiar with using a computer to facilitate communication. Literature mentioned that having basic computer skills is a prerequisite for successful participation in a CSCL environment (Zafeiriou, Nunes, & Ford, 2001). Further, most students were also familiar with working in a group. Hence, participants were ready to work collaboratively in an asynchronous CSCL environment.

The first issue in this study is the effect of reflection on how group members regulate group processes. Managing group tasks by team members, located in different places and working at different times in a determined time period is a complex organisational challenge (Harasim, 2001). The qualitative analysis of the messages showed that students in the experimental condition did more planning than students in the control condition. So, reflection reminds group members to manage the group process.

Providing guidelines and asking for reflection influenced students' behaviour in regulating group processes. Findings in the current study confirm the findings of our previous study described in chapter 4 (Dewiyanti et al., 2004). In the previous study, which was conducted in a laboratory setting and involved only a short time period, we found that reflection on group processes helps students to be aware of maintaining the group process.

Regarding the second issue no clear effect was found with respect to students' behaviour in knowledge co-construction activities. Prompting students to reflect might be useful to guide group members to focus on the group processes, but it does not help to foster knowledge co-construction activities. An explanation might be that our reflective questions are too generic for knowledge co-construction activities. In order to stimulate knowledge co-construction, one suggestion is designing more powerful prompts to guide their

discussions is recommended. Another suggestion is creating an amenable context so students pay more attention on the reflective prompts.

The third issue in this study is the effect of reflection on affective learning activities. It appeared that reflection did not influence affective learning activities. However, groups in the experimental condition generate slightly higher numbers of social talks in comparison with groups in the control condition as can be inferred from the content analysis results. Furthermore, positive statements such as "Working together to complete the task is fun" and "The problems were solved with smile and positive manner" from students' reflection reports confirmed the positive group atmospheres in the experimental condition. Apparently taking time for reflection provided group members with an opportunity to express their views about the group situation and it might help to relieve the students of frustrations.

The fourth issue in this study is the effect of reflection on students' experiences with collaborative learning. As expected, participants in the experimental condition experienced collaborative learning more positively than participants in the control condition. It can be concluded that reflection on group processes in a collaborative learning session stimulated students' perceptions of better collaborative learning. However, the result after the first assignment was a little bit surprising because a reversed difference between the experimental and control condition was found on Monitoring Working Procedure. Tracing back our data, we found that the tutors involved more in the control condition by reminding students about the deadline of task submission. It is possible that the tutor's remainders stimulated students to pay attention in their working procedure.

Thus, our intervention, providing guidelines about effective collaborative learning and prompting students to reflect on group processes, stimulates group awareness to regulate the group process and positive experiences with collaborative learning but it neither stimulates knowledge co-construction nor affective learning activities.

One limitation in this study is the fact that we could not control the communication among the group members outside of the discussion groups. We noticed that some students talked on the phone or arranged a face-to-face meeting with their group. Another limitation is our methodology in analysing the participants' messages. We were aware that the inter-rater reliability of the segmentation process was not calculated as suggested by Strijbos, Martens, Jochems & Broers (2004). Thus, the content analysis can be organised in a more powerful way.

It is frequently claimed that the distance learning institution provides students with greater freedom in the management of their studies. In contrast to traditional distance education, the introduction of CSCL becomes a dilemma for the distance learning institute as well as the students. For distance learners, small group work in an asynchronous CSCL environment can be both

rewarding and frustrating. According to the principle of adult learning (Pieters, 1996), student motivation is enhanced by an authentic and relevant learning experience that draws on the students' intrinsic interest in the learning material. Thus, collaborative learning enables students to integrate knowledge from different sources including reading other learners' perspectives and expressing their prior knowledge. On the other hand, implementing collaborative learning in a distance education setting is a challenge. A number of studies have reported the difficulties of distance learners if they have to be dependent on each other (e.g. Kreijns, 2004; Ng, 2001; Wegerif, 1998; Mason, 1989). The main reason for students to choose distance education is the flexibility in managing their learning pace and collaborative learning means limiting the learners' flexibility. However, distance learners' appreciation of collaborative learning via an asynchronous CSCL environment can be increased, for example, by assigning students certain roles (Strijbos et al., 2004) or embedding guidelines about effective collaborative learning and providing time for reflection in the middle of collaborative learning process as we did in this study. These practices are likely to increase students' appreciation and reduce their frustration in learning collaboratively.

In conclusion, the results of the present study indicate that reflecting on group processes offers the potential to help directing students' attention to regulate the group process and to increase more positive experiences with collaborative learning. Further, students choose distance education because traditionally it allows them to work towards their goal independently without having to interact with others. However, in this study distance learners found that collaborative learning could enhance learning through exchanging resources and evaluating peers work.

CHAPTER 6 - Exploring campus-based students' participation, interaction and experience in an asynchronous computer-supported collaborative learning environment*

Abstract

Working together while accomplishing a task is one of the characteristics of a powerful learning environment that aims at active knowledge construction. Nowadays, collaborative learning by using asynchronous communication tools can have advantages over collaboration in a face-to-face setting. However, it is questionable whether students are able and willing to learn collaboratively through these new kinds of learning environments. The present research investigates whether asynchronous collaborative learning is a feasible learning method for student teachers. In particular, this article explores issues of students' participation, interaction, and experience while using an asynchronous Computer-Supported Collaborative Learning (CSCL) environment to facilitate collaborative learning. Two studies that apply various instructional settings are presented. Findings show that (1) students were more cooperative than collaborative and (2) implementation of an asynchronous CSCL environment to facilitate collaborative learning in campus-based higher education is not an easy job.

The learning approach in teacher education programmes has become a more realistic one (Korthagen, Klaassen, & Russel, 2000). This learning approach emphasises forms of interactive teaching and collaborative learning in which the control of learning is shifted from the teacher to the student. It focuses on the importance of interaction among learners in constructing knowledge. According to the theory (e.g. van Merriënboer & Paas, 2003; Dillenbourg, 1999; Littleton & Häkkinen, 1999), working together while accomplishing a task is a characteristic of a powerful learning environment that aims at active knowledge construction. This article reports on the use of an asynchronous Computer-Supported Collaborative Learning (CSCL) environment in regular higher education. Students' participation and experience in a learning environment were assessed and their interactions were analysed.

*based on: Dewiyanti, S., Brand-Gruwel, S., & Jochems, W. (2004). *Exploring campus-based students' participation, interaction and experience in an asynchronous computer-supported collaborative learning environment.* Manuscript submitted for publication.

Collaborative learning stresses the importance of social engagement with other learners in order to gain new knowledge and skills. In a collaborative learning situation two or more participating learners exchange ideas, experiences and information, and then elaborate and refine them in order to co-construct knowledge (Veerman, 2000; Veldhuis-Diermanse, 2002).

In order to facilitate collaborative learning and to make teaching and learning more effective and efficient teacher education programmes have incorporated information and communication technology in their curriculum. The use of asynchronous communication tools, such as electronic discussion forums to support collaborative learning, however, is relatively new and can be based on a number of considerations. First, this medium allows students to discuss and argue with each other beyond temporary time limitations in the classroom since this tool is accessible from homes or schools and allows students to participate at a convenient time and pace. Second, students have more time to think over the learning material before giving their response. Opportunities to think before answering the question are rather limited in either synchronous communication or a traditional (face-to-face) classroom situation. Third, participants can ask questions and give answers without waiting in turn. Any participant can take a turn at any time. Fourth, this medium can function as source of information because participants can re-read the messages, pick out threads and make a link between those messages.

In sum, working together via an electronic discussion forum has advantages over either synchronous or face-to-face settings. However, it is questionable whether students are able to recognise the usefulness of the tool to work together. The successful use of a CSCL environment for supporting collaborative learning can be reflected in the degree of students' participation, interaction and experience with collaborative learning.

The degree of student participation is a visible indicator that activities occur in a CSCL environment. It is often assumed that active participation by posting messages contributes to learning. So, the number of posted messages indicates the degree to which students are actively engaged in learning processes, and is a preliminary indication that students recognise the usefulness of the CSCL environment to facilitate learning (Henri, 1992).

Research has shown that more effective learning takes places if learners actively interact with fellow learners, rather than being passive listeners. A CSCL environment facilitates learners to be active through posting and answering questions, clarifying ideas and expanding on or debating points raised by others (Brown & Palincsar, 1989; Slavin, 1995; Johnson & Johnson, 1994).

Studying students' experience with small collaborative learning groups can show how they struggle with learning in these groups as well as the group dynamics and learning process. Students' experiences with collaborative

learning reflects their with respect to learning in a CSCL environment (Roberts, 2004).

The successful use of a CSCL environment is also determined by instructional activities within the learning environment. One characteristic of collaborative learning in a CSCL environment is that it is more student-centred. Compared to the traditional classes, collaborative learning, and particularly CSCL is less structured. Collaborative learning is introduced to encourage students to take more responsibility for their own learning. In other words, students must accept more self-responsibility for their learning (Kearsley, 2000). This requires the students to be self-directed in their learning, to be able to work in groups, and to apply content knowledge and skills in solving problems. Some researchers (e.g. O' Donnel & Dansereau, 1992; Webb, 1992) suggested that structuring group interaction could prepare students for group work and promote collaborative behaviour. Structuring group interaction, for example by providing guidelines, is particularly useful for scaffolding students who are unfamiliar with the collaborative learning method (Veerman, 2000). Other researchers recommended structuring group interaction through reflection on group processes. Taking time to reflect and to discuss the group processes in a collaborative learning session provides an opportunity to enhance group members' collaborative learning skills and helps to maintain a good working relationship among group members (Johnson & Johnson, 1994; Hooper, 1992). Moreover, feedback from the teacher that is based on intra-group reflection may help groups work together more effectively (Yager, Johnson, Johnson, & Snider, 1996). Another way to structure group interaction is through teacher moderation. The role of instructor in moderating students' interaction is to foster a secure, meaningful and effective climate in a CSCL environment (Salmon, 2000). The moderator helps ensure that all students are involved in the discussion. Learners need support to structure their learning processes. The support and actions of a moderator help participants to develop new skills of acquiring and managing information and knowledge obtained in a CSCL environment (Salmon, 2000).

This article describes two explorative studies in which reflection on group processes is encouraged through various instructional methods, namely by applying written instruction and teacher moderation. Moreover, we want to know the effect of reflection on students' participation, interaction and experience while using an asynchronous CSCL to facilitate collaborative learning.

The main purpose of this article was to explore whether asynchronous collaborative learning could be a feasible learning method for students in campus-based higher education. In this article the two studies presented each address the three research questions.

1. How is the overall participation across the learning blocks in different instructional settings?

2. How do students interact regarding the regulation of group processes, knowledge co-construction, and affective learning activities in different instructional settings?
3. How do students experience collaborative learning in different instructional settings?

Study 1
Method

Participants

The sample for this case study involved 106 students (24 males and 82 females) from an Arithmetic and Didactics course in a teacher training college for primary education in the Netherlands. All participants were full-time first-year undergraduate students from different classes. The mean age of the participants was about 17-19 years old. The students worked in 28 small groups of four or five students.

Materials

Task

The arithmetic and didactics course consisted of six learning blocks, each lasting three weeks. The second block of this course was delivered through a CSCL environment. The task was adapted from the supplementary workbook to the MILE software. MILE is software for student teachers, developed by the Freudenthal Institute in the Netherlands, consisting of a series of movies that show the authentic daily practices of arithmetic teaching at primary schools in the Netherlands.

The task consisted of two parts. In the first part, students were asked to read the literature and to watch three movie fragments about explaining arithmetic to pupils individually. The second part of the task requested students to react together as a group to four statements about how to explain arithmetic to pupils. At the end of the block they had to produce a joint reaction to each statement including the group argumentation and supportive information.

The CSCL environment

Blackboard, an integrated system offering e-mail, discussion forum and file exchange facilities, was used as a CSCL environment to support asynchronous collaborative learning. The CSCL environment was structured in the following way in order to help students with their collaborative work. First, five discussion forums were created for each group. One discussion forum was for general discussion during the completion of the task and the other four were to placing group members' reactions for each statement. Second, in order to scaffold students in using the discussion forums, information about the

function of each discussion forum and rules to participate in discussion forums were defined. Information and rules were placed in each discussion forum.

Guidelines

The guidelines about how to collaborate effectively included three aspects of group process: (1) norms to participate, e.g., "Every group member must contribute his/her own ideas", (2) activities to understand learning materials, e.g., "Present your supporting perspectives if you agree with the other group members and also present your opposing perspectives if you do not agree with the other group members", and (3) activities to regulate group processes in a CSCL environment e.g., "Try to make a plan to proceed with the task". Midway through the collaborative learning session, participants had to discuss three questions: (1) did you follow participation norms? (2) did you apply the suggested activities to understand learning materials?, and (3) did you regulate and monitor your group processes according to the guidelines?

Questionnaire on individual characteristics

Before the groups started with the second block, a questionnaire on individual characteristics was administered. The questionnaire consisted of five scales. All scales had already been tested in a previous study (Dewiyanti, Brand-Gruwel, & Jochems, 2003) and the reliabilities ranged from .75 to .87. The first scale assessed student's attitudes towards collaboration (Attitude Towards Collaboration, 12 items), e.g., "I find that it is interesting to work together in a group". The second scale rated active or passive orientation to group work (Group Activity, 6 items), e.g., "I like to take the initiative". The third scale tapped information on the student's familiarity with text-based communication (Perceived Text-based Communication, 4 items), e.g., "The discussion group is a pleasant way to communicate". The fourth scale sought information on student's prior knowledge (Prior Knowledge, 4 items), e.g., "I can explain this subject to other students", and the last scale assessed the student's opinion on using Internet (Opinion on Using Internet, 5 items), e.g., "The Internet is a pleasant way to get information from all over the world". The format of all items was a Likert-type scale, ranging from 1 (strongly disagree) to 5 (strongly agree).

Overall participation.

In order to know the extent to which students participated in the discussion group, overall participation was measured based on the number of messages that were posted by individual participants across the learning block in each instructional setting.

Content analysis.

Students' messages during the collaboration process were analysed to measure three dimensions, namely: regulation, knowledge co-construction, and affective learning activities. The messages were analysed per group to assess the nature of interaction within each group. Thus, the group was used as the unit of analysis because participants worked in the same group throughout the study. Before the students' messages were categorised into the three dimensions, every message was segmented into manageable items, so-called units, for subsequent allocation into relevant categories within each dimension. The base unit of analysis was a topic within one message. One topic was one unit. The topic in one message could be more than one. The number of sentences in one message had no relations with the number of either topics or units. For example: when two or more successive sentences dealt with the same topic, they were counted as one unit and when one sentence contained two different topics, it was counted as two separate units. After messages were segmented into units, the units were assigned into the categories within the three dimensions. Each unit could only be categorised in one category within each theme. Units that did not fit into the categories were coded as Other. Next, the three dimensions including the categories within each dimension are described.

Regulation. The first dimension that was measured was the regulation of group processes. The instrument used to measure this dimension was adapted from our previous study (Dewiyanti et al., 2003). This dimension contained six categories including orientation, planning, reflection, monitoring procedure, monitoring progress, and monitoring participation.

Knowledge co-construction. The second dimension was knowledge co-construction. This dimension was identified by using the instrument that was adapted from Weinberger (2002). An inter-rater reliability of .81 was reported for this dimension (Weinberger, 2002). The instrument was used to assess knowledge co-construction that included five categories, namely externalisation, elicitation, quick consensus building, integration-oriented consensus building, and conflict-oriented consensus building.

Affective learning activities. The last dimension was affective learning activities. The instrument from Veldhuis-Diermanse (2002) was used to measure three categories namely affective motivation, affective asking for and affective chatting. Veldhuis-Diermanse (2002) reported a Cohen's Kappa of .82.

Originally each dimension was represented by one instrument. In this study we test the inter-rater reliability of all dimensions as one instrument. A training session was provided for the second rater. Then, 36 messages were randomly selected and the two raters independently segmented and coded the units into the categories within the three dimensions. A substantial inter-rater reliability was achieved (Cohen's Kappa = .74). The remaining messages were segmented and coded by one rater.

The detailed description of each category in each dimension is described in Table 1.

Table 1
Coding scheme

Category	Description
	Dimension 1: Regulation
Orientation	A unit is coded as orientation if it contains (1) review on the task that should be proceeded, (2) the product that should be submitted, and (3) time or date to submit the product.
Planning	A unit is coded as plan if it contains (1) a sequence of activities to complete the task, (2) time schedule to be spent on every part of the task, and (3) task division among group members.
Reflection	A unit is coded as reflection if it contains the response of given intervention from the researcher.
Monitoring procedure	A unit is coded as monitoring procedure if it contains (1) remarks to move to the next activities/steps in completing the task, (2) remarks to reshape or to adjust the group's working procedures, and (3) remarks to keep the working procedure in order to complete the task.
Monitoring progress	A unit is coded as monitoring progress if it contains (1) a summarisation of what the group (not individual) has done or reached, (2) a reminder of deadline/time to submit a product.
Monitoring participation	A unit is coded as monitoring participation if it contains (1) a reminder to a group member to contribute to the group, (2) remarks on looking for non-active group members, (3) remarks on the availability of a group member to participate.
	Dimension 2: Knowledge co-construction
Externalisation	A unit is coded as externalisation if (1) it was the learner's first expression / opinion/product, (2) it was group product, (3) it was an explanation / information that was requested by other group members, and (4) it was a suggestion of something that the group members could do, (5) it was an additional information from external sources, for example from internet, newspapers or magazines.
Elicitation	A unit is coded as elicitation if (1) it aims to directly trigger a specific reaction from the learning partners, and (2) it is a question, order, or instruction to the group members to do something.
Quick consensus building	A unit is coded as quick consensus building if it shows (1) an accepting, (2) a short sign of approvals or (3) a literal repetition of what a group member has already said.
Integration-oriented consensus building	A unit is coded as integration-oriented consensus building if contributions of one or more group members are adopted into one's own considerations.
Conflict-oriented consensus building	A unit is coded as conflict-oriented consensus building if it shows explicit rejections of other group members' opinions or modification of other group members' perspectives.
	Dimension 3: Affective learning activities
Affective motivation	A unit is coded as affective motivation if it shows a general emotional reaction to the messages of other group members without directly reacting to the content of that note. The reaction can be positive, negative or neutral.
Affective asking	A unit is coded as affective asking if it shows a request for a general feedback, responses or opinions by other group members.
Affective chatting	A unit is coded as affective chatting if it shows a chat or social talk that is not relevant to the task.

Questionnaire on student's experiences with collaborative learning

This questionnaire, administered at the end of the second learning block, assessed student's experiences with collaborative learning by use through the seven existing scales. Two of the seven scales were constructed and tested in a previous study (Dewiyanti et al., 2003). These two scales included (1) Monitoring Working Procedure (8 items) e.g., "I remind group members who do not work together properly", and (2) Participation (5 items), e.g." All group members participate in discussions to reach a consensus". The other five scales were used to assess Team Development, Task Strategy, Intra-group Conflict, Group Process Satisfaction, and Sociability. Team Development was adapted from Savicki, Kelley, & Lingenfelter (1996) and aimed to assess the degree of cohesion that was achieved while group members have been working together (11 items), e.g., "All group members understand the group goals and were committed to them". Task Strategy was adapted from Saavedra, Early, & Van Dyne (1993) and assessed the decisions and choices made by a group that performed the task (7 items), e.g., "Our group developed a good strategy for doing the tasks". The Intra-group Conflict consisted of seven items adapted from Saavedra et al. (1993) and measured the degree of conflict in a group (7 items), e.g., "There was a lot of tension among people in our group". Group Process Satisfaction was adapted from Savicki et al. (1996) and aimed at assessing the degree to which participants were satisfied with the group process, e.g. "I felt good that I could participate with my group in coming to a conclusion about the problem". The format of all items was a Likert-type scale, ranging from 1 (strongly disagree) to 5 (strongly agree). The last scale, Sociability (10 items), was adapted from Kreijns (2004) and measured the degree of perceived sociability of a CSCL environment, e.g. "I feel comfortable with this CSCL environment". The format of the items was a Likert-type scale, ranging from 1 (not applicable) to 5 (totally applicable). The data of the collaborative learning experiences were analysed per individual because, like Gillies (2003) and Webb and Farivar (1994), our interest lies in examining the effect of collaboration on individual's learning experiences.

Design & Procedure

The design of this study is presented in the Table 2.

Table 2
Design of the Study

Without guidelines	O1	X	O2, O3, O4
With guidelines	O1	X + G	O2, O3, O4

O1 = Questionnaire on individual characteristics.
X = Task.
X + G = Task with guidelines for effective collaborative learning.
O2 = Overall Participation.
O3 = Content analysis.
O4 = Questionnaire on student's experiences with collaborative learning.

Two instructional settings, without guidelines and with guidelines, were set up. Fourteen groups (n = 55) were assigned into the without guidelines setting. These groups were given full autonomy in managing their group in order to arrive at a joint product. The other 14 groups (n = 51) were assigned into the with guidelines setting. These groups received guidelines about effective collaborative learning and instructions to reflect on and to discuss their group process halfway through their collaborative learning session (approximately after one-and-a-half weeks). All participants received the same assignment and had three weeks to complete the assignment. The teachers sent an e-mail to all students that contained the task and the instructions to place all communication among group members in the discussion forums.

All participants were asked to complete the individual characteristics questionnaire in the beginning of the learning block and the questionnaire on student's experiences with collaborative learning at the end of the learning block. Further, the number of posted messages in each instructional setting was counted to measure participation. Moreover, content analysis was conducted to reveal students' interaction during collaborative learning.

Results

Individual characteristics

Seventy-five of the 106 participants (response rate 70%) returned the individual characteristics questionnaire. Table 3 presents the data of the individual characteristics of the participants (means and standard deviations) in the instructional setting without and with guidelines.

Table 3
Means and standard deviations of variables in individual characteristics

	Without guidelines n = 38		With guidelines n = 37	
Variable	M	SD	M	SD
Attitude towards collaboration	3.16	.35	3.13	.27
Group activity	3.59	.56	3.69	.72
Perceived text-based communication	3.09	.55	3.33	.72
Prior knowledge	3.88	.56	3.89	.67
Opinion on using Internet	3.88	.60	3.87	.60

Note. Unit of analysis is the individual mean.

Participants scored above midpoint on all the variables. No significant differences were found between the instructional setting without and with guidelines. Thus, participants in both instructional settings were equal with respect to the individual characteristics.

Participation

In order to answer our first research question about the participation rate, the means and standard deviations of posted messages across the learning block is reported in the Table 4.

Table 4
Means and standard deviations of number of posted messages per individual

Week	Without guidelines n = 55		With guidelines n = 51	
	M	SD	M	SD
1	2.53	2.51	2.63	2.07
2	3.49	3.12	2.71	2.55
3	2.87	2.94	4.00	3.46
4	.35	1.36	.18	.71

The collaborative learning session lasted officially for three weeks. It means that students had to submit their joint product to the teacher after the third week. However, we noticed that some groups exceeded the official deadline and posted messages in the fourth week. Therefore, we decided to report the overall participation within four weeks.

Participants in the without guidelines setting posted 508 messages (n = 55, $M_{individual}$ = 9.24, $SD_{individual}$ = 4.47) whereas participants in the with guidelines setting posted 485 messages (n = 51, $M_{individual}$ = 9.51, $SD_{individual}$ = 4.45). On the average, each student posted nine messages to complete the task. This participation rate was rather low in both settings. It means that on the average students posted 2-3 messages every week. Additional statistical analysis revealed no significant differences in students' overall participation between both instructional settings, indicating that providing guidelines did not influence students' overall participation. However, the pattern of overall participation in both instructional settings differed somewhat. Participants who received guidelines appeared to be very active in the last week while participants who did not receive guidelines remained stable in posting their messages. Only a few messages were posted in the fourth week in both instructional settings, indicating that most students completed the task on time.

Interaction

Before reporting the results of the content analysis, the number of messages posted as well as the number of units were checked. Participants in the without guidelines setting posted 508 messages that were segmented to 557 units (M_{group} = 39.79, SD_{group} = 24.00), whereas participants in the with guidelines setting posted 485 messages that were segmented to 530 units (M_{group} = 37.86, SD_{group} = 14.24). No significant difference was found between the two instructional settings on the number of units. In order to answer the second research question about interaction among group members, Table 5 presents the means and

standard deviations of variables regarding the regulation of group processes, knowledge co-construction and affective learning activities.

Table 5
Means and standard deviations of units on the categories in the regulation, the knowledge co-construction, and the affective learning dimensions

Dimension category	Without guidelines n = 14		With guidelines n = 14	
	M	SD	M	SD
Regulation				
Orientation	.00	.00	.00	.00
Planning	.00	.00	.07	.27
Reflection	.00	.00	.00	.00
Monitoring procedure	1.21	1.81	3.14	3.51
Monitoring progress	.71	1.07	.50	.94
Monitoring participation	.50	.86	.57	.85
Knowledge co-construction				
Externalisation	27.93	7.73	26.57	6.41
Elicitation	.43	1.09	.21	.58
Quick consensus	3.14	5.17	1.21	2.00
Integration-oriented consensus building	.57	1.16	.86	1.10
Conflict-oriented consensus building	.07	.27	.14	.36
Affective learning				
Affective motivation	1.50	2.14	1.07	1.59
Affective asking	1.36	2.76	.36	.84
Affective chatting	.14	.36	.00	.00

Note. Unit of analysis is the group mean.

Participants in both instructional settings paid more attention to knowledge co-construction than to the regulation of group processes and to affective learning activities.

In the Regulation dimension, participants from both instructional settings showed only a few activities. No group from either instructional setting did any orientation. Further, no group at all in the guidelines setting followed the instruction to reflect on and to discuss their group processes. Groups in the guidelines setting did more Monitoring Procedure than groups in without guidelines, although this activity varied considerably.

The groups that did not receive guidelines varied more in knowledge co-construction activities than the groups that received guidelines. Further, in both instructional settings, participants apparently focused on externalising ideas rather than other activities.

Finally, the activities on the last dimension were also limited. Participants did not show much affective learning activities. Groups in the guidelines setting varied less and showed fewer affective learning activities than groups that did not receive guidelines.

Statistical analysis revealed no significant differences on variables concerning regulation of group processes, knowledge co-construction or affective learning activities.

Experience

The third research question about how students experience collaborative learning was measured by using the questionnaire on students' experiences with collaborative learning. Seven of 55 participants (response rate 12%) who did not receive guidelines responded the questionnaire while 14 of 51 participants (response rate 27%) from the groups that received guidelines returned the questionnaire. The data regarding students' experiences with collaborative learning (means and standard deviations) are shown in the table 6.

Table 6

Means and standard deviations of variables in student's experiences with collaborative learning

	Without guidelines n = 7		With guidelines n = 14	
Variable	M	SD	M	SD
Monitoring working procedure	2.27	.42	2.28	.57
Participation	2.78	.47	2.96	.76
Team development	2.67	.94	3.25	.74
Task strategy	2.82	.54	2.95	.64
Intra-group conflict*	2.59	.42	2.13	.57
Group process satisfaction	2.93	.45	3.23	.65
Sociability	2.13	.69	2.35	.87

Note. Unit of analysis is the individual mean. The scale ranges from 1 to 5, where 1 = strongly disagree and 5 = strongly agree (3 = neutral), except for the Sociability where 1 = not applicable and 5 = totally applicable (3 = moderately applicable).

* $p < .05$.

Students' experiences with collaborative learning were considerably low and varied in both instructional settings. The students who received guidelines slightly varied more in their experiences with collaborative learning than students who did not.

Statistical analyses by using Mann-Whitney U-tests were conducted to compare the differences on students' experiences with collaborative learning between the participants in both instructional settings.

A significant difference was found on the variable Intra-group Conflict ($U = 22$, $Z = -2.03$, $p < .05$). However, because of the small sample size, this result should be interpreted cautiously.

Discussion

The results of the first study show that giving students specific guidelines and instructions did not enhance the collaborative learning process. Findings in this study will be discussed according to the three research questions.

The first question is related to how students participate in the CSCL environment. The findings showed that the level of participation was relatively low, although the teacher encouraged students to use the CSCL environment. Apparently students did not use it effectively. Collaborative learning that is facilitated by an asynchronous CSCL environment was a relatively new learning method for them and that might be the reason that students were not comfortable in working collaboratively in this learning environment. Moreover, one should realise that they had the opportunity to discuss face-to-face because they are in the same college.

The second research question concerned the interaction during the collaboration process. The analysis of students' messages revealed that participants showed very little activity on the regulation of group processes. Further, no groups in the with guidelines setting reflected on and discussed group processes. Regarding knowledge co-construction, participants in both settings appeared to focus on expressing their ideas rather than criticising each other's ideas. On the affective dimension, the participants showed limited affective learning activities. These findings indicated that interaction during the collaboration process were limited. There are two explanations of these findings. First, the group members were unfamiliar with collaborative learning in an asynchronous CSCL environment. So, unfamiliarity seemed to hinder interaction among group members. Another reason might be that because they were in the same school, students might arrange face-to-face meeting rather than to discuss via electronic discussion forums, and electronic discussion forums were used only for posting their ideas or their joint product.

The last research question was about how students experience collaborative learning. Except for the variable intra-group conflict, participants in the guidelines setting did not differ significantly from participants in the instructional setting without guidelines on the variables of student's experiences. Further, the low scores in both settings, on the variables of participant' experiences with collaborative learning, indicated that collaborative learning was not going well.

Findings in this study indicated that the collaboration process was not working well when an asynchronous CSCL environment was used. Specific guidelines and reflection to foster collaboration process has not been effective in this study. Further, students were not likely to use a CSCL environment. They seemed to use this environment for posting ideas or products instead of for discussing their ideas. Besides, they were not likely to follow the instruction to reflect midway through the collaborative learning. Possible reasons maybe the lack of tutor involvement in activities, vague information about the benefit of collaborative learning, and the chance to meet face-to-face. The similar reasons for unsuccessful collaboration in CSCL environments have also been reported by several researchers (e.g., Ng, 2001; Curtis & Lawson, 2001; Molesworth, 2004).

Study 2

The second study addressed the same research questions as in the first study. This study replicated study 1 with four adjustments in the instructional setting. First, a collaborative learning workshop was provided for the students before they started to collaborate. This workshop aimed at giving students an idea about collaborative learning. Second, the researcher and the tutor actively moderated the discussion groups. Third, in order to reduce unfamiliarity among group members, the moderators asked students to introduce themselves in the discussion forum. The personal introduction aimed to help students get to know the other group members. Fourth, a longer time for the collaborative learning session was applied.

Method

Participants

The sample for this study involved 66 students (10 males and 56 females) from the arithmetic and didactics course in a teacher training college for primary education in the Netherlands. All participants were full-time second-year undergraduate students from three different classes. The students worked in 19 small groups of three to five students.

Materials

Task

The first week was used for an introduction about collaborative learning and a personal introduction with group members. The task was again adapted from the supplementary workbook to the MILE software. The goal of this task was to help elementary teachers teaching the percentage concept in their classes. The task consisted of four sub-tasks that should be submitted every three weeks. In the first sub-task, students were asked to choose a theme about teaching the concept of percentage for pupils and to search for five movies fragments that were related to their theme in the MILE software. In the second sub-task, students were asked to formulate research questions based on the selected movies. In the third sub-task, students should write a theoretical background and the fourth sub-task asked students to prepare a group presentation.

The CSCL environment

The CSCL environment was the same as in study 1. So again Blackboard was used to facilitate collaborative learning.

Guidelines

The same guidelines as in study 1 were used in this study. However, in this study the guidelines were not attached to the task. The researcher informed participants about the guidelines while moderating the collaborative process. Halfway through the collaboration process, participants were asked to write a

reflection report based on the same three questions as in study 1. Then the researcher gave feedback on the group process. The feedback was given based on the reflection reports written by the group members. In case group members did not write the reflection report, the feedback was given according to the researcher's observation of their activities in the discussion forum.

Measurements

The measurements were the same as in study 1, with the exception that in this study individual characteristics were not measured because the samples were from the same population.

Design & Procedure

The design of this study is presented in the Table 7.

Table 7
Design of the Study

Without feedback	O1	M	T	O2, O3, O4
With feedback	O1	M	T + F	O2, O3, O4

O1 = Questionnaire on individual characteristics.
M = Moderation.
T = Task.
T + F = Task with feedback from the moderators on group processes.
O2 = Overall participation.
O3 = Content analysis.
O4 = Questionnaire on student's experiences with collaborative learning.

Two instructional settings were set up, namely With Feedback and Without Feedback. Nine groups (n = 34) were assigned to the with feedback setting. These groups received guidelines about effective collaboration from the moderator and were asked to write an individual reflection on group processes and based on the individual reflection report, the researcher provided feedback on their group process. The other ten groups (n = 32) were assigned to the without feedback setting. They were also moderated but they did not receive guidelines; they were not asked to write any reflection, nor did they receive feedback. The researcher and the tutor moderated all groups.

All participants received the same task that lasted for 15 weeks including three weeks' school holiday. The task required a joint product and at the end of the collaborative learning session the groups had to present their product. Participation was measured based on the number of messages posted in each instructional setting. Content analysis was conducted to reveal the students' interaction during collaborative learning. At the end of the collaborative learning session all participants were asked to complete the questionnaire on their experiences with collaborative learning.

Results

Participation

The first research question is answered by using a quantitative overview indicating the participation rate. The means and standard deviations of overall participation across the learning block for participants in the instructional settings without and with feedback are reported in the Table 8.

Table 8
Means and standard deviations of number of posted messages per individual

Week	Without feedback n = 32		With feedback n = 34	
	M	SD	M	SD
1	.16	.52	0	0
2	.28	.06	.58	.24
3	.09	.29	.03	.17
4	.69	.89	.26	.67
5	.69	1.51	.62	.89
6	1.28	2.07	1.91	1.69
7	.22	.49	.41	.78
8	.66	.94	1.06	1.13
9	.34	.83	.47	1.02
10	1.66	1.96	1.15	1.98
11	1.66	1.95	1.53	1.86
12	1.44	2.14	.97	1.14
13	.28	.73	1.26	1.36
14	1.31	2.55	.79	1.29
15	1.22	1.79	1.21	2.01
16	0	0	.03	.17

Participants who did not receive feedback posted 383 messages (n = 32, $M_{individual}$ = 11.97, $SD_{individual}$ = 10.28), whereas those who did posted 400 messages (n = 34, $M_{individual}$ = 11.76, $SD_{individual}$ = 6.48). The participation rate was considered very low in both instructional settings. Additional statistical analyses showed no differences in participation rate between students in both instructional settings.

Interactions

Before describing the results of the content analysis, the number of units was examined. The number of units from the participants who did not receive feedback and from those who did were 537 units (M_{group} = 59.89, SD_{group} = 43.75) and 700 units (M_{group} = 78.11, SD_{group} = 37.44) respectively. No significant differences were found between the two settings on the number of units.

In order to answer the question concerning the extent to which the students interacted in different settings, students' messages were analysed. Table 9 presents means and standard deviations of variables on the regulation of group processes, knowledge co-construction and affective learning activities for group in both instructional settings.

Table 9
Means and standard deviations of units on the categories in the regulation, the knowledge co-construction, and the affective learning dimensions

Dimension Category	Without feedback n = 9		With feedback n = 9	
	M	SD	M	SD
Regulation				
Orientation	.22	.44	.22	.44
Planning*	.00	.00	.78	.97
Reflection	.00	.00	.00	.00
Monitoring procedure*	5.11	4.23	10.11	4.81
Monitoring progress	.11	.33	.22	.44
Monitoring participation	.67	1.12	1.11	1.27
Knowledge co-construction				
Externalisation	13.22	7.63	14.00	7.12
Elicitation	.78	.97	.44	.53
Quick consensus	.56	1.01	.22	.44
Integration-oriented consensus building	.11	.33	.00	.00
Conflict-oriented consensus building	.11	.33	.11	.33
Affective learning activities				
Affective motivation	12.78	12.87	13.78	6.94
Affective asking	7.67	7.84	8.67	6.12
Affective chatting	6.22	3.35	10.33	11.55

Note. Unit of analysis is the group mean.
* $p < .05$.

Students in the with feedback setting monitored their working procedure better than students in the without feedback setting. Except for monitoring procedure, in both instructional settings, students varied and did not show many activities in the regulation of group processes. Regarding knowledge co-construction, participants in both settings focused more on externalisation rather than on other activities. Furthermore, affective learning activities in both settings varied.

Statistical analyses revealed significant differences on two variables in the Regulation dimension, namely Planning ($U = 22.50$, $Z = -2.19$, $p < 0.05$) and Monitoring Working Procedure ($U = 16.50$, $Z = -2.13$, $p < 0.05$). No significant differences were found on the variables on knowledge co-construction and affective learning activities. Caution is needed when interpreting the results because not all students communicated via the discussion forums.

Experiences

Only a very few participants responded to the questionnaire on student's experiences with collaborative learning. The means and standard deviations for both instructional settings are reported in the Table 10.

Table 10
Means and standard deviations of variables in student's experiences with collaborative learning

	Without feedback n = 5		With feedback n = 13	
Variable	M	SD	M	SD
Monitoring working procedure	2.33	.92	2.59	.56
Participation	3.23	.60	3.23	.41
Team development	3.58	.63	3.47	.66
Task strategy	3.65	.78	3.35	.62
Intra-group conflict	2.37	.39	2.36	.88
Group process satisfaction	3.50	.40	3.51	.83
Sociability	1.84	.35	2.34	.93

Note. Unit of analysis is the individual mean. The scale ranges from 1 to 5, where 1 = strongly disagree and 5 = strongly agree (3 = neutral), except for the Sociability where 1 = not applicable and 5 = totally applicable (3 = moderately applicable).

The results show that some of the variables scores are above the midpoint and varied. This indicated that students from both instructional settings showed some positive experience with collaborative learning. Additional statistical analyses did not show any significant differences on the students' experiences with collaborative learning between the settings.

Discussion

The results of the second study showed that the instructional adjustment did not significantly influence collaborative learning. Below, our findings will be discussed according to the three research questions.

Regarding the students' participation, although longer time was applied and students' involvement in online discussions was supported and moderated by the instructor through offering advice and responding to student questions, the level or participation in the CSCL environment remained poor. This might indicate that only limited interactions among group members took place in the CSCL environment. One problem was a lack of participation or late participation by some group members. Another problem was that students used the discussion forums only for placing their joint products rather than used it to collaborate.

Furthermore, not all participants wrote their personal reflection on group processes. Perhaps, they find it unnecessary to write their personal points of view about group processes or they might consider that reflecting on group processes is less important than completing the task. Further, content analysis showed that students in the with feedback setting paid more attention on planning their work and monitoring their working procedure.

Regarding students' experience with collaborative learning processes, the result is unclear because of the very few respondents. Their experiences were varied. Apparently, not all students perceived a positive experience during the collaborative learning session.

Findings in this study showed that the existence of moderators (informing the guidelines and giving feedback on group's collaboration processes) helps students to focus on the group process. In conclusion, moderation of collaborative learning appeared to help students to pay attention on the group processes and it might indirectly improve the participation level (Veldhuis-Diermanse, 2002; Berge 1995).

General discussion

Collaborative learning through a CSCL environment has been said to promote or to put more emphasis on sharing ideas, selecting to specific topics, taking responsibility for managing their time and the resources available to them (Molesworth, 2004). The main goal of the present research was to explore whether asynchronous collaborative learning is a feasible learning method for campus-based students and to see the effect of different instructional settings with the emphasis on reflecting on group processes on students' interaction. In this part, the main findings from both studies are discussed.

The first finding concerned the unequal and diverse students' participation. Results from both studies showed poor students participation rates. Students had the opportunity to see each other because they were studying in the same school. Thus, it was possible that an asynchronous CSCL environment was not advantageous for collaboration because they could collaborate in a face-to-face context too. So, one can question the benefits of an asynchronous CSCL environment in a campus-based setting. What is the purpose of using such environment over meeting face to face? Is there a good combination of the two forms of collaboration possible? More research is desirable to investigate the added value of asynchronous communication by using an asynchronous CSCL environment in campus-based higher education.

The second finding is that students focused more on externalising ideas and opinions, and showed less attention regarding to the regulation of group processes. Results in both studies indicated a large number of externalisation activities and a very few regulatory activities. An explanation of this finding is that students might not understand the real function of an asynchronous CSCL environment. The learning environment was used as a messaging environment instead of as a collaborative environment. Instead of showing collaborative activities in the CSCL environment, students tended to use this environment only to post their individual ideas or their group products. Thus, they were more cooperative than collaborative. Another explanation may be that students viewed collaboration in an asynchronous CSCL environment as unprofitable. As we mentioned earlier, the students had the opportunity to meet face-to-face, and they may prefer to do so.

The third finding indicated that not all students experienced positive collaborative learning. However, because of the limited number of respondents, this finding should be interpreted cautiously. Result showed that students did

not enjoy collaborative learning that was facilitated in a CSCL environment. One explanation is that students are not familiar with these kinds of self-directed ways of learning. Furthermore, it seems that the involvement of teacher in collaborative learning helps students to experience collaborative learning positively.

Moving towards more collaborative learning means a shift in the balance of responsibility between teacher and student, which requires adaptations and new ways of working for both the students and the teacher. Some behaviour such as procrastination of the task, frustration over personal interaction difficulties, and discouragement from a perceived lack of progress are likely to inhibit the implementation of collaborative learning.

Both studies are exploratory in nature and because of the small sample size, generalisability of the results is limited. Not all participants responded to our questionnaires and not all participants used the CSCL environment to facilitate their collaboration process. As we have mentioned before, although students were encouraged to use discussion groups, we could not control students who used emails or met face-to-face.

Is asynchronous collaborative learning a feasible learning method for campus-based students? The answer is not as positive as we expected. This research showed that the implementation of an asynchronous CSCL environment in campus-based higher education is not an easy job. When students can easily meet face-to-face, they seem to choose to collaborate face-to-face rather than to collaborate via a CSCL environment.

Findings in this study seem to provide some support for the findings in the studies of Kennet, Stedwill, Berrill & Young (1996) and Molesworth (2004). Kennet's study revealed that at the university level, cooperative group learning was more difficult to enforce than at the secondary school level and resulted in only a few students being actually engaged in group learning. In the study of Molesworth (2004), students were not interested using a virtual learning environment to facilitate their discussion outside of classroom teaching. Nevertheless, more research is needed to ascertain how asynchronous CSCL environments can successfully facilitate collaborative learning for students who have a chance to meet face-to-face at the school.

CHAPTER 7 – General Discussion

The constructivistic approach to learning views interaction among learners as a critical element in a learning process. Research frequently shows educational advantages that are derived from collaborative activities among students. Studies have shown that interaction among students with different understanding, alternative points of view, and various skills can enrich students' learning experiences (e.g. Brown & Palinscar, 1989; Johnson & Johnson, 1994; Gillies, 2003, Webb, Ender & Lewis, 1986).

Collaborative learning is a pedagogical method that promotes active communication and interaction between learners with their peers and their tutors. It also stresses the shared understanding, the coordinated activities, the mutual engagement, and the active participation among the group members (Roschelle & Teasley, 1995; Brufee, 1993; Lipponen, 2002).

In recent years the integration of information and communication technology (ICT) into higher education has influenced the way of delivering educational programs, for example through the use of various media, and cooperation with tutors and peers in an electronic way (Jochems, Van Merriënboer, & Koper, 2004). One combination of the more contemporary educational approach, namely collaborative learning, and ICT is the use of computer-supported collaborative learning (CSCL) environments. CSCL aims to provide tools for learning processes where distributed learners interact with each other, as well as with the teacher or other experts (Koschman, 1996) and is focused on how collaborative learning supported by technology can enhance peer interaction in groups (Lipponen, 2002).

Nowadays, more and more CSCL environments are used to enhance the learning process in higher education. Evidence of using CSCL suggests that interactions in a learning process such as debating, arguing, explaining, asking and answering questions between learners and teacher might be very beneficial, especially for distance education. In a CSCL environment a group of students has the opportunity to interact with both group members and tutors through posting messages or responding to others' messages in order to complete a joint task. Learning in such an environment requires learners to regulate their learning. They need to make decisions about the planning of activities, the strategies to apply, the time to spend, the procedure to proceed the task, the monitoring of their work and the assessment of their joint product.

This thesis focuses on the use of asynchronous communication in CSCL environments to facilitate students to interact with other students and teachers. The asynchronous CSCL environment provides students the opportunity to interact in a structured way with peers, through reading other students' work and commenting upon it (Dede, 1996). Other benefits of students interacting

with their peers about their learning include improved communication skills and increased individual self-confidence.

The core of this thesis is about the importance of reflection on group processes during collaborative learning. Group members need to assess group processes periodically and to modify their plans, goals, strategies, and effort in relation to the group situation. Reflection is a basic element of collaborative learning in which group members' recapture their collaboration process, think it over and evaluate it (Johnson & Johnson, 1994). The outcomes of reflection may include a new way of doing things, the clarification of an issue, the development of a skill or the resolution of a problem (Boud, Keogh & Walker, 1996).

In this final chapter, the research questions are re-addressed, followed by a summarisation and discussion of the main research findings. This chapter will be closed with practical implications and suggestions for further research.

Review of the results

In the previous chapters, a literature review, two explorative and two empirical studies are reported. Those studies aimed to know how group members regulate the collaboration process while using an asynchronous CSCL environment, and to examine the effect of reflection on the regulation of group processes, knowledge co-construction, and affective learning activities.

Chapter 2: how reflection can stimulate students' awareness of maintaining positive interactions during collaborative learning. This theoretical chapter discusses how reflection can stimulate students' awareness of maintaining positive interaction during collaborative learning, and to generate theory-based guidelines in embedding reflection in asynchronous CSCL environments.

In this theoretical framework, first, three necessary conditions, namely small group size, a group task and involvement of teachers to start interaction in the collaboration process were discussed. Then, the type of interaction and the expected outcomes from the collaboration process were explained. During the collaboration process, two interactions occur in parallel: interaction to co-construct knowledge and interaction to maintain group processes. Both interactions are expected to result in experiencing positively collaborative learning, and gaining new knowledge and skills. Next, the use of reflection on group processes during the collaboration process was elaborated. Reflection can be used as a tool to encourage as well as maintaining positive interaction within the group. An explanation of the importance of doing reflection and the instruction on how to reflect, on which aspects must be reflected, including who needs to be involved in reflection were described in detail. This chapter is closed with the presentation of the theory-based guidelines for embedding reflection in asynchronous CSCL environments. These guidelines were used for our studies.

Chapter 3: how distance learners experience collaborative learning while using a CSCL environment. This study was an exploratory study to observe how distance learners experienced collaborative learning in an asynchronous CSCL environment and whether distance learners were satisfied with collaborative learning in such an environment. Furthermore, individual characteristics and course characteristics that might influence students' experiences with collaborative learning were considered. Moreover, aspects with respect to collaboration that might influence students' satisfaction were explored.

The main conclusion of this study was that distance learners showed positive experiences with working together in an asynchronous CSCL environment. They were satisfied with the opportunity of learning together in such an environment. However, there was an indication that the students did not automatically regulate group processes. Other findings indicated that a joint product stimulated students to regulate group processes, that was, to plan group activities, to monitor the group progress, and to assess their quality of work. In other words, when a joint product is requested it is more likely that the group members regulate group processes. Whilst when an individual product is required group members are likely to regulate group processes less because they are less dependent of each other (Cohen, 1994; Johnson et al., 1994).

In order to investigate further how to stimulate students to regulate group processes and to arrive to the effective and efficient collaboration process, an experimental study was set up in the laboratory.

Chapter 4: the effect of reflection on the regulation of group processes, knowledge co-construction, and students' experiences with collaborative learning: a laboratory study. The research question addressed in this study was: What is the effect of reflection on the regulation of group processes, knowledge co-construction, and students' experiences with collaborative learning? With regard to our research question, we hypothesised that reflection on group processes while learning collaboratively in a CSCL environment is likely to stimulate group members to regulate group processes, to stimulate knowledge co-construction, and to influence positively students' experiences in collaborative learning.

Findings in this study supported the hypotheses partially. Reflection on group processes in a collaborative learning session stimulated group members to orient on the task and to monitor actively their group working procedure as well as group progress, but did not directly influence knowledge co-construction activities. It was also found that reflection on group processes reduced intra-group conflict and tended to promote team development as well as satisfaction with the group process.

However, in this study, a few weaknesses need to be considered. Firstly, the sample size was small. Due to technical problems, the number of participants in the first session was lower than the number of participants in the second and the third sessions. A second consideration was the relatively short duration of the experimental sessions. Having a longer collaborative learning

session is recommended, because the effect of reflection might be stronger. Also other research shows that a longer period of intervention is advisable in order to come to a substantial effect of a specific instruction (Hoogveld, 2003). So the next step in the research project was to investigate the effect of reflection on group processes in a longer collaborative learning session in an ecological valid way.

Chapter 5: the effect of reflection on the regulation of group processes, knowledge co-construction, affective learning activities, and students' experiences with collaborative learning: a field study. The study described in this chapter attempted to assess the effect of reflection on the regulation of group processes, knowledge co-construction, affective learning activities, and students' experiences with collaborative learning in distance education, using an asynchronous CSCL environment to facilitate collaborative learning. The same hypotheses as in the previous chapter were addressed in this study. Additionally, we hypothesised that reflection on group processes was likely to enhance affective learning activities.

The main conclusion of this study was that reflection on group processes influenced students' regulatory activities such as planning group activities and monitoring working procedure in a positive way. Further, students who reflected in a collaborative learning session experienced better collaborative learning in team development and monitoring the participation as compared to students who did not reflect. However, the other two hypotheses regarding knowledge co-construction and affective learning activities could not be confirmed. Besides, it could be concluded that for distance learners an asynchronous CSCL environment was a useful learning environment. This learning environment can facilitate interaction between learners with different perspectives, understanding, and skills with respect to exchange information, to share ideas, and to gain group skills. A limitation in this study was the fact that the communication among the group members outside the discussion groups was not completely under control. It was noticed that some students talked via phone or arranged a face-to-face meeting with their group.

A question that arose from the result in this study was: can the same results be achieved with campus-based higher education students in which the use of an asynchronous CSCL environment is not so natural?

Chapter 6: how the campus-based higher education students collaborate in an asynchronous CSCL environment. This chapter has been concerned with the use of various instructional settings with the emphasis on reflecting on group processes to enhance collaborative learning. Two studies reported how campus-based higher education students participated, interacted and experienced collaborative learning in an asynchronous CSCL environment.

From this study, we concluded that students' participation was unequal and diverse. We also found a large number of externalisation activity and only a few regulatory activities. Further, students seemed not to enjoy collaboration

in an asynchronous CSCL environment. For some students CSCL was merely a messaging tool to make an appointment or to search other group members. Our results suggested that the implementation of an asynchronous CSCL environment to facilitate collaborative learning in a regular higher education setting was not an easy job.

Reflection on the results, implications for practice and directions for future research

From the studies reported in this thesis, there are some points to reflect on. Moreover, implications for practice and directions for future research are elaborated.

The effect of reflection. The results from the empirical studies (Chapter 4 and 5) have indicated that taking time to reflect gives a benefit on the collaboration process. It stimulates students to be aware of regulating their group processes. As for the regulation of group processes, reflection could encourage a student to engage in group regulatory activities such as planning, monitoring, and evaluating. However, from both studies we did not find any effect on knowledge co-construction. Perhaps, it's difficult for individual group members to reflect on their own knowledge co-construction activities. These studies provide evidence that reflection helps group members to be aware of regulating group processes and taking charge of the whole task in a more effective way. Future research needs to pay attention not only to the group process but also to reflection on the other aspects of the collaboration process including the learning process itself. For example by investigating the effect of reflection on the learning performance through collaborative review and assessment.

Short term vs. long term collaboration. Another interesting aspect from the results of the empirical studies in chapter 4 and 5 is the time span. The study in Chapter 4 applied a short time to collaborate, while participants in Chapter 5 collaborated in their group for approximately 5 months. It's nothing wrong to apply a short term to collaborate, however, applying a long term to collaborate is advisable when the teacher want to teach students to collaborate with other peer students or to teach students to reflect on their group processes. Furthermore, a longer term of collaborative learning helps students to become familiar with CSCL environments, with the collaborative learning method and with the group members.

Distance education students vs. campus-based higher education students. In comparing the results of study in Chapter 3, 5, and 6, we notice that different populations of students experienced collaborative learning differently. Studies in Chapter 3 and 5 involved adults' learners from distance education while the population in Chapter 6 were young adults from campus-based higher education. According to adult learning theory, adult learners tend to use their experiences rather than theories in solving the problem. Further, adult learners

prefer a more flexible and less-structured way of learning. Thus, collaborative learning is a recommended learning method for adult learners because they have opportunities to exchange their practical experience as well as their previous knowledge. On the contrary, young adult learners have limited practical experiences and most of them are used to be in a structured learning environment. Therefore, it is not surprising that the results from Chapter 3 and 5 indicated that adult learners showed a higher appreciation of and a better experience with collaborative learning, whilst some students in Chapter 6 did not take full advantages of the CSCL environment and did show less appreciation. Another explanation for this finding is that campus-based higher education students can meet face to face. So, the added value of communication via an electronic learning environment is unclear to them.

Role of the teacher. Another concern in this thesis is the role of the teacher. We did not focus on the teachers' role during collaborative learning. In contrast to a traditional face-to-face learning environment, where teachers have full control of the learning process, the teacher's role in a CSCL environment is more like a tutor. The teacher guides students through the learning process through modelling collaborative activities that the teacher wants students to practice (Rimmershaw, 1999). Another important role of teacher in collaborative learning is to prepare students for group works (Webb & Palinscar, 1996). There is only little research that pays attention to the teachers' role (e.g. Veldhuis-Diermanse, 2002). For the next research, it's important to involve teachers in facilitating reflection on group processes.

The use of CSCL. If we compare the study in Chapter 5 and 6, the participants used the CSCL environment differently. In Chapter 5, CSCL environment was the only learning environment for distance learners. Thus, distance learners used this learning environment to facilitate their collaboration. On the contrary, in Chapter 6, the CSCL environment was an additional learning environment beside the traditional classroom environment. In his study, Molesworth (2004) found that campus-based students were not interested in using a CSCL environment to facilitate their discussion outside the classroom. Only for a few students, a CSCL environment provides an excellent opportunity to express themselves. Therefore, it's not surprising if students from a campus-based institute used a CSCL environment just to place their communication. When an asynchronous CSCL environment is applied in campus-based education, it should be integrated into the whole learning programme and should not replace formal face-to-face contact with other students or tutors (Molesworth, 2004). CSCL environment promote less competitive learning environment and promote equal participation

Final remarks

With advances in computer and Internet technology people can communicate, collaborate and even learn together without time and place

limitation. Although, participation in an asynchronous CSCL environment requires discipline, openness and commitment from learners. Overall, the studies described in this thesis show the importance of reflection on group processes during collaborative learning that takes place in an asynchronous CSCL environment.

So far, reflection during collaborative learning is often neglected. Studies in this thesis showed that it is wise to promote reflection as a crucial element in collaborative learning particularly in an asynchronous CSCL environment. It can enhance the regulation of group processes and can help students to experience collaboration more positive and enjoy it.

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SUMMARY

Collaborative learning is a pedagogical method that facilitates interaction among learners. This method creates a learning situation in which two or more participating learners exchange ideas, experiences and information, then elaborate and refine them in order to co-construct knowledge (Veerman, 2000; Veldhuis-Diermanse, 2002). Nowadays the fast development in information and communication technologies makes it possible to learn together with others regardless of time and space via Computer-Supported Collaborative Learning (CSCL). Via CSCL environments distance learners have an opportunity to collaborate with their peer learners to complete a given task. However, in practice, applying an asynchronous CSCL environment is not simply assigning students in groups and asking them to use the environment to facilitate their collaboration. The use of this medium should be accompanied with specific instructions that aim to help learners to reach a productive collaboration. Example of the instructions used to structure collaboration among students are through assigning roles (Strijbos, 2004), providing scripted cooperation (O'Donnel & Dansereau, 1992), providing social affordance devices (Kreijns, 2003), using computer-based external representations (Van Bruggen, 2003) or stimulating reflection (Johnson, Johnson, Stanne & Garibaldi, 1990). The aims of this thesis are to reveal how campus-based and distance education students collaborate in an asynchronous CSCL environment, how they experience collaborative learning, and the effect of reflection on the regulation of group processes, knowledge co-construction and affective learning activities while students are using an asynchronous CSCL environment to facilitate the collaboration process.

Chapter 2 presents a literature review that aims to build a theoretical framework about the importance of reflection on group processes during a collaborative learning session. The framework begins with three necessary conditions that are needed to start an interaction in an asynchronous CSCL environment. These conditions are small group size, a group task, and teacher involvement. Then, interactions during the collaboration process including the expected outcomes from the collaboration process are discussed. Afterwards, the use of reflection on group processes to maintain positive interaction is elaborated including previous research on reflection. In the CSCL context, reflection is defined as a joint process between group members of trying to structure or restructure an experience, a problem or existing knowledge or insight within a group (Johnson & Johnson, 1994). Current research shows that reflection can have a positive effect on learning achievement (Yager, Johnson, Johnson, & Snider, 1996) as well as on problem solving success (Johnson, Johnson, Stanne, & Garibaldi, 1990). However, the existing CSCL literature does not pay much attention to the importance of reflection on group processes and even lacks from concrete instructional guidelines to promote reflection into

practical use. So, the theory-based guidelines for embedding reflection in asynchronous CSCL environments are presented in this chapter. These guidelines include the goal, the subject, the format, the leader and the time of reflection during collaborative learning.

Chapter 3 describes an explorative study that involved distance learners who were using an asynchronous CSCL environment to facilitate collaborative learning. This study had several aims. First, it aimed to observe how distance learners experienced collaborative learning in an asynchronous CSCL environment and whether distance learners were satisfied with collaborative learning in such an environment. Second, it aimed to reveal the individual characteristics and course characteristics that might influence students' experiences with collaborative learning. Third, aspects with respect to collaboration that might influence students' satisfaction were explored. Participants in this study were students from five distance courses who were working in groups of four to eleven. All distance learners used an asynchronous CSCL environment to facilitate collaboration with their group members. Findings from this study indicated that distance learners showed positive experiences and were quite satisfied with collaborative learning. Other findings suggested that a group product influenced the regulation of group processes and the group cohesion influences students' satisfaction with collaborative learning. From this study, it can be concluded that distance learners appreciate the opportunities to work collaboratively with their peer learners.

The study of Chapter 4 is an empirical study in a laboratory. This study aimed to investigate the effect of reflection on the regulation of group processes, on knowledge co-construction, and on students' experiences with collaborative learning. The participants were 55 first-year students from a teacher training college for primary education in the Netherlands. They were working collaboratively in a CSCL environment in groups of four or five students. Half of the groups were assigned to the experimental condition and half of the groups were assigned to the control condition. The groups in the experimental condition were prompted to reflect on group processes halfway of the collaboration process. The groups that received the prompts oriented more on the task and monitored more actively their group working procedure and their group progress, than the students who did not receive the prompts. Further, it was also found that intra-group conflict was reduced, team development was promoted, and group process satisfaction was increased. No significant difference was found on the effect of reflection on knowledge co-construction. Thus, it is concluded that reflection on group processes stimulated the regulation of the group process and enriched student's experiences with collaborative learning.

In Chapter 5 another field experimental study is reported. This study examined the effect of reflection on the regulation of group processes,

knowledge co-construction, affective learning activities, and students' experiences with collaborative learning in an asynchronous CSCL environment. This study was a replication of the previous study in Chapter 4; only this study employed longer time for collaboration and was conducted in distance education. The participants were 44 distance learners. They worked collaboratively in groups of four for five months to complete the assignments. An asynchronous CSCL environment facilitated the collaboration between group members. The groups were assigned into the experimental or control condition. The guidelines about how to collaborate effectively were embedded in the course website of the experimental condition. Further, the participants in the experimental condition were asked to write an individual reflection report and to discuss their group processes. Results of this study showed that reflection during collaborative learning influenced students' regulatory activities such as planning group activities and monitoring working procedures. Reflection also influenced students' experiences with collaborative learning positively in team development and monitoring the participation.

Chapter 6 presents two explorative studies that aimed to reveal how campus-based students use an asynchronous CSCL environment to facilitate their learning. In both studies, we observed how the students participated, interacted and experienced collaborative learning in an asynchronous CSCL environment. The first study involved 106 students from a teacher training college for primary education. The participants were assigned in groups of three or four. Two different settings, with guidelines and without guidelines about reflection, were set up in the CSCL environment. The groups were randomly assigned to one of the settings. Participants from both settings did not show any differences in participation, interaction and experience with collaborative learning. The second study involved 66 students from the same teacher training college who worked in groups of three or four. In this study, the tutor and the researcher moderated students' activities in an asynchronous CSCL environment. Half of the groups received feedback from one of the moderators and the rest of the groups did not. No significant differences were found on participation and experience with collaborative learning. However, we found that the groups that received feedback from the moderator planned and monitored their working procedure better than the groups that did not received any feedback. In general, both studies showed that participation varied, interaction among students was limited on externalising their ideas, and experiences with collaborative learning were poor. It can be concluded that students did not use the CSCL environment as a collaboration tool. Thus, the implementation of an asynchronous CSCL environment to facilitate collaborative learning in campus-based higher education is not an easy job.

The last chapter presents the summarisation of the studies, reflection on the results, implications for practice and directions for future research. Based on the overall results of the studies, it can be concluded that reflection on group

processes during collaborative learning stimulates students to regulate the group processes. In addition, distance learners showed positive experiences with collaborative learning that is facilitated by an asynchronous CSCL environment. Finally, this chapter is closed with some final remarks.

SAMENVATTING

Samenwerkend leren wordt gekenmerkt door een didactiek die interacties tussen lerenden stimuleert. Door studenten te laten samenwerken ontstaan leersituaties waarin ideeën, informatie en ervaringen kunnen worden uitgewisseld en kunnen worden uitgewerkt en verfijnd. Deze activiteiten leiden tot co-constructie van kennis (Veerman, 2000; Veldhuis-Diermanse, 2002). De snelle ontwikkelingen binnen de Informatie en Communicatie Technologie maken het tegenwoordig mogelijk dat studenten via electronische weg onafhankelijk van tijd en plaats kunnen samenwerken, bijvoorbeeld in de vorm van Computer-Supported Collaborative Learning (CSCL). Het samenwerken binnen dergelijke elektronische omgevingen biedt vooral mogelijkheden voor studenten die participeren in afstandsonderwijs. Echter, het samenwerken via deze weg is geen vanzelfsprekendheid. Het simpelweg verschaffen van een elektronische omgeving en het toewijzen van studenten aan een groep en hen vragen samen een taak uit te voeren via electronische weg, maakt niet dat studenten daadwerkelijk samen leren. Uit verschillende studies blijkt dat studenten moeten leren samenwerken in een electronische omgeving om op een productieve en effectieve wijze de gestelde doelen te bereiken. Er zijn verschillende instructiemaatregelen mogelijk om er voor te zorgen dat de samenwerking tussen studenten wordt gestructureerd; bijvoorbeeld door het toewijzen van rollen (Strijbos, 2004), het geven van 'scripted cooperation' (O'Donnel & Dansereau, 1992), het aanbieden van 'social affordance devices' (Kreijns, 2003) en van computergebaseerde externe representaties (Van Bruggen, 2003) of door het stimuleren van reflectie tijdens het samenwerken (Johnson, Johnson, Stanne & Garibaldi, 1990). Het doel van dit proefschrift is na te gaan hoe studenten binnen afstandsonderwijs en contactonderwijs samenwerken in een asynchrone CSCL-omgeving, hoe ze deze samenwerking ervaren en wat de effecten zijn van reflectie tijdens het samenwerken op regulatieprocessen, kennis co-constructie en affectieve leeractiviteiten.

In Hoofdstuk 2 wordt een theoretisch raamwerk geschetst waarin de rol en invloed van reflectie op groepsprocessen tijdens samenwerkend leren wordt uitgewerkt. Eerst worden drie condities beschreven die kunnen worden gezien als voorwaarden voor het samenwerkend leren in een elektronische omgeving. Deze condities zijn het werken in kleine groepen, het aanbieden van groepstaken en het specificeren van de docentrol. Vervolgens worden mogelijke interacties tijdens het proces van samenwerkend leren en de verwachte leerresultaten besproken. Daarbij wordt vooral aandacht besteed aan het reflecteren op het groepsproces met als doel het waarborgen van een productieve communicatie over en weer. Aan verschillende studies op dit gebied wordt gerefereerd. Reflectie, in een CSCL-context, kan beschreven worden als een proces waarin groepsleden gezamenlijk proberen ervaringen,

problemen, inzichten en bestaande kennis te structureren (Johnson & Johnson, 1994). Onderzoek toont aan dat reflectie een positief effect kan hebben op leerresultaten (Yager, Johnson, Johnson, & Snider, 1996) en op het met succes oplossen van problemen (Johnson, Johnson, Stanne, & Garibaldi, 1990). Echter, in de literatuur over CSCL wordt weinig aandacht geschonken aan het belang van reflectie tijdens groepsprocessen en worden nagenoeg geen concrete richtlijnen voor instructieontwerp beschreven. Aan het eind van het hoofdstuk worden vanuit de beschikbare literatuur ontwerprichtlijnen voor het inbedden van reflectie in asynchrone CSCL-omgevingen worden gespecificeerd.

In Hoofdstuk 3 wordt een exploratieve studie beschreven. Het doel van deze studie, waarin studenten in het afstandsonderwijs gebruik maakten van een asynchrone CSCL-omgeving, was drieledig. Ten eerste is onderzocht hoe studenten het samenwerkend leren via de CSCL-omgeving ervaren en hoe tevreden ze hierover waren. Ten tweede is nagegaan of student- en cursuskarakteristieken van invloed zijn op de ervaringen van de student ten aanzien van het samenwerken. Tot slot is verkend welke aspecten met betrekking tot het samenwerken van invloed zijn op de tevredenheid van de studenten ten aanzien van de samenwerking in de betreffende omgeving. Uit de resultaten bleek dat de studenten de samenwerking in de CSCL-omgeving als positief hebben ervaren voor het leerproces en ook zeer tevreden waren over de kwaliteit van de samenwerking. Verder bleek dat studenten groepsprocessen meer reguleerden tijdens het werken aan een groepstaak en bleek een betere groepscohesie te leiden tot een hogere tevredenheid. Er kan worden geconcludeerd dat studenten die deelnamen aan verschillende cursussen binnen afstandsonderwijs het waardeerden om samen met medestudenten te werken in een CSCL-omgeving.

In Hoofdstuk 4 wordt de eerste experimentele studie, uitgevoerd in een laboratoriumsetting, beschreven. In deze studie is het effect van reflectie tijdens het samenwerkend leren onderzocht op de mate van regulatie van het groepsproces, kennis co-constructie tijdens de samenwerking en de ervaringen van de studenten ten aanzien van de samenwerking. Vijfenvijftig eerstejaars PABO-studenten werkten in groepjes van vier of vijf in een CSCL-omgeving aan een taak en dienden een groepsproduct op te leveren. Zeven groepjes vormden de experimentele conditie en de andere zeven de controleconditie. De studenten in de experimentele conditie kregen richtlijnen voor het effectief reflecteren aangereikt en hen werd gevraagd om halverwege de taakuitvoering te reflecteren om het groepsproces. De studenten in de controleconditie kregen deze aanwijzingen niet. Uit de resultaten bleek dat vergeleken met de groepen uit de controleconditie de groepen uit de experimentele conditie zich meer oriënteerden op de taak, actiever het proces en de voortgang bewaakten. Verder bleken deze groepen minder conflicten en een groter groepscohesie te ervaren. Ook bleken ze meer tevreden. Tussen de groepen uit de experimentele en controleconditie werden geen significante verschillen gevonden op de variabele

'kennis co-constructie'. Uit deze studie kan worden geconcludeerd dat reflectie tijdens het samenwerken een positief effect heeft op de mate van groepsregulatie en de tevredenheid van studenten doet toenemen.

In Hoofdstuk 5 wordt het eerste veldexperiment beschreven. Deze studie is in zeker opzicht een replicatie van de studie beschreven in hoofdstuk 4, maar dan uitgevoerd in een ecologisch valide setting. In deze studie werd het effect van reflectie tijdens het samenwerkingsproces onderzocht op de mate van regulatie van groepsprocessen, de mate van kennis co-constructie, de uitgevoerde affectieve leeractiviteiten en de tevredenheid van de studenten. Vierenveertig studenten uit het afstandsonderwijs (Rechtenstudenten) werkten in groepen van vier gedurende vijf maanden in een asynchrone CSCL-omgeving samen aan verschillende taken. Voor de groepen in de experimentele conditie waren de richtlijnen ten aanzien van reflectie opgenomen in de cursuswebsite. De controlegroepen werkten met een andere website, waarin deze richtlijnen niet waren ingebouwd. Naast deze richtlijnen schreven de studenten uit de experimentele conditie een individueel reflectierapport en werd er in de groep gediscussieerd over de groepsprocessen. De resultaten lieten zien dat het reflecteren tijdens het samenwerkend leren een positief effect had op de mate waarin studenten regulatieactiviteiten uitvoerden, zoals het plannen van groepsactiviteiten en het bewaken van de voortgang. Studenten uit de experimentele conditie bleken tevens meer tevreden over de samenwerking.

In Hoofdstuk 6 wordt verslag gedaan van twee veldstudies, uitgevoerd binnen een PABO-opleiding in het gebruikelijke contact-onderwijs. In beide studies is nagegaan hoe studenten die contactonderwijs volgen participeren en samenwerken als ze gebruik maken van een asynchrone CSCL-omgeving. Ook de ervaringen van de studenten werden daarbij meegenomen. Aan de eerste studie deden 106 studenten mee. Ze werkten in groepjes van drie of vier aan een taak. Er zijn twee condities gecreëerd; één waarin de studenten richtlijnen ten aanzien van reflectie kregen en waarbij studenten werd gevraagd te reflecteren tijdens de samenwerking, en één conditie waarbij de studenten deze richtlijnen niet kregen en waarbij geen reflectiemomenten waren ingebouwd. Uit deze studie bleek dat er geen verschillen werden gevonden tussen de groepen uit de beide condities op participatie, interactie en ervaringen. De tweede studie, waarbij 66 PABO-studenten waren betrokken, was een replicatie van de vorige studie. Enkele wijzigingen zijn daarbij doorgevoerd. De tutor en de onderzoeker traden op als moderator binnen de discussiegroepen. De experimentele groepen kregen extra feedback van de moderator. Echter, ook de resultaten van deze studie gaven geen verschillen te zien tussen de experimentele en controleconditie op de variabelen participatie en ervaringen. Wel bleken de studenten waarbij de moderator feedback gaf hun groepsprocessen beter te plannen en te bewaken, dan de studenten die geen extra feedback kregen. Uit beide studies kan geconcludeerd worden dat er maar weinig via de discussiegroepen binnen de CSCL-omgeving door

studenten werd gecommuniceerd. Ze gebruikten de omgeving niet zozeer om samenwerkend te leren, maar meer als mogelijkheid om tussen- en eindproducten aan elkaar door te geven. Studenten hadden de mogelijkheid elkaar 'face-to-face' te ontmoeten en daar gaven ze de voorkeur aan. Het inbedden van CSCL in contactonderwijs kan gezien worden als een uitdaging voor curriculumontwerpers binnen het Hoger Onderwijs.

Het laatste hoofdstuk van dit proefschrift betreft een samenvatting van de verschillende studies, een reflectie op de resultaten, implicaties voor de praktijk en suggestief voor verder onderzoek. Over het algemeen kan worden geconcludeerd dat reflectie tijdens samenwerkend leren maakt dat studenten hun groepsprocessen meer reguleren. Verder kan worden gesteld dat studenten die deelnemen aan afstandsonderwijs over het algemeen positieve staan tegenover samenwerkend leren met gebruikmaking van asynchrone CSCL-omgeving.