Student Collaboration and Learning

Knowledge construction and participation in an asynchronous computer-supported collaborative learning environment in higher education

Hossein Mahdizadeh

Promotor: Prof. dr. M. Mulder
Hoogleraar Educatie en competentiestudies
Wageningen Universiteit, Nederland

Co-promotor: Dr. H. J. A. Biemans,
universitair (hoofd)docent
Leerstoelgroep Educatie- en competentiestudies
Wageningen Universiteit, Nederland

Leden van de promotiecommissie: Prof.dr.ir. A. J. M. Beulens
Wageningen Universiteit, Nederland

Prof. dr. M. Chizari
Tarbiat Modarres Universiteit, Iran

Prof. dr. J. M. Pieters
Radboud Universiteit Nijmegen, Nederland

Prof.dr. W. Veen
Technische Universiteit Delft, Nederland

Dit onderzoek is uitgevoerd binnen de MANSHOLT onderzoekschool.

Student Collaboration and Learning

Knowledge construction and participation in an asynchronous computer-supported collaborative learning environment in higher education

Hossein Mahdizadeh

Proefschrift

ter verkrijging van de graad van doctor
op gezag van de rector magnificus
van Wageningen Universiteit
Prof. dr. M. J. Kropff,
in het openbaar te verdedigen
op vrijdag 14 september 2007
des namiddags om 16.00 uur in de Aula

Student Collaboration and Learning: Knowledge construction and participation in an asynchronous computer-supported collaborative learning environment in higher education

Keywords: Computer-supported collaborative learning, e-learning, collaborative learning, knowledge construction, feedback

PhD-thesis, Social Sciences Group, chair group of Education and Competence Studies,

Wageningen University and Research Centre, The Netherlands

With summaries in English, Dutch and Persian

ISBN: 978-90-8504-723-0

Abstract

This dissertation reports a PhD study which was designed to investigate students' processes of learning (knowledge construction) and learning outcomes (quality of constructed knowledge) while performing different study tasks in university courses in which CSCL has been implemented. In the study the following research questions were addressed:

1. What is the current use of e-learning environments in general and CSCL environments in particular in higher education?
2. What is the opinion of teachers about e-learning environments in general and CSCL environments in particular in higher education?
3. What is the opinion of students about implementing tasks in ACSCL environments in higher education?
4. How do students participate in learning processes and knowledge construction while performing tasks in ACSCL environments?
5. How can peer group feedback, supported by ACSCL, improve learning quality and facilitate learning processes?

The dissertation is composed of four different studies which address several specific research questions to investigate different aspects of implementing ACSCL in higher education. The first two studies concern two main parties involved in the process of learning: teachers and students. The third study aims at exploring the process of knowledge construction and quality of learning outcomes while performing tasks in ACSCL environments, and finally, the fourth study is designed to investigate the effect of PGF supported by ACSCL on the process of learning.

Based on our study the conclusion is justified that, as a blended learning approach, integrating asynchronous CSCL environments can effectively engage students in the process of learning. Implementing tasks in CSCL environments increases students' participation in learning activities and their interaction with each other and with their teachers outside of class time. We also conclude that asynchronous CSCL does not only foster more students' participation, but more equal participation, in the learning process and might be used successfully to encourage and engage the silent side of the class into the processes of discussion and collaboration. The findings of this study revealed that performing tasks in asynchronous CSCL environments has the potential to increase the level of participation and interaction among students and to foster processes of shared and social knowledge construction. Performing these kinds of tasks has the potential to provide a meaningful supplement to conventional teaching and learning approaches and can help teachers to overcome the limitations of face-to-face collaboration and discussion. Our fourth study revealed that ACSCL can enable teachers to successfully embed 'formative assessment' and 'process-oriented feedback' (which aims at learning rather than assessment) into the learning process.

To my beloved parents,

Whose blessings I feel throughout my life

To my lovely family,

Who, through their love and support, make life enjoyable

Acknowledgement

First and above all I would like to thank and praise Almighty God modestly and thoroughly who granted me and my family health and strength to carry out this PhD research. I wish that with his favour all people in the world have the opportunity to receive as good a level of education as I have had.

I would like to express my deepest gratitude to the Ministry of Science, Research and Technology of the Islamic Republic of Iran and the university of Ilam, for funding my PhD project which allowed me to accomplish this thesis.

With deep gratitude, I wish to express my sincere thanks to my promotor Prof. Dr. Martin Mulder. Dear Martin, I thank you for your invaluable comments, suggestions, support and encouragement throughout my PhD research. I learnt a lot from you and admire your way of thinking about educational research. I am honoured to have had the opportunity to do my PhD under your supervision and I am sure that I will never forget the four years of my life that I was involved in the learning and working environment that you managed and provided. Your comprehensive guidelines and support in all steps of my research enabled me to follow and finally get the job done. I am not sure if I am able to put my gratitude into words so please let me just simply say "Thank you" and I wish you more success in your career, and health and joy in your life. I am pleased that I am able to keep in touch with you in the future as one of the ECS alumni.

I wish to extend my sincere gratitude to my co-promotor Dr. Harm Biemans. Dear Harm, when I look at my thesis I can see your precious ideas throughout all chapters of the book and your emotional support in all stages of the study. Harm, I must admit that without your guidance doing the study would have been far more difficult and perhaps even impossible. I enjoyed all your constructive and helpful comments during our meetings and discussions. I deeply thank you and wish to keep in touch with you in the future.

My sincere gratitude goes to Arjen Wals, Cees van Dam, Renate Wesselink, Thomas Lans, Joke Marinissen, Barbara van Mierlo, and Elke van den Elsen who gave me the opportunity to explore the implementation of ACSCL in their courses and also I would like to thank all students who participated in this study for their contributions to

the CSCL environments. I appreciate Noor van der Hoeven, Corine van der Heide, Kate Collins, Morgane Bosman, Merel Verhoeven, and Natalia Eernstman for helping me with transcribing and coding students' discourses; Judith Gulikers and Hendrik Kupper for their helpful and constructive comments on the first draft of the articles; and my special thanks to Kate Collins for her marvellous and kind help in editing the thesis.

Dear Marja, I will always remember your kind and excellent support during the last four years. I should admit that your support made life and my PhD easier for me and I would never forget all the favours you granted me. I wish you health and joy in your life and hope to see you in the future in Iran. I think you are doing a great job for ECS and I should congratulate Martin for his competence in selecting a good financial manager like you.

Dear Mostafa, I would like to sincerely appreciate you for all your great care, emotional support and helps during last four years, especially at the beginning of my PhD when you helped me to find my way in the Wageningen, and at the end of my study, when you helped me with the layout and format of my thesis. I wish you and your family, and especially Alireza, health and success. I also thank my dear friend Majid for his great creativity in designing the cover page of the dissertation.

I also would like to thank all my friends and colleagues in the chair group of Education and Competence Studies (ECS) , either the ones who have left the group already or those who are still working with us: Anouk, Kate, Dine, Elise, Cees, Elke, Patricia, Minny, Hendrik, Thomas, Joke, Mireille, Jack, Elsbeth, Arjen, Renate, Marjan, Chiel, Marco, Natalia, Judith, Corine, Anna, Anne, Inge, Sanne, Jos, Marlies, Doris, Stephan, Hans, Carla, and Jos. My dear colleagues and friends I enjoyed working with you and I am honoured to have had the chance to work with you. I benefitted from your thoughts and ideas during our formal and informal discussions. You showed me how rich the culture of the Netherlands is. I take this opportunity to express my sincere thanks to all of you.

I am deeply indebted to my brother, Hassan, who supported me and my family throughout the last four years, allowing me to pursue my studies. Dear Hassan, what you did for me is beyond what I could imagine. Thanks a million! I would also like to express my appreciation to my brothers and sisters, brothers and sisters-in-law - especially our dear Pari- for their support throughout my PhD study.

I would like also to express my special gratitude to my Iranian PhD fellows in Wageningen for their invaluable support and friendship. My special thanks to my dear friends, Ali, Majid, and Kazem. It is hard to imagine how I and my family could bear the long Dutch winters without the company of you and your families.

Finally, last and most of all, I offer a special word of thanks to my wife, Farokhlegha, and my daughter and friend Narges and my little baby, Niyayesh. Dear Faroklegha, you left your job, relatives and friends to support me and stay with and beside me. How can I thank you when I think I am not able to express my feeling to you in words. My dearest thank you for all your love and support. My dear Narges, You cannot imagine how much I love you and how much your smiles give me strength and joy in my life. Although the first 3-6 month in the Netherlands were very difficult for you, you adapted very quickly. I hope that all of us learnt punctuality, hard-work, flexibility and tolerance from the Dutch. Niyayesh, you are one of my loveliest memories of the Netherlands. I do not know when you will be able to read these lines but I want to say that playing swing and "Tab Tab Abasi" with you helped me to cope with all the stress that I had and was one of the most enjoyable times of the last year of our stay in the Netherlands.

Hossein Mahdizadeh
Wageningen
14-08-2007

Table of contents

List of tables

List of figures

List of abbreviations

Abbreviation	Description
ICT	Information and Communication Technology
CAL	Computer assisted Learning
E-learning	Electronic learning
CSCL	Computer-Supported Collaborative Learning
CSCLE	computer-supported collaborative learning environment
ACSCL	Asynchronous Computer-Supported Collaborative Learning
PF	Peer Feedback
PGF	Peer group Feedback
CSCW	Computer Supported Collaborative Work
ELV	Electronic learning environments
VLE	virtual learning environments
CMS	course management systems
KB	Knowledge Building
KC	Knowledge Construction
ITS	Intelligent Tutoring Systems
CAI	Computer Assisted/Aided Instruction
SOLO	Structure of Observed Learning Outcome
KC-LA	Knowledge Construction Learning Approach
F2F-LA	Face to Face Learning Attitude
WA-LA	Web-assisted Learning Attitude
LSC	Lack of Self-Confidence
TT-LA	Traditional Teaching and Learning Attitude
PE	Perceived Effects
ELA	E-learning Attitude
EU	Ease of use
SAT	Satisfaction
KC-TLA	Knowledge Construction Teaching and Learning Approach
TO-CAL	Teachers' Opinion about Computer-Assisted Learning
TO-WA	Teachers' Opinion about Web-based Activities
TU-EE	Teachers' Use of E-learning Environments
TP-AVEE	Teachers' Perceived Added Value of E-learning Environments
TAM	Technology Acceptance Model
HCI	Human Computer Interaction
CMC	Computer Mediated Conferencing
CMD	Computer Mediated Discussion
CC	Computer Conferencing
BB	Bulletin Board
ALN	Asynchronous Learning Networks
CMC	Computer Mediated Communications

Chapter 1

General Introduction

1.1 Introduction

Since we moved into the third millennium, there has been a gradual shift from, the so-called, information society to a network society. One of the main characteristics of this new society is working in distributed companies and teams. Therefore, competencies like, working in distributed teams and coping with rapid changes in technology are crucial. The educational system has the responsibility of training and developing the appropriate competencies to prepare learners for living and working in such a networked society. The big challenge for educational systems in a networked society is preparing students for living, working and enjoying themselves in it. Students need to collaborate to achieve and develop all those necessary competencies and they need to learn how to collaborate in face to face teams as well as distributed online teams. In other words, all students, employees, and companies need to ***collaborate to learn and learn to collaborate;*** a skill and competency that should be embedded in the hidden part of any curriculum. New advanced information and communication technology (ICT) influences all aspects of human life. Under these circumstances in education, and educational research, terms like "Computer assisted Learning (CAL)", "Web-based education", "Networked learning", and "E-learning" have emerged to characterize how this new high technology can improve the processes of learning. One of the main applications of e-learning which captivates and fascinates so many researchers in the field of education is "Computer Supported Collaborative Learning (CSCL)" which Stahl (2003) described as learning environments that are tools designed to support the building of shared knowledge and knowledge negotiation. This dissertation reports a PhD study which concentrated on performing tasks in asynchronous computer supported collaborative learning environments as a blended learning approach for on-campus students.

ICT, facilitated and developed distance learning and this sector of education is growing fast. This new high technology improves the quality of learning in distance education and helps teachers in this sector of education to cope with one of the main challenges of tele-learning, poor or non-existent interaction and interactivity; as we discuss later, CSCL applications are promising in this respect. However, we should consider that the face to face approach to education remains prominent in schools,

universities, and other educational institutes. One of the main challenges these institutions face is how to ensure the quality and quantity of education, and the means to develop all the necessary competencies to prepare students to live and work in a networked society. The blended learning approach, which aims at integrating e-learning techniques and traditional teaching methods, is seen as a way to improve the quality of education and reduce the costs of education for all students. The blended learning approach in higher education is a combination of regular, conventional, face-to-face and in-person learning activities with web-based learning activities. It aims at integrating different learning approaches and modes of course material delivery into education.

This dissertation reports the results of a PhD study designed to explore the implementation of ACSCL, one e-learning application, in higher education from a blended learning perspective.

1.2 Research question

The current PhD project was designed to investigate students' processes of learning (knowledge construction) and learning outcomes (quality of constructed knowledge) while performing different study tasks in university courses in which CSCL has been implemented. More specifically, the main objective of the study was to investigate the implementation of ACSCL environments in conventional face-to-face and on-campus higher education following a blended learning approach. The following research questions were addressed:

1. What is the current use of e-learning environments in general and CSCL environments in particular in higher education?
2. What is the opinion of teachers about e-learning environments in general and CSCL environments in particular in higher education?
3. What is the opinion of students about implementing tasks in ACSCL environments in higher education?
4. How do students participate in learning processes and knowledge construction while performing tasks in ACSCL environments?
5. How can peer group feedback supported by ACSCL improve learning quality and facilitate learning processes?

In this PhD research study a total of four studies were conducted addressing several key questions to explore different aspects of implementing ACSCL, as one of the many extant e-learning applications in higher education from a blended learning perspective. The first two studies concerned teachers and students involved in the process of learning. The third study aimed at exploring the process of knowledge construction and quality of learning activities while performing tasks in ACSCL environments, and finally the fourth study was an attempt to investigate the effect of PGF (Peer Group Feedback), supported by ACSCL, on the process of learning. Figure 1.1 represents an overview of the research,; four studies and their specific objectives.

When universities promote ICT use, they need to understand their teachers' and students' attitudes towards its use. Teachers' attitudes are considered a major predictor of the use of new technologies in instructional settings. The first study of this research was designed to explore the current use of e-learning at Wageningen University; a university with a well-equipped ICT infrastructure. In addition, the first study was used to reveal teachers' opinions about the added value of the different functions of an e-learning environment in general, particularly CSCL. Factors that can explain teachers' use of e-learning environments in higher education were also investigated in the first study. Therefore, in the study the following research questions were formulated:

1. Which functions of e-learning environments do teachers use most often?
2. What added value do teachers perceive of e-learning environments?
3. Which factors influence teachers' use of different functions and capabilities of e-learning environments?
4. What are the barriers for implementing e-learning environments in the learning process?

The results of this study are discussed and explained in chapter 3.

Students are one of the main actors in learning processes. Previous studies have shown learners' perceptions of their learning environments tend to guide their attitudes, behaviour and modes of knowledge construction in that environment. Positive relationships between student attitudes towards learning situations and their reactions to them are also reported (Dart et al., 1999; Fraser, 1998; Paris, 2004). Therefore, the

second study was conducted to better understand how learning in an asynchronous computer-supported collaborative learning environment is perceived by groups of on-campus students in higher education. The specific questions addressed in this study were:

1. Are on-campus students satisfied with performing learning tasks in this asynchronous computer-supported collaborative learning environment (ACSCLE)?
2. Do on-campus students perceive any added value of performing learning tasks in an asynchronous computer-supported collaborative learning environment (ACSCLE)?
3. What factors influence student satisfaction with, and perceived learning in, this asynchronous computer-supported collaborative learning environment (ACSCLE)?

Chapter 4 of the study addresses the findings of this study.

As stated above, the third study is designed to investigate the process of learning (knowledge construction) and learning outcomes (quality of knowledge constructed) in university courses in which CSCL is implemented. Also the process of learning and quality of knowledge construction during the performance of different study tasks will be studied. The specific questions addressed in this study were:

1. To what extent do on campus students participate in the process of knowledge construction?
2. How can on campus students' learning processes and knowledge construction be characterised in terms of cognitive, affective and meta-cognitive learning activities?
3. Do on campus students construct knowledge and what is the quality of that constructed knowledge?
4. Is there any change in the students' on campus activities over the duration of the course? What are the patterns of those changes?
5. Is there any change in students' learning activities in different courses and settings?

The results of this study are presented in chapter 5.

Finding an effective way to embed the CSCL application into the whole instructional design of a course is seen as the most challenging task of teachers and facilitators. Educational researchers in the field have tried to figure out how they can help teachers to overcome these challenges. One such suggestion is scripting, describing how students must collaborate ; defined as a guide to the roles and steps people follow for what to do and how to do it in a specific social situation (Dillenbourg & Jermann, 2003; King, 2003). The forth step of the study investigates how peer group feedback, supported by ACSCL, could improve learning quality and facilitate learning processes. For this purpose the following research questions were formulated:

1. How can ACSCL environments improve PF (Peer feedback)?
2. What are students' perceptions of the value of receiving ACSCL-PF? How do these perceptions compare to the perceived value of receiving F-PF (Face-to-face peer feedback)?
3. What are students' perceptions of the value of giving ACSCL-PF? How do these perceptions compare to the perceived value of giving F-PF?
4. What are differences between F-PF and ACSCL-PF in terms of quality of students' feedback and comments?

Chapter 6 of the dissertation reports the result of this study.

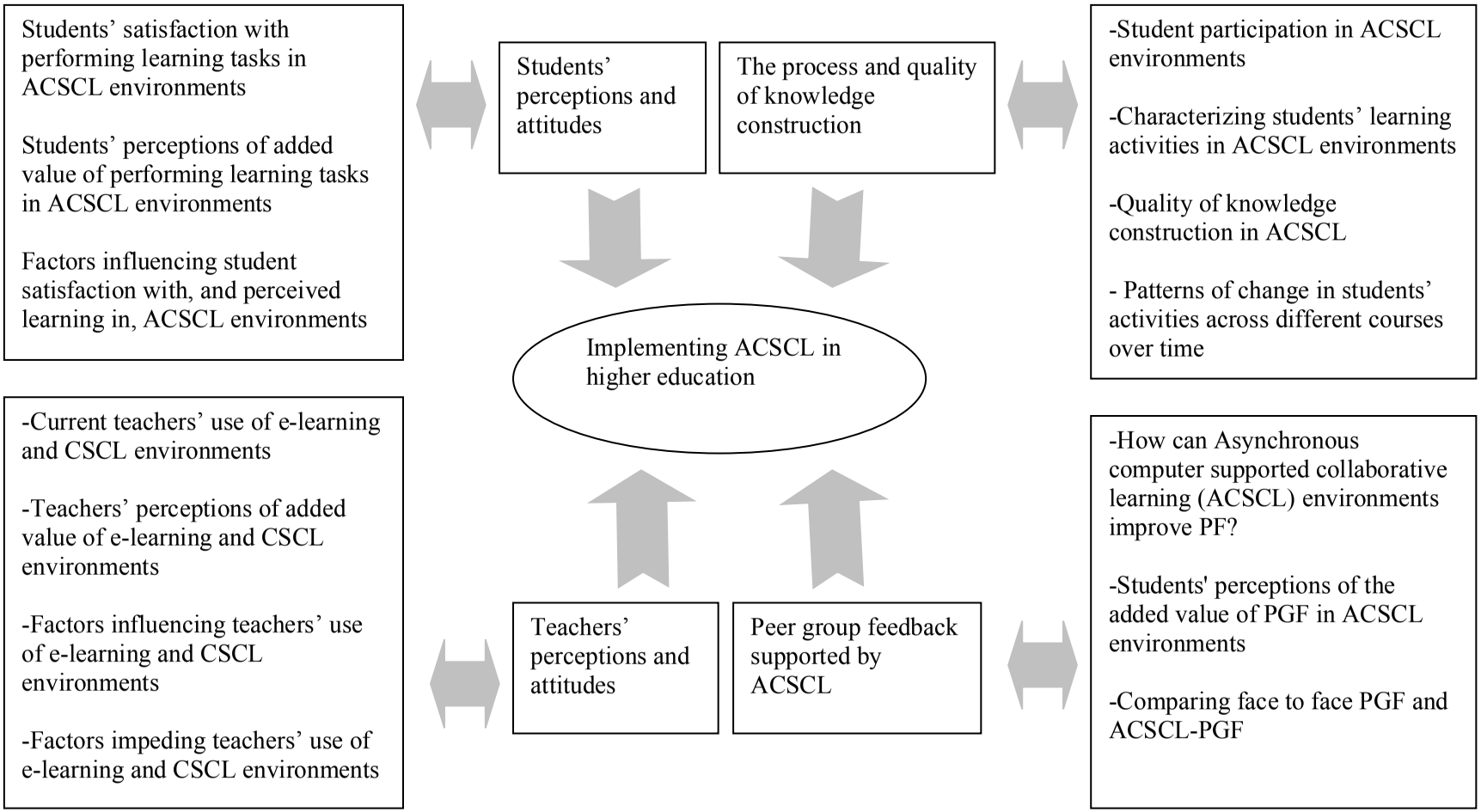


Figure 1.1 Integration of the main research goal with the four different studies of this thesis with their specific research objectives

1.3 The context of study

The study was conducted at Wageningen University. Based on previous research conducted within the chair group of Education and Competence Studies (ECS) by Veldhuis-Diermanse (2002), CSCL is particularly useful in the typical knowledge domains of Wageningen University: multidisciplinary, complex, incorporating conflicting theories, heterogeneous in terms of research approach, and ill-defined concepts with strong values and interesting connotations. Therefore, the study will concentrate on open knowledge domains that allow debate and differences of opinion. Wageningen University and Research Centre (Wageningen UR) is a leading international knowledge institute in the fields of nutrition and health, sustainable agricultural systems, environmental quality, and processes of social change.

Wageningen UR, with over 6000 staff and more than 9000 students, provides education in 18 BSc programmes and 30 MSc programmes. Wageningen University's students come from 98 different countries, providing a very diverse and rich environment for discussion and collaboration. The university carries out research and generates knowledge in the field of life sciences and natural resources; specialising in food and food production, plants and animals, environment and climate, economics and society. In May 2005, based on essential science indicators, the university was in the list of top universities and research centres in the world in terms of publications and citations in the domain of agronomic sciences, plant and animal sciences, and environmental sciences. Developing the use of new technology and ICT in the university was one of its main priorities in the last decade. The seven case studies of this research were conducted in 5 different courses (two courses were involved twice) offered by the chair group of ECS. Course descriptions, aims, content and student activities of the asynchronous CSCL environment of their course are explained in table 1.1.

Table 1.1 Course aims, content, descriptions, and tasks and activities of students in the asynchronous CSCL environment of the courses

	Course title	Course content
1	Education in Developing and Changing Societies	The course aims at supplying the participants, at an introductory level, with knowledge of, and insight into, the functioning of education within processes of development, especially with regard to the complex relations between education and its socio-cultural, political, economic and technological context in order to determine the possibilities and limits within which education can exercise its influence on development. The international setting of this course promotes discussion about the cultural background of knowledge and information exchange.
2	Applied Environmental Education and Communication (AEE&C)*	During the course students explore the instrumental and the emancipatory use of environmental education, communication, participation and whole system re-design in moving towards sustainable lifestyles, organizations and systems. Special attention is paid to the methodological aspects of environmental education and communication. Students are exposed to, and involved in, the design, implementation and evaluation of a public environmental awareness campaign, a community-based social environmental learning project, and a series of education for sustainable living learning activities for both formal and non-formal education settings.
3	Human Resource Development/ Learning and Career Development (HRD)	This course focuses on the theory and practice of human resource development in profit and non-profit organizations. Special attention is given to concepts of lifelong learning, organizational learning, learning in teams, and individual learning. Organizational development is seen as a combination of individual and collaborative learning. Human resource development is viewed from the micro (individual), intermediate (institutional) and macro (societal) level.
4	Human Resource Management (HRM)*	This course focuses on the theory and practice of human resource management (HRM) in profit and non-profit organizations. Special issues addressed during the course are managing diversity, performance analysis and management, employee relations, and managing an intercultural workforce.
5	Didactic Skills (DS)	The student receives knowledge about various didactical and communication skills, most specifically in relation to teaching. They are familiarised with several forms of knowledge transfer (presenting, interacting and delegating) by means of at least four practical exercises.

The courses, Applied Environmental Education and Communication (AEE&C) and Human Resource Management (HRM), were involved twice in the study.

1.4 Summary of the research process

The study was carried out in 4 different phases as shown in figure 1.2. Firstly, all courses taught within the different programs and educational units of the university were examined for possible inclusion in the study. The course description including content, aims, activities, means of assessment and evaluation, and other available course information were reviewed through the study handbook of the university and the various departmental and group websites. In this step we wanted to know the context of the

study and explore the real and current use of ICT at Wageningen University. We also looked into activities that students were supposed to do to discern how CSCL could help the teachers/facilitators and students in the process of teaching and learning. Along with this exploratory study a literature review was conducted to understand the current situation in the field of CSCL and set a theoretical framework for the study. Then, in the second phase, we concentrated on the teacher's point of view in e-learning and CSCL, their use of the different functions of e-learning environments and their perceptions of the added value of these functions. Moreover, we asked teachers about the main activities and tasks that are asked of students in their courses. After that we implemented and integrated ACSCL in a course as a pilot study, and then into all other courses, on a teacher voluntary basis, over two study years. In addition to students' learning activities and contributions to CSCL environments, which were recorded in log files and forums, a series of interviews and focus groups with students were conducted where participants were requested to complete a questionnaire. Based on a preliminary analysis of the collected data a "script" for integrating ACSCL in face-to-face and conventional higher education was formulated and tested in several courses. Finally the results are reported in different articles that comprise the various chapters of the dissertation.

1.5 Overview and structure of the dissertation

In the first chapter of the dissertation, after explaining the main research question and introducing the main objectives of the PhD study, four different studies of the research with their specific research questions were explained. Then the context of the study and seven different courses that were involved in the studies were described. Finally, at the end, all processes of the research and different phases and steps were summarized. This chapter closes with an introduction to the structure, and an overview, of the dissertation.

Chapter 2 illustrates that CSCL suffers from the lack of a sound theoretical framework. The chapter starts with explaining different views and approaches about learning process. By referencing constructivism, cognitive constructivism, radical constructivism, and social constructivism we have tried to ground the study in a theoretical framework. Furthermore the chapter addresses collaborative learning,

knowledge building, and the different aspects of CSCL. The chapter moves forward by defining CSCL and reviewing its historical development. Then how CSCL can help learning and the results of the empirical CSCL research and techniques used to analyze the data in CSCL are discussed. The chapter ends with a summary of the chapter and the main findings in the field.

Chapter 3 reports the results of the first study. As explained earlier, the first study of this research was designed to explore the current use of e-learning at Wageningen University and to reveal teachers' opinions about the added value of different functions of e-learning environments, in general, and CSCL, in particular. Factors that can explain teachers' use of e-learning environments in higher education were also investigated. At the end of the chapter a model explaining teachers' use of e-learning environments is introduced.

The second study, reported in chapter 4, aimed at understanding students' opinions about implementing learning tasks in ACSCL environments. In this chapter both student satisfaction with, and perceived learning as a result of task performance in, ACSCL environments was assessed. Moreover, the results of an attempt to identify factors which might explain students' satisfaction with and perceived learning in ACSCL environments and the correlation between those factors, are reported.

Chapter 5 reports the findings of the third study, which was designed to investigate the process of learning (knowledge construction) and learning outcomes (quality of knowledge constructed) in university courses in which CSCL is implemented. The chapter first reports students' participation in asynchronous CSCL and then concentrates on their learning activities and knowledge construction process while performing tasks in asynchronous CSCL. Furthermore the quality of students' learning outcomes while performing tasks in asynchronous CSCL and the patterns of change in their activities over time and across different courses are discussed. Finally, conditions which might foster the knowledge construction process are explained.

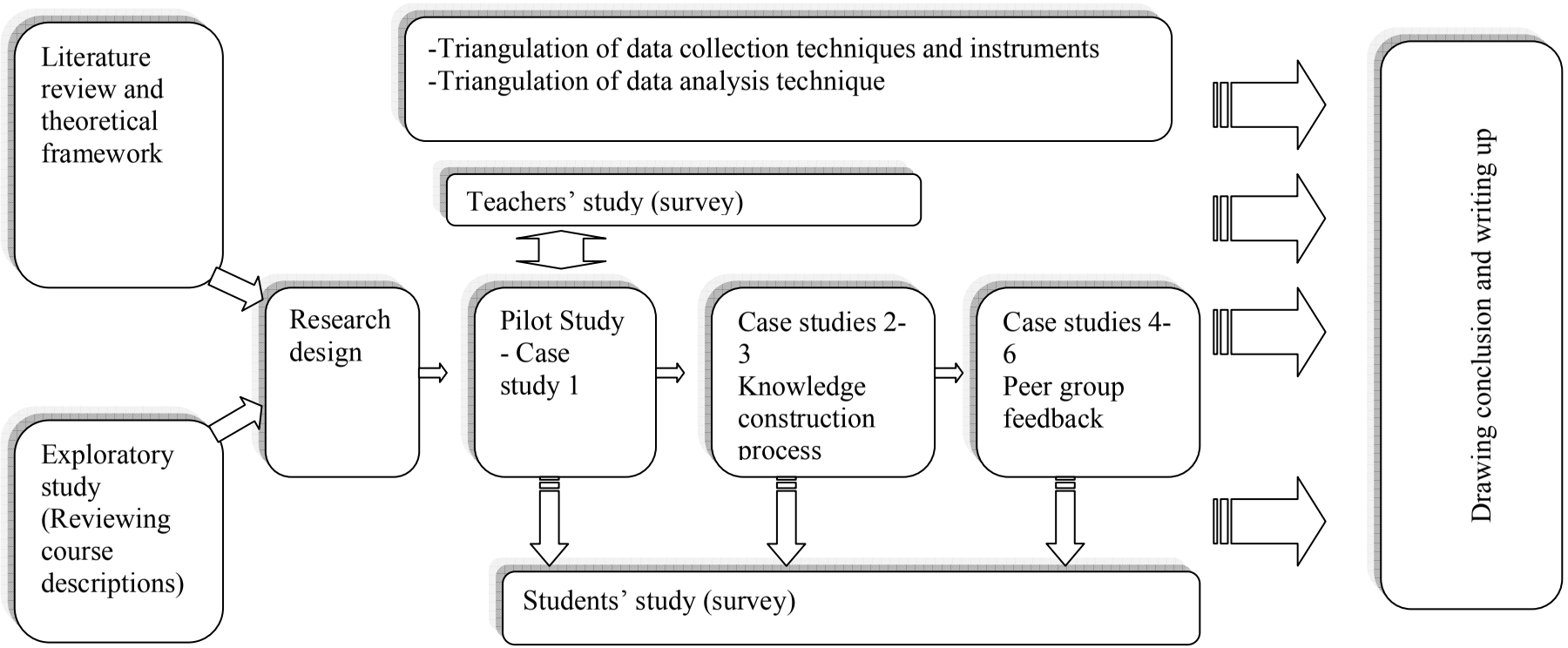


Figure 1.2 Different phases of the study

The results of forth study are presented in chapter 6 of the dissertation, aiming to discover how peer group feedback supported by ACSCL environments could improve learning quality and facilitate learning processes. In addition, this chapter reports the students' reactions to the process of peer group feedback in both face-to-face and ACSCL conditions. We firstly discuss students' opinions about different aspects of giving and receiving feedback and their participation in the process. Then the functions attributed to students' contributions in both face-to-face peer group feedback (F2F-PGF) and asynchronous computer-supported peer group feedback (ACS-PGF) situations are explained. The quality of students' contributions/activities in the feedback processes of F2F and ACS contexts and teachers' opinions about peer group feedback in both conditions are reported further.

In the final chapter of the dissertation, we discuss the main findings of our literature review and summarize the four abovementioned studies. Several conclusions are subsequently posited considering the main research questions of this PhD research, the findings of the four conducted studies, and the literature review. The chapter closes with some practical implications of this research and recommendations for future research.

Chapter 2

Theoretical framework

2.1 Introduction

Computer-Supported Collaborative Learning (CSCL) has grown out of wider research in two fields a) Collaborative learning and b) a specific part of Information Communication Technology (ICT) called Computer Supported Collaborative Work (CSCW). CSCL is focused on how collaborative learning supported by technology can enhance peer interaction and group work and how collaboration and technology facilitate the sharing and distribution of knowledge and expertise among community members.

2.2 Different views and approaches to learning

A glance at the history of knowledge and theories about learning and the learning-teaching process shows the occurrence of a remarkable change during the last century. Mayer (1992) has made a division into three views of learning which emerged during the past 100 years of research on learning: learning as response strengthening, learning as knowledge acquisition, and learning as knowledge construction. He explained that, according to the first view, learning occurs when a learner strengthens or weakens an association between a stimulus and a response. He continued that in this view "the role of the learner is to passively receive rewards and punishments whereas the role of instructor is to administer rewards and punishments,… and the instructional designer's role is to create environments where the learner repeatedly is cued to give a simple response, which is immediately followed by feedback". He continued that "the second view, learning as knowledge acquisition, is based on the idea that learning occurs when a learner places new information in long-term memory. The role of the learner is to passively acquire information, and the teacher's job is to present information". Based on this view, "information is a commodity that can be transmitted directly from teacher to learner" and the instructional designer's role is to create environments in which the learner is exposed to large amounts of information. He mentioned that the third view, learning as knowledge construction, is based on the idea that learning occurs when a learner actively constructs a knowledge representation in working memory. In this point of view, "the learner is a sense maker, whereas the teacher is a cognitive guide who provides guidance and modelling on an authentic

academic task. The instructional designer's role is to create an environment in which the learner interacts meaningfully with academic material". (Mayer, 1999, pp. 144-145).

Kirschner and his colleagues (2004) have distinguished (at least) three major paradigm shifts within the field of psychology. They are behaviourism, which involves changes in human behaviour, cognitivism, which looks inside the 'Black Box' of the mind, and constructivism that differentiates and supports the individual person's knowledge construction of the world in relation to others. Sfard (1998) has introduced two main metaphors of learning: the acquisition metaphor and the participation metaphor. The main question in the more traditional acquisition paradigm concerns the learning outcomes; in this metaphor learning is interpreted in terms of the acquisition of something in an individual mind and knowledge is defined in terms of property and possession. The participation metaphor deals with learning as a participant and knowledge as an aspect of practice, discourse and activity (Lehtinen literature review, 2003). Lipponen, Hakkarainen and Paavola (2004) have proposed that a third metaphor, knowledge creation, should be added to the metaphors presented by Sfard. They believed that this metaphor is represented by the theory of knowledge building proposed by Scardamalia and Bereiter and Engestrom's model of expansive learning. The theory of knowledge creations in organizations by Nonaka and Takeuchi is also mentioned by Lehtinen (2003) as a prototype for this metaphor.

2.3 Constructivism

Constructivism sees learning as a dynamic process in which learners construct new ideas or concepts on their current/past knowledge and in response to the instructional situation. Constructivism implies the notion that learners do not passively absorb information but construct it themselves (Faccini & Jain, 1999). It is a theory of learning that has roots in both philosophy and psychology (Doolittle, 1999). The central idea in constructivism is that learners actively build new knowledge and meaning from their experiences and their previous knowledge and learning. Kanselaar stated (2002) "this view of learning sharply contrasts with one in which learning is the passive transmission of information from one individual to another, a view in which reception, not construction, is key." He also mentioned that constructivist learning is based on students' active participation in problem solving and critical thinking regarding a

learning activity that they find relevant and engaging. They are "constructing" their own knowledge by testing ideas and approaches based on their prior knowledge and experience, applying these to a new situation, and integrating the new knowledge gained with pre-existing intellectual constructs. Active learning is one of the key concepts in the constructivist approach to learning. Van Hout-Wolters, Simons and Volet (Veldhuis-Diermanse, 2002) gave two definitions of active learning. In the first definition, active learning is seen as a form of learning in which the learner uses opportunities to decide about aspects of the learning process. The second definition of active learning refers to the extent to which the learner is challenged to use his or her mental abilities while learning. Biemans (1997) argued that learning is an active process in which learners construct new ideas or concepts based upon their current and past knowledge. Constructivism describes the process of learning as a process in which learners link new knowledge to their prior knowledge, i.e. learning as a cumulative process. Veldhuis-Diermanse (Op. Cit.) believed that the idea of Biemans goes well with the second definition of active learning which refers to performing certain learning activities while processing information from a learning task to learn in a meaningful way.

As Veldhuis-Diermanse (Op. Cit.) summarized in the constructivist approach, learning and education are not teacher-centred but student-centred. Students can influence their education and are not only consumers, as in traditional education. Moreover, according to this view students work in collaboration to solve tasks and build new knowledge based on their prior knowledge. Importance, in this view, is attached to the students' own ideas and the mere reproduction facts becomes less important. Kanselar and his colleagues (as cited in, Simons, van der Linden & Duffy, 2000) stated that constructivism is not a single concept but can involve) a set of epistemological beliefs (that is, beliefs about the nature of reality, whether there is an independent reality); b) a set of psychological beliefs about learning and cognition (e.g. that learning involves constructing one's own knowledge); c) a set of educational beliefs about pedagogy, the best way to support learning (e.g., that one should allow the learner to define their own learning objectives; that knowledge emerges from constructive interaction between the teacher and the student or between collaborating students).

Doolittle (1999) distinguished four essential epistemological tenets of constructivism: first they believe that " Knowledge is not passively accumulated, but

rather, is the result of active cognising by the individual; second is that " Cognition is an adaptive process that functions to make an individual's behaviour more viable given a particular environment; third they stated that " Cognition organizes and makes sense of one's experience and is not a process to render an accurate representation of reality"; and last but not least is that " knowing has roots in both biological/neurological construction, and social, cultural, and language based interactions". Doolittle (Ibid) subsequently divided constructivism into three categories; cognitive constructivism, radical constructivism, and social constructivism.

2.4 Cognitive constructivism

As Doolittle (Ibid) stated, cognitive constructivism is typically associated with information processing and its reliance on the component processes of cognition. It emphasizes that knowledge acquisition is an adaptive process and results from active cognising by the individual learner. He argued that "these particular epistemological emphases lead to defining principles that maintain the external nature of knowledge and the belief that an independent reality exists and is knowable to the individual. Knowledge then, from the cognitive constructivist position, is the result of the accurate internalization and (re) construction of external reality". He believed that this claim, that reality is knowable to the individual, differentiates cognitive constructivism from both social and radical constructivism (Ibid). Cognitive constructivism is based on Piaget's theory of cognitive development.

2.5 Radical constructivism

Doolittle (Ibid) stated that in radical constructivism it is believed that knowledge acquisition is an adaptive process that results from active cognising by the individual learner, rendering an experientially based mind, not a mind that reflects some external reality. He also mentioned that there is a current movement within radical constructivism to recognize social interactions as a source of knowledge. These particular epistemological emphases leads to defining principles that maintain the internal nature of knowledge and the idea that while an external reality may exist, it is unknowable to the individual (Ibid).

2.6 Social constructivism

In social constructivism the social context of learning is very important and it is believed that knowledge is the result of social interaction. Vygotskey, who stated that language usage and social interaction are very important in learning and knowledge construction, is well-known in social constructivism. By the 'zone of proximal development' Vygotskey believes that "students can, with the help from other students or the teacher who are more advanced, can master concepts and ideas that they cannot understand on their own" (Veldhuise-Diermans, 2002). Doolittle (Op. Cit.) believed that "social constructivism lies somewhere between the transmission of knowable reality of the cognitive constructivists, and the construction of a personal and coherent reality of the radical constructivists". As Dolittle (Ibid) stated "this social interaction always occurs within a socio-cultural context, it is believed that truth is not to be found inside the head of an individual person, it is born between people collectively searching for truth, in the process of their dialogic interaction. Truth, in this case, is neither the objective reality of the cognitive constructivists nor the experiential reality of the radical constructivist, but rather is a socially constructed and agreed upon truth resulting from "co-participation in cultural practices".

New technology and new learning theories under the constructivism paradigm of learning influence ideas about education, learning, instruction and knowledge. Most research and theories on CSCL, as well as this research, are based on the constructivist view of learning.

2.7 Constructivism and education

Kanselaar (Op. Cit.) believed that although the roots of constructivism go back to the theories of Piaget, Vygotsky and Dewey, its influence on instruction dates from the early eighties. Constructivism was initially a reaction against the objectivist epistemology of behaviourism and information processing theories of learning. Doolittle (Op. Cit.) distinguished eight factors that characterize a constructivist learning environment.

1. Learning should take place in authentic and real-world environments.
2. Learning should involve social negotiation and mediation.
3. Content and skills should be made relevant to the learner.

4. Content and skills should be understood within the framework of the learner's prior knowledge.
5. Students should be assessed formatively, serving to inform future learning experiences.
6. Students should be encouraged to become self-regulatory, self-mediated, and self-aware.
7. Teachers serve primarily as guides and facilitators of learning, not instructors.
8. Teachers should provide for and encourage multiple perspectives and representations of content.

Jonassen (cited in Kanselaar, 2002) identified eight characteristics that differentiate constructivist learning environments:

1. They provide multiple representations of reality.
2. Multiple representations avoid oversimplification and represent the complexity of the real world.
3. They emphasize knowledge construction instead of knowledge reproduction.
4. They emphasize authentic tasks in a meaningful context rather than abstract instruction out of context.
5. They provide learning environments such as real-world settings or case-based learning instead of predetermined sequences of instruction.
6. They encourage thoughtful reflection on experience.
7. They enable context- and content-dependent knowledge construction.
8. They support collaborative construction of knowledge through social negotiation, not competition among learners for recognition.

Electronic learning environments (ELV) or virtual learning environments (VLE) or course management systems (CMS), with their powerful functionalities can potentially simulate real-world events and authentic tasks which are more close to real situations. They also, by use of both asynchronous (e.g., email, threaded discussions) and synchronous (e.g., chat, video teleconferencing) computer mediated communications (CMC), facilitate the processes of negotiation and interaction. These processes, as mentioned above, are important in the constructivist approach to learning. These learning environments by using text, voice, graph, image, hypertext, and video in

different interactive combinations and forms, providing access to enormous sources of knowledge on the World Wide Web (WWW), enable teachers to provide students with diverse modes and ways of representing knowledge. Therefore teachers and educational institutes (schools, universities) are able to meet the needs of students with different backgrounds, interests, learning objectives, and levels of prior knowledge. Dolittle (Op. Cit.) believed that these environments have easy access to international and culturally diverse resources, including diverse populations and can provide a good environment in this aspect. Using the previous functions of e-learning environments, teachers - or facilitators in constructivism - are able to tailor different modules and courses for learners and make them more relevant and more understandable within the framework of students' prior knowledge. Facilitators are also potentially able to communicate more and give feedback to students during the different steps of the learning process and follow a formative assessment process.

Considering all the above mentioned features, it can be concluded that e-learning environments are a potentially promising technology to enrich the constructivist learning environments. Furthermore computer-supported collaborative learning (CSCL) applications are powerful e-learning environments that facilitate interaction, negotiation, and collaboration amongst and between students and their teachers and external information sources in order to construct new knowledge. Though CSCL suffers from a theoretical framework, in the literature of CSCL, constructivism and both Piaget's and Vygotskey's theories are mentioned as theoretical foundations of learning. Scardamalia and Bereiter (1994) claimed that the central tenet of CSCL is shared knowledge building by learners and the principles of shared knowledge building and CSCL are consistent with a constructivist view of learning.

2.8 Collaborative learning

In educational research in general and in the constructivist approach in particular it is widely believed that through discussion and collaboration students, instead of passively receiving knowledge from teachers, can develop their cognitive skills (e.g., problem solving and knowledge construction), and meta-cognitive skills (e.g., critical thinking) (Guan, Tsai & Hwang, 2006).

Collaborative learning (CL) as the second half of the acronym, CSCL, is one of the pedagogical methods that can stimulate students to discuss information and problems

from different perspectives, and to elaborate and refine them in order to reconstruct and co-construct (new) knowledge (Veerman, 2000). Roberts (2004) defined collaborative as "an adjective that implies working in a group of two or more to achieve a common goal, while respecting each individual's contribution to the whole. Collaborative learning is a learning method that uses social interaction as a means of knowledge building." Veldhuis-Diermanse (2002) defined collaborative learning as a learning situation in which participating learners exchange ideas, experiences and information to negotiate about knowledge in order to construct personal knowledge that serves as a basis for common understanding and a collective solution to a problem. Dillenbourg (1999, p. 5) stated that "collaborative learning describes a situation in which particular forms of interaction among people are expected to occur, that would trigger learning mechanisms, but there is no guarantee that the expected interactions will actually occur. Hence, a general concern is to develop ways to increase the probability that some types of interaction occur''

Boxtel (2000) stated that collaborative learning in both educational practice and educational research attracts teachers and researchers. She mentioned that "In educational practice, the interest in collaborative learning coincides with the shift to more student-centred learning environments in which the students can take more responsibility for their learning"(page). In educational research, how, and under which conditions student interaction facilitates learning, was considered as an important topic for research. Dillonbourg believed that four characteristics are evident in any real collaborative learning situation: first, the situation can be classed as more or less collaborative by means of symmetry. For this purpose he mentioned that symmetry of action (the extent to which the same range of actions are allowed for each agent), symmetry of knowledge, skills or development (the extent to which agents possess the same level of knowledge, skills or development) and symmetry of status (the extent to which agents have a similar status with respect to their community) are necessary; second, he believes that a collaborative situation is interactive and learners negotiate and work together; third, learning mechanisms in a collaborative learning situation are more intrinsically collaborative (e.g., that grounding has a stronger collaborative flavour than induction); and finally he stated that "the fourth element concerns the effects of collaborative learning, not because this element is used to define collaboration itself, but

because the divergent views concerning how to measure the effects of collaborative learning participate in the terminological wilderness of this field". Paniz (1996) believed that collaborative learning is based upon the following principles: working together, resulting in a greater understanding than working individually; spoken and written interactions; opportunity to become aware of relationships between social interactions and increased understanding, some elements of this increased understanding are unpredictable: participation is voluntary and free. He continued that cooperative learning is very similar except that it introduces a more structured setting with the teacher in total control of the learning environment.

Linden, Erkens, Schmidt & Renshaw (2000) believe that changes in ideology and views on learning and the nature of knowledge helped collaborative learning to become a popular teaching method. They believed that the importance attached to collaborative learning as a teaching method is related to forms of cooperation in society at large. One of the big learning perspective changes was to give learners an active and constructive role and to consider the knowledge construction process as a process of interaction and negotiation with other agents in the learning environment, including teachers, fellow pupils and teaching materials. In this formulation knowledge construction has individual, as well as social, aspects. They added that, based on a cognitive-acquisition oriented perspective on constructivism, an individual's (solo) knowledge construction, can and should be enhanced by a facilitating social context.

In a collaborative learning environment the learner can learn through interaction, discussion, and explanation of a problem to others (Lehtinen, Sinko & Hakkarainen, 2001; Stahl, 2003; Veldhuise-Diermans, 2002). As Van der Linden et al (Op. Cit.) stated, learning is more productive when learning tasks or problem assignments are solved together with fellow students rather than in individual or teacher-pupil teaching/learning situations and collaboration learning also seems to have positive effects on motivational factors and areas related to social skills. Veldhuis-Diermanse believed that in a setting of collaborative learning, students can criticize their own and other students' contributions, can ask for explanations, can give counter arguments and, in this way, students will stimulate themselves and their fellow students. Additionally, they can motivate and help each other to finish the task. According to Van der Linden et al. (Ibid) "compared to individual, cooperative partners can acquire a shared meaning,

notably a better common problem representation, through the exchange of various ideas and strategies, and through improvement that may subsequently be proposed."

There is a growing consensus among researchers about the positive effects of collaborative learning on student achievement (Slavin as cited in Velhuise-Diermanse, 2002). In their Meta-analysis study Qin, Johnson and Johnson reported that in 87% of studies the cooperative and collaborative condition resulted in a better learning effect and, as summarized (Van der Linden et al., 2000), other meta-analyses of research in this field revealed that the cognitive achievements of students working in this field are usually more than students who are involved in traditional, individual or competitive learning situations. Bossert believed that motivation, self-confidence and mutual relations between students can be enhanced through cooperation and collaboration. (Ibid)

In some documents cooperation and collaboration are interchangeable. Panitz (Op. Cit.) tried to explain the differences between collaboration and cooperation. They hold that in the cooperative model the teacher maintains complete control of the class, even though the students work in groups to accomplish the goal of the course, but in the collaborative model groups would assume almost total responsibility for answering the question posed. In the collaborative situation the teacher would be available for consultation and would facilitate the process by asking for frequent progress reports from the groups.

2.9 Knowledge building

Knowledge building or knowledge construction is one of the most widely used concepts in the CSCL literature, that Scardamalia and Bereiter (2003) believe aims at emphasizing the process of producing externally visible "knowledge objects", such as scientific concepts and theories. They defined knowledge building "as the production and continual improvement of ideas of value to a community, through means that increase the likelihood that what the community accomplishes will be greater than the sum of individual contributions and part of broader cultural efforts" (p. 1370). They also defined the idea of knowledge building communities as: "groups of persons exchanging ideas, information and experiences to reach a more advanced level of knowledge" (Veldhuis- Diermanse, 2002, p.8). The process of knowledge building in collaborative

learning, as explored by Harasim, involves the mutual examination of arguments, agreements and disagreements, mutual questioning of positions, dynamic interaction and waving of ideas (Sorensen, 1997). Distinguishing between knowledge construction from learning Scardamalia and Bereiter (Op.Cit) believed that "learning is an internal, unobservable process that results in changes of belief, attitude, or skill. It is a process through which the cultural capital of a society is transferred from one generation to the next. Knowledge building, by contrast, results in the creation or modification of public knowledge—knowledge that lives 'in the world' and is available to be worked on and used by other people".

2.10 CSCL

Computer-Supported Collaborative Learning (CSCL) has grown out of wider research in two fields a) Collaborative learning and b) a specific part of Information Communication Technology (ICT) entitled Computer Supported Collaborative Work (CSCW). The first CSCL workshop took place in 1991 (Koschmann, 1994) and the first international CSCL conference was held in 1995 in Bloomington, Indiana (Daphne, 1996; Lipponen, 2001). Lehtinen and his colleagues (1999) mentioned that CSCL is closely related to the recent developments in theories of learning and instruction. For many researchers some kind of CSCL application seems to be one of the most promising ways of using information technology to put forward desired changes in educational practice. Lipponen (2001; 2002) stated that "CSCL is focused on how collaborative learning, supported by technology, can enhance peer interaction and work in groups and how collaboration and technology facilitate sharing and distributing of knowledge and expertise among community members". Kirschner (2002) stated that "Computer supported collaborative learning (CSCL) environments are seen as tools that permit educators to latch on to current constructivist insights in teaching and learning that rely heavily on collaborative learning, encompassing dialogue and social interaction amongst the group members and allow learners and instructors to be geographically dispersed, thus relaxing the need to be collocated for meetings and discussions". He stated that CSCL application allows learners to engage in learning at any time, dismissing necessity for co-presence, which he believes is a characteristic enabling a shift from real-time contiguous learning groups to asynchronous distributed learning

groups. Newman, Johnson, Webb and Cochrane (1999) pointed out that "By Computer-Supported Collaborative Learning we mean the use of appropriately chosen or designed computer software and network computer hardware, in an instructional context that supports group learning processes". Koschmann (1996), in his first book on CSCL, suggested CSCL as an emerging paradigm of educational technology that is grounded in very different concepts of learning, pedagogy, research methodology, and research questions than its antecedents, CAI (Computer Assisted Instruction), ITS (Intelligent Tutoring Systems), and, Logo-as-Latin (Hakkarainen, Rahikainen, Lakkala & Lipponen, 2001).

Steinberg stated that the CAI (Computer Assisted Instruction) paradigm reflected the ideas of behaviourism and instructional efficacy and Koschmann (Hakkarainen et al., 2001, p. 11) believed that the CAI programs "utilized a strategy of identifying a specific set of learning goals, decomposing these goals into a set of simpler component, task, and finally developing a sequence of activities designed to eventually lead to the achievement of the original learning objectives". The CAI paradigm was followed by the Intelligent Tutoring Systems (ITS) Paradigm. Hakkarainen and colleagues (2001, p. 11) stated:

> *"Intelligent Tutoring Systems are able to interact "intelligently" with students on the basis of what students know, and in doing so, ITS promotes students' self initiated exploratory activity… ITS applied methods of Artificial Intelligence research to understand skilled tutoring in complex domains. Based on information processing theory and considering cognitive processes as computational, the proponents of this paradigm were interested in instructional competence; this is, in answering the question, Could a computer program function as adaptive and skilled teacher or tutor? Despite their differences such as, ITS representing perhaps a more interactive model of learning and aspiring to more complex skills than CAI, they share realist and absolutist epistemological assumptions, and both rely on the transmission model of instruction"*

Crook places these two paradigms under the same metaphor, namely, computer as tutor, and points out that both are representatives of "teaching technology, sensitive to individual learners" (Lipponen, 2001). The third instructional paradigm proposed by Koschmann (as cited in Hakkarainen et al., 2001) was the Logo-as-Latin paradigm which focuses on instructional transfer and on asking the question: do programming skills affect planning and meta-cognition, for instance. Hakkarainen et al (Ibid) summarized some of the differences between the three historical paradigms of instructional technology and stated that CSCL relies on very different concepts of learning, pedagogy, research methodology, and research questions than its predecessors did; whilst the previous paradigms relied on pure computational and mentalist mind models, CSCL is progressing based on socially oriented theories of cognition and learning. Whilst the antecedents of CSCL relied strongly on experimental research design, CSCL adopts a variety of methods from the fields of anthropology, communication science, and linguistic research. Unlike the earlier paradigms that studied human cognition with experimental design in laboratories, CSCL research is conducted in "real world contexts". In addition, CSCL utilizes the new possibilities of networked technology, which were not, of course, previously available. Even if a new paradigm emerges in instructional technology, the old types of software and ideas are still popular among educators and instructional designers. Nowadays these ideas are usually loosely veiled as different types of multimedia programs (Lipponen, 2001).

2.11 Effects of computers and the world wide web on learning

In spite of the debate on the effect of "Media" and "Method", several researchers in the field believe that technology, in general, and computers, the Internet, and the world wide web, in particular, have positive effects on the teaching-learning process and on learning outcomes. Large-scale meta-analyses on the effectiveness of computers have shown that, in the majority of experiments, the use of technology has markedly improved learning outcomes (Khaili & Shashaani, 1994; Kulik, 1994). Lehtinen stated that thousands of experimental studies on the educational impact of ICT have been carried out since the first attempts to assess the educational use of information technology in the early 1970s. These results have been summarized in dozens of review articles and meta-analyses. He mentioned that their overviews of these reviews,

covering more than one thousand original experiments, allowed some general conclusions to be drawn (Lehtinen, Sinko & Hakkarainen, 2001). The reviews and meta-analyses of the experiments showed that by using ICT-based learning and teaching methods students learned more and faster than students in control groups. The former also showed improved motivation and social interaction. However, Whelen et al. (2001), in their review of the literature on web-based learning from 1993 through to 2001 reveal a sobering picture. They mention that while there is great enthusiasm for, and optimism about, the use of this medium in learning and instruction, the research that has been reported is mainly of an exploratory and descriptive nature, and little empirical evidence exists for the effectiveness of online learning.

CSCL, from a pedagogical point of view, is related to a knowledge construction view of learning and the constructivism paradigm of psychology and participation, and the knowledge creation metaphor. From the technological point of view it is related to a specific field of Information Communication Technology (ICT) called Computer Supported Collaborative work (CSCW). It also concerned with Human Computer Interaction (HCI), Computer and Web-Based Instruction, Computer Aided Instruction (CAI) and Computer Mediated Communication (CMC). Several researchers (Lehtinen, 2003; Lipponen, 2002; Stahl, 2002; 2003) in the field have tried to explain a theoretical foundation for CSCL. As Stahl (2002) stated, even if the stress in CSCL research is on socially oriented theories of learning, there is still no unifying and established theoretical framework, no agreed objects of study, no methodological consensus, or agreement about the unit of analysis. He believed that on the positive side this ambiguity can be seen to reflect the richness or diversity of the field. Negatively interpreted, it seems that the field is proceeding along increasingly divergent lines. Kirschner (2002, p. 21) pointed out the need to analyze the concept 'computer-supported collaborative learning' to determine what a CSCL-environment should entail. According to him, in CSCL "First of all we are talking about *learning*, and in the twenty-first century we are usually talking about constructivist learning .The proximate modifier (adverb) is the word *collaborative*. To collaborate is to work jointly with others especially in an intellectual endeavour. Thus, the work that is to be carried out is learning, and the way that it is done is together with others. Finally, the ultimate modifier is *computer-supported* (a compound adverb). That the computer supports

something means that the computer (and some network) enables something to occur and/or that the computer keeps something going. The 'thing' that the computer supports is collaborative learning."

Gerry Stahl (2002) stated that four themes are important for thinking about computer support for collaborative learning (CSCL):

a) Collaborative knowledge building
b) Group and personal perspectives
c) Mediation by artefacts
d) Interaction analysis

He believed that although these themes have been developed in distinct academic literatures

(e.g., education, psychology, activity theory and conversation analysis, respectively) they should be brought together for the kind of theoretical and methodological framework required by the complex and profoundly interdisciplinary field of CSCL. He concluded that a theory for CSCL should help us to think about collaborative learning, to structure pedagogy, to design software media and to study the actual occurrences of knowledge building inside and outside the classroom.

2.12. How CSCL applications improve learning

CSCL has several features which have relevance to education, in general, and higher education, in particular, especially when "independency and autonomy" and "deep learning, problem solving and critical thinking" are important and the main goal of instruction. Although e-learning and CSCL applications, like other instructional technologies, can be considered and used as tools to facilitate the process of learning in the traditional approach to learning , most of the literature in the field stated that they are more connected to constructivist (more specifically socio- constructivist) and knowledge construction approaches to learning. However, there is no well-grounded theory on e-learning and CSCL yet (Stahl, 2003).

Although CSCL suffers from lack of a well-grounded theory which can explain its effect on the process of learning and knowledge construction and mechanisms through them CSCL might improve learning (Ibid), it is reported that CSCL environments -if properly and effectively implemented and integrated in the process of

learning- through fostering, facilitating, and promoting mechanisms like reflection, externalization, explicitation of individual knowledge elements, explanation, interaction, cooperation, collaboration, writing, negotiation, and argumentation improve students' learning and construction of shared knowledge (De Wever et al., 2006; Koschmann, Hall & Miyake, 2002; Lehtinen, 2003; Pena-Shaff & Nicholls, 2004; Scardamalia & Bereiter, 1994; Stahl, 2002). As De Wever and colleagues (Op. Cit.) stated, in CSCL-environments, online asynchronous discussion groups, which are known as Computer Mediated Conferencing (CMC), Computer Mediated Discussion (CMD), Computer Conferencing (CC), Bulletin Board (BB), or Asynchronous Learning Networks (ALN) hold a central place. In these environments writing is the main mode of communication. As Harasim (1990; 1994) stated, in the text-based mode of communication, people focus on the message, not the messenger; and the process of writing makes thinking visible and tangible, forces attentiveness, and is potentially and socially equalizing. The asynchronicity gives the participants plenty of time for reflection, analysis, and composition. It encourages thinking, and also enables participants to do retrospective analysis by recording the whole transcript discussion in the system. Many-to-many communication, as one of the unique characteristics of CSCL, facilitates peer learning and the resolution of conceptual conflicts in groups, resulting in new insights on the topic. Place independence is also seen as one of the advantages of CSCL environments. Henri (1992) explained that a written text demands exactness, careful consideration, and the explicit expression of thoughts. The asynchronous nature of interaction through ICT makes it possible to participate without restrictions of time and place, to have enough time is important when it is a question of formulating valid grounds to support one's opinions. The act of writing is reported to foster higher order thinking for reasons that have to do with the relationships between writing and cognition (Lapadat, 2002); participants in such environments "can and do take time to think, to polish what they say, and to edit. Participants in asynchronous conferences produce less in total quantity (e.g., number of words), but their contributions to the discussion tend to be carefully crafted, adapted to the audience, dense with meaning, coherent, and complete" and perhaps the most unique feature of these technologies is the possibility for many-to-many discussions. Unlike F2F classes, where teachers or certain other participants often dominate the process of discussion and

collaboration, in ACSCL there is a greater possibility of incorporating all participants' perspectives. Lapadat (Ibid) argues the fact that participants in asynchronous conferences are writing for a real audience of their peers and this motivates them to express their perspectives clearly for several reasons. First, with a real audience, whose opinion matters, there is a purpose in communicating. Second, one does not like to lose face by voicing perspectives that are poorly thought-out. It is widely believed that learning environments that provide students with moments for reflection and encourage active learning, participation, interaction, negotiation, and dialogue foster the process of knowledge construction. This belief is supported by constructivist and learning approach theories. Solomon believes that "exchange of ideas and negotiation of meaning affects not only the individual's cognition but also the group's ''distributed cognitions'' as participants transmit, negotiate and transform their ideas and create new knowledge" (cited in Pena-Shaffa, 2004). As Pena-Shaffa (Ibid) summarized, dialogue is a way of thinking because in the process of explaining, clarifying, elaborating, and defending our ideas and thoughts we engage in cognitive processes such as integrating, elaborating and structuring. Therefore, it is in the process of articulating, reflecting and negotiating that we engage in a meaning-making or knowledge-construction process. This process can become even more powerful when communication between peers occurs in written form because writing, done without the immediate feedback of another person as in oral communication, requires a fuller elaboration in order to successfully convey meaning.

Lipponen (2002) believed that both major traditions of developmental psychology, the Vygotskyan and the Piagetian, contribute to our understanding of collaborative learning. As Lakkala (Op. Cit.) and her colleagues stated, there are two basic interpretations of Vygotsky's thoughts. They stated that the first view assumes that "because of engagement in collaborative activities, individuals can master something they could not do before the collaboration." In other words, collaboration is interpreted as a facilitator of individual cognitive development. The other interpretation of Vygotsky's ideas, as outlined by Cole and Wertsch, emphasizes the role of mutual engagement and co-construction of knowledge. Based on this view, knowledge emerges through a network of interactions, and learning is more a matter of participation in a social process of knowledge construction than an individual endeavour (Lipponen,

Ibid). Vygotskey's idea of the zone of proximal development implies that collaborative activity amongst children promotes growth if children have developmental differences. In other words More advanced peers are likely to be operating within one another's proximal zones of development. (Lehtinen, 2003)

Piagetian socio-cognitive conflict, which implies that children at different levels of cognitive development or children at the same level of cognitive development, with differing perspectives, can engage in social interactions that lead to a cognitive conflict. As Lipponen (2002, p.74) summarized:

> *"This shock of our thought coming into contact with others may create a state of disequilibrium within participants, resulting to construction of new conceptual structures and understanding. According to this view, new knowledge is not so much a product of co-construction or shared understanding but is rather understood as taking place in the individual minds. This new understanding can then be brought back to the level of social interaction, and collaborative activities."*

Another interpretation of Piaget's theory stresses more the idea of co-construction of knowledge and mutual understanding. The co-construction of knowledge takes place through one's increasing ability to take other peoples' perspectives into account.. Cognitive research on peer interaction indicates that cognitive conflicts emerging in social interaction situations facilitate cognitive performances (Lehtinen, 2003; Veldhuis-Diermanse, 2002).

In a collaborative situation individuals have to explain their ideas and conceptions to others, and through this externalization process they also have to construct a better mental model about the issue or concept in question (Lehtinen, 2003; Stahl, 2002;Veldhuis-Diermanse, 2002). Hatano and Inagaki have argued that "deep conceptual understanding is fostered through explaining a problem to other learners. In order to explain one's view to one's peers, an individual student has to cognitively commit him or herself to some ideas, to explicate beliefs, and also to organize and reorganize existing knowledge" (as cited in Lehtinen, 2003).

According to Veldhuis-Diermanse (2002, p.2) "besides group learning, CSCL seems to be a powerful constructivist learning tool for yet another reason. Using a CSCL-system implies that students have to write down their ideas, solutions, remarks and so on. When deep learning is the ultimate learning goal, writing seems to be an effective tool for learning. Writing can be seen as the most important tool of thinking, and it has a crucial significance in explication and articulation of one's conceptions".

Moreover the existence of a 'conversation history' in CSCL environments enables students and teachers to re-read contributions or notes, and understand by whom a particular note was written, when a note was written, and whether the note was a reaction to a previous note posting (Ibid)

The concept of "legitimate peripheral participation" developed by Lave and Wenger (1991) implies that learning is entirely located in a social and cultural system. In this, learning is seen as the process of change in social relations and the changes taking place in the "community of practice" (Lehtinen, 2003).

Hara, Bonk, & Angeli, (2000, p.116) explained that despite "clear advantages, there are also a myriad of disadvantages with CMC". They believe that the removal of time constraints can require overload both instructors and students with ceaseless opportunities to learn and work. The lack of visual communication, or nonverbal, cues – gestures, smiles, or tone of voice- are another significant disadvantage of CSCL. As Shapard (Ibid, p.117) believes, "active listeners" or "lurkers" might read, but not respond to, the conferencing messages, and finally, in asynchronous online discussion, people have to wait for answers or feedback from the others. Either the discussion might progress too slowly or their messages might never be answered.

2.13 Empirical research in the field

The last decade has seen a host of research on Computer Supported Collaborative Learning (CSCL) as an electronic learning environment. From this, two different conclusions emerge about the effectiveness of CSCL for learning processes and outcomes. The first is that CSCL can facilitate learning processes and promote learning outcomes. The second is that CSCL is just useful for exchanging ideas and delivering information and documents.

The findings of research on CSCL environments are contradictory. Although several researchers believe that there is no solid evidence of a role for CSCL in deep learning (Garrison, Anderson & Archer, 2000; Stahl as cited in Liponnen, 2002), there exists a large body of evidence reporting positive effects of CSCL applications and environments on different aspects of the process of learning and knowledge construction.

Although, and as stated earlier, CSCL applications are assumed to improve participation, interaction and high level learning, there are reports in several empirical studies of low participation rates and few written notes posted in the learning environment forums (Capsi et al., 2003; Davis & Huttenlocher, 1995; Guzdial, 1997; Guzdial & Turns, 2000; Hara, Bonk & Angeli, 2000; Hewitt & Tevlops, 1999; Hsi, 1997; Hoadley & Linn, 2000; Howell-Richardson & Mellar, 1996; Lipponen, 1999; Muukkonen, Hakkarainen & Lakkala, 1999; Nurmela, Lehtinen & Palonen, 1999). In a similar vein, another reported malfunction of CSCL environments (Guzdial, 1997; Guzdial & Turns, 2000; Hewitt & Tevlops, 1999; Lipponen, Rahikainen, Lallimo & Hakkarainen, 2003) is short discussion threads containing only a few contributions; an indication that the topic is not well elaborated and the main discussion topic is often not sustained, but proceeds along diverging short discussion threads that lack topicality and a coherent structure (Lipponen et al., 2003; Thomas, 2002). Moreover, some of the previous studies have shown that superficial categories of knowledge construction can be seen in CSCL (Gunawardena et al., 1997; Hara et al, 2000; Pena-Shaff & Nicholls, 2004; Zhu, 1996) and conflict, negotiation and dialogical processes of meaning construction often did not occur. Meyer (2003) found that most (approximately 69 %) of the student postings were located at the first two levels of thinking. Sing and Khine (2006) found that most knowledge building activities were in the first phase of the knowledge construction process. In their study, Guan et al (2006) found that in the forum of their learning environment the most frequently involved interaction type was ‘direct response’, and the most frequently used cognitive skill was ‘elementary clarification’.

On the other hand, the review of Lehtinen et al. (1999) revealed positive effects of CSCL environments and a meta-analysis study (Cavanaugh, 2001) has shown positive effects of face-to-face teaching as a result of support from CSCL applications.

Lehtinen (2003, p.48) also reported that, in total, "reviews of experiments on network-based collaborative learning show some positive learning effects when CSCL systems have been applied in classroom learning in connection to face-to-face learning situations". Several studies indicated that participation in CSCL activities increases and improves participation in group activities (Kiesler, Siefel, & McGuire, 1984; Pullinger, 1986; Spitzer, 1989, as cited in Mazur, 2004). The results of a number of studies have shown that CSCL applications: significantly facilitate task-oriented and reflective activity (Cohen & Scardamalia, 1998) ; foster deeper overall critical thinking ratios (Newman et al., 1995); facilitate inter-professional collaboration (Connor, 2003); increase students' meta-cognitive understanding (Brown, Ellery & Campione, 1998; Cohen and Scardamalia, 1998), complex reasoning and levels of argumentation (Hoadley & Linn, 2000); facilitate the collaborative learning of complex scientific concepts (Roschelle, 1992); create a "virtual community of inquiry" (Garrison et al., as cited in Marra et al., 2004); improve reasoning and argumentation skills (Marttunen & Laurinen, 2002; Pilkington & Walker, 2003); critical thinking, reflection, problem-solving (Orvis et al., 2002); progress in the use of conceptual models (Bell, 1997), foster sharing information and constructing new knowledge (McConnell, 1999); social construction of knowledge (Diermans-Veldhuis-diermanse et al., 2002; Hara et al., 2000); increase reflection and new idea construction (Vonderwell, 2003); and finally facilitate developing sophisticated cognitive skills such as self-reflection, elaboration, and in-depth analysis of course content, allowing the purposeful construction of knowledge (Pena-Shaff et al., 2001). Moreover, from the learners' points of view, the results of some research in the field revealed that students described CSCL environments as valuable for their learning (Dewiyanti, Brand-Gruwel, Jochems & Broers, 2007).

It is believed that interaction, cooperation, collaboration, discussion, and negotiation amongst and between students and other staff of the course will help students to achieve those aims. In these circumstances CSCL environments can play a very positive role. Turcotte (2004, p.) believed that "The integration of CMC as a mixed mode in traditional university settings is becoming more and more prevalent. Not only is its value as a learning tool in distance education recognized but it is also accepted as a worthwhile learning activity in traditional education based face-to-face

meetings". In higher education, where deep learning, problem solving, critical thinking, and ability of presenting well-grounded arguments are the main aim of education (Marttunen & Laurinen, 2001; Terenzini et al., 1995; Veldhuis-diermanse, 2002), using asynchronous online learning environments for both on and off campus students has proved beneficial. For instance, Turcotte (2004) integrated an online discussion forum in a campus-based undergraduate biology class. They reported that asynchronous activities in the computer conference, not only improved the participation of students, but also enriched the content of the class activities, as assessed by both the students and the professor. The time-frame of courses in the conventional classroom does not allow students adequate discussion time with their teachers and peers. CSCL environments seem to provide on-campus teachers and students with the opportunity for more interaction, discussion, and collaboration.

As Lipponen, Rahikainen, Lallimo and Hakkarainen (2003) stated, the results of the studies conducted under the label of CSCL cannot be compared fully because of their differences in terms of setting, applied instructional design, teachers' preparation, commitment and moderation, technical support and technologies used, and how some particular applications were used. They concluded that "the advantages and disadvantages of CSCL appear to be widely debated, hence, there remains a need for more research to further inform these debates and help resolve the issues" (Lipponen, Rahikainen, Lallimo & Hakkarainen, 2003, p. 489).

2.14 Analysing data in CSCL

Student activities in CSCL environments can be studied from different aspects such as: participation in the process of knowledge construction, motivation for co-constructing shared knowledge, types of interaction during the collaboration and cooperation process, knowledge construction and learning activities that occur during the process, quality of discourse during discussion and collaboration, and finally the quality of learning outcomes.

In some studies critical thinking was the main, or one of the main, measured variables (Bullen, 1998; Fahy, Crawford, Ally, Cookson, Kellar & Prosser, 1999; Garrison, Anderson & Archer, 2000; Newman, Webb & Cochrane, 1995; Weiss & Morrison, 1998) and in others, participation and social interaction were the central points (

Blanchette, 1999; Hara, Bonk & Angeli, 2000; Henri, 1991; McDonald ,1998; Rourke et al., 2001; Weinberger & Fischer, 2006 ; Zhu, 1997). In some studies more attention was paid to knowledge construction aspect of discourse (Gunawardena et al., 2001; Kanuka & Anderson, 1998; Veldhuis-diermanse et al., 2002; Zhu, 1997). Also cognitive and meta-cognitive aspects of the interaction process formed the core points of some studies (Hara, Bonk & Angeli, 2000; Henri, 1991; McDonald, 1998; Veldhuis-diermanse et al.) and argumentation was a primary aspect of some research themes (Hara, Bonk & Angeli, 2000; Veerman, 2000; Weinberger & Fischer, 2006).

At the first level of analysis, indicators like frequency of writing, reading of messages, length of written notes, and time that learners work in the system were used to understand to what extent students participate and take part in online debate and discourse in CSCL environments. Interaction patterns in CSCL environments were studied by means of social network analysis and measures like density and centrality; and graphical representations like socio-grams were also used (Lipponen, Rahikainen, Lallimo, Hakkarainen, 2003; Martinez, Dimitriadis, Rubia, Gomez, Garrachon & Marcos, 2003; Puntambekar & Luckin, 2003,). Content analysis is one of the frequently used techniques for analysing written notes and transcripts of discourse in CSCL environments. As De Wever et al. (2006) explained "Although this research technique is often used, standards are not yet established. The applied instruments reflect a wide variety of approaches and differ on their level of detail and the type of analysis categories used." This technique (content analysis of written notes or transcribed conversations) was seen as a way to achieve an in depth insight into the processes of learning and discourse in CSCL environments. For this purpose several studies have developed, and introduced, a coding scheme to analyse written notes or transcripts drawn from students' conversations in CSCL environments (Gunawardena, Lowe & Anderson, 1997; Henri, 1992). Quantitative content analysis, as Berelson defined, is "a research technique for the objective, systematic, quantitative description of the manifest content of communication" (Rourke et al. 2001, p.4).

Henri (1992), one of the pioneers of content analysis, introduced a five dimensional model and coding scheme for analyzing message content. Concentrating on critical thinking, Newman, Webb and Cochrane (1996) developed a model comprising indicators and categories such as relevance, justification, novelty, and ambiguities.

Gunawradena, Lowe and Anderson (1997) developed a model to characterise the process of knowledge construction in CSCL. Their model has five progressive phases labelled as sharing; comparing of information; discovery of dissonance; negotiation of meaning/co-construction of knowledge; testing and modification of proposed synthesis; agreement/ application of newly constructed meaning. Each phase consists of a number of operations such as stating an observation or asking questions. Guzdial and Turns (2000) operationalized learning in CSCL environments as average number of postings, average length of threads, and proportion of participants/non-participants. They employed on/off task notes as indicators to assess learning. Lipponen, Rahikainen, Lallimo and Hakkarainen (2003) first divided student contributions in the environment into on and off task. They then broke them down into categories like "providing information", "asking research/ clarification questions, and something else".

Later on, researchers in the field stated that, participation and interaction in CSCL environments results in online interactions that are rather complex and should be studied on different aspects. They believe that to be able to understand the nature of interaction in CSCL environments we need an appropriate and multidimensional means of analysis which considers participation, interaction, quality of interaction, process of knowledge construction and learning outcomes of all those activities. For instance, Hmelo-Silver (2003) believe that since collaborative knowledge construction is a multifaceted phenomenon, mixing methods of data analysis should be implemented to characterise its process.

As explained, there is no unambiguous theory available to guide research on computer mediated interaction (Stahl, 2003; De Wever et al., 2006). Lack of a theoretical model of the collaborative learning process makes it difficult to find or develop empirical indicators that will form the basis of a coding instrument as a standard means of assessment of learning effectiveness in CSCL (Gunawardena et al., 2001; De Wever et al., 2006). As Rourke and Anderson (2003) suggested, instead of developing new coding schemes, in the study presented here we used schemes that have already been developed and used in previous research. Applying existing instruments fosters replicability and the validity of the instrument (Stacey & Gerbic, 2003 as cited in De Wever et al., 2006). In this research we want to explore how on campus students in the context of green (food, animal, plant, and environmental) sciences collaborate and

construct knowledge in asynchronous CSCL environments. Therefore attention has partly been paid to learning activities during the process of knowledge construction. Moreover, we tried to document participation, interaction, and quality of knowledge construction during the performance of collaborative tasks in asynchronous CSCL environments.

2.15 Concluding remarks (Summary of literature in the field)

Computer-Supported Collaborative Learning (CSCL) has grown out of wider research in two fields a) collaborative learning and b) a specific part of information communication technology (ICT) labelled computer supported collaborative work (CSCW). CSCL is focused on how collaborative learning, supported by technology, can enhance peer interaction and group work, and additionally how collaboration and technology facilitate the sharing and distribution of knowledge and expertise among community members. Nowadays there is acceptance of the value of CSCL in distance education and traditional face-to-face education. In higher education, where deep learning, problem solving, critical thinking and ability of presenting well-grounded arguments are the main aim of education, using asynchronous online learning environments for both on and off campus students has proved beneficial.

2.15.1 Toward a theoretical framework

Several researchers in the field have tried to elaborate a theoretical foundation for CSCL. Stahl (2002) summed this up as, even if the stress in CSCL research is on socially oriented theories of learning, there is still no unifying and established theoretical framework, no agreed objects of study, no methodological consensus, or agreement about the unit of analysis. He believed this ambiguity can be seen in a positive light as reflecting the richness or diversity of the field. However in a negative sense, it seems that the field is proceeding along increasingly divergent lines. Though CSCL suffers from the lack of an agreed theoretical framework, in the literature, constructivism and the two major traditions of developmental psychology; Vygotskey's idea of the zone of proximal development implying that collaborative activity among children promotes growth if children have developmental differences; and Piagetian socio-cognitive conflict which implies that children at different levels of cognitive

development or at the same level of cognitive development but with differing perspectives, can engage in social interaction that leads to a cognitive conflict, are frequently reported in the CSCL literature.

2.15.2 Analysing data in CSCL

Different aspects of students' activities in CSCL environments can be studied, such as: participation in the process of knowledge construction, motivation for co-constructing shared knowledge, types of interaction during collaboration and cooperation processes, knowledge construction and learning activities, quality of discourse during discussion and collaboration, and the quality of learning outcomes. Indicators like frequency of writing and reading of messages, length of written notes, and time that learners work in the learning environment were used to understand to what extent students participate in online debate and discourse in CSCL environments. Social network analysis and variables like density and centrality and graphical representations like socio-grams were also used to study interaction patterns in CSCL environments. Content analysis is one of the most frequently used techniques for analysing written notes and transcripts of discourse in CSCL environments. This technique (content analysis of written notes or transcribed conversations) was seen as a way to get an in-depth insight into the processes of learning and discourse in CSCL environments. For this purpose, several researchers introduced a coding scheme to analyse written notes or transcripts drawn from students' conversations in CSCL environments. Although the lack of a theoretical model of the collaborative learning process makes it difficult to find or develop empirical indicators that will form the basis of a coding instrument as a standard way of assessing of learning effectiveness in CSCL, researchers in the field stated that participation and interaction in CSCL environments results in online interaction which is rather complex and should be studied on several different aspects. They believe that to be able to understand the nature of interaction in CSCL environments we need an appropriate and multidimensional way of analysis which considers participation, interaction, quality of interaction, process of knowledge construction and learning outcomes of all those activities.

2.15.3 How CSCL facilitates learning

CSCL has several features which are relevant to education, in general, and higher education, in particular, especially when "independency and autonomy" and "deep learning, problem solving and critical thinking" are important and the main goal of instruction. In the general educational research, particularly in the constructivist approach, it is widely believed that through discussion and collaboration students, instead of passively receiving knowledge from teachers, can develop their cognitive skills (e.g., problem solving and knowledge construction) and meta-cognitive skills (e.g., critical thinking).

It is reported that CSCL environments through fostering, facilitating, and promoting mechanisms like reflection, externalization, explicitation of individual knowledge elements, explanation, interaction, cooperation and collaboration, writing, negotiation, and argumentation improve students' learning and construction of shared knowledge. In asynchronous CSCL environments the text-based mode of communication is dominant. The act of writing is reported to foster higher order thinking for reasons that have to do with the relationship between writing and cognition. In a text-based computer-mediated communication, people focus more on the message than the messenger; the process of writing makes thinking visible and tangible. The asynchronicity, by recording the whole transcript discussion in the system, gives the participants plenty of time for reflection, analysis, composition, thought, and retrospective analysis.. Many-to-many communication is one of the unique characteristics of CSCL and can facilitate peer learning and the resolution of conceptual conflicts in the group, which can result in new insights into the topic. Place independence is also seen as one of the advantages of CSCL environments.

2.15.4 Finding of previous research

In spite of the debate on the effects of "Media" and "Method", several researchers in the field believe that technology, particularly computers, the Internet, and the world wide web have positive effects on the teaching-learning process and on learning outcomes. In the literature it is widely believed that e-learning environments are, potentially, a promising technology to enrich the constructivist learning environments. Computer-supported collaborative learning (CSCL) applications are powerful e-learning environments that facilitate interaction, negotiation, and

collaboration amongst and between students, their teachers, and external information resources in order to construct new knowledge. In summary, the reviews and meta-analyses of the experiments showed that in ICT-based learning-teaching methods, students learned more and faster than students in control groups, and they also showed improved motivation and social interaction.

Many studies have been carried out to investigate the effects of CSCL environments in education. The findings of research on CSCL environments are contradictory. While several researchers believe that there is no solid evidence of the role of CSCL in deep learning, the review of studies in the field revealed positive effects of CSCL environments, positive effects of face-to-face teaching supported by CSCL applications, and positive effects of CSCL environments when they were applied in combination with face-to-face learning situations. The results of the studies already conducted on CSCL differ on various factors such as: setting, applied instructional design, teachers' preparation, commitment and moderation, technical support, technologies used, and the way in which particular applications were used; thereby making full comparisons difficult. Furthermore the advantages and disadvantages of CSCL appear to be widely debated, hence, there remains a need for more research to further inform these debates and help resolve the issues.

In sum, the comparability of the results of previous CSCL studies is dubious because of the differences highlighted above. The means employed to studying CSCL and analyse the resulting data might also be a source of contradiction in the extant CSCL studies. In some cases CSCL was only implemented in one course with a small number of participants, while others focused more on the discussion part of CSCL environments than on the collaborative aspect. In other studies, participants were asked to perform a collaborative task. In our opinion, these differences in research design make it difficult to draw conclusions between the effects of course characteristics, tasks, teacher roles and other instructional variables and ACSCL environments.

Chapter 3

Determining factors of the use of e-learning environments by university teachers*

* This chapter is based on Mahdizadeh, H., Biemans, H. & Mulder, M. (In press). Determining factors of the use of e-learning environments by university teachers. *Computers & Education*.

Abstract

E-learning environments increasingly serve as important infrastructural features of universities that enable teachers to provide students with different representations of knowledge and to enhance interaction between teachers and students and amongst students themselves. This study was designed to identify factors that can explain teachers' use of e-learning environments in higher education. A questionnaire was completed by 178 teachers from a wide variety of departments at Wageningen University in the Netherlands. We found that 43% of the total variance in teacher use of e-learning environments could be explained by their opinions about web-based activities and their opinions about computer-assisted learning (predictors) and the perceived added value of e-learning environments (mediating variable). In other words, teachers' use of e-learning environments can be explained, to a high extent, by their perceptions of the added value of these environments, which in turn are substantially influenced by their opinions about web-based activities and computer-assisted learning.

Keywords: Computer-mediated communication, cooperative/collaborative learning, distance education and tele-learning, media in education, multimedia/hypermedia systems

3.1 Introduction

Whilst traditional teaching methods, such as face-to-face lectures, tutorials, and mentoring, remain dominant in the educational sector, universities are investing heavily in learning technologies, to facilitate improvements with respect to the quality of learning (Cancannon, Flynn & Campbell, 2005). The implementation of information and communication technology (ICT), as an advanced flexible technology with its unique characteristics, is one of the main new destinations of investment. However, it should be noted that "despite their potential, telematics applications are not yet regularly used as instructional tools (e.g., in The Netherlands, with one of the world's highest concentrations of Internet users and personal and organisational computer use, a national study has indicated that almost all university students use e-mail and the World Wide Web on a personal basis, but in general computer use in educational programmes is limited to occasional information searches)" (Veen, 1999, cited in Collis, Oscar & Pals, 2001, P. 97). While the use of ICT in distance learning for off-campus students is already accepted, Cancannon et al (op cit) stated that there is also a trend in higher education to utilise the benefits of e-learning to improve the learning performance of campus-based students. As a result of this trend, many universities around the world are expanding their investment in ICT (Cheung & Huang, 2005).

Nevertheless, equipment and connectivity do not guarantee successful or productive ICT use (Granger, Morbey, Lotherington, Owston & Wideman, 2002). We should consider that implementing technology in education is complex, shaped by pedagogical philosophies, curricular requirements, and the proliferation of ICT in society at large (Granger et al., 2002). Literature on instructional technology shows that the use of the Internet in education has the potential to motivate students and teachers, increase student participation and interaction in the classroom, and provide students with a more active role in their learning, increased motivation, and increased autonomy in the educational process (Claudia, Steil & Todesco, 2004). While teachers are requested to use the capability of the new high technology to facilitate learning processes, students are encouraged to improve their learning through computer and networked-based activities.

In many cases, however, educational institutions do not pay enough attention to the questions of how, what, and why ICT should be implemented. According to Greenhalgh (cited in Masiello, Ramberge & Kirsti, 2005) ICT implementation often takes place without a theory and many institutions do not spend any resources on trying to understand what kind of changes ICT and computers bring into their system; they just follow the new trend, casting doubt on the success and cost effectiveness of such initiatives.

When universities promote ICT use, they need to understand their teachers' and students' attitudes towards its use. Teachers' attitudes are considered as a major predictor of the use of new technologies in instructional settings (Albirini, 2006). An analysis of cross-cultural studies carried out in the 1990s revealed that sometimes changes in attitudes are more important than changes in skills for teachers' advances with technology integration (Albirini, 2006). Therefore, we agree with Cheung and Huang (2005) that only when parties involved in the process of learning are making use of ICT to really benefit students' learning, is IT investment justified in terms of a university's scarce resources.

Use of ICT in education has been studied by many researchers in terms of factors that influence the likelihood of implementation success for innovative technologies in an educational setting (e.g. Brett & Nagra, 2005; Cheung & Huang, 2005; Collis et al., 2001; Dewiyanti, Brand-Gruwel, Jochems & Broers, 2007; Goodyear, Jones, Asensio, Hodgson & Steeples, 2005; Granger et al, 2002; Ma, Anderssonw & Streithw, 2005; Masiello et al., 2005; Selim, 2003). Some of them (Collis et al., 2001; Selim, 2003) have introduced a model for the use of ICT in education. They used the Technology Acceptance Model (TAM), which was proposed by Davis (1993) and is shown in Figure 3.1, as a basis for their research. TAM describes that a person's behavioural intention concerning the use of an application is determined by perceived usefulness (the belief that using an application will increase one's performance) and perceived ease of use (the belief that one's use of an application will be free of effort) (Selim, 2003). Since its introduction by Davis, TAM has been widely used for predicting the use of information technologies (Ibid).

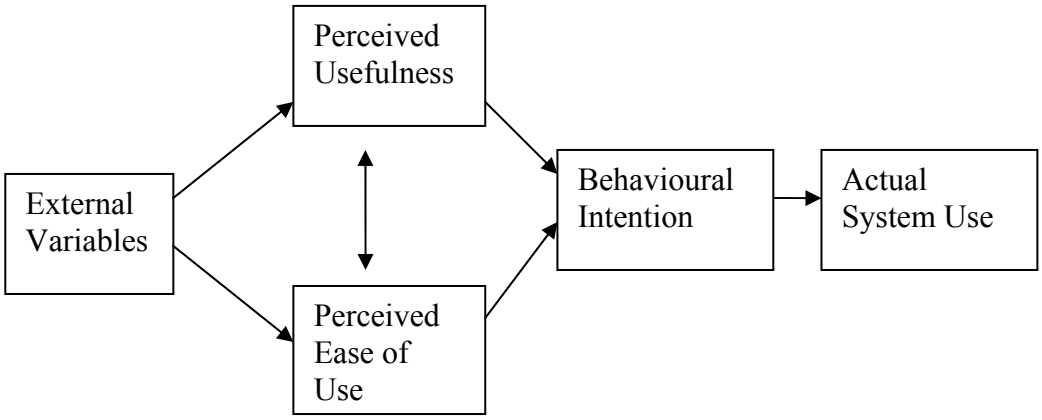


Figure 3.1 Technology Acceptance Model (TAM) (Davis, 1993)

Selim (Ibid) studied the use of a course website by students as a result of its perceived usefulness and ease of use by the students (see Figure 3.2). Course Website Usefulness is defined as the student's belief that using the course website will increase his or her learning performance, efficiency, and effectiveness. Course Website Ease of Use refers to the degree to which the student expects the use of the course website to be free of effort. Course Website Use is the intention to use the course website, which is used as an indicator of the acceptance of course websites.

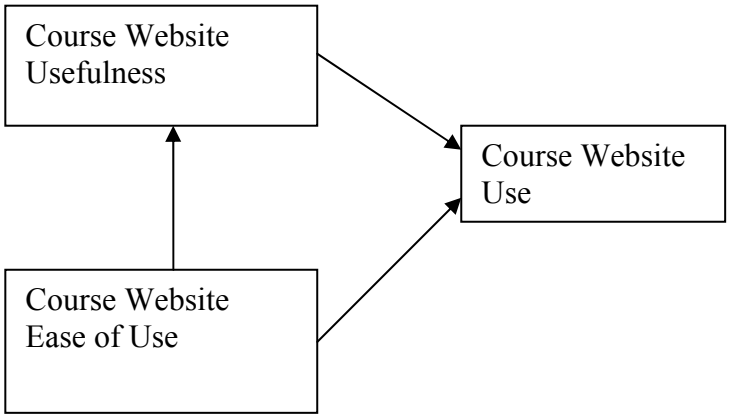


Figure 3.2 Course Website Acceptance Model (CWAM) (Selim, 2003)

Atkinson and Kydd (1997) examined the influence of playfulness, ability to use the computer, ease of use, and usefulness on the use of the World Wide Web. They found that all the considered constructs affected World Wide Web use. Collis et al. (op cit) described an attempt to develop and validate a model focussing on the use of ICT (in particular email, the WWW and videoconferencing) in teaching and learning

activities. They believed that an individual's acceptance of technological innovations in his or her learning-related activities is based upon four rather simple concepts: environment, effectiveness, ease of use, and engagement. These four "E's" were the basis of a conceptual model for prediction of the acceptance of ICT innovations by an individual in an educational context. Perceived usefulness and ease of use were also studied by Cheung and Huang (2005).

Several studies concentrated on barriers to using technology in education (Muir-Herzig, 2004). Findings have shown that barriers include lack of teacher time, limited access and high cost of equipment, lack of vision or rationale for technology use, lack of teacher training and support, and current assessment practices that may not reflect what is learned with technology. The time needed by a teacher to learn how to use the new technology includes the time the teacher needs to become competent with the computer as a personal tool but also as an instructional tool (Brand, 1998, cited in Muir-Herzig, 2004).

Other researchers have highlighted other factors which they think might be influential in teachers' and students' attitudes toward the use of ICT in education. Educational researchers such as Biggs and Ramsden have identified different approaches to learning that can be used to characterise the ways in which students engage in learning tasks and their learning environment (Brett & Nagra 2005). Instructional and learning strategies in connection with computer technology use should be examined (Lowerison, Sclater, Schmid & Abrami, 2006). These authors believe that before assessing the impact of technology on education, one should focus on how teachers teach and how students learn. Race (2003) identified the constructivist learning approach and instructional strategy as being important. Lowerison et al. (2006) also considered learning strategy and instructional technique as two effective factors of students' perceived effectiveness of computer technology use. Paris (2004) studied the effect of prior ICT experience on secondary students' attitudes toward online web-based learning.

Based on the literature mentioned above, we assumed that teachers' use of e-learning environments might be related to teachers' perceptions of the added value of e-learning. These perceptions are, in turn, assumed to be influenced by the teachers' learning and teaching approach, their general interest in and opinion about computer-

assisted learning, their tendency toward web-based education, the time needed to launch, update and maintain a course website, ease of use, and teaching experience. Reviewing well-known scientific journals in the field has shown that the literature lacks investigations of real teacher use of e-learning environments.

Previous research concentrated on teachers' intentions to use e-learning environments or their use of several specific functions of e-learning environments like e-mail or PowerPoint presentations (e.g. Collis et al., 2001; Ong & Lai, 2006;). In this study, however, we focussed on teachers' use of a wide variety of e-learning environmental functions and their opinions about the added value for learning processes. We assessed teachers' use of 25 different e-learning capabilities and features that were available for them (see section 3.2.2 for details). In this respect, we believe that our study provides a more informative and precise picture regarding teachers' use of e-learning environments than previous studies in this field.

Therefore, in the present study we examined the real use of different functions of e-learning environments as indicators of teachers' use of e-learning environments. In this study the following research questions were formulated:

1. Which functions of e-learning environments do teachers use most often?
2. What added value do teachers perceive of e-learning environments?
3. Which factors influence teachers' use of different functions and capabilities of e-learning environments?
4. What are the barriers for implementing e-learning environments in the learning process?

The research presented in this article concerns the use of e-learning at Wageningen University in The Netherlands. Wageningen University and Research Centre (Wageningen UR) is a leading international knowledge institute in the fields of nutrition and health, sustainable agricultural systems, environmental quality and processes of social change. Wageningen UR, with its more than 6000 staff and more than 9000 students provides education in 18 BSc programmes and 30 MSc programmes. Wageningen University's students come from 98 different countries which results in a very diverse and rich environment for discussion and collaboration. The university does research and generates knowledge in the field of life sciences and natural resources. The university specialises in food and food production, plants and animals, environment and

climate, economics and society. In May 2005, based on essential science indicators, the university was in the list of top universities and research centres in the world in terms of publications and citations in the domain of agronomic sciences, plant and animal sciences, and environmental sciences. Developing the use of new technology and ICT in the university was one of the main priorities of the university in the last decade.

3.2 Methodology

3.2.1 Participants

A sample of teachers in MSc programmes at Wageningen University participated in this study. First, we identified the MSc courses in the university study guide of about 80 educational units and groups of Wageningen University. Internships, theses, and capita selecta courses were excluded. In sum, 517 MSc courses were identified. A questionnaire was sent to the contact person or the main teacher of each course. Teachers who were involved in more than one course were asked to fill out the questionnaire for the main course for which they were responsible. The questionnaire was piloted to measure its reliability and to determine whether it was understandable for the target group. Moreover, the validity was improved by consulting and discussing with 7 experts in the field and 10 university teachers. The final version of the questionnaire was sent to all identified university teachers. It was distributed to 404 teachers of many different chair groups and departments of the university. Useable responses were received from 178 teachers, corresponding to a 44% response rate. From the teachers who did not send back the questionnaire, 87 teachers replied that they did not have enough time to fill out the questionnaire and 37 persons mentioned that they did not use e-learning environments in their work. A few teachers refused to participate in the study and stated that they used computers solely for calculation and as tools which were necessary to complete the course. Finally, 26 teachers reported that they were not working for the university anymore. In sum, we think that lack of time needed to fill out the questionnaire and lack of familiarity with e-learning environments were the main reasons for non-response.

3.2.2 Instrument

In order to develop a valid and reliable questionnaire, the following steps were undertaken. First, for each variable, several items and indicators were formulated based on a literature study of previous research in this domain (Chou & Liu, 2005; Goodyear et al, 2005; Madden, Ford, Miller & Levy, 2005; Paris, 2004; Race, 2003; Williams & Pury, 2002; Wu & Hiltz, 2004), consultations with experts in the field, and in-depth interviews with teachers at Wageningen University and colleagues in the chair group of Education and Competence Studies (ECS). Then, we asked a sample of experts in the field to judge the relevancy of those items for the related constructs and their validity. Furthermore, we piloted the first version of the instrument and asked teachers to report on the clarity of the items and the time needed to complete the questionnaire. Second, exploratory factor analysis was conducted to identify factors and latent variables. In the third and final step, a series of confirmatory factor analyses, using LISREL 8.72, were carried out to see whether each set of items could accurately capture the relevant construct.

The first part of the final questionnaire concentrated on general information about the teachers, their workload and their teaching experience. The second part consisted of items for all factors in this study. The last part consisted of 25 questions about teachers' use and perceived added value of 25 different features and capabilities of e-learning environments. With most questions, teachers were asked to indicate the level of their agreement or disagreement with the statements in the questionnaire on a five point scale (1: strongly disagree; 5: strongly agree). Moreover, they were asked to specify to what extent they used different features of e-learning environments in performing their teaching tasks and to what extent they believed in the added value of each feature.

3.2.3 Data analysis

Because of the exploratory nature of this research, exploratory factor analysis using principal components factor extraction and VARIMAX rotation was conducted to identify the factors in our research model. The following 4 commonly used decision rules were applied to identify the factors (Hair, Anderson, Tatham & Black., 1995): 1) minimum Eigenvalue of 1; 2) minimum factor loading of 0.4 for each indicator item; 3)

simplicity of factor structure; and 4) exclusion of single item factors. Items that did not fulfil these rules were trimmed. Subsequently, the reliability of each factor was evaluated by determining the internal consistency of the indicator items of each construct by using Cronbach's alpha. Moreover, using LISREL 8.72, a series of confirmatory factor analyses was performed to further examine the items for each factor and construct. A joint domain factor analysis was performed, including all the items used to develop the research constructs. The result provided significant support for factorial and discriminant validity of the measurement scales. Furthermore, the data were analyzed using the bivariate correlation test. The bivariate correlation test computes Pearson's correlation coefficient, and measures how all measured constructs and extracted factors are related. Finally, structural equation modelling was carried out to see how identified factors can explain teachers' use of e-learning environments. Kelloway has suggested that the use of the chi-square test is reasonable when the study involves a large sample (Wen, Tsai, Lin & Chuang, 2004). Therefore, we decided not to use chi-square in this study because of the number of participating teachers (N=178). However, according to Joreskog and Sorbom (cited in Wen, Tsai, Lin & Chuang, 2004), as the chi-square is very sensitive to sample size, the degree of freedom can be used as an adjusting standard by which to judge whether the chi-square is large or small. Therefore, the chi-square per degree of freedom and other types of goodness-of-fit measures including Root Mean Square Error of Approximation (RMSEA), Normed Fit Index (NFI), Non-Normed Fit Index (NNFI), Comparative Fit Index (CFI), Root Mean Square Residual (RMR), Goodness of Fit Index (GFI), and Adjusted Goodness of Fit Index (AGFI) were used to evaluate the properness of the solution and goodness-of-fit of the model.

3.3 Results

The results of this study are explained in several sections. First, teachers' use of different capabilities and functions of e-learning environments and teachers' perceptions of their added value are explained. Next, teachers' general opinions about e-learning environments and factors which might prevent them from utilizing these learning environments are discussed. Then, the factor structure of all constructs and their relationships with Teachers' Perceived Added Value of E-learning Environments (AV)

and Teachers' Use of E-learning Environments (USE) is described. Finally, the results of structural equation modelling are explained.

3.3.1 Teachers' Use of E-learning Environments (USE)

As mentioned before, 25 different functions and capabilities of e-learning environments in universities had been identified. Teachers were asked to specify to what extent they used these functions and capabilities as part of their teaching tasks on a five-point scale (1: Not at all; 5: Usually). Their answers to these questions in combination (factor score) led to the dependent variable of this study, USE.

Table 3.1 presents the descriptive statistics of the use of several selected functions and capabilities of e-learning environments. "Presenting course material and literature" (M= 4.31), "PowerPoint presentation" (M= 4.11) and "E-mail and mailing list" (M= 4.07) were used most frequently, while "Voice conferencing" (M= 1.13) and "Shared whiteboard" (M= 1.16) were used least frequently. "Online discussion" (M=1.36) and "Online collaboration" (M=1.46) were also not used very frequently.

Table3.1 Descriptive statistics (percentages, M, SD) of teachers' use of selected features and capabilities of e-learning environments (USE)

	Feature	1	2	3	4	5	M	SD
1	Presenting course material and literature	5.1	1.1	11.9	20.5	60.8	4.31	0.08
2	PowerPoint presentation	8.0	5.1	9.1	22.2	53.4	4.11	0.10
3	E-mail and mailing list	5.1	2.8	19.9	23.9	47.7	4.07	0.09
4	Course information	5.1	4.0	18.2	33.0	39.2	3.98	0.08
5	Course calendar and schedule	13.6	6.3	14.2	30.1	35.2	3.67	0.10
6	Course announcement and news	10.8	8.0	30.7	21.0	28.4	3.49	0.10
7	Online collaboration	73.3	9.7	14.2	1.1	1.1	1.46	0.07
8	Online discussion	75.0	13.6	10.2	0.6	0	1.36	0.05
9	Application sharing	79.5	5.1	5.7	2.8	1.1	1.31	0.06
10	Online test	85.8	4.5	4.5	1.1	2.8	1.29	0.06
11	Videoconferencing and net-meeting	80.7	9.7	7.4	1.1	0	1.28	0.05
12	Shared whiteboard	85.8	2.8	2.8	0.6	1.1	1.16	0.05
13	Voice conferencing	89.2	7.4	2.8	0	0	1.13	0.03

1= Not at all; 2= Rarely; 3= Sometimes; 4= Often; 5= Usually
M= Mean; SD= Standard Deviation

3.3.2. Teachers' Perceived Added Value of E-learning Environments (AV)

The same procedure was followed to determine AV. Teachers were asked to indicate on a five-point scale (1: Not at all; 5: Very High) to what extent each function and capability of e-learning environments had added value for students' learning. Again, the factor score of this construct was determined. As shown in Table 3.2, "Presenting course materials and literature" (M=3.97) was believed to have the most added-value, followed by "Course information" (M=3.77) and "PowerPoint presentation" (M=3.74). According to the teachers, "Voice conferencing" (M=1.19), "Shared whiteboard" (M=1.28) and "Videoconferencing and net-meeting" (M=1.31) had the least added value. The reported added value of "Online discussion" (M=1.69) and "Online collaboration" (M=1.72) was low as well.

Table 3.2 Descriptive statistics (percentages, M, SD) of teachers' perceived added value (AV) of selected features and capabilities of e-learning environments

	Feature	1	2	3	4	5	M	SD
1	Presenting course materials and literature	7.4	4.5	16.5	26.7	44.9	3.97	1.21
2	Course information	6.8	5.7	19.3	39.8	28.4	3.77	1.13
3	PowerPoint presentation	10.2	5.7	17.6	33.0	33.5	3.74	1.27
4	E-mail and mailing list	13.6	11.4	17.0	24.4	33.5	3.53	1.41
5	Course calendar and schedule	13.1	7.4	17.0	38.6	23.9	3.53	1.29
6	Announcements (news)	11.9	10.2	19.9	30.7	27.3	3.51	1.31
7	Online simulation programs and software	46.6	12.5	16.5	13.1	11.4	2.30	1.45
8	Online collaboration	53.4	31.3	5.7	9.7	0	1.72	0.95
9	Computer-based test	60.8	18.8	10.2	8.5	1.7	1.72	1.06
10	Online discussion	56.3	26.7	9.1	7.4	.6	1.69	0.95
11	Online test	65.3	19.3	6.3	8.0	1.1	1.60	0.99
12	Videoconferencing and net-meeting	81.3	9.7	6.3	2.8	0	1.31	0.71
13	Shared whiteboard	85.2	6.8	4.0	2.3	1.7	1.28	0.79
14	Voice conferencing	85.8	9.1	9.0	0	0	1.19	0.51

1= Not at all, 2= A little, 3= Moderately, 4= High, 5= Very high

3.3.3 Teachers' general opinions about e-learning environments and impeding factors

We also asked participants to give their opinions about e-learning in general and about impeding factors that might prevent them from using ICT in their teaching. As can be seen in Table 3.3, 43.1 % of the teachers believed that the quality of students' learning in their course was improved by using computers (M=3.10) and 28.5 % of them had the same opinion about the internet (M=2.64). In sum, 73.3 % of the teachers reported that they were not able to find useful and relevant computer software to support their teaching tasks (M=3.74) and 65.9 % reported a lack of useful and relevant websites in this respect (M=3.60). Although 59.1 % of the teachers disagreed with the statement that e-learning environments had no added value for their course (M=2.26), 52.9 % of them preferred face-to-face teaching (M=3.28). Some teachers mentioned technical infrastructure (M=1.88), difficulty of working with e-learning environments (M=1.78) and (lack of) time (M=2.79) as impeding factors.

Table 3.3 Descriptive statistics (percentages, M, SD) of teachers' opinions about selected statements

	Abbreviated items	1	2	3	4	5	M	SD
1	Quality of students' learning in my course is improved by using computers.	14.8	18.8	23.3	27.8	15.3	3.10	1.29
2	Quality of students' learning in my course is improved by using internet.	21.0	30.1	20.5	20.5	8.0	2.64	1.24
3	Lack of useful and relevant computer software to support my teaching tasks.	8.5	9.1	9.1	46.6	26.7	3.74	1.20
4	Lack of useful and relevant websites to support my teaching tasks.	9.7	12.5	11.9	40.3	25.6	3.60	1.26
5	I think e-learning environments have no added value for my course.	45.5	13.6	18.2	15.3	7.4	2.26	1.36
6	Time.	22.7	22.2	19.9	23.9	11.4	2.79	1.34
7	Difficulty of working with e-learning environments.	58.0	19.3	11.9	8.0	2.8	1.78	1.11
8	I prefer face-to-face teaching.	19.9	8.5	18.8	29.0	23.9	3.28	1.43
9	Technical infrastructure.	55.1	18.8	15.9	4.0	6.3	1.88	1.19

1= Strongly disagree, 2= Disagree, 3= Neither agree nor disagree, 4= Agree, 5= Strongly agree

3.3.4. Factor structure of constructs

As mentioned before, a three-step procedure was followed to identify factors which might contribute to teachers' use of e-learning environments. First, based on a literature study, a pilot study, and in-depth interviews with teachers and experts, statements and items were formulated to gain information about the teachers' teaching and learning approach and their attitude toward, and opinion about, e-learning environments. They were asked to indicate to what extent they agreed or disagreed with the statements and items of the questionnaire on a five-point scale (1: strongly disagree; 5: strongly agree). After that, an exploratory factor analysis and a confirmatory factor analysis were carried out (see Methodology section).

Running exploratory factor analyses, we were able to extract 5 factors from all of the 38 items of the instrument, accounting for 61.54 % of the total variance. Cronbach's alpha reliability index indicated that all identified factors were reliable. Table 3.4 shows all factors with their Eigenvalue, explained variance, and Cronbach's alpha.

Table 3.4 Identified factors in exploratory factor analysis with number of items, Cronbach alpha, Eigenvalue, and percentage of explained variance

Factor	Label	Number of Items	Cronbach alpha	Eigenvalue	Explained Variance (%)
1	Knowledge Construction Teaching and Learning Approach (KC)	4	.73	3.76	19.78
2	Teachers' Opinion about Computer-Assisted Learning (CAL)	4	.72	2.23	11.74
3	Teachers' Opinion about Web-based Activities (WA)	4	.70	2.48	13.03
4	Ease of Use (Difficulty)	4	.70	1.71	9.01
5	Time	3	.86	1.52	7.98

Except for the fifth factor "Time", the factor structure derived from the exploratory factor analysis was confirmed with some minor changes by the confirmatory factor analysis (see Table 3.5).

Table 3.5 Structure of the factors identified in confirmatory factor analysis

	Item	Factor loading	T-value
	Factor 1: Knowledge Construction Teaching and Learning Approach (KC)		
1	Learning should involve social negotiation and mediation.	.51	5.41
2	Students should construct their own knowledge through their activities in the course.	.62	6.58
3	Teachers primarily are guides and facilitators of learning, not instructors.	.73	8.53
	Factor 2: Teachers' Opinion about Computer-Assisted Learning (CAL)		
4	Quality of students' learning in my course is improved by using computers.	.74	11.21
5	I really enjoy using computers to support my teaching practice.	.79	15.12
6	Using computers for learning costs students important learning time.	-.52	-5.88
7	I prefer not to use computers to support my teaching practice.	-.72	-12.76
	Factor 3: Teachers' Opinion about Web-based Activities (WA)		
8	Students learn more doing web-based activities than activities on paper.	.51	4.41
9	Finding the way on a website is easier than finding the way in a book.	.53	6.03
10	I prefer web-based activities to activities on paper.	.76	7.46
	Factor 4: Ease of Use (Difficulty)		
11	Designing, updating, managing, and maintaining a website is difficult.	.72	10.07
12	Using e-learning environments is difficult for students.	.64	8.73
13	Using e-learning environments is complicated for teachers.	.75	11.61
14	E-learning environments are not clear and understandable.	.43	6.08

3.3.5. Bivariate correlations

To examine to what extent all measured constructs in this study were related to USE and AV, we used bivariate correlation tests. As can be seen in table 3.6, teachers' teaching and learning approach aimed at knowledge construction (KC) is positively

correlated with USE and AV. The same holds for their opinion about computer-assisted learning (CAL): the more teachers were positive about computer-assisted learning, the more they used e-learning environments and perceived the added value of these environments. Although no significant correlation was found between teachers' opinions about web-based activities (WA) and their actual use of e-learning environments, results indicated a fairly high correlation between WA and AV. Ease of use (perceived difficulty) appeared to be negatively correlated with both USE and AV. Teachers' previous experience with e-learning environments (E-Experience) had a rather high positive relationship with the actual use and the perception of the added value of e-learning environments. No significant relationships were found for Time and Teaching Experience (T-Experience).

Table 3.6 Correlations between all identified factors and TU-EE and TP-AVEE

	Teachers' Use of E-learning Environments (TU-EE)	Teachers' Perceived Added Value of E-learning Environments (TP-AVEE)
Knowledge Construction Teaching and Learning Approach (KC-TLA)	.141(*)	.237(**)
Teachers' Opinion about Computer-Assisted Learning (TO-CAL)	.416(**)	.430(**)
Teachers' Opinion about Web-based Activities (TO-WA)	.074	.406(**)
Ease of Use (Difficulty)	-.236(**)	-.147(*)
Time	-.101	-.069
Teachers' Use of E-learning Environments (TU-EE)	1.000(**)	.593(**)
Teachers' Perceived Added Value of E-learning Environments (TP-AVEE)	.593(**)	1.000(**)
Previous Experience with E-learning Environments	.499(**)	.310(**)
Teaching Experience	.009	.074

*p<.05
**p<.01

3.3.6 Structural model

As mentioned in the previous section, the results of the bivariate correlation tests revealed that, except for Time and Teaching Experience, all other variables somehow were related to AV and USE. However, to gain an in-depth insight, we were more interested in exploring a model that could explain the effect of all the abovementioned factors on AV and USE. Therefore, based on the conceptual framework of the study and the extracted factors, a model was developed (see Figure 3.3). This section describes the results of structural equation modelling (SEM).

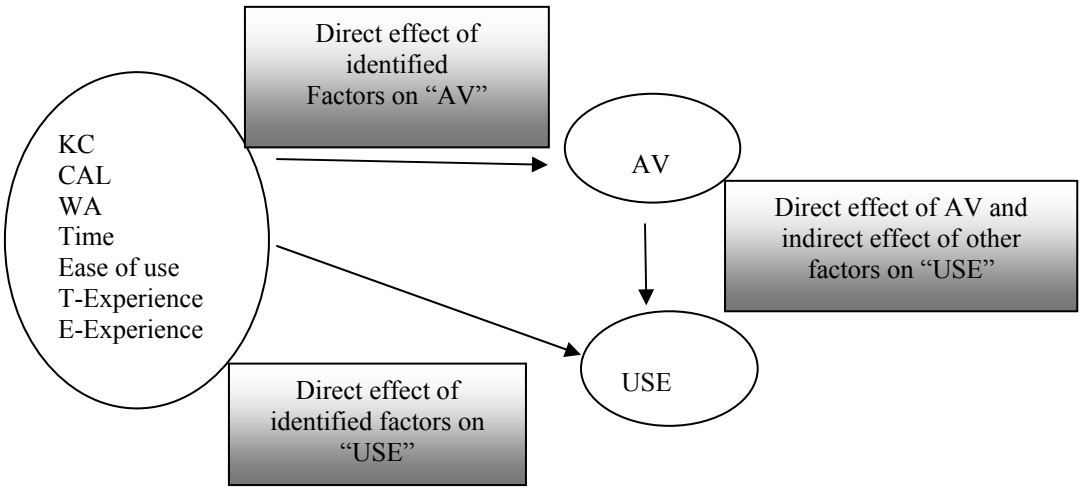


Figure 3.3 Final conceptual model of factors which might contribute to Teachers' Perceived Added Value of E-learning Environments (AV) and Teachers' Use of E-learning Environments (USE)

In conducting structural equation modelling, the 4 extracted factors in the confirmatory factor analysis (see Table 3.5) were used as predictor variables, AV as the intermediate, and USE as the outcome variable to examine the proposed structural relationships between variables. The final proper solution and structural model of this study is presented in Figure 3.4.

To evaluate the final model, the modification indices suggested by LISREL were taken into consideration. The ratio (K^2/DF) is 3.33, which is acceptable. The RMSEA and RMR values are 0.062 and 0.084, indicating a good fit. Furthermore, NFI (0.90), NNFI (0.94), GFI (.89), AGFI (0.82), and CFI (.96) are all within acceptable levels. The estimated parameters and the corresponding t-values of the final research model are shown in Table 3.7 and Figure 3.4.

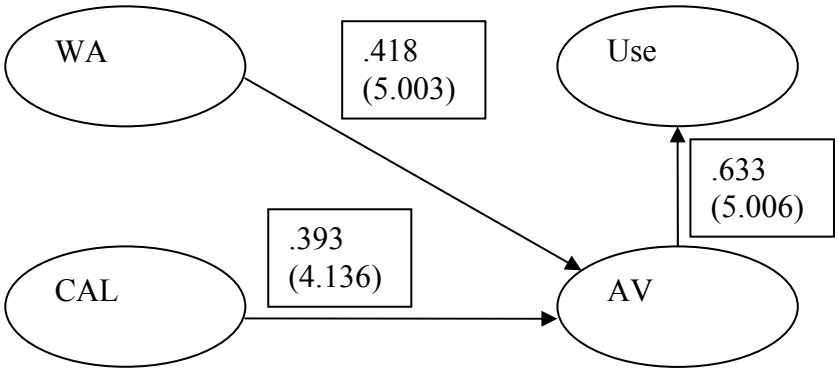


Figure 3.4 Model of Teachers' Use of E-learning Environments (USE Model)

As illustrated in Table 3.7, the results indicate that the explained variance of USE is 0.427; Teachers' Opinion about Web-based Activities *(*WA) and Teachers' Opinion about Computer-Assisted Learning (CAL) explained .178 of it. Also WA and CAL explain .416 of variance in AV. As illustrated in Figure 3.4 and Table 3.7, the direct paths from WA and CAL to AV and from AV to USE are significant. Furthermore, the indirect effects of WA and CAL on USE are significant.

Table 3.7 Path coefficients and percentages of variance explained by the final model

Path			Path Coefficient	T-value	R^2	Result
WA	→	AV	.418	5.003	.416	Accepted
CAL	→	AV	.393	4.136		Accepted
AV	→	USE	.633	5.006	.427	Accepted
WA	→	USE	.264	3.742	.178	Accepted
CAL	→	USE	.249	2.594		Accepted

3.4 Discussion

The purpose of this study was to investigate teachers' use of e-learning environments as teaching and learning tools in higher education and to explore factors which explain teachers' use of those e-learning environments. In the previous paragraph, we introduced the Teachers' Use of E-learning Environments Model (USE Model) which consists of Teachers' Opinions about Web-based Activities (WA) and Teachers' Opinions about Computer-Assisted Learning (CAL) as predictors, and Teachers' Perceived Added Value of E-learning Environments (AV) as the mediating variable. Using structural equation modelling techniques, the USE Model was validated and the results indicated a good fit to the data. The relationships between the constructs from the USE Model were supported, accounting for 43% of the total variance in teacher use of e-learning environments. In the following sections, the findings of our study are discussed in relation to the research questions formulated in the introductory paragraph of this chapter.

3.4.1 Which functions of e-learning environments do teachers use most often?

In line with Lowerison et al.'s (2006) findings, the results of our research have shown that ICT was used more frequently for communication (e.g. e-mail), presentation (e.g. PowerPoint) and information (e.g. putting the reader and related literature on the website of the course) purposes. To be more specific, we found that general course information functions (like course calendar and schedule and course announcement and news), content management functions (like presenting course material and literature and PowerPoint presentations) and communicating functions (like mail and mailing list) are used most frequently. Other communication functions (like video conferencing, chatting, and voice conferencing) and collaboration functions (like online discussion, online collaboration, shared whiteboard, and application sharing) are the least used features of e-learning environments. Although some very advanced functions of e-learning (e.g. interactive course modules, interactive online simulation programs) are reported, we can claim, based on the results mentioned above, that e-learning is still at an early stage of its use in the university. It can be concluded that e-learning is not well-integrated into higher level learning processes and that teachers just use the superficial capabilities of e-learning tools.

3.4.2 What added value do teachers perceive of e-learning environments?

Comparable to the pattern of the actual use of e-learning environments mentioned above, our results indicate that teachers believe that presentation of course materials and literature, presentation of information about the courses, PowerPoint presentations, and E-mail have the most added value for teaching and learning processes. Voice conferencing, shared whiteboard, and videoconferencing and net-meeting are believed to have the least added value for teaching and learning processes. The assumed added value of online discussion and online collaboration is low as well.

3.4.3 What are the barriers for implementing e-learning environments in the learning process?

Our results reveal that teachers believe that they do not face serious technical problems and they are able to work with ICT tools and e-learning environments. Probably, at this university, more attention has been paid to the technological aspects of e-learning than to the pedagogical aspects. Teachers are satisfied with the facilities and connectivity but they feel that they do not have access to relevant software, websites and content. Most teachers believe that computers and the internet have added value for teaching and learning processes but they themselves need to learn (and want support) how they can use the different functions of e-learning in their own courses.

3.4.4 Which factors influence teachers' use of different functions and capabilities of e-learning environments?

As discussed in detail in the results section, while conducting exploratory and confirmatory factor analysis, we were able to extract different factors like Knowledge Construction Teaching and Learning Approach (KC), Teachers' Opinion about Computer-Assisted Learning (CAL), Teachers' Opinion about Web-based Activities (WA), Ease of Use (perceived difficulty), and Time which might contribute to the explanation of teachers' actual use of e-learning environments (USE). Consistent with previous studies (Collis et al., 2001; Selim, 2003), we found that perceived usefulness and added value of e-learning environments play a critical role in this respect. We can conclude that teachers' perceptions of e-learning environments directly influence the

actual use of e-learning environments and account for a substantial part of the variance in actual use. Moreover, our results have shown that teachers' previous e-learning environment experience is also correlated with their use of e-learning environments. In contrast with our expectations, we cannot conclude that the time needed for working with e-learning environments has an effect on, nor even has any relation to, both teachers' perceptions of the added value and their actual use of e-learning environments. Furthermore, our study indicates that teachers' attitudes and opinions about computer-assisted learning and web-based activities are effective in shaping their attitudes toward e-learning environments. In other words, teachers' attitudes toward e-learning environments are intertwined with their general feelings about computers and the web. Although the teacher's learning and teaching approach is not included in the final model, bivariate correlation does disclose its positive relations with both the actual use and the perceived added value of e-learning environments. In addition, in contrast to our expectation and Madden et al's findings (2005), we cannot conclude that less experienced teachers use e-learning environments to a greater or lesser extent than teachers with more general teaching experience.

3.5 Conclusion

In sum, we were able to identify 5 different factors shaping teachers' opinions about e-learning environments. We labelled them as Knowledge Construction Teaching and Learning Approach (KC), Teachers' Opinion about Computer-Assisted Learning (CAL), Teachers' Opinion about Web-based Activities (WA), Ease of Use (perceived difficulty), and Time. Studying all those factors together with teachers' general teaching experience and their previous experience with e-learning environments, we found that teachers' previous experience with e-learning environments, WA, CAL, and ease of use can help us to explain teachers' perceptions of the added value and usefulness of e-learning environments and their actual use of these environments.

Results of our study have shown that, in line with Davis' Technology Acceptance Model (TAM) (Figure 3.1) and similar to Selim's Course Website Acceptance Model (CWAM) (Figure 3.2), ease of use and usefulness (we prefer to label this as perceived added value) can be used to predict teachers' actual use of e-learning environments. However, those parts of our results indicate that teachers' previous

experience with e-learning environments and their opinion about web-based activities can also help us to explain their use of e-learning environments.

The results of our LISREL analysis (Figure 3.4) enable us to say that teachers' perceived added value of e-learning environments is part of their general attitude and opinion about computers and the web. In other words, the actual use of these environments is, to a high extent, -almost two thirds of the variance- influenced by their opinions about computers and the web. At first glance, these results seem obvious because e-learning, as one of the main ICT applications, is affected by the general feelings of teachers regarding ICT. Though the question remains that while computers and the web, as technological aspects of e-learning environments, have a direct impact on the perceived added value of e-learning environments, how can we explain the impact of instructional and pedagogical aspects of those learning environments? Why do technological aspects still play the main role? Do we need more activities to integrate e-learning environments in education? Do we need to develop new approaches that see e-learning as a new learning paradigm and not just as a tool which facilitates the traditional way of learning? Does this mean that we can claim that teachers' attitudes toward computers, and the web -technological aspects- are more important than their learning approach and other instructional and pedagogical aspects? Apparently, further studies are needed to shed light on the unexplained part of the variance of teachers' use of e-learning environments.

At this moment, two limitations of this study need to be acknowledged. One limitation is that we focused on courses at MSc level and, thus, we cannot generalize our findings for the whole university. Also, some courses were taught by more than one teacher and we sent the instrument to just one of them. This might have affected the results to some extent.

Nevertheless, in our opinion, the results of this study have several important implications for educational practice. First, we should note that, although well-arranged technical support and reliable infrastructure are important, they are not enough. In the current study, the Teachers' Use of E-learning Environments Model (USE Model) was identified. Based on this model, teachers' perceptions of the added value of e-learning environments account for around half of the variance in the actual use of these environments. This indicates that any program for enhancing the actual use of e-

learning environments should focus on teachers' attitudes. Second, a teacher's first-hand experience has a positive effect on his or her use of e-learning environments. Therefore, teachers should be encouraged to try e-learning in their own courses. For example, they could be assisted in preparing useful content for their courses. In this way, the use of e-learning environments in higher education could be fostered.

Acknowledgement

We would like to thank all teachers who contributed to this study and all persons who helped us to improve and validate the instrument. The research reported in this article was financially supported by the Ministry of Science, Research, and Technology (MSRT) of the Islamic Republic of Iran. The authors want to express their gratitude for this support. Finally, we would like to thank Dr. Ivo van der Lans for his advice and assistance regarding data analysis and Kate Collins for editing this manuscript.

Chapter 4

Experiences of on-campus students in performing tasks in asynchronous computer-supported collaborative learning environments*

* Submitted as: Mahdizadeh, H., Mulder, M. & Biemans, H. Experiences of on-campus students in performing tasks in asynchronous computer-supported collaborative learning environments.

Abstract

A study was conducted with 148 on-campus university students in 7 courses on the relationships between student attitudes towards different varieties of learning, their satisfaction with, and perceived learning from, performing tasks in asynchronous computer-supported collaborative learning environments (ACSCLE). The results show that 54% of the students agreed with the statement that ACSCLE could facilitate student learning, 49.3% of the students believed that performing tasks in ACSCLE improved their learning, and 44% of the students mentioned that they were satisfied with their learning. A preliminary regression analysis with perceived effects of learning tasks in the ACSCLE as the dependent variable showed four factors that were significant: attitude towards e-learning (β=.585), ease of use (β=.301), self-confidence (β=.154), and attitude regarding face-to-face learning activities (β=.147) (total R^2=.701; p=.000). A second regression analysis with student satisfaction with the ACSCLE as the dependent variable showed again that attitude towards e-learning (β=.666), ease of use (β=.279), and self-confidence (β=-.137) were significant. Also, student opinions about web-assisted learning activities (β=-.164) and previous experience with e-learning and ACSCLE (β=.097) were significant (total R^2= .749; p=.000). The study has major implications for on-campus learner support in asynchronous online collaborative course environments.

Key words: Electronic learning (e-learning); computer-mediated communication; asynchronous CSCL environment; collaborative learning; computer-supported collaborative learning; knowledge construction

4.1 Introduction

Constructivism in general (and social constructivism in particular) emphasizes interaction. Based on this theory, learning environments should facilitate interaction and negotiation in learning processes. From this perspective, instruction should facilitate student-to-student as well as student-to-teacher interactions and provide students with opportunities to negotiate ideas, conduct inquiry and reflect on their thoughts.

A major strength of collaborative learning (CL) is that it can enhance multi-perspective discussions about given information, analyses of problems, and elaborations and refinements to reconstruct and co-construct knowledge (Veerman, 2000). Veldhuis-Diermanse (2002, p. 13) defined collaborative learning as '…a learning situation in which participating learners exchange ideas, experiences and information to negotiate about knowledge in order to construct personal knowledge that serves as a basis for a common understanding and a collective solution to a problem.' Dillenbourg (1999, p. 5) stated that '…collaborative learning describes 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. Hence, a general concern is to develop ways to increase the probability that some types of interaction occur.' Qin, Johnson and Johnson (1995) found that in 87% of the studies they included in their meta-analysis, cooperation and collaboration showed better learning results. Based on another meta-analysis of the research in this field, Van der Linden, Schmidt and Renshaw (2000) concluded that cognitive achievement of students working in the field of cooperative and collaborative learning is usually higher than that of students who are learning in traditional, individual or competitive educational programs. Furthermore, Bossert (1998) stated earlier that cooperation and collaboration can improve motivation, self-confidence and mutual relations in student groups.

Numerous studies have suggested that learners' perceptions of learning environments will guide their attitudes, behaviour and ways of knowledge construction in that environment (Dart et al., 1999; Fraser, 1998). Paris (2004) has stated that teachers have long known that there is a positive relationship between student attitudes towards learning situations and their reactions to them, and that they (the teachers) have the 'dynamic task' to improve the curriculum and the teaching and learning process, to

influence the attitudes of students in a positive way, and thus, influence the learning results. Lowerison (2006) goes on to stipulate a positive relationship between student perceptions of education and educational effectiveness, more specifically between the use of computer technology in a course and perceived course effectiveness.

Student attitudes toward the use of information and communication technology in education was the topic of several studies, and factors such as perceived added value, perceived usefulness, perception of learning, student characteristics, learning experiences, learning strategies, instructional techniques, actual computer use in the course, ease of use, student confidence or lack of confidence, and satisfaction were studied by researchers in the field (Anandarajan, Simmers & Igbaria, 1998; Cheung & Huang, 2005; Collis & Pals, 2000; Dewiyanti et al., 2004; Goodyear, Jones, Asensio, Hodgson & Steeples, 2005; Laurillard, 2002; Shuell & Farber, 2001; Wen, Tsai, Lin & Chuang, 2004). On the other hand, Ma et al. (2005) stated that, although attitude appeared to be a significant determinant of behavioural intention in various studies in social sciences, and that it was also a strong mediator for motivational variables that predict the behavioural intentions of computer technology use, recent studies have shown that the importance of attitude in behavioural intention to computer technology use is decreasing. Nevertheless, it can be expected that the use of computer technology increases the effectiveness of learning and instruction as perceived by students, particularly when this use of computer technology stimulates active learning and reflection (Lambert & McCombs, 1998).

Asynchronous online discussion and collaboration is one of the e-learning functions and computer applications that facilitate processes of collaboration and learning. In asynchronous online discussion and collaboration, in contrast to face-to-face discussion and collaboration, students are required to put their thoughts in writing. Theoretically this leads to more reflection on the subject and a deeper involvement in the particular subject. The results of these processes are permanently recorded in the environment. Students and teachers can access these products of discussion and articulation at any time (Wu & Hiltz, 2004).

Based on this explorative research literature review, we conducted a study to better understand how an asynchronous computer-supported collaborative learning

environment and learning in that environment is perceived by groups of on-campus students in higher education. The specific questions addressed in this study were:

1. Are on-campus students satisfied with performing learning tasks in this asynchronous computer-supported collaborative learning environment (ACSCLE)?
2. Do on-campus students perceive any added value of performing learning tasks in an asynchronous computer-supported collaborative learning environment (ACSCLE)?
3. What factors influence student satisfaction with, and perceived learning in, this asynchronous computer-supported collaborative learning environment (ACSCLE)?

4.2 Methodology

4.2.1. Subjects

The subjects who participated in this study included a total of 151 graduate and undergraduate students who were enrolled in 7 courses over two study years at Wageningen University in the Netherlands. Table 4.1 shows the course titles and descriptions and the tasks and activities that participants performed in the asynchronous CSCL environments of the courses. To facilitate communication within groups, the courses used 'Blackboard' as an asynchronous online collaboration environment.

During the first class of the courses the objectives of the study were introduced to the students and they were invited to participate. All students were divided into small groups consisting of 4 to 6 persons and were asked to do 2 to 3 different online collaborative tasks over 5 to 8 weeks. Except for the course 'Education in developing and changing societies', participation in the online collaborative activities was part of their final mark. However, students were free to choose another task instead of online collaborative work if they were not able (for example because of RSI) or willing to participate in the study. At the end of each period (study periods typically last 8 weeks) students were requested to complete a questionnaire regarding their experiences with the online collaborative learning activities. A total of 148 students responded to the survey representing a 98.5% response rate. Having performed 2 to 4 different activities

in the asynchronous CSCL environment of the course -which might be considered as one of the advantages of the current study as compared to previous studies- students were able to assess the added value of those environments in their learning processes. We do believe that students' perceptions, which were based on performing different activities in asynchronous CSCL environments, can provide a clear picture of the advantages and disadvantages of performing tasks in such learning environments in the eyes of the students.

Since Wageningen University is a very international university, participants came from sixteen different countries, however, the majority of the students came from the Netherlands; 97% had access to a computer with a high-speed internet connection at home. They were all competent in working with computers and the internet and received specific instruction about asynchronous online collaborative learning tasks during the first week of each period. The language of all courses was English, which was the second language for 91% of participants. However, most of them claimed they did not have problems in communicating in the English language. The students were enrolled in programs in the fields of environmental, animal, plant, food and social sciences.

Internet experience of respondents varied from 4 to 10 years and 84% of them had experienced an e-learning environment before their study. Whilst 37% of participants had been involved in a general online forum for their own interest before their study, just 26% of them had experienced an online discussion and collaboration environment for learning purposes.

Table 4.1 Course descriptions and student tasks and activities in the asynchronous CSCL environment of the courses

	Course title	Course content	Tasks and activities done in the asynchronous CSCL environment of the course
1	Education in developing and changing societies	The course aims at supplying the participants, at an introductory level, with knowledge of, and insight into, the functioning of education within processes of development, especially with regard to the complex relations between education and its socio-cultural, political, economic and technological context in order to determine the possibilities and limits within which education can exercise its influence on development. The international setting of this course promotes discussion about the cultural background of knowledge and information exchange.	-Students conducted an asynchronous online debate and discussion on three different themes which were taken from the 47th session of the International Conference on Education (ICE), which was held in Geneva, 8-11 September 2004. -Students were asked to write a paper in small groups on the debated themes based on their own experiences, opinions, ideas, attitudes or they could elaborate one of the themes and apply it to a particular country or region, or a comparison of two countries or regions.
2	Applied Environmental Education and Communication	During the course students explore the instrumental and the emancipatory use of environmental education, communication, participation and whole system re-design in moving towards sustainable lifestyles, organizations and systems. Special attention is paid to the methodological aspects of environmental education and communication. Students are exposed to and involved in the design, implementation and evaluation of a public environmental awareness campaign, a community-based social environmental learning project and a series of education for sustainable living learning activities for both formal and non-formal education settings.	-Each week students were asked to discuss an article about the main topic of the course. -Each group of students was asked to summarize 2-3 articles or book chapters about the topic of the course and formulate 1-2 questions about them and take the lead in a group discussion about the questions. -Each group was asked to conduct a mini case study on an environmental issue in three steps: first exploring and defining an environmental issue and challenge then exploring different strategies to cope with the challenge and selecting and advising the best and most appropriate strategy and a way to evaluate the impact of the strategy. - Participants were asked to give feedback on different steps of other groups' mini case study as the period (semester) progressed via asynchronous CSCL environment of the course and help them to improve their solution
3	Human Resource Development/ Learning and Career	This course focuses on the theory and practice of human resource development in profit and non-profit organizations. Special attention is given to concepts of lifelong learning, organizational learning, learning in teams, and	-Students were asked to do a mini case study in three steps: first they were supposed to select an organization and explore major and radical changes which might affect it, and to choose one of the major changes, and explore its consequences for the selected organization. In the second step they were asked to investigate different HRD strategies that can help the organization to face the chosen major change and suggest a key HRD

	Development	individual learning. Organizational development is seen as a combination of individual and collaborative learning. Human resource development is viewed from the micro (individual), intermediate (institutional) and macro (societal) level.	strategy as the strategic solution for the selected organization to prepare itself to face the chosen major change and when actually facing the chosen major change. Finally at the third step they were asked to finalize their strategic solution based on feedback that they received from other students. -Participants were asked to give feedback on different steps of other groups' mini case study as the period (semester) progressed via asynchronous CSCL environment of the course and help them to improve their solution.
4	Human Resource Management	This course focuses on the theory and practice of human resource management (HRM) in profit and non-profit organizations. Special issues addressed during the course are managing diversity, performance analysis and management, employee relations, and managing an intercultural workforce.	-For three weeks students were asked to discuss an article about the main topic of the course. -Each group of students was asked to read 1-2 articles or book chapters about the topic and then formulate 2 questions about them. Other students were supposed to discuss the questions. -Students were asked to conduct a SWOT (strengths, weaknesses, opportunities, and threats) analysis on a real organization through the asynchronous CSCL environment of the course. -Each week students were asked to discuss a theme related to the topic of the course on that specific week. -Students were asked to do a mini case study on a real HRM-related crisis of a company which was introduced by the HRM department of the company itself; in three steps: first they were supposed to investigate and analyze HRM approaches of the company and explore different aspects of the crisis. In the second step they were asked to investigate and discuss different solutions for the crisis and suggest a key HRM strategy as the strategic solution for it. Finally at the third step they were asked to finalize their strategic solution based on feedback that they received from other students. -Participants were asked to give feedback on different steps of other groups' mini case study as the period (semester) progressed via asynchronous CSCL environment of the course and help them to improve their solution
5	Didactic skills		Students were asked to discuss problem-based learning as a teaching and learning method and write and develop guidelines and tutorials about problem-based learning for student teachers and teachers.

Note: The study was conducted twice for courses 2 and 3

4.2.2 Instrument

A questionnaire was constructed which comprised four main sections and 74 items. The first section (6 items) assessed students' previous experience with computers, internet, e-learning and online discussion and collaboration. The second section (11 items) captured students' preferences for online collaboration and modes of teaching and learning. The third section (26 items) collected information on students' learning approaches and their preferences regarding pedagogical practices. The fourth and last section (31 items) assessed student satisfaction with, and perceived learning from, performing the asynchronous online collaborative learning tasks in the course. All 57 items of sections three and four of the questionnaire used a five-point Likert scale (1=strongly disagree; 5=strongly agree). In section two, students were asked to specify their preferences on a five-point scale (1=not at all; 5=very important) to what extent different ways of teaching and learning contributed to their learning. The questionnaire was administered at the end of the course, using some open-ended questions at the end of the questionnaire. The students were asked to write their comments regarding the online tasks of the course.

The questionnaire was piloted to determine its reliability and validity. Validity of the questionnaire was improved by a consultation of experts in the field and teachers at the university. In order to develop a valid and reliable instrument, first, several indicators and items were adopted from a previous study (Mahdizadeh, Mulder & Biemans, 2005) and literature and previous research in the field (Chou & Liu, 2005; Goodyear, Jones, Asensio, Hodgson & Steeples, 2005; Liaw, 2002; Madden, Ford, Miller & Levy, 2005; Paris, 2004; Passig & Levin, 2000; Race, 2003; Spellman, 2000; Williams & Pury, 2002; Wu & Hiltz, 2004).

4.2.3 Data analysis

In addition to descriptive statistics, exploratory factor analysis using principal components factor extraction and VARIMAX rotation was conducted to identify factors in sections three and four of the instrument. Four commonly used decision rules were applied to identify the factors (Hair et al., 1995): 1) minimal Eigenvalue of 1; 2) minimal factor loading of 0.4 for each indicator; 3) simplicity of the factor structure;

and 4) exclusion of single item factors. Items that did not fulfil the above-mentioned rules were deleted. Then, the reliability of each factor was evaluated by calculating Cronbach's alpha.

The identified factors were further analyzed using bivariate correlation tests. Pearson's correlation coefficients were computed, showing how the various factors were related to student satisfaction with, and perceived learning from, the online learning tasks. Furthermore, a multiple regression analysis showed which factors can be used as predictors of student satisfaction with, and perceived learning from, the online learning tasks.

4.3. Results

The results of this study are presented in the following three sections of this article. First, student satisfaction with, and perceived learning from, the asynchronous online collaborative learning tasks in the courses are described. Second, the factor structure of all items and their relationships with student satisfaction and perceived learning are addressed. Third, the results of the correlation tests between the identified factors in the study and the results of the multiple regression analysis are explained.

4.3.1 Student satisfaction with, and perceived learning from, the online tasks

Table 4.2 shows the agreement scores of students with statements indicating satisfaction with, and learning in, the asynchronous online collaborative course environment. More than half of the students think ACSCLE can facilitate student learning (54.0% agree or strongly agree with this statement (11); M=3.41; SD=.961). Many students are also satisfied with their own learning (44.0% agree or strongly agree with this statement (10); M=3.45; SD=.621) and 61.5% of the students are satisfied with their learning experiences with ACSCLE (statement (6); M= 3.68; SD=.857). Moreover, 58.8% of them stated that they enjoyed sharing knowledge with other students in ACSCLE (statement (8); M= 3.54; SD=.899). However, nearly half of the students (46.6%; statement (12); M=3.37; SD=.843) thought that ACSCLE took more time than face-to-face collaboration. Nevertheless, nearly 40% of them reported that ACSCLE had added value for the students (39.9%; statement (14); M=3.30; SD=.830), while 11.5% of the students thought it did not have added value.

On the other hand, only 12.1% (statement (31); M=2.68; SD=.825) of the students said they felt that the quality of online collaboration was higher than face-to-face collaboration. Furthermore, 12.9% of the students (statement (30); M=2.72; SD=.962) (strongly) agreed with the statement that ACSCLE provided useful social interaction. And only 18.9% of them (statement (29); M=2.74; SD=.941) (strongly) agreed with the statement that in ACSCLE they learned more from their fellow students. These results suggest that a mix of online learning and face-to-face learning is more effective for on-campus students than asynchronous online collaborative learning only.

Looking in depth at the data in Table 4.2 reveals that on average, 30.35% of the participants agree or strongly agree with all items formulated to assess the positive learning effects of performing tasks in ACSCLE (items 2, 4, 7-13, 16-21 in Table 4.2), and 19.27% of them disagree or strongly disagree with these items; 50.35% of them neither agree nor disagree (average score for all the items is 3.12). Similarly, 43.54% of the participants agree or strongly agree with items meant to capture students' satisfaction with performing tasks in ACSCLE (items 1, 3, 5-6, 14-15 in Table 4.2), and 11.37 % of the students disagree or strongly disagree; 45.7% of them neither agree nor disagree with those items.

4.3.2. Factors identified from the item lists regarding students' general learning attitudes to performing asynchronous online collaborative learning tasks

As mentioned above, section three of the questionnaire measured general student attitudes towards learning and preferences regarding pedagogical practices. All 26 items were selected from previous studies and their reliability and validity were positively evaluated. To explore factors which might explain student satisfaction with, and perceived learning effects of, the ACSCLE part of the course (research question 3), an exploratory factor analysis was conducted. Based on the available data, 5 factors were identified (see Table 4.3). Together, these factors explain 75% of variance.

Table 4.2 Agreement scores of students with statements indicating satisfaction with and learning effects from the asynchronous computer-supported collaborative learning environment (ACSCLE) (1= strongly disagree; 2=disagree; 3=neither agree, nor disagree; 4=agree; 5=strongly agree; M=Meav; SD=Standard deviation)

	Statement	1--	2 -	3 +/-	4 +	5 ++	M	SD
1	Learning should involve social negotiation and mediation	0	2.0	18.2	56.1	23.6	4.01	.709
2	Collaborative and cooperative teamwork is a suitable learning method	.7	0	20.9	56.8	21.6	3.99	.700
3	Students should construct their own knowledge through their activities in the course	0	6.1	12.8	61.5	19.6	3.95	.754
4	Quality of students' learning is improved by using internet	1.4	4.1	17.6	54.7	22.3	3.93	.826
5	Students learn more by discussing together	0	8.1	27.0	45.3	19.6	3.76	.860
6	Overall, I was satisfied with my learning experience with the ACSCL environment	0	9.5	29.1	45.3	16.2	3.68	.857
7	Online discussion and collaboration activities of the course improved my learning	0	2.7	48.0	33.1	16.2	3.63	.758
8	I enjoyed sharing knowledge with other students in online discussion	0	16.2	25.0	47.3	11.5	3.54	.899
9	I received new ideas and approaches regarding my topic	0	4.1	48.6	42.6	4.7	3.48	.654
10	I am satisfied with my learning	0	2.7	53.4	39.9	4.1	3.45	.621
11	It can facilitate student learning	4.1	13.5	28.4	45.9	8.1	3.41	.961
12	It took more time than face-to-face collaboration	3.4	8.1	41.9	41.2	5.4	3.37	.843
13	I am satisfied with working in asynchronous online teams and groups	0	7.4	58.8	27.7	6.1	3.32	.702
14	It had added value for students	3.4	8.1	48.6	34.5	5.4	3.30	.830
15	It helped me to learn a lot from peers	4.7	5.4	54.1	29.7	6.1	3.27	.846
16	It improved the quality of my learning	5.4	7.4	54.7	25.0	7.4	3.22	.892
17	It was suitable for my learning	3.4	8.8	55.4	27.7	4.7	3.22	.804
18	It motivated me to do good work	3.4	8.1	57.4	26.4	4.7	3.21	.793
19	It made me more interested in the topic	3.4	8.1	57.4	27.0	4.1	3.20	.782
20	It broadened my knowledge	4.7	13.5	48.6	27.0	6.1	3.16	.904
21	I am satisfied with the final product of my group	1.4	15.5	55.4	23.0	4.7	3.14	.783
22	I am satisfied with the quality of collaboration in my group	2.0	13.5	52.7	31.8	0	3.14	.719
23	It motivated me to learn	4.7	16.2	54.1	19.6	5.4	3.05	.875
24	Web-assisted activities are more interesting than paper-assisted activities	6.8	25.0	39.9	18.9	9.5	2.99	1.05
25	Students learned more through online collaboration than by face-to-face collaboration	7.4	21.6	39.9	29.1	2.0	2.97	.943
26	It was more difficult than face-to-face collaboration	3.4	26.4	48.6	14.2	7.4	2.96	.918
27	Students learn more using web-assisted activities than paper-assisted activities	6.8	24.3	43.2	20.3	5.4	2.93	.967
28	It improved my communication skills	7.4	26.4	43.2	15.5	7.4	2.89	1.00
29	I learned more from my fellow students	11.5	23.6	45.9	16.9	2.0	2.74	.941
30	It provided useful social interaction	10.8	25.7	50.7	6.8	6.1	2.72	.962
31	I felt that the quality of online collaboration was higher than face-to-face collaboration	6.8	32.4	48.6	10.1	2.0	2.68	.825
32	Online discussion wastes my time	5.4	41.2	41.9	8.1	3.4	2.63	.843

Table 4.3 Factor loadings of agreement scores on learning attitudes regarding pedagogical practices (varying from traditional to e-learning approaches) (F1=Factor 1, etc.)

Item	Factors	F1	F2	F3	F4	F5
	Knowledge Construction Learning Approach (KC-LA)					
1	Learning should involve social negotiation and mediation	.912				
2	Students should construct their own knowledge through their activities in the course	.836				
3	Teachers serve primarily as guides and facilitators of learning, not as instructors	.819				
4	Students should be encouraged to become self-regulatory	.844				
	F2F Learning Attitude (F2F-LA)					
5	Students learn more while performing group collaborative tasks		.853			
6	I think learning can be facilitated by students working in groups		.858			
7	Collaborative and cooperative teamwork are suitable learning methods		.740			
8	I like to learn in teams or small groups		.694			
	Web-assisted Learning Attitude (WA-LA)					
9	Students learn more using web-assisted activities than using paper-assisted activities			.760		
10	Web-assisted activities are more interesting than paper-assisted activities			.828		
11	Finding the way around a website is easier than finding the way around a book			.785		
12	If I had a choice I would prefer to learn from a book than from a website			.823		
	Lack of Self-Confidence (LSC)					
13	I was concerned about the quality of my written English				.900	
14	I did not feel as if I had anything to add to what people had already said				.899	
15	I prefer to post my contributions anonymously				.828	
	Traditional Teaching and Learning Attitude (TT-LA)					
16	I prefer lectures to discussions					.894
17	I prefer to study with traditional education methods					.761
18	I prefer individual tasks (such as presentations and writing papers) above group tasks					.877

Items which did not load in the identified factors were deleted. The first factor, which is labelled Knowledge Construction Learning Approach (KC-LA), consists of four items and Cronbach α for this construct is .922, indicating more than sufficient reliability. The second factor, labelled F2F Learning Attitude (F2F-LA), is comprised of 4 items and the Cronbach α is .844, which is also more than sufficient. The third factor is labelled Web-assisted Learning Attitude (WA-LA); this construct consists of four items and has a Cronbach α of .894; also more than sufficient. The fourth construct is Lack of Self-Confidence (LSC), which consists of three items and has a Cronbach α of .897; also more than sufficient. The fifth and last construct comprises three items and is labelled Traditional Teaching and Learning Approach (TT-LA); this factor has a Cronbach α of .700, which can be regarded as sufficient.

As mentioned above, section four of the questionnaire measured student satisfaction with asynchronous online collaborative learning tasks and the perceived learning from performing those tasks. The exploratory factor analysis resulted in a list of 21 items which were significantly loaded on four factors with an Eigenvalue of over 1, which together explain 67.35% of the total variance (see Table 4.4).

The first factor is labelled as Perceived Effects of ACSCLE (PE) and consists of ten items. The Cronbach α of .931 indicates a high internal consistency for the set of items. The second factor is labelled as E-learning Attitude (EL-A), comprises four items and has a Cronbach α of .834, which also represents good reliability. The third factor is labelled Ease of Use of ACSCLE (EU), and consists of three items with a Cronbach α of .908, also indicating high reliability. The fourth factor is labelled Satisfaction with ACSCLE (SAT), and consists of four items with a Cronbach α of .826, which is also more than sufficient.

The number of items per factor, the Eigenvalue of the factors, the amount of explained variance and the reliability indices are listed in Table 4.5.

Table 4.4 Factor loadings of agreement scores on statements about satisfaction with, and learning within, the asynchronous computer-supported collaborative learning environment (ACSCLE) (F1=Factor 1, etc.)

Nr	Item	F1	F2	F3	F4
	Perceived Effects of ACSCLE (PE)				
1	It motivated me to learn	.855			
2	It provided useful social interaction	.895			
3	It broadened my knowledge	.830			
4	It improved my communication skills	.825			
5	It improved the quality of my learning	.816			
6	It has added value for students	.818			
7	It was suitable for my learning	.837			
8	It made me more interested in the topic	.698			
9	It motivated me to do good work	.850			
10	It helped me to learn a lot from peers	.617			
	E-learning Attitude (ELA)				
11	The quality of student learning is improved by using computers		.795		
12	The quality of student learning is improved by using the internet		.809		
13	I really enjoy using computers to support my learning		.782		
14	I really enjoy using the internet to support my learning		.836		
	Ease of use of ACSCLE (EU)				
15	Using the asynchronous computer-supported collaborative learning environment (ACSCLE) was easy			.776	
16	Working with the asynchronous computer-supported collaborative learning environment (ACSCLE) was clear and understandable			.887	
17	It takes only a short time to learn how to use the asynchronous online collaborative course environment			.845	
	Satisfaction with ACSCLE (SO)				
18	I am satisfied with my learning during performing asynchronous online collaborative learning tasks				.674
19	I am satisfied with working in an asynchronous online team and group				.756
20	I am satisfied with the final product of our group				.613
21	I am satisfied with sharing my knowledge with peers in online groups				.774

Table 4.5 Number of Items (NI), Eigenvalues (EV), Variance Explained (R^2) and reliability index (CA=Cronbach Alpha) of identified factors based on sections three (learning attitudes) and four (satisfaction with and learning from ACSCLE) of the questionnaire

	Factor name	NI	EV	R^2	CA
1	Knowledge Construction Learning Approach (KC-LA)	4	4.1	22.52	.922
2	F2F Learning Attitude (F2F-LA)	3	2.2	12.20	.700
3	Web-assisted Learning Attitude (WA-LA)	4	2.5	13.61	.894
4	Lack of Self-Confidence (LSC)	3	1.2	6.80	.897
5	Traditional Teaching and Learning Attitude (TT-LA)	4	3.5	19.38	.844
6	Perceived Effects of ACSCLE (PE)	10	7.4	35.35	.931
7	E-learning Attitude (ELA)	4	2.6	12.36	.834
8	Ease of Use of ACSCLE (EU)	3	2.2	10.50	.908
9	Satisfaction with ACSCLE (SO)	4	1.9	9.15	.826

4.3.3 Correlations and relations between factors

To see to what extent the identified factors are related to students' satisfaction with (SAT), and perceived learning effects (PLE) from, performing tasks in the ACSCLE, bivariate Pearson correlation coefficients were computed.

First of all, it can be noted that the correlation between SAT and PLE is high (r=.728; p=.000). This implies that students who are more satisfied with ACSCLE also perceive more learning effects from asynchronous online collaborative learning tasks.

Moreover, SAT and PLE are strongly related to the general attitudes of students towards e-learning (EL-A). The following correlations were found: for the relationship between EL-A and SAT r=.815 (p=.000), and between EL-A and PLE r=.764 (p=.000). This means that students' general attitudes regarding e-learning strongly influence the way in which asynchronous online collaborative learning tasks are being perceived. The general attitude towards e-learning (EL-A) is also strongly related to the ease of use of ACSCLE (r=.647; p=.000) and, to a lesser degree, to the attitude towards web-based learning activities (r=.348; p=000). EL-A is negatively related to traditional teaching and learning approach (r=-.331; p=.000) and lack of self-confidence (LSC) (r=-.192; p=.019).

Experience with asynchronous online collaborative learning activities in other courses is not significantly related to EL-A (r=-.082; p=.321), SO (r=.027; p=.741) or PE (r=.007; p=.930). Table 4.6 shows the correlation coefficients between all identified factors.

Table 4.6 Correlation coefficients between identified factors and satisfaction with ACSCLE (SO) and perceived effects of ACSCLE (PE)

	Factors	**ELA**		**SO**		**PE**	
		R_p	Sig	R_p	Sig	R_p	Sig
1	Knowledge Construction Learning Approach (KC-LA)	.077	.352	.041	.622	.172	.036 *
2	F2F Learning Attitude (F2F-LA)	.038	.645	-.050	.544	.283	.000 **
3	Web-assisted Learning Attitude (WA-LA)	.348	.000 **	.181	.028 *	.363	.000 **
4	Lack of Self-Confidence (LSC)	-.192	.019 *	-.321	.000 **	.052	.533
5	Traditional Teaching and Learning Attitude (TT-LA)	-.331	.000 **	-.276	.001 **	-.337	.000 **
6	Ease of Use of ACSCLE (EU)	.647	.000 **	.680	.000 **	.680	.000**
7	E-learning Attitude (ELA)	-	-	.815	.000 **	.764	.000 **
8	Satisfaction with ACSCLE (SO)	-	-	-	-	.728	.000 **
9	Perceived Effects of ACSCLE (PE)	-	-	-	-	-	-
10	Experience with asynchronous online collaborative learning	-.082	.321	.027	.741	.007	.930

Rp= Pearson correlation coefficient

Sig=Significance (2-tailed)

* Correlation is significant at the 0.05 level (2-tailed).

** Correlation is significant at the 0.01 level (2-tailed).

The data in Table 4.6 indicate that the ease of use of asynchronous online collaborative learning tasks is most strongly related to both SO and PE. Both correlations are .680 (p=.000). The other correlations are much lower, and do not exceed r=.363 (p=.000) for the relationship between the attitude towards web-assisted learning activities (WA-LA) and the perceived learning effects of the asynchronous online collaborative learning tasks. The attitude towards face-to-face learning (F2F-LA) and PE (r=.283; p=.000), and the attitude towards knowledge construction and PE (r=.172; p=.036) are also positively correlated. As for SO, the only other positive correlation exists with WA-LA (r=.181; P=.028). There is also a negative correlation between the lack of self-confidence (LSC) and SO (r=-.321; p=.000) although not with PE (r=.052; p=.533). This means that students with a higher lack of self-confidence regarding issues that are relevant for the ACSCLE are less satisfied with the ACSCLE, and vice versa. This implies that students' self-confidence regarding ACSCLE needs careful attention when asynchronous online collaborative learning tasks are implemented in courses. Given the factor composition, this holds, first of all, for student concerns about the quality of their English writing (which is understandable since the

meaning of the written contributions should be clearly understood, otherwise effective interaction becomes impossible). Moreover, attention should be paid to students who have the feeling that they have little or nothing to contribute to discussions. If this is a general feeling of students, it can indeed negatively influence their participation in, and satisfaction with, online discussions. This is a concern that should be further investigated, as the question is whether the students indeed can or cannot contribute much or anything to the discussion. Teacher interventions based on monitoring discussions may help to stimulate contributions from students who otherwise have the feeling that they cannot contribute much.

The same inverse relationship with SO exists for the factor Traditional Teaching and Learning Attitude (TT-LA); for this factor r=-.276 (p=.001). The relationship between TT-LA and PE is also negatively significant, and even higher than for SO (r=-.337; p=.000). This means that, on average, the more traditional the attitude of students towards teaching and learning (as indicated by the items in Table 4.3), not only the lower their satisfaction with ACSCLE, but also the lower their perceived learning results in ACSCLE. This result also needs careful attention, and maybe further discussion is needed with the students concerned about principles of knowledge construction and social-constructive learning, although the differences in attitudes of students regarding individual and social learning, and lectures and discussions, reflect fundamentally different epistemologies regarding cognitive and constructivist learning.

4.3.4 Multiple regression analysis

To determine to what extent each factor explains student satisfaction with and perceived learning from asynchronous online collaborative learning tasks, two multiple regression analyses were conducted, one for student satisfaction with, and one for perceived learning effects in, ACSCLE. For the regression analyses a backward elimination method was used.

First of all, student satisfaction with asynchronous online collaborative learning tasks in the course (SO) was taken as the dependent variable. Previous experience with e-learning environments and the factors that resulted from the factor analyses were included in the equation. This resulted in a regression model that retained Previous Experience with E-learning Environments, Web-assisted Learning Attitude (WA-LA),

E-learning Attitude (ELA), Lack of Self-Confidence (LSC), and Ease of Use of ACSCLE (EU) as statistically significant predictors of student satisfaction with ACSCLE (R^2=.749; F(5,142)=84.77; p=.000) (see Table 4.7).

Table 4.7 Results of first regression analysis (dependent variable: student satisfaction with the ACSCLE)

	B	Std. Error	Beta	T-Value	Sig
Constant	1.008	.543		1.86	.065
Previous Experience with e-learning and learning in a ACSCLE	.361	.157	.097	2.30	.023
Web-assisted Learning Attitude (WA-LA)	-.058	.017	-.164	-3.50	.001
E-learning Attitude (ELA)	.129	.011	.666	11.61	.000
Lack of Self-Confidence (LSC)	-.084	.027	-.137	-3.16	.002
Ease of Use of ACSCLE (EU)	.131	.028	.279	4.66	.000

R= .865, R^2= .749, F (5,142) =84.77, P=.000

In the second regression analysis, "perceived learning effects of the asynchronous online collaborative learning activities (PE)" was taken as dependent variable. Again, Previous Experience with E-learning Environments and the factors that resulted from the factor analyses were included in the equation. This resulted in a regression model that retained Face-to-Face Learning Attitude (F2F-LA), E-learning Attitude (ELA), Lack of Self-Confidence (LSC) and Ease of Use of ACSCLE (EU) as statistically significant predictors of perceived learning effects of ACSCLE (PE) (R^2=.701; F(4,143)=83.79; P=.000) (see Table 4.8).

Table 4.8 Results of second regression analysis (dependent variable: perceived learning effects in the ACSCLE)

	B	Std. Error	Beta	T- Value	Sig
Constant	3.885	1.168		3.33	.001
F2F Learning Attitude (F2F-LA)	.134	.050	.147	2.66	.009
E-learning Attitude (ELA)	.212	.023	.585	9.43	.000
Lack of Self-Confidence (LSC)	.177	.064	.154	2.75	.007
Ease of Use of ACSCLE (EU)	.265	.056	.301	4.71	.000

R= .837, R^2= .701, F (4,143) =83.79, P=.000

Combining the results from the two regression analyses, it can be observed that the attitude towards e-learning (ELA) predicts most of the variance of student satisfaction (SO) with, and of, the perceived learning effects (PE) of asynchronous online collaborative learning activities. Ease of Use of ACSCLE (EU) is the second factor

explaining the variance of SO and PE. Interestingly, Lack of Self-Confidence (LSC) is a negative predictor of SO, while it is a positive predictor of PE. Students who reported a higher lack of self-confidence were less satisfied with ACSCLE, but did perceive higher added value of ACSCLE.

4.4 Discussion and Conclusions

The purpose of this study was to investigate student satisfaction with, and perceived learning effects of, performing asynchronous online collaborative learning tasks in courses in higher education. Descriptive statistics were used to see to what extent students were satisfied and to discern their perceived learning effects. Exploratory factor analysis was conducted to identify factors that might explain student satisfaction (SO) and perceived learning effects (PE). Furthermore, multiple regression analyses were conducted to see which factors predict SO and PE. In this section conclusions will be drawn related to the research questions in this study.

4.4.1 Student satisfaction of performing learning tasks in the ACSCLE

Our findings showed that 44.0% of students were satisfied with their own learning in ACSCLE and 58.8% of them enjoyed sharing knowledge with other students in the ACSCLE of the course. Overall, 61.5% of students were satisfied with their learning experiences with ACSCLE in their courses. In total, 43.5% of students agreed with the items concerning their satisfaction with performing tasks in the ACSCLE and 45.7% of students took a neutral position.

Based on these findings it can be concluded that these on-campus students were rather satisfied with performing learning tasks in ACSCLE. Although the research design did not allow for the comparison of student satisfaction with performing learning tasks in a face-to-face situation and asynchronous online collaborative teamwork, participants were asked to indicate (based on their previous experiences) the differences between regular face-to-face collaborative teamwork and asynchronous online collaborative teamwork. Students stated there were no differences between F2F and asynchronous online collaboration in terms of difficulty of performing tasks and perception of learning. These results lead to the conclusion that students evaluate the

quality of asynchronous online collaborative learning as equal to the quality of F2F learning.

4.4.2 Student perceptions of learning effects of performing learning tasks in the ACSCLE

More than half of the participants (54.0%) stated that student learning can be facilitated by working in online groups and about half of them (49.3%) stated that their learning was improved by participating in the online discussion and collaboration activities of their courses. On a five-point scale (1=strongly disagree; 5=strongly agree), the average agreement with the statement that ACSCLE had added value for students was 3.30, with the statement that it helped students to learn a lot from their peers 3.27, and with the statement that it improved the quality of student learning 3.22. However, with the statement that students learned more through ACSCLE than by F2F collaboration, the average agreement was 2.97, and the average agreement with the statement that students learned more from their fellow students 2.74. With the statement that the quality of online collaboration was higher than F2F collaboration, the average agreement was 2.68, and, finally, with the statement whether they received new ideas and approaches regarding the topic, the average agreement was 3.48. However, these results are still above the critical line of 2.5 in 5-point Likert scales, which means that the results, which seem relatively negative, are in fact in the range of 'neither agree, nor disagree'. As mentioned before, in total, 30.35% of the students agreed with all items related to positive learning effects of performing tasks in ACSCLE and 50.35% of them were neutral (Mean=3.12).

These results lead to the conclusion that the perceptions of the learning effects of performing tasks in an asynchronous computer-supported collaborative learning environment (ACSCLE) are neutral to positive. Thus, we can conclude that ACSCLE should not be rejected because of a negative evaluation of perceived learning effects by students, although at a detailed level, further research is necessary to examine the mixed feelings about online collaboration. Based on the results mentioned above and considering the fact that more than one third of the students are satisfied with, and report that they learn from, their activities in ACSCLE, we can conclude that in an inclusive approach to education using this e-learning and networked functionality one is

able to involve a considerable part of the students who would be silent in face-to-face conditions. Moreover, based on the fact that around half of the students were neutral about PE and SO, we can conclude that, although e-learning and networked learning environments in general, and ACSCLE in particular, make learning and teaching more flexible, for most of the students, technology, per se, is not a determining factor. It seems that we can argue that for these students the instructional setting is more important and the effect of new technology should be considered together with the instructional setting.

4.4.3 Factors influencing student satisfaction with, and perceived learning effects from, performing learning tasks in the ACSCLE

As mentioned earlier, philosophies of constructivism and knowledge construction have influenced theories of education and changed the perspective of students from being passive receivers of information to being active collaborative knowledge constructors. Exploratory factor analysis in this study revealed two factors related to students' philosophies of (or attitudes towards) teaching and learning. These factors are the Knowledge Construction Learning Approach (KC-LA) and the Traditional Teaching and Learning Attitude (TT-LA). The results have shown that while KC-LA is positively correlated with perceived learning effects resulting from learning tasks in an asynchronous online collaborative environment, TT-LA is negatively related to both student satisfaction with, and perceived learning results from, learning tasks in that environment. From the above-mentioned results two conclusions can be drawn. First, asynchronous online environments can foster students to be more active in the process of learning. The ACSCLE gives them the opportunity to change the traditional idea of being a passive receiver and container of knowledge towards being an active constructor of new knowledge. It is widely believed that e-learning environments facilitate such processes of knowledge construction. Second, the ACSCLE seems to be better for students with a Knowledge Construction Learning Approach. At least, these students benefit more from the ACSCLE.

Regarding the F2F learning attitude, previous studies have shown that collaboration and activation lead to better learning results. In this study we found that the more students believe in F2F collaborative teamwork, the more they are satisfied

with, and perceive learning results from, performing learning tasks in the ACSCLE. One might think that it is obvious that faith in F2F learning is one of the main conditions for working in ACSCLE. However, it should be noted that it is not clear to what extent students are happy with collaborative teamwork and to what extent this factor can help to predict student satisfaction and learning. For instance, some participants in our study were not satisfied with working in groups. The F2F learning attitude was also retained as a factor in the final regression model, which illustrates its importance in this study.

Regarding the E-learning Attitude (ELA) and the Web-assisted Learning Attitude (WA-LA) of students, the results of this study indicate that ELA and WA-LA are positively correlated with both satisfaction with and perceived learning effects of the ACSCLE. Student experiences with the ACSCLE seem to be influenced by their general opinions about E-learning environments and Web-assisted learning opportunities. This conclusion needs special attention during the implementation of ACSCLE. Students should be made aware of the power of this learning environment in a careful and convincing way, since many of them already have negative experiences with the early introduction of e-learning in their study programs.

Regarding Lack of Self-Confidence, in the last two decades anxiety with respect to working with computers has been one of the main issues in research on computer use among teachers and students. In this study this factor was also identified and retained in the regression model for both dependent variables (satisfaction and perceived learning effects). It seems that students need to learn how to work in such an environment. In an ACSCLE participants should write their ideas and comments, and it is possible that students are more careful and cautious about what they write. Moreover, students in a F2F situation can simply be silent during the discussion and collaboration but in an ACSCLE they are under pressure from their peers and teachers to be active. While in F2F communication inactive students remain somewhat hidden, in an ACSCLE their silence is very visible from their lack of contributions to discussions. Furthermore, when processes of discussion and collaboration proceed, very often students need to think deeper about the topic. If they cannot cope with this, their underperformance is also visible, which can make them reluctant to participate in this learning environment.

Ease of use (EU) was another aspect of ACSCLE influencing both student satisfaction with, and perceived learning results in, the ACSCLE. It was also a factor that was retained in the final regression models of the study. This factor represents a recurrent issue in CSCL and e-learning design and implementation especially with respect to the way in which users can work with these innovative learning environments, and this part of our findings confirms the importance of it.

Finally, although our results have shown that there are students who are negative about performing asynchronous online collaborative learning tasks in their courses, on average, students are neutral to positive about it. However, the way in which this way of learning is implemented is more important than the technology itself. We do believe – and this study confirms this belief – that ACSCLE have the potential to play a very important role in on-campus learning situations, especially since more and more students have different commitments which put pressures on their agendas. Functional integration of asynchronous online collaborative learning in courses is more important than just using the learning environment itself.

The most obvious reason for functional integration is independence from place and time in distance learning. But for on-campus students, the added value of ACSCLE is that it can enhance the quality of learning processes and results. ACSCLE can help teachers to reduce the disadvantages of face-to-face collaborative work and prepare students for working in virtual teams, which is becoming ever more important in our knowledge society. But again, careful implementation is necessary. Inadequate and inappropriate use of this attractive and powerful learning technology can turn student attitudes toward it in an opposite, and negative, direction.

Acknowledgement

We would like to thank all students and teachers who contributed to this study and all persons who helped us to improve and validate the instrument. The research reported in this article was financially supported by the Ministry of Science, Research, and Technology (MSRT) of the Islamic Republic of Iran. The authors want to express their gratitude for this support.

Chapter 5

Fostering processes of knowledge construction of on-campus students through asynchronous computer-supported collaborative learning[1]

[1]Submitted as: Mahdizadeh, H., Biemans, H. & Mulder, M. Fostering processes of knowledge construction of on-campus students through asynchronous computer-supported collaborative learning.

Abstract

A study was conducted to investigate the application of asynchronous computer-supported collaborative learning (ACSCL) in order to foster and accelerate the process of knowledge construction in face-to-face and on-campus higher education as a blended learning approach. 151 BSc and MSc students who participated in 7 courses were asked to perform 19 different tasks in small groups of 4 to 6 persons. We found that performing tasks in ACSCL environments fostered more, and equal, participation and could be used to encourage and engage the silent side of the class into processes of discussion and collaboration. Results showed that the quality of discussion was related to the instructional design of the course. Task structure, task complexity, and support that students received while performing the tasks in ACSCL environments, were shown to play a crucial role in the level of their participation and the quality of their learning activities.

Keywords: Computer-supported collaborative learning, CSCL, collaborative learning, computer-mediated communication, asynchronous discussion and collaboration, knowledge construction, content analysis

5.1 Introduction

In educational research in general, and in constructivist approaches in particular, it is widely believed that through discussion and collaboration, students, instead of passively receiving knowledge from teachers, can develop their cognitive skills (e.g., problem solving and knowledge construction) and meta-cognitive skills (e.g., critical thinking) (Guan, Tsai & Hwang, 2006). One of the main applications of e-learning that occupies many researchers in the field of education is "Computer-Supported Collaborative Learning (CSCL)". Stahl (2003) described CSCL environments as tools designed to support the building of shared knowledge and knowledge negotiation.

New Information and Communication Technology (ICT) in general, and CSCL in particular, were promising for teachers and students in the field of distance learning and off-campus education to increase communication, discussion and collaboration between students and teachers and students and their peers. Positive experiences of integration of CSCL environments and applications in distance learning are reported (Dewiyanti, Brand-Gruwel, Jochems & Broers, 2007). There is also a strong trend in face-to-face and on-campus education to integrate ICT and CSCL in the process of learning to benefit from the capabilities and functions of such technology-enriched learning environments. Therefore, universities invest many resources to provide a good infrastructure for ICT in their campuses. Turcotte (2004, Conclusion section, Para. 3) believed that "the integration of CMC [Computer Mediated Communication] as a mixed mode in traditional university settings is becoming more and more prevalent and not only is its value as a learning tool in distance education recognized but it is also accepted as a worthwhile learning activity in traditional education based face-to-face meetings". In higher education, where deep learning, problem solving, critical thinking and ability of presenting well-grounded arguments are the main aims of education (Marttunen & Laurinen, 2001; Terenzini, Spinger, Pascarella & Nora, 1995; Veldhuis-Diermanse, 2002) using asynchronous online learning environments for both on- and off-campus students have proved beneficial. For instance, Turcotte (2004) integrated an online discussion forum in a campus-based undergraduate biology class and reported that asynchronous CSCL activities not only improved the participation of students but also enriched the content of the class activity, as assessed by both the students and the professor. The time frames of courses in conventional classrooms often do not allow

students enough discussion time with their teachers and peers. ACSCL environments seem to provide on-campus teachers and students with the opportunity for more interaction, discussion and collaboration.

Several studies have been carried out to investigate the effects of CSCL environments in education. The findings of research on CSCL environments are contradictory. While several researchers believe that there is no solid evidence of the role of CSCL in deep learning (Garrison, Anderson & Archer, 2000; Stahl as cited in Lipponen, Rahikainen, Lallimo & Hakkarainen, 2003), the review of Lehtinen, Hakkarainen, Lipponen, Rahikainen & Muukkonen (1999) revealed positive effects of CSCL environments and in a meta-analysis study (Cavanaugh, 2001) positive effects of face-to-face teaching supported by CSCL applications were shown. Lehtinen (2003) also reported that a review of experiments in the field revealed positive effects of CSCL environments when they had been applied in combination with face-to-face learning situations. As Lipponen et al. (2003, p. 489) stated, the results of the studies conducted on CSCL, because of differences in setting, applied instructional design, teachers' preparation, commitment and moderation, technical support and technologies used, and the way in which particular applications were used, can not be fully compared and, as they concluded, "the advantages and disadvantages of CSCL appear to be widely debated, hence, there remains a need for more research to further inform these debates and help resolve the issues."

The way of studying CSCL and analysing data might also be a source of the contradictory results of CSCL studies. Some of the studies implemented CSCL only in one course with a small number of participants, and some focused more on the discussion part of CSCL environments than on the collaborative aspect. In other studies, participants were asked to perform a collaborative task. In our opinion, these differences in research design make it difficult to draw conclusions on the effects of course characteristics, tasks, teacher roles and other instructional variables, and ACSCL environments. In the current study, ACSCL was implemented in 7 different courses and in each course students were asked to perform different collaborative tasks (see methodology section for details) and conduct discussions and debate, which enabled us to compare the effects of ACSCL across different courses. Moreover, we studied the

patterns of changes in students' learning activities over time, which can also be considered as an added value of this research as compared to previous studies.

Different aspects of students' activities in CSCL environments can be studied, like: participation in the process of knowledge construction, motivation for co-constructing shared knowledge, types of interaction during collaboration and cooperation processes, knowledge construction and learning activities, quality of discourse during discussion and collaboration, and the quality of learning outcomes. Indicators like frequency of writing and reading of messages, length of written notes, and time that learners work in the learning environment were used to understand to what extent students participate in online debate and discourse in CSCL environments. Social network analysis and variables like density and centrality and graphical representations like socio-grams were also used to study interaction patterns in CSCL environments. (Lipponen et al, 2003; Martinez, Dimitriadis, Rubia, Gomez & Fuente, 2003; Puntambekar & Luckin, 2003). Content analysis is one of the more frequently used techniques for analysing written notes and transcripts of discourses in CSCL environments. As De Wever, Schellens, Valcke & Van Keer (2006, p. 6) explained, "although this research technique is often used, standards are not yet established. The applied instruments reflect a wide variety of approaches and differ in their level of detail and the type of analysis categories used." This technique (content analysis of written notes or transcribed conversations) was seen as a way to get in-depth insight into the processes of learning and discourse in CSCL environments. For this purpose, several researchers introduced a coding scheme to analyse written notes or transcripts drawn from students' conversations in CSCL environments (Calvani, Sorzio & Varisco, 1997; Gunawardena, Lowe & Anderson, 1997; Henri, 1992a; 1992b; Kanuka & Anderson, 1998). Berelson (cited in Rourke, Anderson, Garrison & Archer, 2001, p. 4) defined quantitative content analysis as "a research technique for the objective, systematic, quantitative description of the manifest content of communication."

Lack of a theoretical model of the collaborative learning process makes it difficult to find or develop empirical indicators that can form the basis of a coding instrument as a standard way of assessing learning effectiveness in CSCL (Gunawardena, Carabajal & Lowe, 2001; De Wever et al., 2006). In the current study, the content of students' postings was evaluated using two coding schemes developed by

Veldhuis-Diermanse (2002). These coding schemes were chosen because they consider both process and outcomes of learning which are important in the knowledge construction approach to learning. While the first coding scheme includes learning activities during the process of knowledge construction, the second coding scheme assesses the quality of the learning outcomes based on the Structure of Observed Learning Outcome (SOLO) taxonomy proposed by Biggs and Collis (1982), which defines the levels of student understanding.

In this research, we wanted to explore how on-campus university students in the context of green (food, animal, plant, social and environmental) sciences collaborate and construct knowledge in asynchronous CSCL environments. Therefore, attention was paid to learning activities during the process of knowledge construction. Moreover, we analysed students' participation and quality of knowledge construction while performing collaborative tasks in asynchronous CSCL environments.

The following research questions were formulated in the present study with respect to students performing collaborative tasks in asynchronous CSCL environments:

1. To what extent do on-campus students participate in the process of knowledge construction?
2. How can on-campus students' learning and knowledge construction processes be characterised in terms of cognitive, affective, and metacognitive learning activities?
3. Do on-campus students construct knowledge and what is the quality of the constructed knowledge?
4. Are there any changes in on-campus students' learning activities over time and what are the patterns of those changes?
5. Are there any differences in students' learning activities in different courses and settings?

5.2 Methodology

5.2.1 Subjects and context of the study

Subjects in this study included a total of 151 BSc and MSc students who participated in 7 courses (see Table 5.1) over two study years at Wageningen University in the Netherlands. Participants were from 16 different countries and followed different educational programs in the fields of environmental, animal, plant, food and social sciences. To facilitate communication within groups, Blackboard was used in the courses as an asynchronous online collaboration environment. During the first meeting of the courses the objectives of the study were introduced to the students and they were invited to participate.

All participant students were divided into small groups consisting of 4 to 6 persons and were asked to do 2 to 3 different online collaborative tasks over 5 to 8 weeks. Students were able to access the website of their course from inside and outside the campus. They were all competent in working with computers and the internet and received specific instructions about asynchronous online collaborative learning tasks during the first week of each course. The language of all courses was English, which was the second language for 91% of participants. However, most of them claimed they did not have problems with communicating in the English language.

5.2. 2 Data collection

All written notes and posted contributions of the participants in different forums were used as data in this study. In total 2477 messages were generated in 19 different forums in 7 courses. For the purposes of this article, we analyzed 774 messages from 7 randomly selected forums (one forum from each course) containing 1482 ideas. Although students' messages in the ACSCL environments of their course formed the main data, for the purpose of this article, in order to capture students' opinions on ACSCL activities, we interviewed the students at the end of their course to enable us to explain the results better. Moreover, several focus group discussions were organized.

Table 5.1 Tasks and activities done in the asynchronous CSCL environment of the courses

	Course title	Tasks and activities done in the asynchronous CSCL environment of the course
1	Education in Developing and Changing Societies	-Students conducted an asynchronous online debate and discussion on three different themes which were taken from the 47th session of the International Conference on Education (ICE), which was held in Geneva, 8-11 September 2004. -Students were asked to write a paper in small groups on the debated themes based on their own experiences, opinions, ideas, attitudes or they could elaborate one of the themes and apply it to a particular country or region, or a comparison of two countries or regions.
2	Applied Environmental Education and Communication (AEE&C)*	-Each week students were asked to discuss an article about the main topic of the course. -Each group of students was asked to summarize 2-3 articles or book chapters about the topic of the course and formulate 1-2 questions about them and take the lead in a group discussion about the questions. -Each group was asked to conduct a mini case study on an environmental issue in three steps: first exploring and defining an environmental issue and challenge then exploring different strategies to cope with the challenge and selecting and advising the best and most appropriate strategy and a way to evaluate the impact of the strategy. - Participants were asked to give feedback on different steps of other groups' mini case study as the period (semester) progressed via the asynchronous CSCL environment of the course and help them to improve their solution
3	Human Resource Development/ Learning and Career Development (HRD) *	-Students were asked to do a mini case study in three steps: first they were supposed to select an organization and explore major and radical changes which might affect it, and to choose one of the major changes, and exploring its consequences for the selected organization. In the second step they were asked to investigate different HRD strategies that can help the organization to face the chosen major change and suggest a key HRD strategy as the strategic solution for the selected organization to prepare itself to face the chosen major change and when actually facing the chosen major change. Finally in the third step they were asked to finalize their strategic solution based on feedback that they received from other students. -Participants were asked to give feedback on different steps of other groups' mini case study as the period (semester) progressed via the asynchronous CSCL environment of the course and help them to improve their solution.
4	Human Resource Management	-For three weeks students were asked to discuss an article about the main topic of the course.

	(HRM)	-Each group of students was asked to read 1-2 articles or book chapters about the topic and then formulate 2 questions about them. Other students were supposed to discuss the questions. -Students were asked to conduct a SWOT (strengths, weaknesses, opportunities, and threats) analysis on a real organization through the asynchronous CSCL environment of the course. -Each week students were asked to discuss a theme related to the topic of the course for that specific week. -Students were asked to do a mini case study of a real HRM-related crisis of a company which was introduced by the HRM department of the company itself; in three steps: first they were supposed to investigate and analyze HRM approaches of the company and explore different aspects of the crisis. In the second step they were asked to investigate and discuss different solutions for the crisis and suggest a key HRM strategy as the strategic solution for it. Finally in the third step they were asked to finalize their strategic solution based on feedback that they received from other students. -Participants were asked to give feedback on different steps of other groups' mini case study as the period (semester) progressed via asynchronous CSCL environment of the course and help them to improve their solution
5	Didactic Skills (DS)	Students were asked to discuss problem-based learning as a teaching and learning method and write and develop guidelines and tutorials about problem-based learning for teacher students and teachers.

*Note: The courses 2 and 3 were provided twice (2005 and 2006)

We included students with different perspectives and different rates of participation in the ACSCL environment in our focus group discussions. Therefore, the focus groups consisted of participants who were not active in the environment, those who were very active, those who were negative and positive about the added value of these activities, and finally those who took middle positions. In personal interviews with participants and focus groups we asked students to explain their experiences with the different aspects of performing tasks in ACSCL environments; and to describe situations that generated more in-depth and thoughtful messages, factors that motivated them to participate more and factors that impeded their participation and contribution. They

were also asked to explain their opinions about the teachers' role, the level and the way of support that would motivate them to participate more and to generate well-grounded messages.

5.2.3 Data analysis

In addition to superficial quantitative indexes like numbers of read and written notes and for deeper understanding of the nature of online discussion, it is necessary to analyse the content of notes and learning activities. Content analysis is one of the more frequently used techniques for analysing written notes and transcripts of discourse in CSCL environments. In the current study the content of the postings was evaluated using two coding schemes which had been developed by Veldhuis-Diermanse (Veldhuis-Diermanse, 2002; Veldhuis-Diermanse et al., 2006). Three coders received introductory training in the segmentation and coding procedure, followed by segmenting and assigning codes to 30 randomly selected written notes as a way for better understanding of the procedure. Although Veldhuis-Diermanse reported satisfactory reliability values for her coding schemes, .82 for assigning codes to learning activities (first scheme) and .72 for quality of learning outcomes (second scheme), we preferred to calculate the reliability of the coding procedure in our study as well. For this purpose, like Veldhuis-Diermanse (2002), we used Cohen's kappa as a reliability index of inter-rater agreement. Results showed that Cohen's kappa for segmentation, for the first and for the second coding scheme (0.71, 0.73, and 0.71 respectively) indicate substantial and acceptable levels of agreement. In order to calculate the intra-rater reliability -stability of coders over time- after 3 weeks, we asked the coders to repeat the coding procedure for about 15 percent of the messages; the results for all coders were quite satisfactory (at least .89). We asked a third coder to assign codes to the messages to which different codes had been assigned by the first two coders. In our analysis of those messages we used the code at least two coders had agreed upon. Moreover, our findings can be used as an indication of replication reliability (the ability of multiple and distinct groups of researchers to apply a coding scheme reliably, Rourke et al., 2001, p. 7) for the implemented schemes. In this study, unit of meaning was used as the unit of analysis, considered as "a statement or a continuous set of statements, which convey

one identifiable idea" (Avive as cited in Murphy & Ciszewska-Carr, 2005, p. 550). Therefore, sometimes a student's message contained more than one unit of meaning.

5.2.3.1 Analyzing participation

Writing notes and reading notes are two of the main ways of participation in asynchronous CSCL environments. While writing notes involves active contributions to the discussion and collaboration from students, reading notes is a more passive activity in the sense that the students merely read other participants' notes without making any comments within the discourse. The importance of writing in learning, especially when deep learning is the main goal of learning, as emphasized in different studies.

5.2.3.2 Analyzing learning activities

As mentioned before, a coding scheme developed by Veldhuis-Diermanse (2002) was used for analysing the learning activities that took place during the discourse in the asynchronous learning environments in this study. She made a distinction between cognitive, affective, and meta-cognitive learning activities and introduced several subcategories within each category of learning activities (for more details see Veldhuis-Diermanse, 2002; Veldhuis-Diermanse et al., 2006).

Cognitive learning activities

Veldhuis-Diermanse (2002, p. 44) described cognitive learning activities as "the activities students use to process the learning content and to attain the learning goals … These cognitive learning activities lead to mental learning results such as knowledge, understanding, insights and skills". She defined three subcategories: 'debating' which refers to the process of negotiation, critical thinking, asking questions and discussing subjects with other participants in the database; 'using external information and experiences' which refers to using information like articles found on the Internet, notes made from a lecture or a summary of a book chapter; and finally 'linking or repeating internal information' which refers to information found in the discussion students are engaged in.

Affective learning activities

According to Veldhuis-Diermanse (2002, p. 45), "affective learning activities provide information about students' feelings expressed in their notes while working in the networked learning environment and make it possible to interpret the nature of the social interactions between students".

Meta-cognitive learning activities

Veldhuis-Diermanse (2002, p. 45) explained that "meta-cognition refers to a learner's awareness of objectives, ability to plan and evaluate learning strategies and capacity to monitor progress and adjust learning behaviours to accommodate needs". She further subdivided meta-cognitive learning activities into 'planning' which concerns "designing a learning process dependent on the learning goals, subject matter, tools, and time"; 'preserving clarity' pertaining to "messages written in order to keep the structure and the content of the notes clear"; and 'monitoring' which refers to "activities aimed at monitoring the planning, aim, or time schedule".

Rest category

This category concerns notes which could not be described by using the categories mentioned above.

5.2.3.3. Analyzing the quality of students' knowledge construction

To analyse the content of the notes more deeply and to gain insight into the quality of the written notes in the environment, Veldhuis-Diermanse (2002) proposed a second coding scheme which was based on the taxonomy of the Structure of the Observed Learning Outcome (SOLO), as proposed by Biggs and Collis (1982). The levels of the SOLO taxonomy reflect stages of increasing structural complexity of the discourse as students proceed in their learning process.

In the second coding scheme, five quality levels (increasing from level E to level A), that can be encountered in students' responses to academic tasks, are discerned. For each of the levels (except level E "no understanding at all"), corresponding verbs were identified and described: the quality analysis included four levels (levels D to A). While analysing the quality of students' knowledge construction, one quality level code was

assigned to each note (for more details see Veldhuis-Diermanse, 2002; Veldhuis-Diermanse et al., 2006).

5.3. Results

As stated, 1482 units of meaning derived from students' notes in the asynchronous CSCL environments of all seven courses of the present study were analyzed. Results of the analysis of those units of meaning are discussed in three sections; first, students' participation in the learning environment is explained, then attention is given to the process of knowledge construction and students' learning activities while performing collaborative tasks in the asynchronous CSCL environment of the courses, and finally the quality of students' knowledge construction is discussed.

5.3.1. Students' participation in asynchronous CSCL

Table 5.2 gives an overview of students' participation in the asynchronous CSCL environment of the courses which shows that, on average, each student writes around 10 and reads 277 meaningful units over five weeks of discussion and collaboration. It should be noted that both reading and writing activities were done in the "out of class" time of students which means that combining asynchronous CSCL with face-to-face learning as a blended learning approach in terms of active participation (writing two notes per week) is rather/fairly successful and in terms of passive participation (reading fifty five notes per week) is quite successful.

Table5.2 Students' participation in performing tasks in asynchronous CSCL environments

	Course	Number of generated meaningful units	Number of students	Number of generated units of meaning per student	Number of notes read per student	Number of notes read per student per unit of meaning
1	Education in developing and changing societies	147	14	10.5	85.71	0.58
2	Didactic skills	93	12	7.75	615.6	2.05
3	Applied Environmental Education and Communication (2005)	300	23	13.04	209.5	1.52
4	HRD-Learning & Career Development (2005)	408	27	15.11	510.6	1.25
5	Human Resource Management	181	24	7.54	103.8	1.12
6	Applied Environmental Education and Communication (2006)	215	23	9.35	228.3	1.06
7	HRD-Learning & Career Development (2006)	138	25	5.52	185.2	1.02
	Total	1482	148	-	-	-
	Average	211.71	-	10.01	277	1.23
	Chi Square	335.31	-	.85	906.73	1.03
	Sig.	<.01**	-	>.05	<.01**	>.05

As expected, the number of generated meaningful units in the courses is significantly related to the number of participants (χ^2=335.31, Sig <.01). However, no significant relationship was found between the number of generated units of meaning per student and the number of participants in the course (Sig>.05). Moreover, as can be seen in Table 5.2, students in courses with high numbers of participants read more notes than students in courses with low numbers of participants (χ^2=906.73, Sig<.001). Yet, the amount of reading per student per unit of meaning in different courses is not different (χ^2=1.03, Sig >.05). When we look at the number of times that a note is read and compare that to when that note was written, it can be seen that contributions written

in the first week were read more (Mean =60.4) than notes written in the last weeks (Mean = 5.17). One of the advantages of asynchronous CSCL is that all written notes and threads of notes can be recorded in the system and students are able to review the discussion. The fact that students' contributions in the first two weeks were read 6 to 10 times more than those that were posted in the last two weeks, and the decreasing trend of reading notes over the five weeks (see Figure 5.1) show that, in practice, students did benefit from this potentially advantageous learning environment. On average each note was read 26.7 times.

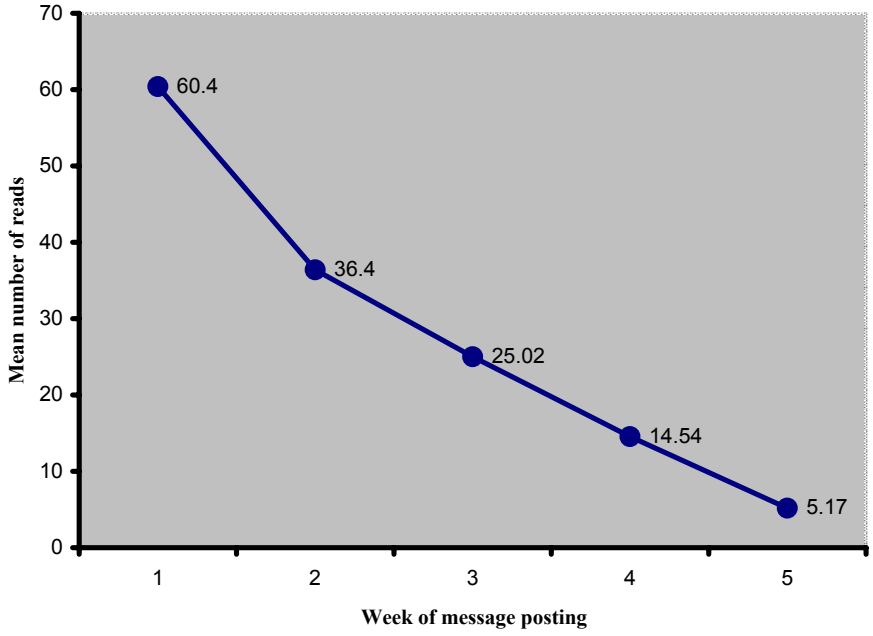


Figure 5.1 Total number of readings (Mean) of posted-messages based on the course-week they were generated

5.3.2 Students' learning activities and knowledge construction processes while performing tasks in asynchronous CSCL

As explained earlier, in the first coding scheme, which was used to characterize students' learning activities in CSCL, three categories of learning activities were discerned: cognitive, affective, and meta-cognitive activities. Cognitive activities were further broken down into three subcategories: debating, using external information and experiences, and linking or repeating internal information. Meta-cognitive activities were subdivided into planning, keeping clarity, and monitoring. As shown in Table 5.3, while 89.2 % (1320 notes) of students' contributions are coded as cognitive learning

activities, 8.4 % (124 notes) are coded as meta-cognitive and 2.1 % (31 notes) as affective learning activities. The results of applying a Chi square to test whether the observed frequencies reflect an equal distribution of notes across the three main categories of learning activities show that the number of cognitive activities is higher than the other categories (χ^2 =3277.59, Sig<.001). Looking at the subcategories of the coding scheme, it can be seen that 'debating' in the cognitive category and 'keeping clarity' in the meta-cognitive category appeared more. The distribution of codes across subcategories is also unequal (χ^2 =3379.3, Sig<.001). Table 5.3 also shows that only 31 units (2.1 %) are coded as affective, which is reasonably low.

Table 5.3 Overview of students' learning activities in performing tasks in asynchronous CSCL environments

	Frequency	Percentage
Cognitive learning activities:	***1320***	***89.2%***
Debating	882	59.6%
Using external information and experiences	303	20.5%
Linking or repeating internal information	135	9.1%
Meta-cognitive learning activities:	***124***	***8.4%***
Planning	23	1.6%
Keeping clarity	93	6.3%
Monitoring	8	.5%
Affective learning activities	***31***	***2.1%***
Rest	***4***	***.3%***

5.3.3 Quality of students' learning outcomes while performing tasks in asynchronous CSCL

In the current study, in addition to students' learning activities and knowledge construction processes while performing tasks in asynchronous CSCL environments, attention was also paid to the quality of students' contributions. As mentioned before, the second coding scheme was used to assess the quality of students' contributions. For each of the four quality levels (levels increasing from D to A) corresponding verbs were identified and described. Our findings (see Table 5.4) show that 75.1% of students' contributions were assessed as level B, which is reasonably high, and that 11.1% of the notes were coded as level C. The distribution of written notes across different quality

levels is not equal (χ^2=1989.06, Sig<.001). Table 5.4 also shows that the distribution of notes based on the subcategories of the second coding scheme (verbs) is also not equal (χ^2=3013.12, Sig<.001). In total 51.2% were assessed as "explain", 14.7% as "relate/combine", and 9.3% as "apply/compare/contrast"

Table 5.4 Overview of the quality of students' knowledge construction during performing tasks in asynchronous CSCL environments

Course	Frequency	Total
Level D:	***90***	***6.1%***
Identify	21	1.4%
Define	69	4.7%
Level C:	***164***	***11.1%***
List/enumerate/number	61	4.1%
Describe/organize	100	6.8%
Classify	3	.2%
Level B:	***1111***	***75.1%***
Explain	757	51.2%
Relate/combine	217	14.7%
Apply/compare/contrast	137	9.3%
Level A:	***114***	***7.7%***
Reflect/conclude	52	3.5%
Generalize/theorize/hypothesize	62	4.2%

5.3.4 Students' learning activities and quality of knowledge construction while performing tasks in asynchronous CSCL over time

To see whether patterns of change could be found in students' learning activities and quality of knowledge construction over time, we divided all the processes of discussion in the asynchronous CSCL environments into five sequential weeks. Table 5.5 summarizes the results over the five weeks of assigning codes to the meaningful units based on the first coding scheme and Table 5.6 is based on the second coding scheme. As can be seen in Table 5.5, while the process of asynchronous CSCL proceeded, students' cognitive learning activities increased and their meta-cognitive and affective learning activities decreased. With respect to the subcategories, messages encoded as 'debating' and 'linking or repeating internal information' showed an increasing trend and those encoded as 'planning' and 'keeping clarity' showed a

decreasing trend. Moreover, most of the messages encoded as 'keeping clarity' appeared at the beginning and those encoded as 'monitoring' appeared in the middle of the process of discussion and collaboration. Furthermore, results of Chi square tests indicated that both the main learning activities (χ^2=57.1, Sig<.001) and their subcategories (χ^2=103.53, Sig<.001) changed significantly over time (in the five week course period).

Table 5.5 Overview of students' learning activities in performing tasks in asynchronous CSCL environments over time

	Week 1	Week 2	Week 3	Week 4	Week 5	Whole period
Cognitive learning activities:	***76.0%***	***87.9%***	***89.1%***	***93.0%***	***95.1%***	***89.2%***
Debating	47.9%	54.4%	60.1%	67.3%	63.1%	59.6%
Using external information and experiences	22.9%	25.6%	20.9%	14.6%	15.5%	20.5%
Linking or repeating internal information	5.2%	7.9%	8.1%	11.1%	16.5%	9.1%
Meta-cognitive learning activities:	***14.6%***	***9.9%***	***9.0%***	***5.0%***	***4.9%***	***8.4%***
Planning	6.3%	1.2%	1.1%	1.7%	-	1.6%
Keeping clarity	8.3%	7.4%	7.3%	3.2%	4.9%	6.3%
Monitoring	-	1.2%	.6%	-	-	.5%
Affective learning activities	***6.3%***	***2.2%***	***1.9%***	***1.7%***	***-***	***2.1%***
Rest	***3.1%***	***-***	***-***	***.3%***	***-***	***.3%***

Our findings also revealed that the quality of students' contributions, based on the second coding scheme, for both main quality levels (χ^2=49.1, Sig<.001) and verbs and subcategories (χ^2=161.5, Sig<.001) changed significantly over time as well (see Table 5.6). It seemed that messages encoded as 'apply/compare/contrast' and 'reflect/conclude' showed an increasing trend and messages encoded as 'list/enumerate/number' and 'describe/organize' showed a decreasing trend.

Table 5. 6 Overview of the quality of students' knowledge construction while performing tasks in asynchronous CSCL environments over time

Weeks	Week 1	Week 2	Week 3	Week 4	Week 5	Whole period
Level D:	***9.4%***	***7.1%***	***5.3%***	***4.1%***	***9.7%***	***6.1%***
Identify	6.3%	-	1.7%	1.7%	-	1.4%
Define	3.1%	7.1%	3.6%	2.3%	9.7%	4.7%
Level C	***21.9%***	***8.9%***	***14.5%***	***7.3%***	***4.9%***	***11.1%***
List/enumerate/number	9.4%	6.9%	3.6%	.9%	1.9%	4.1%
Describe/organize	12.5%	2.0%	10.4%	6.4%	2.9%	6.8%
Classify	-	-	.6%	-	-	.2%
Level B:	***57.3%***	***79.6%***	***71.4%***	***79.9%***	***77.7%***	***75.1%***
Explain	37.5%	56.4%	45.2%	58.9%	48.5%	51.2%
Relate/combine	14.6%	15.3%	17.9%	10.5%	9.7%	14.7%
Apply/compare/contrast	5.2%	7.9%	8.3%	10.5%	19.4%	9.3%
Level A:	***11.5%***	***4.4%***	***8.9%***	***8.7%***	***7.8%***	***7.7%***
Reflect/conclude	5.2%	.7%	4.3%	3.8%	7.8%	3.5%
Generalize/theorize/hypothesize	6.3%	3.7%	4.5%	5.0%	-	4.2%

5.3.4 Students' learning activities and quality of knowledge construction while performing tasks in asynchronous CSCL across different courses

To see whether there are significant differences between students' learning activities and the quality of their contributions in different learning conditions (instructional settings, teachers and lecturers, content, students, etc.) our data were analysed across all the different forums in the seven courses. Our findings showed that although, in all courses, cognitive activities were found most frequently, their proportion differed across different courses. For example, in the courses "Human Resource Development /Learning & Career Development (HRD) 2005" and "Applied Environmental Education and Communication (AEE&C) 2005" the proportion of cognitive activities was relatively higher (see Table 5.7). Students in the course "Education in developing and changing societies " showed relatively more affective learning activities and students in the courses "Human Resource Development /Learning & Career Development (HRD) 2006" and "Education in developing and changing societies " showed relatively more meta-cognitive learning activities. Results of Chi square tests indicated that both for the main learning activities (χ^2=65.9,

Sig<.001) and for their subcategories (χ^2=132.8, Sig<.001) students' learning activities differed across the different courses.

Our findings also revealed that both for the main quality levels (χ^2=141.6, Sig<.001) and for their subcategories and verbs (χ^2=300.7, Sig<.001) the quality of students' contributions differed across the different courses (see Table 5.8). In total, in terms of quality, most messages were encoded as level 'B' or (to a lower extent) as level 'C'. However, in the course "Applied Environmental Education and Communication (AEE&C) 2005", a relatively high percentage (30.4 %) of the messages were encoded as level 'A' (see Table 5.8).

5.3.5 Conditions for productive knowledge construction processes while performing tasks in ACSCL environments from the students' perspective

The process of collaborative knowledge construction is complex and multidimensional. The idea that students, while performing group tasks, automatically construct knowledge was rejected a long time ago. Collaborative conditions which might foster the process of knowledge construction became one of the main topics of research in the field of collaborative learning and CSCL. From an educational point of view 'scripting collaboration' is seen as a way to foster the knowledge construction process. As stated earlier, most participants (83 %) were interviewed at the end of their course and, moreover, several focus group discussions (19 sessions) were conducted with different group combinations.

Table 5.7 Overview of students' learning activities in performing tasks in asynchronous CSCL environments across different courses

Course	1	2	3	4	5	6	7	Total
Cognitive learning activities:	***81.3%***	***88.0%***	***91.3%***	***95.6%***	***87.1%***	***87.4%***	***85.1%***	***89.2%***
Debating	56.3%	55.3%	78.3%	61.8%	59.1%	57.7%	53.0%	59.6%
Using external information and experiences	22.9%	22.0%	8.7%	22.1%	16.1%	23.3%	20.4%	20.5%
Linking or repeating internal information	2.1%	10.7%	4.3%	11.8%	11.8%	6.5%	11.6%	9.1%
Meta-cognitive learning activities:	***12.5%***	***10.3%***	***4.3%***	***3.7%***	***9.7%***	***9.8%***	***13.3%***	***8.4%***
Planning	6.3%	1.3%	2.2%	-	1.1%	.9%	2.2%	1.6%
Keeping clarity	6.3%	7.7%	2.2%	3.7%	7.5%	7.9%	10.5%	6.3%
Monitoring	-	1.3%	-	-	1.1%	.9%	.6%	.5%
Affective learning activities	***6.3%***	***1.3%***	***2.2%***	***.7%***	***3.2%***	***2.8%***	***1.7%***	***2.1%***
Rest	*-*	***.3%***	***2.2%***	***-***	***-***	***-***	***-***	***.3%***

1 = Education in developing and changing societies; 2 = Didactic skills; 3 = Applied Environmental Education and Communication (AEE&C) 2005; 4 = Human Resource Development /Learning & Career Development (HRD) 2005; 5 = Human Resource Management (HRM); 6 = Applied Environmental Education and Communication (AEE&C) 2006; 7 = Human Resource Development /Learning & Career Development (HRD) 2006

Table 5. 8 overview of the quality of students' knowledge construction during performing tasks in asynchronous CSCL environments across different courses

Course	1	2	3	4	5	6	7	Total
Level D:	***6.3%***	***5.7%***	***8.7%***	***5.9%***	***6.5%***	***5.6%***	***5.5%***	***6.1%***
Identify	6.3%		4.3%	1.5%				1.4%
Define	-	5.7%	4.3%	4.4%	6.5%	5.6%	5.5%	4.7%
Level C	***14.6%***	***13.0%***	***10.9%***	***8.8%***	***7.5%***	***9.3%***	***14.4%***	***11.1%***
List/enumerate/number	6.3%	5.3%	4.3%	2.2%	1.1%	3.7%	6.6%	4.1%
Describe/organize	6.3%	7.7%	6.5%	6.6%	6.5%	5.6%	7.7%	6.8%
Classify	2.1%	-	-	-	-	-	-	.2%
Level B:	***70.8%***	***74.3%***	***50.0%***	***83.1%***	***78.5%***	***81.9%***	***71.3%***	***75.1%***
Explain	45.8%	53.0%	15.2%	60.3%	55.9%	59.1%	47.5%	51.2%
Relate/combine	18.8%	12.7%	17.4%	15.4%	16.1%	11.6%	13.8%	14.7%
Apply/compare/contrast	6.3%	8.7%	17.4%	7.4%	6.5%	11.2%	9.9%	9.3%
Level A:	***8.3%***	***7.0%***	***30.4%***	***2.2%***	***7.5%***	***3.3%***	***8.8%***	***7.7%***
Reflect/conclude	2.1%	4.3%	8.7%	2.2%	4.3%	.9%	5.0%	3.5%
Generalize/theorize/hypothesize	6.3%	2.7%	21.7%		3.2%	2.3%	3.9%	4.2%

1 = Education in developing and changing societies; 2 = Didactic skills; 3 = Applied Environmental Education and Communication (AEE&C) 2005; 4 = Human Resource Development /Learning & Career Development (HRD) 2005; 5 = Human Resource Management (HRM); 6 = Applied Environmental Education and Communication (AEE&C) 2006; 7 = Human Resource Development /Learning & Career Development (HRD) 2006

In personal interviews with participants and focus groups, students were asked to explain their experiences with the different aspects of performing tasks in ACSCL environments, and to describe situations that led to generating more in-depth and thoughtful messages, factors that motivated them to participate more and factors that impeded their participation and contribution. They were also asked to explain their opinions about the teacher's role, and the level, type, and process of support that motivated them to participate more and generate well-grounded messages. Analysing the discourses of all interviews and focus groups, many different and diverse opinions about various aspects of performing tasks in ACSCL environment were identified. We tried to categorize all those diverse opinions to help us to understand the students' experiences better. In this section, the results of the interviews and focus group discussions will be explained with respect to task structure, support, teacher's role, task complexity, and group composition, which are all discussed under the term 'scripting CSCL' in the literature. King (2003, p.15) defined a script as "a guide to the roles and

steps people follow for what to do and how to do it in a specific social situation" and as Dillenbourg and Jermann (2003, p. 275) stated, "a script describes the way students have to collaborate: task distribution or roles, turn taking rules, work phases, deliverables, etc". According to Weinberger (2003), cooperation scripts provide a structure to collaborative knowledge construction by specifying, sequencing, and assigning roles or activities to learners. In the interviews and focus groups students stated that instructional design and setting of the course were more influential in their participation in the ACSCL environment of the course than technical features of the learning environment.

5.3.5.1 Task structure

Two different opinions were raised in the interviews and focus group discussions about the level of structure of tasks. When a task was not structured, and students themselves were asked to make a plan for doing their task; being free to structure and decide upon the content of each stage, they faced the problem of starting their asynchronous online collaborative work, especially in the first two weeks. The process of discussion and collaboration in this situation was slow and the number of generated messages was low, mostly encoded as meta-cognitive in terms of learning activities. Students were not satisfied with this mode of task formulation . On the other hand, when the task was structured, students were able to carry it out easily but they believed that, in this situation, there was not enough room for their own creativity and most of them were not satisfied with such a task either. In the interviews and focus groups students were asked to discuss this topic (level of structuring of the task in ACSCL) in detail and almost all students believed that structuring of the task was necessary for performing tasks in ACSCL. However, students from European countries complained more and some of them were very unsatisfied with highly structured tasks. They believed that they could work better in more loosely-structured task situations, whereas Chinese and African students stated that they preferred more structured tasks. In sum, it can be concluded that almost all students felt that some kind of structuring was necessary. However, the optimal level of task structuring for ACSCL depends on the learning paradigm behind the previous education of students and probably their culture. Students' prior knowledge should also be taken into account.

3.5.2. Support

Support that students need while performing tasks in ACSCL environments, and the way they should receive that support, were issues that were raised several times by students in the interviews and focus groups. Groups who were asked to work on their group task and groups, who along with performing their group task received some kind of support, showed different patterns of participation. More specifically, in some case studies students were asked to first discuss and debate some themes, articles, and reports about the topic of the course in the first two weeks -sometimes the entire period- as a kind of support for them in performing their task, both technically and scientifically. Students in this situation were able to gain knowledge and discuss some aspects of the field, and also had the opportunity to practice working with the learning environment in addition to the initial introductory instruction that they received during the first meeting. Students in this situation participated more and showed more high quality learning activities. The necessity of receiving support was raised by the majority of students in the interviews and focus groups, though they were not able to come to an agreement on the time and amount of support that they needed.

5.3.5.3 Teacher's role

In the case studies the role of teachers, or external experts, and the way they can moderate the process of collaboration in ACSCL was not explored. However, in the interviews and focus groups the topic received students' attention from different aspects. Many students (75 %) stated that the teacher and the external expert are sources of information, that their information is more reliable than the information from their peers and that they are able to motivate students to participate more. They believed that the presence of the teacher and/or external expert is helpful and sometimes necessary (90 %) for a lively discussion and collaboration, and a majority of them (55 %) believed that without the teacher or an expert being present during the process of knowledge construction, they cannot reach their expected learning goals. The teacher is also seen as a person who can direct the collaboration process and keep it on track and prevent 'free riding' of some of the students.

5.3.5.4 Task complexity

In the focus group discussions several groups mentioned that a challenging task is important for ACSCL. Students believe that when a task is too easy to accomplish or so difficult that it cannot be achieved by distributed teams with a reasonable effort in the supposed time framework of the course, the process of collaboration gets stuck and students produce low quality notes.

5.3.5.5 Group composition

Group composition was mentioned by several individuals and groups of students as one of the determining factors in ACSCL. There was no definite decision and agreement in the focus group discussions on the best group composition for performing tasks in ACSCL. Some groups thought that homogeneous groups in terms of previous knowledge of, and experience with, the task could work better and others believed that they would prefer heterogeneous group compositions.

5.4 Conclusions and discussion

5.4.1 Participation

Based on our study it is justified to conclude that a blended learning approach integrating asynchronous CSCL environments can effectively engage students in the process of learning in their outside class time in both reading and writing notes. Although students read more notes in courses with high numbers of participants, no significant difference was found in the number of generated meaningful units per student across different courses. Moreover, students tend to review messages in the recorded thread and benefit from this feature of CSCL. Although the design of our study does not allow us to compare asynchronous CSCL situations with conventional face-to-face settings, both average and minimum numbers of participants, together with the dispersion patterns of their participation support the claim that asynchronous CSCL fosters more and equal participation and might be used to encourage and engage the silent side of the class into the processes of discussion and collaboration.

5.4.2 Process of knowledge construction

Although finding distinct phases in the process of performing tasks in ACSCL environments is difficult, in our study a pattern could be determined consisting of three phases. In the first phase, learning activities like planning, explaining, and affective learning activities appeared more. In the second phase, debating, keeping clarity, interaction, counter argumentation, and sometimes conflict could be seen frequently. Finally, in the third phase, construction of new and shared knowledge, applying the new knowledge to find a solution to the problem, and concluding and theorizing appeared more. Most activities are found in the first phase and fewer activities were seen in the second and third phases. However, it should be mentioned, that the percentage of each activity across different courses differed.

5.4.3 Quality of students' knowledge construction while performing tasks in CSCL environments

As mentioned before, one of the main theoretical assumptions about CSCL is that the quality of students' written notes and contributions to the forums in such environments is high. Previous empirical studies revealed contradictory results in this respect. While a large body of studies has shown that indicators of deep learning, critical thinking, and problem solving can be seen during discourse in CSCL, other studies only show superficial levels of knowledge construction. In these studies negotiation, sharing knowledge, and construction of meaning did not often occur. In our study, the quality of students' contributions is mainly at level 'B' which indicates a good quality of discussion and collaboration. However, the quality of discussion was significantly related to the design and setting of the course. The percentage of messages and notes whose quality was assessed as the highest quality level 'A' was unsatisfactory for all but one course. In general, our findings support the conclusion that, although asynchronous CSCL environments enable teachers to engage on-campus students more in the process of knowledge construction, and signs of good interaction and quality of knowledge construction can be seen in this blended learning approach, like other instructional technologies, the effectiveness of asynchronous CSCL environments is highly related to instructional design and course setting.

5.4.4 Relationships between variables in this study

The results of our study revealed that students in courses with high numbers of participants read more than students in courses with lower numbers of participants. However, our findings did not show significant differences between the numbers of students' written notes in the ACSCL environments of the different courses. Moreover, considerable differences were found between students' activities while performing tasks in ACSCL environments. There even were differences with respect to the level of student participation and their learning activities within courses that were provided on two occasions (with the same learning objectives and tutors). For example, students in course HRD-2005 contributed three times more than students involved in course HRD-2006, yet their meta-cognitive activities were only a quarter of those of the 2006 group. Students in course AEE&C 2006 showed twice as many meta-cognitive activities than students in course AEE&C 2005 and also generated more messages encoded as 'debating' and fewer messages (around one-third) encoded as 'using external information and experiences'. Similarly, big differences can be seen in the quality of learning outcomes and student activities across different courses, again even in those courses that were provided twice. For instance, while the quality of almost one-third of students' written notes in the course AEE&C 2005 were encoded as level 'A' just a small proportion (3.3 %) of written notes in course AEE&C 2006 were given the same quality code.

All the findings and differences mentioned above, along with the contradictory findings from previous research, enable us to confirm that instructional design and setting are still the golden and critical keys in the process of learning, which is in line with what Clark (1994) suggested in the crucial debate on the role of "media" and "method".

Because the courses differed on various aspects, the research design does not allow us to compare them. However, we will try to explain the differences between courses with respect to students' participation and learning activities in ACSCL environments in light of the course descriptions (see Table 5.1), type, and description of learning tasks and activities students were asked to do (see Table 5.1), and, finally, based on students' opinions (as expressed in the interviews and focus group discussions).

The fact that students in the courses HRD and AEE&C, which were provided twice in our study (including the same tutors and learning goals and objectives), showed different degrees of participation has lead us to the conclusion that the role of 'task characteristics' in ACSCL environments is very important and probably needs more consideration than in face-to-face collaboration. When tasks are very structured, the students are able to find their way easily but the number of messages showing higher-order learning is low. When the task is vague and there is little structure, however, the students face problems in finding their way in the environment. Therefore, task structure is a key characteristic which needs further research and study. This study also showed that when students, before and along with their group task in the ACSCL environment of the course, are asked to conduct an online debate on topics that help them to gain knowledge related to the topic of the course, they participate more in the ACSCL learning environment and produce more in-depth contributions. When they are just asked to work on their group task, their knowledge of the topic is unsatisfactory. This finding indicates that students need support to acquire both declarative and procedural knowledge with respect to the topic of their group task; online debating about relevant review articles or book chapters can play this role successfully. This is in line with the role of 'support' in the literature of discovery and inquiry-based learning. The role and criteria for the optimal level of 'support' and the way that students should receive support needs more study.

In an attempt to explain the differences between courses we noticed that, when we divided the learning tasks into different steps, thus giving students the opportunity to discuss and perform the task in different phases, they engaged more in the learning environment. This might be explained in light of the 'formative assessment' and 'process-oriented feedback' by tutors and peers, which both aim at improvement of the process and more worthwhile in-depth investigation. Although the relationship between students' attitudes and their participation in ACSCL environments is discussed in another article (Mahdizadeh, Mulder & Biemans, 2007), we conclude that when students feel that activities in the ACSCL environment are a real part of the course –not just an extra activity- and that these activities are well-designed and integrated into the design of the course and help them to achieve their learning goals, the degree of participation is reasonably high. How students perceive their teacher's belief in ACSCL

activities plays a critical role in their contribution to the environments. In other words, when students think that teachers themselves deeply believe in the added value of the ACSCL activities of the course, they also take this part of the course seriously and participate more frequently and more thoroughly. Moreover, in courses in which participation in CSCL environments accounts for a reasonable part of the final mark, the level of participation is high. Finally, students who had done an introductory course on the topic of the course were more active than others.

Learning to work in distributed teams is one of the main competencies that should be developed in higher education to prepare students for working in a knowledge and network society. The findings of this study reveal that performing tasks in asynchronous CSCL environments have the potential to increase the level of participation and interaction among students and to foster processes of shared and social knowledge construction. Performing these kinds of tasks has the potential to provide a meaningful supplement to conventional teaching and learning approaches and can help teachers to overcome the limitations of face-to-face collaboration and discussion. However, in line with what Clark (1994) suggested, we conclude that the flexibility that this new and rich learning environment provides for teachers should be embedded in an instructional design and course setting that provokes higher levels of interaction, thinking and reflection, and knowledge construction. In other words, such learning environments will remain luxury tools if teachers cannot properly integrate them into the instructional design of the course to help students to achieve their learning goals. To conclude, although we found that performing tasks in asynchronous CSCL has added value for higher education, especially when deep learning and well-grounded and well-supported argumentation are the main goals of learning, the relationships found between course characteristics and students' learning activities and the quality of their contributions (and the contradictory findings in previous research) support the claim that instructional design and course setting are crucial for the successful implementation of this new technology.

In our opinion, future research is needed to address issues such as: In which instructional design and course setting do on-campus students generate more in-depth notes of higher quality? How, and when, can asynchronous CSCL replace some activities in traditional approaches to learning and, more importantly, when and how can

they function as a new approach to foster higher level thinking and interaction? In which conditions can students' active participation and writing be increased? In which conditions can a process of argumentation be fostered in which students contribute more well-grounded arguments to the forums? How can an unmanageable workload for both teachers and students in performing tasks in asynchronous CSCL environments be prevented? How can individual students be persuaded to think deeply about their contributions to the asynchronous CSCL environments of their courses? How can the performance of groups of on-campus students in asynchronous CSCL environments be improved? How can we change patterns of interaction to promote knowledge sharing, debating, and shared knowledge construction? In which conditions do teachers and students in on-campus higher education perceive more added value from performing tasks in asynchronous CSCL environments? What is the optimal level of task structure and task complexity for performing tasks in ACSCL? How much support do students need and how should they be provided with that support? Future research should shed light on these –and other- issues regarding the implementation and effects of ACSCL in higher education.

Acknowledgement

The research reported in this article was financially supported by the Ministry of Science, Research, and Technology (MSRT) of the Islamic Republic of Iran. The authors want to express their gratitude for this support. Our sincere gratitude goes to Arjen Wals, Cees van Dam, Renate Wesselink, Thomas Lans, Joke Marinissen, Barbara van Mierlo, and Elke van den Elsen who gave us the opportunity to explore the implementation of ACSCL in their courses. We would like to thank all students who participated in this study for their contributions to the CSCL environments; and Noor van der Hoeven, Corine van der Heide, Kate Collins, and Natalia Eernstman for helping us with transcribing and coding student discourses; Judith Gulikers and Hendrik Kupper for their helpful and constructive comments on the first draft of the article; and Kate Collins for editing this manuscript.

Chapter 6

Asynchronous Computer-Supported Peer Group Feedback in Higher Education[1]

[1] Will be submitted as Mahdizadeh, H., Biemans, H. & Mulder, M. A study of Asynchronous Computer-Supported Peer Group Feedback in Higher Education.

Abstract

A study was conducted to investigate the application of peer group feedback in face to face class meetings and asynchronous computer-supported collaborative learning (ACSCL) environments. Seventy MSc students who participated in 3 courses were asked to conduct a collaborative task (case study) in small groups of 4 to 6 persons. Of these, 30 students presented the results of their group work in face to face class meetings and received feedback from other students afterwards. The other 40 students uploaded the results of their group work to their course website and received feedback from their peers through the ACSCL environment of the course. We found that asynchronous computer-supported peer group feedback (ACS-PGF) works better than face to face peer group feedback (F2F-PGF) in terms of students' participation and interaction and can facilitate the participation of the silent side of the class. However, we found that there was a significant difference between the feedback functions for both conditions; with students in the ACS groups being more critical than those in the F2F groups.

Keywords: Computer-supported collaborative learning (CSCL), Peer Group Feedback, Collaborative learning, Computer-mediated communication, asynchronous discussion and collaboration, knowledge construction, content analysis

6.1 Introduction

Learning from peers is reported to be important for education in different ways. Theoretically, this was supported by what Vygotskey called the Zone of proximal development (ZPD) and Piaget's theory. It also plays an important role in constructivist learning theories and the collaborative approach to learning. In practical terms it is seen as a way to involve students in the process of learning and persuade them to be more active and play a more central role in the process of learning and new knowledge construction. Moreover, this will help students to be more autonomous and is seen as a way to decrease the teachers' work load. In order to stimulate learning from peers several instructional settings were introduced, among them "Peer Assessment (PA)" and "Peer Feedback (PF)", these are well-known techniques in language learning skills and, more specifically, in second language learning (L2). Van den Berg, Admiraal and Pilot, (2006a, p. 341) believe that "There is an increasing amount of attention being given in higher education to the concept of peer assessment, which can be understood as an educational arrangement in which students assess the quality of their fellow students' work and provide each other with feedback". In order to avoid the disadvantageous assessment aspect of PA, we decided to concentrate on PF which is defined as an instructional setting in which students provide each other with feedback on the different steps and stages of performing their learning tasks. Although meta-analysis and reviews of research in the field (Kluger & DeNisi, 1996) reveal that Feedback Intervention (FI) has a variable effect on performance and can, only in some circumstances, improve performance, it is still reported in several studies that there are positive effects of PA and PF on learning processes (Topping, 1998; Van den Berg, Admiraal & Pilot, 2006).

New Information and Communication Technology (ICT), in general, and Computer-Supported Collaborative Learning (CSCL) environments, in particular, yielded a new era for researchers in the field of education to explore how this new high technology could facilitate different collaborative instructional settings like PA and PF. Some of the experiences of implementing PA and PF in CSCL environments have already been reported (Ertmer et al., 2007).

In an exploratory study at Wageningen University we found that, in around 82 % of courses, the main tasks asked of students were to conduct a case study or write a report or an essay to be presented for teachers and other students at the plenary session of their

course. Then students and teachers are supposed to explain their ideas about the presentation and give their feedback; primarily in order to help the presenter(s) to improve their study. The current paper is the result of research which concentrated on the study of both Face to Face Peer Group Feedback (F2F-PGF) and Asynchronous Computer- Supported Peer Group Feedback (ACS-PF). CSCL environments have several features which could potentially provide the conditions for effective PF and PA. Immediacy is seen as one of the determining factors for effective feedback (Mory, 2003) and CSCL environments, due to their time and place independence, could accelerate this giving and receiving of feedback. Multifaceted and multi-source feedback is also considered important for its feedback effectiveness. It seems that in conventional classrooms, where time is often a limiting factor, there is usually only time for a few students to present their work and to receive the comments and reactions of their peers. However, in CSCL environments, more specifically, in Asynchronous CSCL (ACSCL) environments, all students can write and explain their comments in the forum and present "Delayed Feedback"; presenters have enough time to think about their peers' comments and remarks. This feature of CSCL environments seems very important for classrooms with high numbers of participants. In the conventional classroom situation participants face time pressures –normally 15-30 minutes for presentation and follow up discussion- and their peers have to react immediately; a common concern that reactions and reflections in this setting may not be well thought out provides the rationale to move beyond this setting. Asynchronicity in ACSCL environments could, potentially, afford students the opportunity to reflect more deeply on a topic and give well-structured, detailed and well-supported feedback to their peers. Moreover, this fact that the process of giving and receiving feedback in the forums is available to all users, irrespective of time and place, means that they are able to review the process in their own time and contribute to feedback processes and mechanisms better. It should be noted that PA, when used solely as a means of peer assessment at the end of a course – summative evaluation- is reported to have negative consequences for learning and also for the way students contribute to the PA process. However, PA, from a formative assessment perspective, could provide useful feedback for students from their peers' perspective which could enable them to improve their work; thereby becoming PF instead of PA. In conventional educational course settings, often due to

time constraints, arranging and managing just one time feedback processes for all students is sometimes difficult but ACSCL environments enable teachers to arrange formative PF for different steps of the course, thereby successfully converting PA to formative PF. Additionally, PF could increase meaningful interactions between peers. In the current study we tried to explore students' reactions to PF in asynchronous CSCL environments and to find out how we can use such new technology in the process of learning. We also investigated the quality of students' contributions and comments in such learning environments. For this purpose the following research questions were formulated:

1. What are students' perceptions of the value of Peer Group feedback (PGF) in both Asynchronous Computer-Supported (ACS) and Face to Face (F2F) conditions?
2. To what extent do students participate in Peer Group feedback (PGF) in both Asynchronous Computer-Supported (ACS) and Face to Face (F2F) conditions?
3. What are the functions of student feedback in both Asynchronous Computer-Supported (ACS) and Face to Face (F2F) Peer Group feedback (PGF)?
4. What is the quality of student feedback in both Asynchronous Computer-Supported (ACS) and Face to Face (F2F) Peer Group feedback (PGF)?

6.2 Methodology

6.2.1 Subject and context of the study

In this study we want to document participation and quality of peer feedback in a conventional face to face classroom and asynchronous CSCL environment in higher education. The study was conducted at Wageningen University in the Netherlands which is one of the leading universities in Europe, and the world, in the field of environmental, animal, plant, food, and social sciences. Students from 16 different countries and a variety of programs and disciplines in the fields of environmental, animal, plant, food and social sciences participated in the research. This mix represents a typical group in the domain and makes the current study a representative study for it. Participants in this study included a total of 70 MSc students who enrolled in 3 courses (Table 6.1) at the University (for more information about participants and courses refer to Mahdizadeh, Mulder & Biemans, 2007, submitted). To facilitate communication

within groups, the courses used 'Blackboard' as an asynchronous online collaboration environment. At the first meeting of every course the students were informed about the objectives of peer group feedback (PGF) and its procedures, the objectives of the study were introduced to them and they were invited to participate. All students were divided into small groups consisting of 4-6 persons and then all groups were assigned to either "Face to face peer group feedback (F2F-PGF)" or "Asynchronous computer supported peer group feedback (ACS-PGF)" conditions. In total 30 students (6 groups) were involved in F2F-PGF conditions and 40 students (8 groups) were involved in ACS-PGF conditions. All participants were asked to perform a group task in 3 steps. Those who were in F2F-PGF were asked to present their step one and two results in the conventional plenary face to face classroom meeting for other students; other students were required to give them feedback on their presentations. Students who participated in ACS-PGF were expected to upload the results of their first and second steps to the computer supported collaborative learning environment of Blackboard, the course management system or virtual learning environment of the courses. Subsequently, just as in the F2F-PGF situation, other students were required to give them feedback on their presentation. There was a guideline and criteria for each of the steps of the group task to help the students perform their task. Participants also received guidelines and criteria on how to give feedback to other groups. We tried to help students find an authentic group-work task and they were free to accomplish the task in their own way. Students under F2F-PGF conditions received feedback from tutors during the plenary session and those who were involved in ACS-PGF received feedback from tutors via Blackboard. In one of the courses all of the groups (both F2F- and ACS-PGF) received feedback from an external expert as well. Each group in F2F-PGF had 45-60 minutes (Mean = 48 Minutes) for presentation and the giving and receiving of feedback; this seems much higher than what is normally experienced in these situations. Students in ACS-PGF were able to upload text (word) or PPT (PowerPoint) files to the learning environment of their group and other students had one week to post their feedback. Although students were supposed to accomplish the task within their group, they were asked to give feedback individually. As mentioned, the tasks were divided into three steps; while the first step was mostly about problem definition and comprehensibility, it had consequences for the different organizational, societal and stakeholder aspects. The

second step concerned the different possible solutions to the problem and making a plan to deal with it. The plan was supposed to present strategic advice and a sound solution to prevent the problem re-occurring, diminishing its consequences, and resolving it. Although all three courses were different, the group tasks followed the same reasoning and style of thinking in dealing with a problem and solving it (the same problem-solving strategy). Finally, the third step of the task was the group's final plan which was supposed to be revised based on the comments and remarks that were received during the two rounds of feedback in the first and second steps.

Students were able to access the website of their course from inside and outside of the campus. They were all competent in working with computers and the internet and received specific instructions about the asynchronous online collaborative learning environment of their course and tasks during the first week of each period. The language of all courses was English, which was the second language for more than 95% of participants. However, most claimed that they did not have problems communicating in the English language.

6.2.2 Data collection

In order to answer our research questions we used data from different sources that were collected using various techniques. A questionnaire was constructed comprising six different sections. The first section (10 items) was meant to capture students' opinions about peer assessment and feedback in education. The second section (19 items) assessed students' satisfaction with the peer group feedback process in their course. The third section (26 items) collected information on students' perceptions of learning through a feedback process and mechanism in their course.

Table 6.1 Course descriptions and student tasks and activities in both conditions.

	Course title	Course content	Tasks and activities done in the asynchronous CSCL environment of the course
1	Applied Environmental Education and Communication (AEE&C)	During the course students explore the instrumental and the emancipatory use of environmental education, communication, participation and whole system re-design in moving towards sustainable lifestyles, organizations and systems. Special attention is paid to the methodological aspects of environmental education and communication. Students are exposed to, and involved in, the design, implementation and evaluation of a public environmental awareness campaign; a community-based social environmental learning project.	-Each group was asked to conduct a case study on an environmental issue in three steps: first exploring and defining an environmental issue and challenge then exploring different strategies to cope with the challenge and selecting and advising the best and most appropriate strategy and a way to evaluate the impact of the strategy.
2	Human Resource Development/ Learning and Career Development (HRD)	This course focuses on the theory and practice of human resource development in profit and non-profit organizations. Special attention is given to concepts of lifelong learning, organizational learning, learning in teams, and individual learning. Organizational development is seen as a combination of individual and collaborative learning. Human resource development is viewed from the micro (individual), intermediate (institutional) and macro (societal) level.	-Students were asked to do a case study in three steps: first they were supposed to select an organization and explore major and radical changes which might affect it, and to choose one of the major changes, and explore its consequences for the selected organization. In the second step they were asked to investigate different HRD strategies that can help the organization to face the chosen major change and suggest a key HRD strategy as the strategic solution for the selected organization to prepare itself to face the chosen major change and when actually facing the chosen major change. Finally in the third step they were asked to finalize their strategic solution based on feedback that they received from other students.
3	Human Resource Management (HRM)	This course focuses on the theory and practice of human resource management (HRM) in profit and non-profit organizations. Special issues addressed during the course are managing diversity, performance analysis and management, employee relations, and managing an intercultural workforce.	-Students were asked to do a case study on a real HRM-related crisis of a company which was introduced by the HRM department of the company itself; in three steps: first they were supposed to investigate and analyze HRM approaches of the company and explore different aspects of the crisis. In the second step they were asked to investigate and discuss different solutions for the crisis and suggest a key HRM strategy as the strategic solution for it. Finally at the third step they were asked to finalize their strategic solution based on the feedback that they received from other students.

The fourth section (10 items) assessed students opinions about the added value of peer group feedback in performing their group task and improving their final plan. The fifth section captured the students' learning approach (26 items) and finally the last section (6 items) collected information on the students' previous experience with computers, internet, e-learning and online discussion and collaboration. In all sections except the last one, all items of the questionnaire used a five-point Likert scale (1=strongly disagree; 5=strongly agree). There were also three open-ended questions at the end of the questionnaire for the online groups, asking them to compare F2F-PGF with ACS-PGF, and explain the advantages and disadvantages of ACS-PGF and the way that it can be implemented effectively in higher education. The questionnaire was piloted to determine its reliability and validity. Validity of the questionnaire was improved by consultation with experts in the field. At the end of the courses all students were individually interviewed about their feelings towards the different aspects of peer group feedback and also several focus groups were conducted with different group combinations (productive and non-productive groups, students who were reasonably satisfied with and those who were unsatisfied with PGF). Last, but not least, the written notes and posted contributions of participants in ACS-PGF and the transcripts of students' discussions in F2F-PGF were analyzed to gain an in-depth insight into the process of giving and receiving feedback. This triangulation of data collection techniques helped us to study PGF from different perspectives.

6.2.3 Data analysis

The collected data were analyzed in different ways. Firstly descriptive (mean, standard deviation, percentage, frequency) statistics were applied to students' responses to the questionnaire and, as the items measured student opinion using a Likert scale, Mann-Whitney U test was used to compare their opinions about the different aspects of PGF in both face to face and asynchronous online circumstances. In addition, we used T-tests to compare students' satisfaction with perceived learning and perceived added value of PGF in their course. Moreover, we used content analysis technique to go through the quality and content of written notes of participants under ACS-PGF conditions and transcribed the discourse of F2F-PGF. In the current study the content of

feedback was evaluated using two coding schemes. The first of these schemes (see table 6.2) was developed by Veldhuis-Diermanse (2002) and the second (see table 6.3) is a moderated and adapted version of a coding scheme that was used by Van Den Berg et al. (2006). The first scheme concentrates on the depth of learning based on the Structure of Observed Learning Outcome (SOLO) taxonomy proposed by Biggs and Collis (1982); it shows the levels of students' comprehension. The second scheme codes feedback in relation to its product-oriented and process-oriented functions. The notes were divided into meaningful units and each meaningful unit was assigned a code based on both coding schemes. The teacher(s) of each course and the three coders (fellow researchers in Education and Competence Studies Group of Wageningen University who received introductory training in the segmentation and coding procedure) encoded the units. In this study the unit of meaning is considered as "a statement or a continuous set of statements, which convey one identifiable idea" (Avive as stated in Murphy & Ciszewska-Carr, 2005). Therefore, sometimes a message contains more than one unit of meaning. Finally, we asked the tutors of the courses to assess the quality of meaningful units based on the first coding scheme and we additionally asked them to rate all units from "0" to "4" in terms of "Support" (referring to participants' level of argumentation, including the theoretical and empirical evidence to support their comments and ideas), "Structure" (referring to consistency and logical reasoning of feedback), "Clarity" (to assess to what extent the feedback is clear and understandable), "relevance" (to discern the extent of student feedback as relevant and to the point) and finally style which concerned linguistic aspects (Table 6.4).

Table 6.2 Coding scheme for assessing the quality of students' feedback (Veldhuis-Diermanse, 2002)

Level	*Verb*	*Description*
D	Identify	Recognising or distinguishing something from others. One point or item is given that is not related to other points in the discourse. Furthermore, this new point is not elaborated.
	Define	Describing clearly what something is. The description is taken over from a text or someone else; it is not a self-made definition.
C	List/enumerate/ number	Writing things one after another, usually in a particular order; but it can be a disorganised collection of items, too. Marking something with a number, usually starting at one.
	Describe/organise	Giving a self-made definition of something (like a theory, idea, problem or solution) which explains its distinguishing characteristics. Organising ideas or a theory, but descriptive in nature. No deeper explanatory relations are given; it concerns a rough structure of information.
	Classify	Dividing things into groups or types so that things with similar characteristics are in the same group.
B	Explain	Giving reasons for a choice made. Elaborating on an idea, theory or line of thought.
	Relate/combine	Linking two or more things or facts, which are related to each other.
	Apply	Using acquired knowledge.
	Compare/contrast	Considering things and discovering differences or similarities between them.
A	Reflect/conclude	Criticising arguments on their relevance and truth. Deciding something is true or not, after considering relevant facts. A judgement is given after considering an argumentation or theory. (The conclusion has to be a point; it must rise above the earlier statements, and not be just a summary)
	Generalise/ theorise/ hypothesise	Surpassing the concrete ideas and formulating one's own view or theory. Predicting that something will be true because of various facts; this prediction has to be checked/examined.

Table 6.3 Categories of different functions of students' feedback and their descriptions

	Feedback Functions	Description
1	Clarifying questions (Clarification)	Includes comments aimed at comprehensibility the presentation of the task
2	Evaluation/ Criticism	All explicit and implicit quality statements
3	Motivate/ Praise	Motivating and encouraging statements related to the solution
4	Revision/ Advice/ Alternative/ Suggestion	Suggested measures for improvement
5	Orientation	Includes communication which aims at structuring the discussion of the feedback
6	Support / supplement	Introducing similar studies and useful cases, and related literature/website, source of information, informant expert, relevant organization and NGO to help students with doing their task
7	Not Applicable	Comments not fitting one of categories

Table 6.4 Different assessed aspects of students' feedback and their descriptions

	Assessed aspects of Feedback	Description
1	Reasoning / Argumentation	To what extent is the feedback well-grounded? To what extent do students use theoretical and empirical evidence (from the reader or other documents and sources) to support their feedback?
2	Structure	To what extent is the feedback well-structured and follows a logical way of reasoning (Format)?
3	Clarity	To what extent is the feedback clear and understandable? To what extent is the feedback easy to understand?
4	Linguistic	To what extent is the feedback well-formulated in terms of language?
5	Relevance	To what extent is the feedback relevant and to the point?

6.3. Results

The results of this study are presented in the following sections of this article. First, the results of a survey on students' opinions about different aspects of giving and receiving feedback are described. Second, students' participation in the feedback processes in different case studies and in different conditions is addressed. Finally, the quality of feedback in both face to face and asynchronous online conditions is

discussed. Before explaining our findings we should draw the readers' attention to the point that although, from a blended learning approach, we wanted to explore a way to integrate CSCL environments into the learning process, the main purpose of this study is not to say if one condition is better than the other. In other words, this study is rather an exploration of CSCL environments to discern their usefulness as tools to improve the quality of one of the most common educational tasks (presenting a report followed by discussion and feedback) and increasing students' participation (especially the silent side). Moreover, we wanted to explore the different functions of each condition and discover how they can be effectively integrated.

6.3.1 Students' opinion about different aspects of giving and receiving feedback

This section describes the results of a questionnaire survey about students' views on the feedback process in their courses. For this purpose students were asked to explain their opinions about seven different aspects of participation in the feedback process in their course by indicating the extent of their agreement with 33 different statements. The statements were formulated based on a Likert scale (1= strongly disagree and 5= strongly agree). Table 6.5 shows the students' level of agreement with these statements.

6.3.1.1 Satisfaction

Items 1-7 show the agreement scores of students with statements indicating their level of satisfaction of participating in the feedback processes of their courses. As is shown, for all items separately and also for the total score of the first aspect, "satisfaction", students participating in both conditions agree (in this study we assume that mean scores less than 1.5 indicate that students strongly disagree; mean scores from 1.5 to 2.5 show that they disagree; mean scores from 2.5 to 3.5 demonstrate that they neither disagree nor agree; mean scores from 3.5 to 4.5 point out that they agree; and finally mean scores higher than 4.5 indicate that they strongly agree with the specified statement/s) with the items relating to their satisfaction with the feedback process. Students who were involved in asynchronous computer-supported peer group feedback overall (item 7) (ACS-PGF) (M=4.02, SD=0.563) are more satisfied with the feedback process compared to those who were involved in face to face peer group feedback (F2F-PGF) (M=3.63, SD=0.765). However, the result of the Mann-Whitney U test for all

items together (aspect I=Satisfaction) shows that there is no significant (Sig= 0.19) difference between the two conditions. It should be noted that students in ACS-PGF, in comparison with F2F-PGF students, agree with items 2 and 7 to a significantly higher extent and to a lesser extent with items 1 and 4 . The significant difference between the two conditions indicates that, in terms of quantity of feedback that students gave to their peer group, those who engaged in ACS-PGF were more satisfied.

6.3.1.2 Quality of feedback process

Items 8-14 were meant to capture students' opinions about the quality of feedback in their courses. The results revealed that students in both ACS-PGF (M=3.98, SD= 0.290) and F2F-PGF (M=3.58, SD=0.475) agreed with the statements under the second aspect "quality of feedback"; on the whole this indicates that both groups were positive about the peer group feedback process. Results of the Mann Whitney U test (Sig. = 0.000) showed that students in the ACS-PGF setting were more positive about the quality of the peer group feedback process in their groups. When we look at each statement independently it can be suggested that, in spite of item 10, in all other statements students participating in ACS-PGF groups were significantly more positive. This implies that they – students in ACS-PGF groups- agreed, to higher level, that the feedback process was "relevant", "in-depth", "informative" and "constructive". Furthermore we found that students in F2F-PGF neither agreed nor disagreed with items 12 and 13; indicating their level of agreement with the depth of comments that they received (M=3.33, SD=.661) and comments that they gave (M=3.43, SD=0.679). This part of the result signifies that students in F2F-PGF conditions were in doubt about the depth of feedback that they gave and received, although they did not totally dismiss the statements.

6.3.1.3 Perceived effects for learning

Items 15-18 were related to students' perceptions of the effects of peer group feedback for learning. Our findings showed that students in both ACS-PGF (M=4.17, SD=.290) and F2F-PGF (M=4.01, SD=0.374) conditions were positive about the learning effects of peer group feedback. Moreover, the rate of agreement of students who were involved in ACS-PGF with each statement independently and with the third

aspect "Perceived effects for learning" was higher than students in F2F-PGF conditions. However, we found that, for item 17 only, the difference between both conditions was significant. For the other statements the differences were not significant. In addition, for "Perceived effects for learning" the level of significance was, on the whole, reasonable (Sig=.055).

6.3.1.4 Comprehensibility

The forth studied aspect of peer group feedback was "Comprehensibility", which concerns the level that students believe they were able to understand other students' comments and the extent to which they think that their comments were understood correctly. Results reveal that, although students in F2F-PGF agreed with both items 19 (M=3.97, SD=0.850) and 20 (M=3.77, SD=0.679) under the aspect "Comprehensibility" and with the entire aspect taken as a whole (M=3.87, SD=0.680), students in ACS-PGF neither agreed nor disagreed with item 19 (M=3.45, SD=.916). Conducting Mann Whitney U test we discovered that the rate of agreement of students who were involved in F2F-PGF with item 19 was significantly higher than ACS-PGF (Sig. =0.020) and also the level of significance for the aspect "comprehensibility" (0.058) is reasonable overall. This finding implies that students in ACS-PGF were struggling with understanding their peer group comments and feedback and they were in doubt whether they understood them correctly or not.

6.3.1.5 Added Value of peer group feedback for performing group tasks

Six items were formulated to see what students think is the added value for them of taking part in feedback processes when carrying out their group task. Results showed that students in both circumstances agreed that the feedback process had added value for them in performing their group task. Again, the level of agreement of students in ACS-PGF (M=4.10, SD=0.283) was significantly higher (Sig. = 0.012) than those who were involved in F2F-PGF (M=3.89, SD=0.397). Students believed that they received new ideas about their topic and were enlightened about the different aspects of their task. Looking at the statements separately showed that students agreed with all items under the "Added value" aspect of taking part in the feedback process.

6.3.1.6 Motivation

In the study we investigated the effect of involvement in peer group feedback on student motivation (Items 27- 29). We discovered that there is not a significant (Sig. = 0.793) difference between the level of agreement of students in F2F-PGF (M=3.98, SD=0.678) concerning "Motivation" and those who were engaged in ACS-PGF (M=3.88, SD=0.477).

6.3.1.7 Interaction

We were interested to explore students' opinions about the effects of their involvement in peer group feedback on their interactions with other students. For this purpose students were asked to indicate their level of agreement with 4 different statements (30-33) under an aspect entitled "Interaction". Results showed that students in both settings agreed with most of the items, which indicates their belief that their involvement in the peer group feedback process increased their levels of interaction.

The only exception was students in ACS-PGF who neither agreed nor disagreed that their interactions with teachers had increased.

Students in ACS-PGF (M=3.90, SD=0.692) agreed to a higher level with statement 30; indicating that they think that their interaction with their classmates had increased. Moreover, students in F2F-PGF (M=4.30) agreed, significantly and to a higher level, with statement 31; showing that they think that involvement in the PGF process improved their communication skills (sig. =0.050).

Table 5 Agreement scores of students of both asynchronous computer-supported (ACS) and Face to Face (F2F) groups with statements indicating different aspects of peer group feedback (PGF) in performing group tasks in their courses (M=Mean, SD=Standard deviation, Sig. =2-tailed Significant level of Mann-Whitney U test).

	Groups	ACS-PGF		F2F-PGF		Sig.
	Statements	M	SD	M	SD	
I	***Aspect* I: *Satisfaction***	***3.86***	***0.317***	***3.67***	***0.482***	***0.19***
1	I am satisfied with the amount of feedback that I received	3.67	0.612	3.50	0.509	0.083
2	I am satisfied with the amount of feedback that I gave	4.00	0.541	3.70	0.596	0.028
3	I am satisfied with the quality of feedback that I received	3.64	0.656	3.57	0.679	0.384
4	I am satisfied with the quality of feedback that I gave	4.02	0.348	3.83	0.592	0.081
5	I am satisfied with sharing knowledge and information during giving and receiving feedback	4.05	0.539	3.87	0.681	0.203
6	I enjoyed peer group feedback	3.64	0.618	3.57	0.626	0.277
7	Overall, I was satisfied with the learning experience of the feedback mechanism	4.02	0.563	3.63	0.765	0.020
II	***Aspect* II: *Quality of Feedback***	***3.98***	***0.290***	***3.58***	***0.475***	***0.000***
8	Comments that I received were relevant and to the point	3.98	0.643	3.47	0.571	0.001
9	I was able to give relevant and to the point feedback	4.10	0.431	3.63	0.556	0.000
10	Comments that I received were constructive	4.00	0.494	3.77	0.626	0.072
11	I was able to give constructive feedback	4.05	0.439	3.73	0.521	0.008
12	I received in depth comments and feedback	3.81	0.552	3.33	0.661	0.001
13	I was able to give in depth comments and feedback	3.95	0.379	3.43	0.679	0.000
14	Comments that I received were informative	3.98	0.348	3.70	0.702	0.042
III	***Aspect* III: *Perceived effects for learning***	***4.17***	***0.290***	***4.01***	***0.374***	***0.055***
15	Processes of giving and receiving feedback improve my learning	4.21	0.470	4.20	0.714	0.888
16	Feedback processes broaden my knowledge	4.07	0.407	3.93	0.640	0.271
17	Learning quality can be improved by Peer group feedback	4.19	0.397	3.83	0.531	0.002
18	Peer group feedback is a suitable learning method	4.19	0.505	4.07	0.521	0.322
IV	***Aspect* IV: *Comprehensibility***	***3.55***	***0.516***	***3.87***	***0.68***	***0.058***
19	I was able to understand all feedback that I received	3.45	0.916	3.97	0.850	0.020
20	Other students were able to understand my comments and feedback	3.64	0.618	3.77	0.679	0.458
V	***Aspect* V: *Added Value***	***4.10***	***0.283***	***3.89***	***0.397***	***0.012***
21	Quality of my work was improved by peer's comments and feedback	4.02	0.468	3.90	0.803	0.628
22	The feedback from peers helped me to reflect on my merits and shortcomings in learning	3.98	0.348	3.57	0.504	0.000
23	Feedback mechanism helped me to see different aspects of my topic from different points of view	4.21	0.520	3.97	0.615	0.079
24	Peer group feedback has added value for students	4.12	0.328	4.10	0.607	0.975
25	Peer group feedback allows for effective sharing of knowledge and information	4.26	0.544	3.87	0.629	0.008

	Groups	ACS-PGF		F2F-PGF		Sig.
	Statements	M	SD	M	SD	
26	I received new ideas and approaches regarding my topic	3.98	0.412	3.93	0.583	0.689
VI	***Aspect* VI: *Motivation***	***3.88***	***0.447***	***3.98***	***0.678***	***.793***
27	Feedback mechanism was stimulating	3.64	0.791	3.87	0.860	0.304
28	Feedback processes made me more interested in the topic	3.93	0.513	4.03	0.765	0.507
29	Feedback processes motivated me to improve my work	4.07	0.513	4.03	0.718	0.835
VII	***Aspect* VII: *Interaction***	***4.02***	***0.487***	***3.98***	***0.427***	***0.133***
30	I had more communication and interaction with my classmates	3.90	0.692	3.70	0.596	0.103
31	Peer group feedback improves communication skills	4.02	0.563	4.30	0.651	0.050
32	Feedback mechanism in the course helped me to learn how to react to others	3.98	0.517	3.70	0.952	0.166
33	Peer group feedback provides useful social interaction	4.19	0.740	4.20	0.551	0.750

6.3.2 Students' participation in the process of giving and receiving feedback

In total, the 30 participants in face to face peer group feedback (F2F-PGF) contributed to the discussion 312 times (Mean = 10.4, SD=8.89); where the maximum number of contributions from any one participant was 32 utterances, we had a single participant who only contributed once to the discussion. In asynchronous computer supported peer group feedback (ACS-PGF) 40 students posted 672 message to the website of their courses (Mean = 16.8, SD= 4.09). The maximum number of contributions from any one student was 27 and the minimum number of posted message per student was 7. Our findings revealed that students in ACS-PGF conditions participated more in the process of feedback (on average each student posted 16.8 message as compared to 10.4 utterances in F2F) and all students were active (Min = 7). In F2F some students dominated the discussion (Max=32) and the teachers contributed more. It is necessary to highlight that students in F2F settings had, at least, 48 minutes for their final presentation, discussion and feedback, which is not normally feasible in an actual higher education situation (usually the time available for this kind of task and presentation is 15-30 minutes of class meeting time per group for presentation, discussion and feedback). In other words, generally, the time afforded in a real F2F setting is significantly less than what students in our case studies experienced, while in

ACS-PGF conditions a one week time frame is reasonably feasible in a real course setting.

6.3.3 Feedback functions in F2F-PGF and ACS-PGF conditions

As explained before, we content analyzed the students' contributions to the process of feedback in terms of the function that was assigned to that contribution and its level of quality. For this purpose we divided each contribution into meaningful units and then asked teachers and three external coders to assign code to each unit. In total we content analyzed two thirds of all forums in ACS-PGF (758 units) and also two thirds of all sessions in F2F-PGF (550 units) settings.

After implementing our coding scheme for the feedback function (table 6.3), we found differences between F2F and ACS (($\chi^2$2=108.8, DF=6, Sig=.000). As is shown in table 6, most feedback for both conditions was determined as clarifying questions (43.6 % of F2F utterances and 46.2 % of ACS posted messages), though it seems that participants in the ACS-PGF groups needed more clarification. We found that around 20 % of student feedback in both conditions contained a suggestion to improve the other groups' presentations. Whereas 17.4 % of posted notes of the ACS groups were encoded as "Evaluation/Criticism" and 6.6 % as "motivate/praise", around 7.6 % of the utterances of the students in F2F were coded as "Evaluation/Criticism" and 1.8 % as "Motivate/ Praise". Also we found that students in F2F groups tried to orientate the process of feedback more (9.5 % compared to 1.8 % for ACS groups) which might indicate that there was more deviation during the F2F discussions and feedback. Finally, we found that around 5 % of both groups' contributions were coded as "Support/ Supplement" which means that they supported their peer group by providing them with some documents or new sources of information for their case study.

Table 6.6 Functions applied to students' contributions in the feedback process

		F2F-PGF		ACS-PGF	
		Frequency	Percent	Frequency	Percent
1	Clarifying questions/clarification	240	43.6	350	46.2
2	Evaluation/Criticism	42	7.6	132	17.4
3	Motivate/ Praise	10	1.8	50	6.6
4	Revision/ Advice/ Alternatives/ Suggestion	114	20.7	152	20.1
5	Orientation	52	9.5	14	1.8
6	Support/ Supplement	32	5.8	38	5.0
7	Not Applicable	60	10.9	22	2.9
	Total	550	100.0	758	100.0

6.3.4 Quality of students' contributions/activities in feedback processes in F2F and ACS conditions

In order to assess the quality of students' contributions in the processes of peer group feedback we used two different rubrics/coding schemes. Firstly, we used a coding scheme developed by Veldhuis-Diermanse (2002; 2006) based on the Structure of Observed Learning Outcome (SOLO) taxonomy proposed by Biggs and Collis (1982) which determines levels of student comprehension. Results showed that 2.9 % of the participants' contributions in both conditions were assessed as "A level" and showed an in-depth feedback and high level of quality. Moreover, whereas 56.7 % of the F2F group units were assessed as "C and D level", 53.1 % of ACS group units were assigned the same level of quality. After conducting the Mann-Whitney U test (Z= 2.438, Sig= .015), we found that the quality of students' feedback in ACS (Mean= 2.36, Mean rank= 674.70) groups was significantly higher than F2F (Mean= 2.25, Mean rank= 626.67) groups (Table 6.7).

Table 6.7 Quality level of students' contributions to the feedback process based on the Veldhuis-Diermanse coding scheme (A- highest, most advanced quality level; D-lowest, most basic quality level)

	Level	F2F-PGF		ACS-PGF	
		Frequency	Percent	Frequency	Percent
1	A	16	2.9	22	2.9
2	B	222	40.4	354	44.0
3	C	196	35.6	256	34.6
4	D	116	21.1	126	18.5
Total		550	100.0	758	100.0
Mean		2.25		2.36	
Standard Deviation		.818		.788	
Mean Rank		626.67		674.70	

Secondly, we asked the course lecturers and three external fellows to score all units of analysis in the feedback processes from 0 to 4 according to the different aspects mentioned and explained in table 6.4. As is shown in Table 6.8, students' posted notes from the ACS groups were significantly (Sig = .000) clearer (Mean = 2.99) than the utterances of the F2F (Mean= 2.66) groups. The ACS students also posted significantly (Sig=.000) more structured notes (Mean=3.01) than students in F2F groups (Mean= 2.72). From a linguistic point of view the quality of students' posted notes in ACS groups was significantly (Sig = .000) higher (Mean = 2.98) than students' utterances in F2F (Mean= 2.73) groups. Moreover we found that students in ACS groups posted significantly (Sig= .041) more to the point and relevant notes (Mean = 2.88) than those from the F2F groups (Mean= 2.75). Finally we discovered that the quality of feedback in terms of "Reasoning/ Argumentation" for both groups was low (Mean score of 1.91 for F2F and 1.96 for ACS groups) and there was no significant difference between the two.

Table 6.8 Mean quality scores of different aspects of students' contributions in the feedback process per unit of analysis

		F2F-PGF		ACS-PGF		Sig.
		Mean	SD	Mean	SD	
1	Reasoning/ Argumentation	1.91	1.18	1.96	1.14	.292
2	Structure	2.72	.817	3.01	.206	.000
3	Clarity	2.66	.823	2.99	.277	.000
4	Linguistic	2.73	.774	2.98	.241	.000
5	Relevance	2.75	.894	2.88	.499	.041

As reported so far, we assessed the quality of a "*meaningful unit*" in each utterance or posted note based on two different coding schemes. We were also interested in the quality of the "*whole discourse*" of each session from a holistic point of view. Therefore, we asked the assessors to score and assess the quality of the discourse in each F2F session and ACS forum in terms of the five aspects already mentioned (table 6.4). In total, 8 F2F sessions and 10 ACS forums were assessed. The results (Table 6.9) showed that the student contributions to the feedback process of ACS-PGF groups were significantly more clear and better in terms of linguistic use. Although the forums in ACS-PGF received better scores in terms of "structure" and "Relevance" from teachers, from an holistic point of view, their differences were not significant.

Table 6.9 Mean quality scores of different aspects of the whole discourse of students' contributions in the feedback process

		F2F-PGF		ACS-PGF		Sig
		Mean	SD	Mean	SD	
1	Reasoning/ Argumentation	2.38	0.52	2.4	0.52	.916
2	Structure	2.75	0.46	3	0.47	.270
3	Clarity	2.63	0.74	3.7	0.48	.006
4	Linguistic	2.5	0.53	3.5	0.53	.004
5	Relevance	3.25	0.46	3.6	0.52	.149

6.3.5 Teachers' opinion about peer group feedback under both conditions

We interviewed teachers both during the course and also after they had assessed and assigned code to the students' contributions. Two teachers believed that the quality of ACS posted notes was better than the utterances of the face to face groups. One of the teachers believed that, in terms of discussion, the F2F situation was better but, in terms of generating new ideas that help the groups to improve their case study and report, that ACS was better. Two teachers thought that ACS functioned better for those with low prior knowledge and poor language and F2F communication skills. All of them believed that combining the two conditions as a blended learning approach reasonably improves the quality of students' group work.

6.4 Discussion and conclusion

The purpose of this study was to investigate students' participation in, satisfaction with, and perceived learning effects of, participating in peer group feedback. We also tried to study feedback functions and the quality of students' contributions to the PGF. Finally, we wanted to see students' reactions in both F2F and ACS conditions to the PGF processes.

6.4.1 Participation and interaction

In considering students' participation in the feedback process we are lead to conclude that both F2F and ACS peer group feedback conditions, as kinds of formative peer assessment (PA) and peer feedback (PF), engage students in the learning process. It can be concluded that ACSCL potentially allows teachers to integrate ACS-PGF effectively to engage students in the process of learning outside of normal class time. We are also able to claim that designing tasks and activities like PGF will increase the level of students' participation in the learning process. It must be noted that, while some portions of class- time were devoted to F2F-PGF, ACS-PGF activities were carried out entirely outside of class times. As mentioned, our findings show that the level of participation in ACS-PGF was higher than in F2F. As students stated, PGF triggered interaction among students themselves and with their teachers. This means that, if the course workload allows, teachers can include such CSCL activities to improve students' participation and interaction in group work. This issue will be discussed more at the end of this section.

6.4.2 Students' perceptions

In this study students' opinions about the effect of PGF on seven different aspects of the learning process were investigated. We found that students were satisfied with participating in group feedback and assessed the quality of feedback as good. They also perceived PGF as effective for learning and stated that they were able to improve their group task based on the comments they received through PGF. Students' motivation for learning and doing group tasks and their interactions with each other and their teachers increased during PGF. Students also believe that their involvement in PGF has added value for them in doing their group task, constructing new knowledge, and looking at

the topic of their course from a different perspective. Students in ACS groups were more positive about the quality of PGF and its added value than F2F groups but they were less positive about the PGF learning effects than their F2F counterparts. There was no significant difference between students' perceptions of the effect of PGF on motivation, interaction, and satisfaction. Cautiously we can conclude that students in F2F conditions thought that they were able to understand their peers' feedback better than those who were involved in ACS groups.

6.4.3 Quality of Students' contribution to the feedback process

Based on the literature in the field, asynchronous CSCL environments enable students to think deeply, and in their own time, about their peers' presentations. Moreover they can consult the course material provided and other sources of information (online and hardcopy). Therefore we expect that posted notes and messages of students in ACS groups contain in-depth comments and remarks.

As mentioned, the quality of students' contributions to the processes of peer group feedback was assessed in different ways. Using a coding scheme which was developed by Veldhuis-Diermanse (2002), we found that, although the quality of students' feedback in ACS groups was significantly higher than F2F groups, both groups could not give a high level of feedback to their peers. Secondly, lecturers of the courses and three external assessors were asked to score students' contributions in the discussion and feedback processes from different aspects. Results showed that students' in ACS groups posted clearer, more structured and more relevant notes than the utterances of the F2F group students. From a linguistic point of view the quality of student notes posted in ACS groups was also better than students' utterances in the F2F groups. However, we discovered that the quality of feedback in both groups' contributions, in terms of "Reasoning/ Argumentation", was low and there was no significant difference between both conditions. As explained, we expected that students in ACS groups would post high quality notes on their course website. To justify this result we interviewed the students in the ACS groups and asked them how they normally post their notes. We found that 90 % of students react immediately after reading the presentation of their peer group without consulting with the reader (course material) or exploring the internet and other available sources of information. This means that students did not behave as

we originally thought. In fact, in reality, they skim through the posted presentation and choose the part that they find most appealing to them for immediate reaction. We can conclude that teachers in ACSCL environments should adopt an instructional design and task setting that persuades or pushes students to truly benefit from "asynchronicity" and provide their feedback by thinking deeply about the other students' posted notes and refer to available information on the topic. Otherwise CSCL environments merely enable teachers in distance education to promote interaction (which is an important added value) and teachers in conventional F2F education to engage students in debate and discussion-based learning activities outside of class meeting time (which again has clear added value). However, in order to generate in-depth messages and contributions and show higher order learning activities, specific instructional design and task settings are crucial necessities.

6.4.4 Feedback functions in F2F-PGF and ACS-PGF conditions

As explained before, we studied the students' contributions to the process of feedback in terms of the function that is implied by that contribution and the quality of that contribution. We found that both conditions (F2F and ACS) were characterized by different feedback functions. While most of the feedback in both conditions consisted of clarifying questions, around 20 % of students' feedback in both conditions also contained a suggestion to improve the other groups' presentation, which seems reasonable. Participants in ACS conditions posted more notes encoded as "Evaluation/Criticism" and as "motivate/praise", than the utterances of the students in F2F conditions. Also, we found that students in F2F groups tried to orientate the process of feedback more than the ACS students did. We can conclude that ACS-PGF can work better as a tool to critique peer group presentations.

6.4.5 Practical Implications

In F2F higher education, lecturers and teachers are able to integrate ACS-PGF into their instructional design to increase student participation and their interaction with each other and with their teachers. If we accept that discussion and collaboration are two common activities in an active learning approach, ACS-PGF is a good way to engage all students –not just a part of them- in the learning process. In other words, we

recommend an increase in CSCL activities to increase participation and interaction for all students, particularly the silent side of the class.

This finding leads to the conclusion that ACS-PGF can function as well as F2F-PGF in generating new ideas and could work better in terms of reviewing the work produced by peer groups (presentations etc). Teachers could use it to trigger collaboration among students and provide students with feedback from their peers.

If teachers would like their students to give well-grounded and high quality feedback to their peers they need to adopt an instructional setting that persuades students to think about their feedback to other groups and push them to try to benefit from the "Asynchronicity" aspect of asynchronous CSCL environments. Otherwise students tend to react immediately –like F2F meetings- and post their feedback without adequate forethought. However, even in such a situation, ACS-PGF works better than F2F-PGF on certain aspects (clarity, structure …).

6.4.6 Recommendation for future research

We think that exploring ways to trigger students to generate well-grounded and high quality feedback in asynchronous CSCL environments is necessary. This research was carried out with MSc students; doing a similar study with undergraduate students can help us to study the role of PGF in higher education better. More importantly, students, in these environments, do not behave as we initially anticipated. They have their own way and it is necessary to study how students actually contribute to the CSCL environments. Therefore, in our study, we focused on the participation and quality aspects of student activities in CSCL environments but we think it is also necessary to study how students act in CSCL environments; then we can explore how we can trigger students to post in-depth messages and notes to the environments.

Acknowledgement

The research reported in this article was financially supported by the Ministry of Science, Research, and Technology (MSRT) of the Islamic Republic of Iran. The authors want to express their gratitude for this support. Our sincere gratitude goes to Arjen Wals, Renate Wesselink, and Thomas Lans who gave us the opportunity to explore the implementation of ACS-PFG in their courses and helped us to assess the quality of students' contributions to the feedback process. We would like to thank all students who participated in this study for their contributions to the CSCL environments; and Kate Collins, Morgane Bosman, Corine van der Heide, Merel Verhoeven, and Natalia Eernstman for helping us with transcribing and coding students discourses; and Kate Collins for editing this manuscript.

Chapter 7

Discussion and Conclusions

7.1. Introduction

The overall objective of this study was to provide an insight into different aspects of implementing ACSCL; one means of applying e-learning in higher education, from a blended learning perspective. The discourse presented here is composed of four different studies which address several specific research questions to investigate different aspects of implementing ACSCL in higher education. The first two studies concern two main parties; teachers and students involved in the process of learning. The third study aims at exploring the process of knowledge construction and quality of learning activities while performing tasks in ACSCL environments and finally the fourth study is an attempt to investigate the effect of PGF supported by ACSCL on the process of learning. In this chapter we first summarize the results of previous studies in the field on the effects of CSCL in learning processes. Second, we explain the results of different studies of the research and then we explain some general conclusions about implementing ACSCL in higher education. Moreover we recommend different topics for future research in the field and, finally, we explain some practical recommendations.

7.2. Review of CSCL literature

Based on a review of the literature on CSCL the conclusion can be drawn that in higher education, where deep learning, problem solving, critical thinking and presenting well-grounded arguments are the main aims of education, using asynchronous online learning environments has proved beneficial for both on and off campus students. However, there is still no unifying and established theoretical framework, no agreed object of study, no methodological consensus, or agreement about the unit of analysis. Constructivism, in general, and social constructivism, in particular, is a major tradition in developmental psychology. Vygotsky's idea of the zone of proximal development and Piagetian socio-cognitive conflict are frequently reported in the literature on CSCL.

To analyze data in CSCL, indicators like frequency of writing and reading of messages, length of written notes, and time that learners work in the system as well as techniques like social network analysis and content analysis were frequently used. Researchers in the field believe that to be able to understand the nature of interaction in CSCL environments, an appropriate and multidimensional way of analysis is needed

which considers participation, interaction, quality of interaction, process of knowledge construction and learning outcomes of all those activities.

Although, theoretically, e-learning and CSCL environments are seen as powerful tools for the learning process, the results of empirical research in the field are contradictory. While some research in the field reported low levels of participation, interaction and depth of learning, many studies described and concluded positive effects of CSCL environments, positive effects of face-to-face teaching supported by CSCL applications, and positive effects of CSCL environments applied in combination with face-to-face learning situations. Moreover, the results of studies conducted on CSCL are not fully comparable because of differences in setting, applied instructional design, teachers' preparation, commitment and moderation, technical support and technologies used, and the way in which particular applications were used.

7.3. Study 1

The purpose of the first study was to investigate teachers' use of e-learning environments as teaching and learning tools in higher education and to explore factors which explain teachers' use of those e-learning environments. In the study the following research questions were formulated:

1. Which functions of e-learning environments do teachers often use?
2. What added value do teachers perceive of e-learning environments?
3. Which factors influence teachers' use of different functions and capabilities of e-learning environments?
4. What are the barriers for implementing e-learning environments in the learning process?

In e-learning environments (in the literature they are also referred to as Virtual Learning Environments or Course Management Systems) general course information functions (like course calendar and schedule and course announcement and news), content management functions (like presenting course material and literature and PowerPoint presentations) and non-interactive communicating functions (like mail and mailing lists) are used most frequently. Other communication functions (like video conferencing, chatting, and voice conferencing) and collaboration functions (like online

discussion, online collaboration, shared whiteboard, and application sharing) are the least used features of the e-learning environments.

Comparable to the pattern of the actual use of e-learning environments mentioned above, the results of the first study indicate that teachers believe that presentation of course materials and literature, presentation of information about the courses, PowerPoint presentations, and E-mail have the most added value for teaching and learning processes. Voice conferencing, shared whiteboard, videoconferencing and net-meeting are believed to have the least added value for teaching and learning processes. The assumed added value of online discussion and online collaboration is low as well. In addition, teachers believe they do not face serious technical problems when working with ICT tools and e-learning environments. Finally, teachers are satisfied with the facilities and connectivity but they feel that they do not have access to relevant software, websites and content.

Running exploratory and confirmatory factor analysis we identified different factors like Knowledge Construction Teaching and Learning Approach (KC), Teachers' Opinion about Computer-Assisted Learning (CAL), Teachers' Opinion about Web-based Activities (WA), Ease of Use (perceived difficulty), and Time which contribute to the explanation of teachers' actual use of e-learning environments (USE). We found that a teacher's previous experience with e-learning environments, WA, CAL, and ease of use can help us to explain teachers' perceptions of the added value and usefulness of e-learning environments and their actual use of these environments. At the end, we were able to introduce the Teachers' Use of E-learning Environments Model (USE Model) which consists of Teachers' Opinions about Web-based Activities (WA) and Teachers' Opinions about Computer-Assisted Learning (CAL) as predictors, and Teachers' Perceived Added Value of E-learning Environments (AV) as the mediating variable.

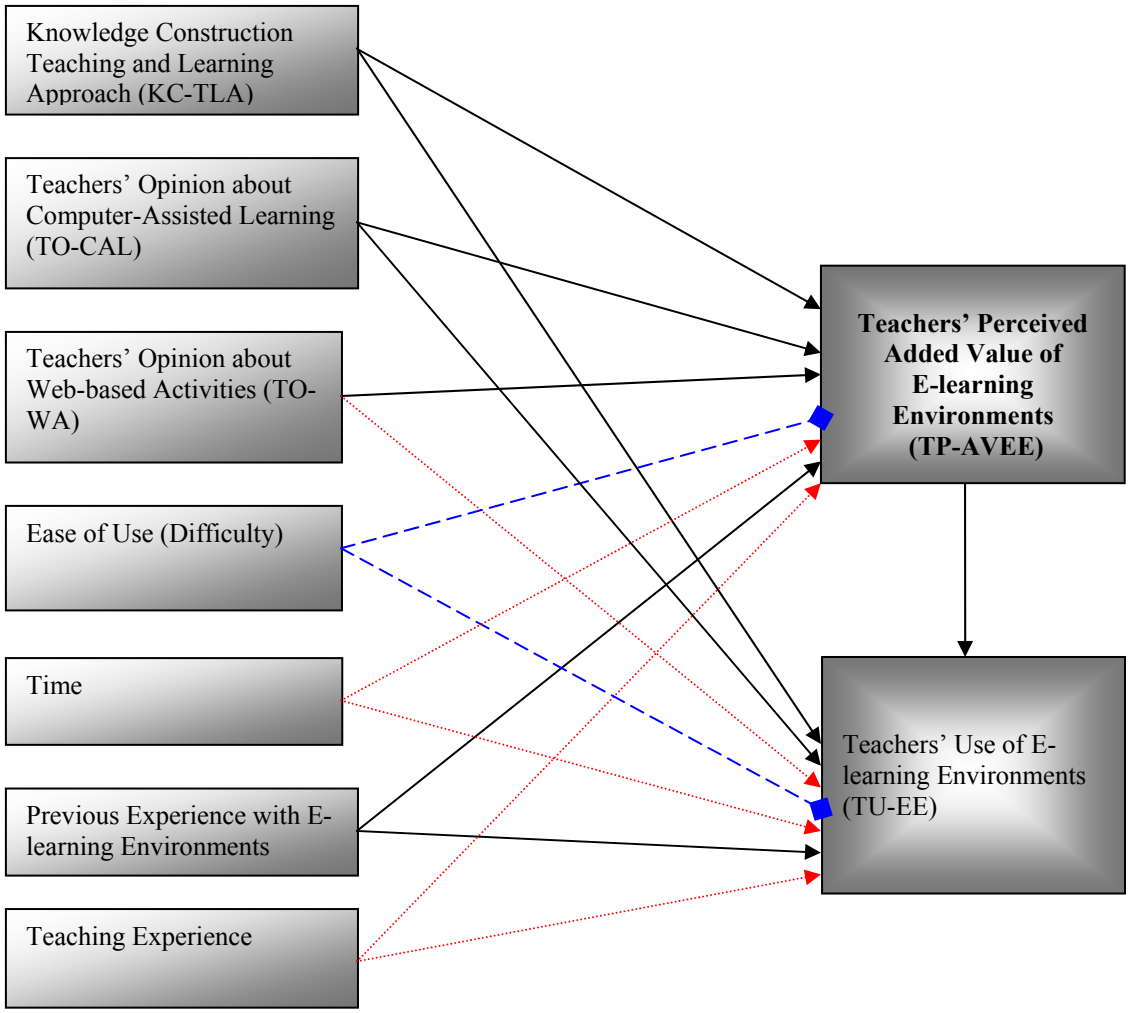
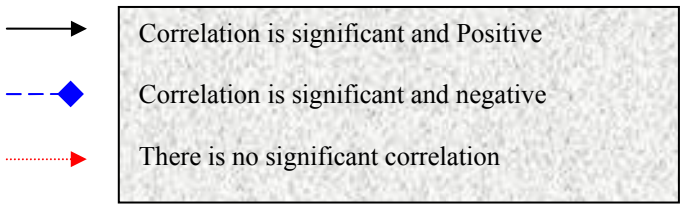


Figure 7.1 Summary of the results of the first study - Relationships between different identified factors in the study with Teachers' Perceived Added Value of E-learning Environments (TP-AVEE) and Teachers' Use of E-learning Environments (TU-EE)



7.4. Study 2

While the first study concentrated on teachers as one of the parties involved in the teaching and learning process, the second study was aimed at investigating student satisfaction with, and perceived learning effects of, performing asynchronous online collaborative learning tasks in courses in higher education. The specific questions addressed in this study were:

1. Are on-campus students satisfied with performing learning tasks in this asynchronous computer-supported collaborative learning environment (ACSCLE)?
2. Do on-campus students perceive any added value of performing learning tasks in an asynchronous computer-supported collaborative learning environments (ACSCLE)?
3. What factors influence student satisfaction with, and perceived learning in, this asynchronous computer-supported collaborative learning environment (ACSCLE)?

Overall, 61.5% of the students were satisfied with their learning experiences with ACSCLE in their courses and, on average, 43.5% of the students agreed with all the items concerning their satisfaction with different aspects of performing tasks in the ACSCLE; with 45.7% of the students taking a neutral position. From the students' point of view there were no differences between F2F and asynchronous online collaboration in terms of difficulty of performing tasks and perception of learning. These results lead to the conclusion that students evaluate the quality of asynchronous online collaborative learning as equal to the quality of F2F learning. In total, 30.35% of the students positively agreed with all the statements meant to capture their opinions about the learning effects of performing tasks in ACSCLE and 50.35% of them were neutral (Mean=3.12).

Running exploratory factor analysis we identified different factors like Knowledge Construction Learning Approach (KC-LA), F2F Learning Attitude (F2F-LA), Web-assisted Learning Attitude (WA-LA), Lack of Self-Confidence (LSC), Traditional Teaching and Learning Attitude (TT-LA), E-learning Attitude (ELA), and

Ease of Use of ACSCLE (EU) which might contribute to the explanation of students' Satisfaction with ACSCLE (SO) and Perceived Effects of ACSCLE (PE).

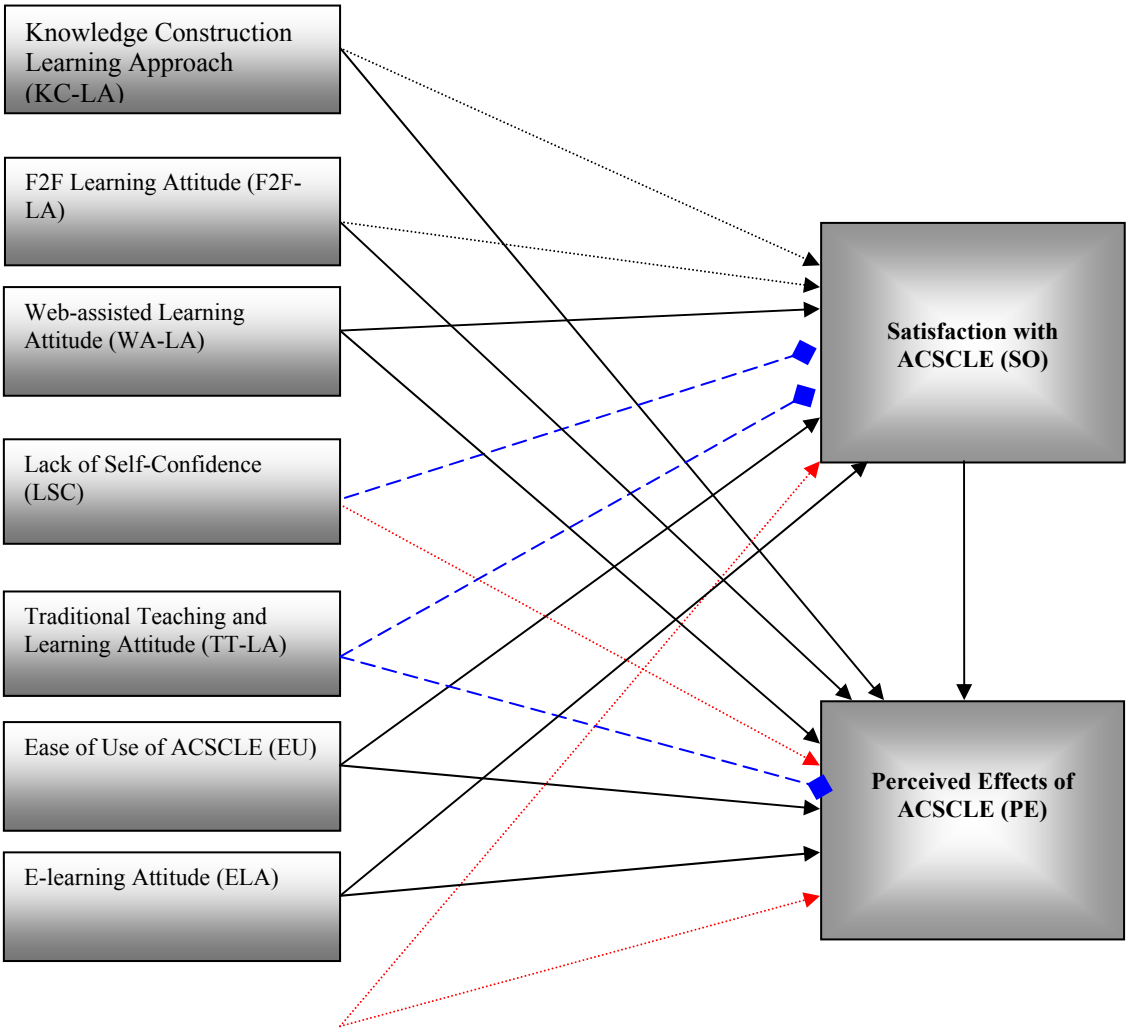
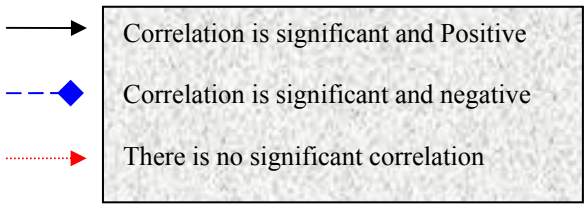


Figure 7.2 Summary of the results of the Second study - Relationships between different identified factors in the study with students' Satisfaction with ACSCLE (SO) and students' Perceived Effects of ACSCLE (PE)



Web-assisted Learning Attitude (WA-LA), Ease of Use of ACSCLE (EU), and E-learning Attitude (ELA) were shown to be positively correlated, and Traditional Teaching and Learning Attitude (TT-LA) and Lack of Self-Confidence (LSC) were negatively correlated with both student Satisfaction with ACSCLE (SO) and Perceived Effects of ACSCLE (PE). Moreover our results showed that Knowledge Construction Learning Approach (KC-LA) and Satisfaction with ACSCLE (SO) were positively correlated with students' Perceived Effects of ACSCLE (PE).

Conducting multiple regression analysis we discovered that students' Previous Experience with e-learning and learning in ACSCLE, Web-assisted Learning Attitude (WA-LA), E-learning Attitude (ELA), Lack of Self-Confidence (LSC) and Ease of Use of ACSCLE (EU) contributed to the explanation of students' Satisfaction with ACSCLE (SO) and F2F Learning Attitude (F2F-LA), E-learning Attitude (ELA), Lack of Self-Confidence (LSC), and Ease of Use of ACSCLE (EU) contributed to the explanation of students' Perceived Effects of ACSCLE (PE).

7.5. Study 3

The third study was conducted to explore how on-campus university students in the context of green (food, animal, plant, social and environmental) sciences collaborate and construct knowledge in asynchronous CSCL environments. Therefore, attention was paid to learning activities during the process of knowledge construction. Moreover, we analysed students' participation and quality of knowledge construction while performing collaborative tasks in asynchronous CSCL environments. The following research questions were addressed in the study with respect to students performing collaborative tasks in asynchronous CSCL environments:

1. To what extent do on-campus students participate in the process of knowledge construction?
2. How can on-campus students' learning and knowledge construction processes be characterised in terms of cognitive, affective, and meta-cognitive learning activities?
3. What is the quality of the constructed knowledge of on-campus students?

4. Are there any changes in on-campus students' learning activities over time and what are the patterns of those changes?
5. Are there any differences in students' learning activities in different courses and settings?

In this study, considering the fact that -on average- students wrote two notes and read fifty five notes per week, we concluded that students' active participation in the learning environment was rather/fairly successful and their passive participation was quite successful. While, on average, each note was read 26.7 times, those contributions written in the first week were read more (Mean =60.4) than notes written in the last weeks (Mean = 5.17). Through content analysis of the students' written notes and learning activities by means of a coding scheme developed by Veldhuis-Diermanse (2002), 89.2 % of students' contributions were coded as cognitive learning activities, 8.4 % as meta-cognitive, and 2.1 % as affective learning activities. Looking at the subcategories of the coding scheme, we found that 'debating' in the cognitive category and 'keeping clarity' in the meta-cognitive category appeared most. To assess the quality of students' contributions to the discussion and collaboration process another coding scheme developed by Veldhuis-Diermanse (2002) was used. For each of the four quality levels (levels increasing from D to A) corresponding verbs were identified and described. In total, 75.1 % of students' contributions were assessed as level B, which is reasonably high, 6.1 % as Level D (Lowest quality), 7.7 % as level A (Highest quality) and 11.1 % as level C.

Results indicated that both the main learning activities and their subcategories changed significantly over the course duration (a period of five weeks). We noticed that while the process of asynchronous CSCL proceeded, students' cognitive learning activities increased and their meta-cognitive and affective learning activities decreased. With respect to the subcategories, messages encoded as 'debating' and 'linking or repeating internal information' showed an increasing trend and those encoded as 'planning' and 'keeping clarity' showed a decreasing trend. Moreover, most of the messages encoded as 'keeping clarity' appeared at the beginning and those encoded as 'monitoring' appeared in the middle of the process of discussion and collaboration.

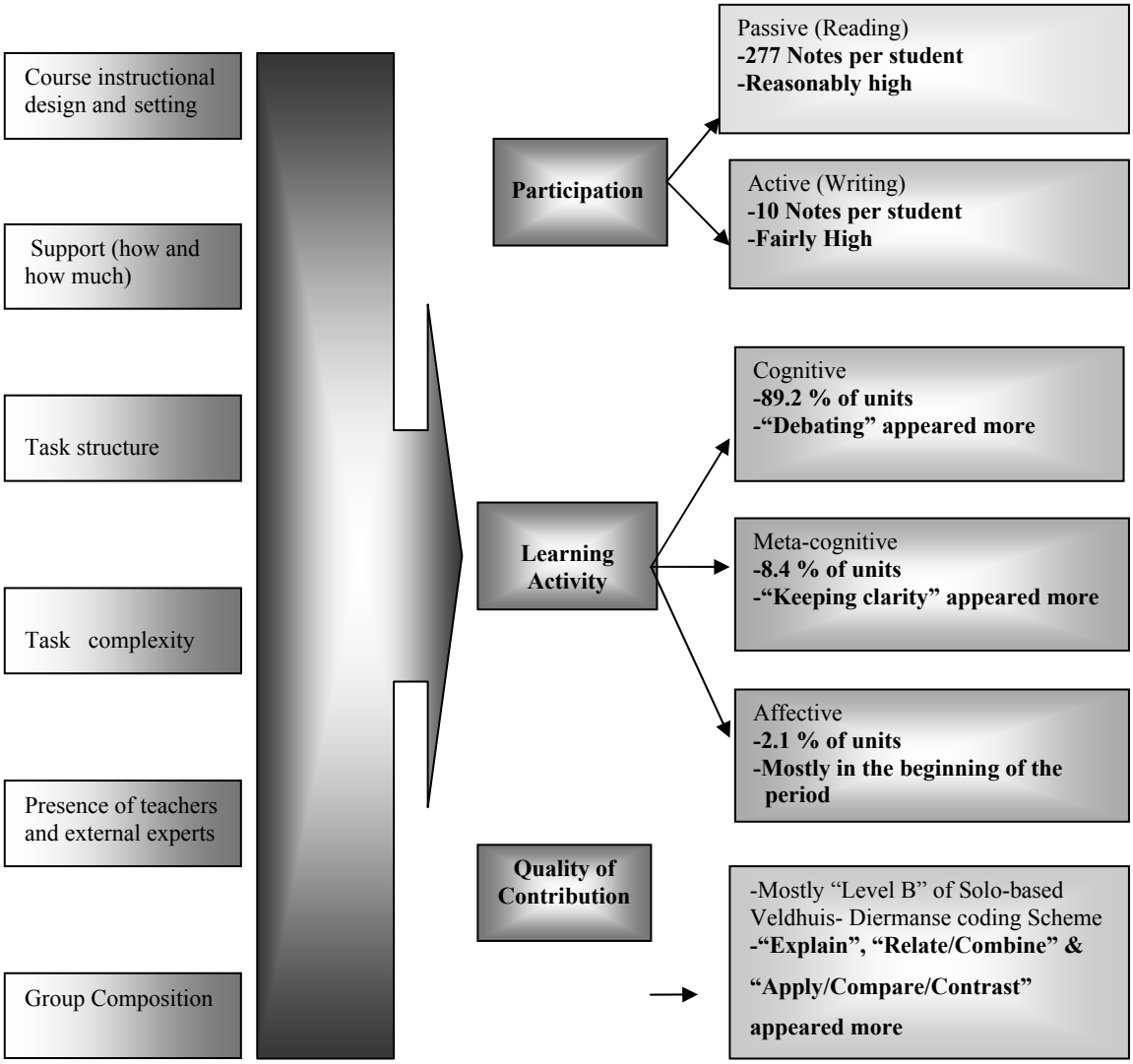


Figure 7.3 Summary of the results of the third study – Factors which influenced students' participation, learning activites and quality of their contributions while performing tasks in Asynchronous Computer-Supported Collaborative Learning Environments (ACSCLE)

Our findings also showed that both for the main learning activities and for their subcategories, students' learning activities differed across the different courses. Furthermore we found that for both the main quality levels and their subcategories, the quality of students' contributions differed across the different courses. Finally, by conducting in-depth interviews and focus groups with participants and looking at the open questions of the questionnaire we concluded that task structure, level of support that students receive, teacher's role, task complexity, and group composition, which can all be discussed under the term 'scripting CSCL', are the main factors that students consider to be important for their learning activities and the quality of their contributions to ACSCL environments.

7.6. Study 4

In the forth study we concentrated on the application of peer group feedback in face to face class meetings and asynchronous computer-supported collaborative learning (ACSCL) environments. More specifically, we surveyed student participation in, satisfaction with, and perceived learning effects of, participating in peer group feedback and studied functions and quality of student contributions to the PGF processes in both F2F and ACS conditions.

For this purpose the following research questions were formulated:

1. To what extent do students participate in Peer Group feedback (PGF) in both Asynchronous Computer-Supported (ACS) and Face to Face (F2F) conditions?
2. What are students' perceptions of the value of Peer Group feedback (PGF) in both Asynchronous Computer-Supported (ACS) and Face to Face (F2F) conditions?
3. What is the function of the students' feedback in both Asynchronous Computer-Supported (ACS) and Face to Face (F2F) conditions during Peer Group feedback (PGF)?
4. What is the quality of the students' feedback in both Asynchronous Computer-Supported (ACS) and Face to Face (F2F) conditions during Peer Group feedback (PGF)?

Our findings revealed that students in the ACS-PGF condition participated more in the process of feedback and all students were active (the distribution was better). In F2F conditions some students took over the discussions and teachers contributed more.

Table 7.1 Summary of the results of the forth study from different aspects (F2F= face to Face; ACS= Asynchronous computer supported; PGF= Peer Group Feedback; M=Mean)

	Groups	ACS	F2F	Sig
A	Students' participation in feedback processes			
	Mean	16.8	10.4	**0.001**
	Max	27	32	
	Min	7	1	
	SD	4.09	8.89	**0.000**
B	Functions applied to students' contributions in the feedback process:	%	%	
1	Clarifying questions/clarification	46.2	43.6	
2	Evaluation/Criticism	17.4	7.6	
3	Motivate/ Praise	6.6	1.8	
4	Revision/ Advice/ Alternatives/ Suggestion	20.1	20.7	
5	Orientation	1.8	9.5	
6	Support/ Supplement	5.0	5.8	
C	Students' opinions on different aspects of PGF in their groups: (1=Strongly disagree…,5=strongly agree)	Mean	Mean	Sig.
1	Aspect I: Students' Satisfaction	3.86	3.67	0.19
2	Aspect II: Students' opinion of the quality of feedback	3.98	3.58	**0.000**
3	Aspect III: Students' perceived effects of PGF for learning	4.17	4.01	**0.055**
4	Aspect IV: Students' opinion of the comprehensibility	3.55	3.87	**0.058**
5	Aspect V: Students' perceived added value of PGF	4.10	3.89	**0.012**
6	Aspect VI: Students' perceived motivational effects of PGF	3.88	3.98	0.793
7	Aspect VII: Students' perceived effects of PGF on interaction	3.91	3.94	0.388
D	Quality of students contribution to PGF processes based on solo-based Veldhuis-Diermanse coding scheme	2.36	2.25	**0.015**
E	Quality of students contribution to PGF processes based on teachers and external assessor assessment in terms of (from 0 through 4):			
1	Reasoning/ Argumentation	1.96	1.91	0.292
2	Structure	3.01	2.72	**.000**
3	Clarity	2.99	2.66	**.000**
4	Linguistic	2.98	2.73	**.000**
5	Relevance	2.88	2.75	**.041**

The minimum amount of contributions under ACS conditions was much higher than under F2F conditions. Students in both conditions were satisfied with their participation

in group feedback and perceived PGF as effective for learning. They stated that they were able to improve their group task based on comments that they received through the PGF process. They believed that their interaction with each other and with their teachers improved during PGF and that involvement in PGF has added value for them in conducting their group tasks and constructing new knowledge. Students in ACS groups were positive, to a higher level, about the quality of PGF and its added value. However, there was no significant difference between students' perceptions of the effect of PGF on motivation, interaction, and satisfaction.

We found that both ACS and F2F conditions differed with respect to the students' contributions. For example, the students' notes posted in the ACS groups were significantly clearer, more structured and more to the point than students' utterances in F2F groups. Students in the ACS conditions posted more notes that were encoded as "evaluation/criticism" and as "motivate/praise" than the students in F2F conditions. Finally, the quality of feedback contributions of both groups in terms of "reasoning/argumentation" was low and there was no significant difference between both ACS and F2F conditions.

7.6. Concluding remarks

Factors like technical issues, time that is needed to implement e-learning, and teaching experience were not among the factors impeding the use of e-learning environments by teachers. A teacher's previous e-learning environment experience and approach to learning, the level of difficulty (ease of use) of the e-learning environment, the perceived usefulness and added value of the e-learning environment, and teacher opinions about computer-assisted learning and web-based activities were strongly correlated with their use of e-learning environments. This leads us to the conclusion that although well-arranged technical support and reliable infrastructure are important, they are not enough. A teachers' first experience with using e-learning environments and their attitude toward ICT are more important. Furthermore teachers' attitudes toward e-learning environments are intertwined with their general feelings about computers and the web. The importance of e-learning and CSCL in distance education is accepted (for providing the opportunity of discussion, interaction and collaboration) but in regular face to face on-campus education the opinion of teachers is still more important than the

technical infrastructure. Moreover, those who use e-learning environments most frequently use non-interactive and superficial features and functions. Interactive features, like CSCL, are rarely used. It seems that, in practice, more attention has been paid to the technological aspects of e-learning than to the pedagogical aspects and, as a result, these advanced learning environments have only been considered as tools to facilitate traditional learning and teaching approaches. Educational practice needs to integrate and use these powerful learning environments effectively in line with constructivist learning theory to provide more flexible and active learning situations for students to construct knowledge. This feeling that some universities just follow the global trend to use fashionable instructional technology without looking in-depth at the related pedagogical aspects enables us to claim that e-learning is not well-integrated into the higher level learning processes and is still at an early stage of its use in higher education. In this respect, a new teaching and learning approach aimed at implementing CSCL is starting to be developed.

Tasks in CSCL environments need more attention than in face to face collaborative learning. In order to integrate CSCL effectively in the learning process characteristics/issues like structure and the level of structuring of the task, complexity of the learning process, task complexity, the formulation of the task, support that learners receive, and the way that they receive that support are very important. Finding the optimal level of structuring and complexity of the task and amount of support that students receive, depending on the course content and objectives, and students' characteristics, should be carefully taken into consideration. E-learning and CSCL environments are a very flexible technology. They enable teachers to design and formulate different learning modules and allow students to follow a module that they think will help them, to a greater extent, to achieve their learning goals.

As Harasim (1990 & 1994) stated, in the text-based mode of communication people focus on the message, not the messenger; and the process of writing makes thinking visible and tangible; forces attentiveness; and is potentially and socially equalizing (our study showed that participation in CSCL environments as compared to the F2F condition was more equally distributed). The asynchronicity gives the participants plenty of time for reflection (although in this study we found that a specific instructional setting is needed to persuade students to try to benefit from this feature,

otherwise there is a tendency to react immediately, as in the F2F condition), analysis, and composition; encourages thinking, and also enables them to do retrospective analysis by recording the whole transcript discussion in the system (students appeared to benefit from this feature and teachers were also able to monitor the process of discussion and collaboration, which helped them to understand the misunderstanding of students and the weakness and strength of the participants, and could effectively direct and facilitate the learning process). Many-to-many communication as one of the unique characteristics of CSCL facilitates peer learning, and resolving conceptual conflict in the group results in new insights into the topic and gives students the opportunity to face and encounter different opinions and perspectives about the topic of discussion and collaboration. Time and Place Independence is also seen as one of the advantages of CSCL environments, which given the busy and diverse time schedules of learners, provide a more flexible learning process. Henri (1992) explained that a written text demands exactness, careful consideration, and explicit expression of thoughts (the current study confirmed these claims); the asynchronous nature of interaction through ICT makes it possible to participate without restrictions of time and place, and to have enough time to formulate valid grounds in support of one's opinions. The act of writing is reported to foster higher order thinking for reasons that have to do with the relationships between writing and cognition (in the current study we did not find a significant difference between ACSCL and F2F groups in terms of argumentation and reasoning; this might be related to the way students behave in ACSCL environments).

Based on our study the conclusion is justified that, as a blended learning approach, integrating asynchronous CSCL environments can effectively engage students in the process of learning. Implementing tasks in CSCL environments increases students' participation in learning activities and their interaction with each other and with their teachers outside of class time. We also conclude that asynchronous CSCL does not only foster more, but also more equal participation in the learning process and might be used successfully to encourage and engage the silent side of the class into the processes of discussion and collaboration. However, regarding the limited number of teachers and the students' workload during the course, we would like to raise the question of what the importance and priority of CSCL are for teachers, as compared to other teaching and learning options they might have. In other words, can a teacher plan

different worthwhile activities which can help teachers and students to meet the course and learning goals? This question might be an interesting topic for further research in the field. In sum we can conclude that performing tasks in ACSCL environments has the potential to provide a meaningful supplement to conventional teaching and learning approaches and can help teachers to overcome the limitations of face-to-face collaboration and discussion.

Considering the fact that one third of the students perceived performing tasks in an asynchronous computer-supported collaborative learning environment (ACSCLE) as more effective, and around half of them perceived performing tasks in such environments as good and as effective as in regular F2F conditions, we can conclude that ACSCL environments can, potentially, be integrated into the learning process following a blended learning approach. Based on an inclusive approach to education it must even be included in the learning process to satisfy the needs of a large group of students who prefer and enjoy working and learning in such environments. The mixed feelings about online discussion and collaboration and the contradictory results of studies in the field can be interpreted in two different ways. First, the instructional design of the course and the way that CSCL is integrated into the learning process are more important to determine its effectiveness. In other words, for a majority of students, technology, per se, is not a determining factor. Second, the success of CSCL is often based on students' learning approach and previous experience and prior knowledge. For example, we found a big difference between European students' and African and Chinese students' perceptions of learning and satisfaction with performing tasks in ACSCL environments. It seems that students with a Knowledge Construction Learning Approach benefit more from the ACSCLE. To sum up, we do believe – and this study confirms this belief – that ACSCLE have the potential to play a very important role in on-campus learning situations, especially since more and more students have different commitments that put pressure on their agendas. Functional integration of asynchronous online collaborative learning in courses is more important than just using the learning environment itself.

In our third study the quality of students' contributions to the discussion was mainly assessed as "Level B" -in one of the case studies as "Level A"- and in the forth study the number of critical comments and remarks under ACSCL conditions was

significantly and clearly higher than under F2F conditions, which led us to the conclusion that ACSCL environments can foster higher-order learning skills. However, we should remember that the quality of discussion was significantly related to the design and setting of the course. Moreover, we found that the notes posted by students in the ACS groups were clearer, more structured and of greater relevance than students' utterances in F2F groups.

Learning to work in distributed teams is one of the main competencies that should be developed in higher education to prepare students for working in a knowledge and network society. The findings of this study revealed that performing tasks in asynchronous CSCL environments has the potential to increase the level of participation and interaction among students and to foster processes of shared and social knowledge construction. Performing these kinds of tasks has the potential to provide a meaningful supplement to conventional teaching and learning approaches and can help teachers to overcome the limitations of face-to-face collaboration and discussion.

We found that students' contributions to ACSCL environments function differently from their contributions in F2F conditions. We conclude that following a blended learning approach and taking course objectives into consideration, we can benefit from the added value of e-learning and CSCL environments. For example, our forth study revealed that ACSCL can enable teachers to successfully embed 'formative assessment' and 'process-oriented feedback' (which aims at learning rather than assessment) into the learning process. As stated before, the quality of students' contributions in groups operating under ACS conditions was significantly higher than in F2F groups and they posted more critical comments. This allows us to conclude that asking students to conduct tasks in CSCL environments and combining these activities within the learning process can improve depth of learning and critical thinking.

Implementing tasks in ACSCL environments can increase the potential of receiving feedback from teachers and students in two ways. In conventional face to face teaching, constrained by limited class contact hours, students usually only have one opportunity to report the result of their work and receive feedback from teachers and/or other students. However, we found that ACSCL environments can be used successfully to create several opportunities to receive feedback at different steps and stages. In fact, in our study, we concluded that when we divided the learning tasks into different steps,

thus giving students the opportunity to discuss and perform the task in different phases, they engaged more in the learning environment. This might be explained in light of the 'formative assessment' and 'process-oriented feedback' by tutors and peers. Both techniques are aimed at improvement of the assessment and feedback process and are more worthwhile and in-depth than one time feedback at the end of a course, which is most often the case with teacher and peer assessment.

Our finding, in the forth study, that students in CSCL environments posted clearer notes combined with the fact that in networked society effective working in distributed teams and virtual offices and teams is a crucial competency for students, lead us to conclude that students do not only need to collaborate to learn but they also need to learn how to collaborate. In other words, students should learn to work in virtual and distributed teams in a way that mutual understanding between them and the people they work with is created.

It is commonly expected that in ACSCL environments students benefit from "asynchronicity" of the environment. By reading background literature in the field and written course material, and thinking deeply about the topic, students can provide in-depth and well-grounded "delayed feedback". However our study showed that this is not the normal strategy followed by students. In other words, first we need to learn how students work in ACSCL environments, which is not necessarily as we expect, and second to develop an instructional design and script CSCL activities in a way that persuades students to take advantage of the power of ACSCL environments. Without doing so CSCL environments will lose one of their main advantages over conventional F2F conditions.

7.7. Recommendations for educational practice

The results of this study have several important implications for educational practice. First, we should notice that, although well-arranged technical support and reliable infrastructure are important, they are not enough. Our study indicates that any program for enhancing the actual use of e-learning environments should first focus on teachers' attitudes; then, teachers should be encouraged and supported to try e-learning in their own courses for the first time. For example, they could be assisted in preparing

useful content for their courses. In this way, the use of e-learning environments in higher education could be fostered.

ACSCL environments have the potential to play a very important role in on-campus learning situations, especially since more and more students have different commitments which put pressure on and limit their timetables. We suggest functional integration of asynchronous online collaborative learning in higher education which we think is more important than just using the learning environment itself.

Integrating CSCL environments in higher education is, for two different reasons, not only an option but a necessity. First, in the knowledge and networked society students need to acquire competencies to learn in distributed and virtual teams. Second, one third of students prefer to learn and learn more through their activities in CSCL environments which, from an inclusive and flexible approach to education, means that CSCL environments are able to satisfy the needs of a reasonable portion of students.

To ensure that students write well-grounded and high quality messages in the learning environments we should adopt an instructional setting that persuades students to think deeply about their contributions and persuades them to read course material and other literature in the field and pushes them to try to benefit from the "Asynchronicity" aspect of asynchronous CSCL environments. Otherwise students will continue to react immediately –like in F2F meetings- and post their contributions straight away without forethought.

On the one hand, asking students to implement a task in ACSCL environments with a very general, superficial and basic script would not help them to achieve their learning goals. On the other hand, over-scripting contradicts the ultimate goal of education and works as a barrier to student creativity and autonomy, and educational objectives.

7.8. Recommendations for future research

In our opinion, future research is needed to figure out other variables and factors that explain teachers' use of e-learning environments and we should explore how we can change the current use of e-learning environments. We need to find a way to persuade educational systems, teachers and students to use the interactive functions and flexible learning modules of e-learning environments, otherwise spending the scarce

resources of universities to develop and maintain such environments is not very wise. Moreover, future research in the field should mainly focus on finding instructional design and course settings that foster on-campus students to generate well-grounded and high quality note postings. How and when can asynchronous CSCL replace some of the activities of the traditional approaches to learning and, more importantly, when and how can it function as a new approach to foster higher level thinking and interaction? In what circumstances can students' active participation and writing be increased? Under which conditions can a process of argumentation be fostered in which students contribute more well-grounded arguments to the forums? How can an unmanageable workload for both teachers and students in performing tasks in asynchronous CSCL environments be prevented? How can individual students be persuaded to think deeply about their contributions to the asynchronous CSCL environments of their courses? How can the performance of groups of on-campus students in asynchronous CSCL environments be improved? How can we change patterns of interaction to promote knowledge sharing, debating, and shared knowledge construction? Under which conditions do teachers and students in on-campus higher education perceive more added value from performing tasks in asynchronous CSCL environments? What is the optimal level of task structure and task complexity for performing tasks in ACSCL? How much support do students need and how should they be provided with that support? Future research should shed light on these –and other- issues regarding the implementation and effects of ACSCL in higher education. More important, students do not behave desirably in CSCL environments. They have their own way and it is necessary to study the ways of how students contribute to CSCL environments. In other words, in our study we focused on the participation and quality aspects of students' activities in CSCL environments but we think it is necessary to study how students behave and act in CSCL environments; then we can explore how we can trigger students to post in-depth messages and notes to these environments.

References

Albirini, A. (2006). Teachers' attitudes toward information and communication technologies: the case of Syrian EFL teachers. *Computers & Education*, *47(4)*, 373–398.

Amigues, R. & Agostinelli, S. (1992). Collaborative problem-solving with computer: How can an interactive learning environment be designed? *European Journal of Psychology of Education, Vol. VII*, 325-337.

Anandarajan M., Simmers C. & Igbaria M. (1998). An exploratory investigation of the antecedents and impact of Internet usage: an individual perspective. In *Proceedings of Hawaii International Conference on System Sciences,* (p. 12). Washington : IEEE Computer Society,.

Armin Weinberger, A. (2003). *Scripts for Computer-Supported Collaborative Learning Effects of social and epistemic cooperation scripts on collaborative knowledge construction*. PhD dissertation, Ludwig-Maximilians-University, Munchen.

Atkinson, M., & Kydd, C. (1997). Individual characteristics associated with World Wide Web use: an empirical study of playfulness and motivation. *The Data Base for Advances in Information Systems*, *28(2)*, 53–62.

Bennett, N., & Dunne, E. (1991). The nature and quality of talk in co-operative classroom
groups. *Learning and Instruction*, *1*, 103–118.

Bereiter, C. (2002). *Education and mind in the knowledge age*. Hillsdale, NJ: Lawrence Erlbaum Associates.

Biemans, H.J.A. (1997). *Fostering activation of prior knowledge and conceptual change*. Ph. D . Dissertation, University of Nijmegen, Nijmegen.

Blanchette, J. (1999). Register choice: Linguistic variation in an online classroom. *International Journal of Educational Telecommunications, 5 (2),* 127-142.

Van Boxtel, C. (2000). Collaborative Concept Learning: collaborative learning tasks, student interaction and the learning of physics concepts., Universiteit Utrecht.

Brown, A. L., Ellery, S., & Campione, J. C., (1998). Creating zones of proximal development electronically. In Greeno, J. G. & Goldman, S. V. (Eds.), *Thinking practices in mathematics and science learning,* NJ, USA: Lawrence Erlbaum Associates (pp. 341-367).

Bullen, M. (1998). Participation and Critical Thinking in Online University Distance Education. *Journal of Distance Education* 13(2), 1-32.

Cohen, A., & Scardamalia, M. (1998). Discourse about ideas: Monitoring and regulation in face-to-face and computer-mediated environments. *Interactive Learning Environments*, 6(1-2), 93-113.

Connor, C. (2003) Virtual learning and inter-professional education: developing computer-mediated communication for learning about collaboration, *Innovations in Education and Teaching International*, 40 (4), 341-347.

Van den Berg, I., Admiraal, W. & Pilot, A. (2006a). Design principles and outcomes of peer assessment in higher education. *Studies in Higher Education. 31 (3)*, 341–356.

Van den Berg, I., Admiraal, W. & Pilot, A. (2006b). Designing student peer assessment in higher education: analysis of written and oral peer feedback. *Teaching in Higher Education*. *11 (2)*, 135-147.

Biggs, J.B. & Collis, K.F. (1982). *Evaluating the quality of learning: the SOLO Taxonomy*. New York: Academic Press.

Boxtel, C. van, van der Linden, J.L., & Kanselaar, G. (2000). Collaborative learning tasks and the elaboration of conceptual knowledge. *Learning and Instruction, 10*, 311-330.

Brett, P., & Nagra, J. (2005). An investigation into students' use of a computer-based social learning space: lessons for facilitating collaborative approaches to learning. *British Journal of Educational Technology*, *36(2)*, 281–292.

Calvani, A. , Sorzio, O. & Varisco, B. M. (1997). Inter-university cooperative learning: an exploratory study, *Journal of Computer Assisted Learning*, *13(4)*, 271-280.

Cancannon, F., Flynn, A., & Campbell, M. (2005). What campus-based students think about the quality and benefits of e-learning? *British Journal of Educational Technology,. 36(3)*, 501–512.

Cavanaugh, C. (2001). The effectiveness of interactive distance education technologies in K-12 learning: A meta-analysis. *International Journal of Educational Telecommunications, 7(1),* 73-88.

Chan, C.K.K. and Van Aalst, J. (2004). Learning assessment and collaboration in computer supported environments. In J. -W. Strijbos, P. Kirschner & R. Martens (Eds.), *What we know about CSCL and implementation it in higher education*. Amsterdam: Kluwer Academic Publisher (pp. 87-112).

Cheung, W., & Huang, W. (2005). Proposing a framework to assess Internet usage in university education: an empirical investigation from a student's perspective. *British Journal of Educational Technology, 36(2)*, 237–253.

Chou, S., & Liu, C. (2005). Learning effectiveness in a Web-based virtual learning environment: a learner control perspective. *Journal of Computer Assisted Learning*, *21(1)*, 65–76.

Clark, R.E. (1983). Reconsidering research on learning from media. *Review of educational research, 53*(4), 445-459.

Clark, R. E. (1994). Media will never influence learning. *Educational Technology Research and Development*, *42 (2*), 21-29.

Claudia, M., Steil, A. & Todesco, J. (2004). Factors influencing the adoption of the Internet as a teaching tool at foreign language schools. *Computers & Education, 42(4)*, 353–374.

Cohen, E. G. (1994). Restructuring the classroom: conditions for productive small groups. *Review of Educational Research*, *64*, 1–35.

Collis, B., Oscar, P., & Pals, N. (2000). A Model for Predicting an Individual's Use of a Telematics Application for a Learning-Related Purpose. *International Journal of Educational Telecommunications, 6(1)*, 63-103.

Collis, B., Oscar, P., & Pals, N. (2001). A model for predicting the educational use of information and communication technologies. *Instructional Science, 29(2),* 95–125.

Crook, C. (1994). *Computers and the collaborative experience of learning*. London: Routledge.

Crookes, G. (1986). *Task classification: A cross-disciplinary review*: *Technical Report No. 4*. Manoa, Hawaii: Center for Second Language Classroom Research, Social Science Research Institute, University of Hawaii.

Daphne, H. (1996). *CSCL theories*. Retrieved March 21, 2003 from http://www.edb.utexas.edu/csclstudent/Dhsiao/theories.html#vygot

Dart B., Burnett P., Boulton-Lewis G., Campbell J., Smith D. & McCrindle A. (1999). Classroom learning environments and students' approaches to learning. *Learning Environments Research, 2*, 137–156.

Davis, F. D. (1993). User acceptance of information technology: system characteristics, user perceptions and behavioural impacts. *International Journal of Man-Machine Studies*, *38(3)*, 475–487.

Davis, J. R. & Huttenlocher, D.P (1995). Shared Annotation for Co-operative Learning. Proceedings of CSCL'95. In *The First International Conference on Computer Support for Collaborative Learning*. Mahwah, NJ: Erlbaum.

Dewiyanti, S., Brand-Gruwel, S., Jochems, W., & Broers, N.J. (2007). Students_ experiences with collaborative learning in asynchronous Computer-Supported Collaborative Learning environments. *Computers in Human Behaviour*, *23(1)*, 496–514.

Dillenbourg P. (1999) *Cognitive and Computational Approaches.* Amsterdam: Pergamon.

Dillenbourg, P. & Jermann, P. (2007) Designing integrative scripts. In F. Fischer, I.. Kollar, H. Mandl & J. M. Haake (Eds.). *Scripting computer-supported collaborative learning*.. USA: Springer (275-301).

Dochy, F., Segers, M. & Sluijsmans, D. (1999). The use of self-, peer and co-assessment in higher education: a review. *Studies in Higher Education*, *24*, 331–350.

Doolittle P.E. (1999). *Constructivism and Online Education*. Retrieved December 22, 2006, from http://edpsychserver.ed.vt.edu/workshops/tohe1999/text/doo2.pdf

Ertmer, P. A, Richardson, J. C., Belland, B., Camin, D., Connolly, P., Coulthard, G. et. al. (2007). Using peer feedback to enhance the quality of student online postings: An exploratory study. *Journal of Computer-Mediated Communication*, *12(2)*, article 4. Retrieved from http://jcmc.indiana.edu/vol12/issue2/ertmer.html

Faccini, B. & Jain, M. (1999). Towards Open Learning Communities. Retrived March 15, 2007 from http://www.unesco.org/education/educprog/lwf/doc/portfolio/definitions.htm

Fishman, B. J. & Gomez, L. M. (1997). How activities foster CMC tool use in classrooms. In *Proceedings of the Second International Conference on Computer Support for collaborative Learning*. Toronto.

Fletcher-Flinn, C. M. and Gravatt, B. (1995). The Efficacy of Computer Assisted Instruction (CAI): A meta-analysis. *Journal of Educational Computing research,* 12 (3), 219-41.

Fraser B.J. (1998) Classroom environment instruments: Development, validity and applications. *Learning Environments Research, 1*, 7–33.

Garrison, D. R., Anderson, T. & Archer, W. (2001). Critical Thinking, Cognitive Presence, and Computer Conferencing in Distance Education. *The American Journal of Distance Education, 15(1)*, 7–23.

Goodyear, P., Jones, C., Asensio, M., Hodgson, V., & Steeples, C. (2005). Networked learning in higher education: Students' expectations and experiences. *Higher Education*, *50(3)*, 473–508.

Granger, C. A., Morbey, M.L., Lotherington, H., Owston, R.D., & Wideman, H.H. (2002). Factors contributing to teachers' successful implementation of IT. *Journal of Computer Assisted Learning*, *18(4)*, 480-488.

Guan, Y. , Tsai, C., Hwang, F. (2006). Content analysis of online discussion on a senior-high-school discussion forum of a virtual physics laboratory. *Instructional Science*, 34(4), 279-311.

Gunawardena, C. N., Lowe, C. A., & Anderson, T. (1997). Analysis of a global online debate and the development of an interaction analysis model for examining social construction of knowledge in computer conferencing. *Journal of Educational Computing Research, 17,* 397–431.

Gunawardena, C. N., Carabajal, K., & Lowe, C. A. (2001). Critical analysis of models and methods used to evaluate online learning networks. In *American Educational Research Association Annual Meeting*. Seattle: American Educational Research Association.

Guan, Y., Tsai, C. & Hwang, F. (2006). Content analysis of online discussion on a senior-high-school discussion forum of a virtual physics laboratory. *Instructional Science*, *34 (4)*, 279–311.

Guzdial, M. (1997). Information ecology of collaboration in educational settings: influence of tool. In R. Hall, N. Miyake, & N. Enyedy (Eds.), *Proceedings of CSCL '97: The second international conference on computer support for collaborative learning* (pp. 83–90). Mahwah, NJ: Erlbaum.

Guzdial, M., & Turns, J. (2000). Effective discussion through a computer-mediated anchored forum. *Journal of the Learning Sciences*, *9*, 437–469.

Hair J., Anderson R., Tatham R. & Black W. (4th ed.) (1995) *Multivariate data analysis*. New York: Prentice Hall.

Hakkarainen, K.P.J. (1998). *Epistemology of scientific inquiry and computer supported collaborative learning*. PH.D dissertation, University of Toronto,Toronto.

Hakkarainen, K., Järvelä, S., Lipponen, L., & Lehtinen, E. (1998). Culture of collaboration in computer supported learning: Finnish perspectives. *Journal of Interactive Learning Research, 9*, 271-287.

Hakkarainen, K., Rahikainen, M., Lakkala, M., Lipponen, L. (2001). Implementation of Progressive Inquiry in Finnish CSCL-settings. In M. Lakkala, M. Rahikainen, M., & K. Hakkarainen (Eds.), *Perspectives of CSCL in Europe: A Review* (pp30-45). A report for the European Commission. Retrieved April15, 2005 from http://www.euro-cscl.org/site/itcole/D2_1_review_of_cscl.pdf

Hara, N., Bonk, C., & Angeli, C., (2000). Content analyses of on-line discussion in an applied educational psychology course. *Instructional Science, 28*(2), 115-152.

Harasim L.M. (1990) Online Education: An Environment for Collaboration and Intellectual Amplification. In L.M. Harasim (Ed.). *Online Education: Perspectives on a New Environment.* New York: Praeger Publishing (pp 39–64).

Harasim, L. (Ed). (1994). *Global Networks: Computers and International Communication.* Cambridge, Mass: The MIT Press.

Henri, F. (1991). Computer conferencing and content analysis. In A. Kaye (Ed.). *Collaborative learning through computer conferencing: The Najaden papers.* London: Springer-Verlag (pp. 117–136).

Henri, F. (1992). Computer conferencing and content analysis. In A.R. Kaye (Ed.). *Collaborative learning through computer conferencing: the Najaden papers*. Springer: New York (pp. 115–136).

Hewitt, J., & Tevlops, C. (1999). An analysis of growth patterns in computer conferencing thereads. In C. Hoadley (Ed.), *Proceedings of CSCL '99: The third international conference on computer support for collaborative learning* (pp. 232–241). Mahwah, NJ: Erlbaum.

Hmelo-Silver, C. E. Analyzing collaborative knowledge construction: multiple methods for integrated understanding. *Computers & Education*, 41 (4), 397–420.

Hoadley, C., & Linn, M. (2000). Teaching science through online peer discussions: speakeasy in the knowledge integration environment. *Journal of Science Teaching*, *22(?)*, 839–857.

Howell-Richardson, C., & Mellar, H. (1996). A methodology for the analysis of patterns of participation within computer mediated communication courses. *Instructional Science*, *24(?)*, 47–69.

Hsi, S. (1997). *Facilitating knowledge integration in science through electronic discussion: The multimedia kiosk forum*. Berkley, CA: University of California at Berkeley.

Kanuka, H. & Anderson, T. (1998). Online social interchange, discord, and knowledge construction. *Journal of Distance Education, 13(1),* 57-75. Retrieved April 20, 2007 from http://cade.athabascau.ca/vol13.1/kanuka.html

Kanselaar G. (2002). *Constructivism and Socio-constructivism*. Retrived March 15, 2007 from http://edu.fss.uu.nl/medewerkers/gk/files/Constructivism-gk.pdf

Khalili, A. & Shashaani, L. (1994). The Effectiveness of Computer Applications: A Meta-analysis. *Journal of Research on Computing in Education*, 27 (1), 48-62.

King, A. (2007). Scripting collaborative learning processes: A cognitive perspective. In F. Fischer, I.. Kollar, H. Mandl & J. M. Haake (Eds.). *Scripting computer-supported collaborative learning*. USA: Springer (13-37).

Kirschner, P.A. (2000). The inevitable duality of education: co-operative higher education. In *Inaugural address*. Maastricht: Maastricht University.

Kirschner, P.A. (2002). Can we support CCSL? Educational, social and technological affordances for learning. In *Inaugural address*. Netherlands: Open University.

Kirschner, P. A., Martens, R. L. & Strijbos, J. (2004). CSCL in higher education. In J. W. Strijbos, P. A. Kirschner & R. L. Martens (Eds.), *What we know about CSCL, and implementing it in higher education*. Boston: Kluwer Academic Publishers (pp. 3-30).

Kluger, A. N. & DeNisi, A. (1996). The effects of feedback interventions on performance: A historical review, a meta-analysis, and a preliminary feedback intervention theory. *Psychological bulletin*, *19 (2)*, 254-284.

Koschmann, T. (1994). Toward a theory of computer support for collaborative learning. *Journal of the learning sciences, 3*, 219-225.

Koschmann, T. (1996). Paradigm shifts and instructional technology: An introduction. In T. Koschmann, (Ed.). *CSCL: Theory and practice of an emerging paradigm*. Mahwah, NJ: Lawrence Erlbaum Associates (pp. 1- 23)..

Koschmann, T. & Hall, R. & Miyake, N. (2002). *CSCL 2: Carrying forward the conversation*. United States of America : Lawrence Erlbaum Associates..

Kozma, R. (1991). Learning with media. *Review of educational Research, 61*(2), 179-212.

Kozma, R. (1994). Will media influence learning? Re-framing the debate. *Educational Technology Research, and Development, 42*(2), 7-19.

Kreijns, k., Kirschner. P. A., Van Buuren, H., & Jochems, W. (2004). Determining Sociability, social space and social presence in (a)synchrounous collaborative groups. *Cyberpsychology & Behaviour, 7(2),* 155- 172.

Kulik, C. & Kulik, J. (1994). Meta-analytic studies of findings on computer-based instruction. In Baker, E. L. and O'Neill, H. F. (Eds.). *Technology Assessment in Education and Training*. Hillsdale, NJ: Lea Publishers.

Kumaravadivelu, B. (1993). The name of the task and the task of naming: Methodological Aspects of task-based pedagogy. In G. Crookes and S. Gass (Eds.). *Tasks in a pedagogical context: Integrating theory and practice.* Bristol: Longdunn Press (pp. 69-96).

Lapadat, J.C. (2002). Written interaction: A key component in online learning. *Journal of Computer-Mediated Communication,* 7 (4), 21-3?.

Lehtinen, E. (2003). Computer-supported collaborative learning: an approach to powerful learning environments. In E. De Corte, L. Verschaffel, N. Entwistle & J. Van Merriëboer (Eds.). *Unravelling basic componets and dimensions of powerful learning environments.* Amsterdam: Elsevier (pp. 35–53).

Lehtinen, E., Hakkarainen, K., Lipponen, L., Rahikainen, M. & Muukkonen, H. (1999). *Computer-supported collaborative learning: A review of research and development. Netherlands*: *The J.H.G.I. Giesbers Reports on Education, 10.* Nijmegen, The Netherlands: University of Nijmegen, Department of Education Sciences.

Lehtinen, E., Sinko, M. & Hakkarainen, K. (2001). ICT in Finnish education: How to scale up best practices. *International journal of educational policy, Research and practice, 2 (1)*, 77-89.

Liaw S.S. (2002). An Internet survey for perceptions of computers and the World Wide Web: relationship, prediction, and difference. *Computers in Human Behaviour, 18*, 17–35.

Linden J. van der, Erkens G., Schmidt H. & Renshaw P. (2000). Collaborative learning. In P.R.J. Simons, J. van der Linden & T.M. Duffy (Eds.). *New Learning.* Dordrecht: Kluwer Academic Publishers (pp. 37-54).

Lipponen, Lasse (2001). Supporting collaboration with computers. In *Perspectives of CSCL in Europe: A review*. Retrieved March 10, 2004 from http://www.euro-cscl.org/site/itcole/D2_1_review_of_cscl.pdf

Lipponen, L. (2002). Exploring foundations for computer supported collaborative learning. In G. Stahl (Ed.). *Computer support for collaborative learning: Foundation for a CSCL community.* Hillsdale, NJ: Lawrence Erlbaum (pp. 72-81).

Lipponen, L., Hakkarainen, K., & Paavola, S. (2004). Practices and orientations of CSCL. In J. W. Strijbos, P. A. Kirschner & R. L. Martens (Eds.), *What we know about CSCL, and implementing it in higher education*. Boston: Kluwer Academic Publishers (pp. 31-50).

Lipponen, L., Rahikainen, M., Lallimo, J., & Hakkarainen, K. (2003). Patterns of participation and discourse in elementary students computer-supported collaborative learning. *Learning and Instruction, 13 (5)*, 487–509.

Lowerison, G., Sclater, J., Schmid, R.F., & Abrami, P.C. (2006). Student perceived effectiveness of computer technology use in post-secondary classrooms. *Computers & Education*, *47(4)*, 465–489.

Ma, W. W., Anderssonw, R. & Streithw, K. (2005). Examining user acceptance of computer technology: an empirical study of student teachers. *Journal of Computer Assisted Learning*, *21(6),* 387–395.

Madden, A., Ford, N., Miller, D., & Levy, P. (2005). Using the Internet in teaching: the views of practitioners (A survey of the views of secondary school teachers in Sheffield, UK). *British Journal of Educational Technology*, *36(2)*, 255–280.

Mahdizadeh H., Mulder M. & Biemans H. (2005) E-Learning in Green Sciences: The case study of Wageningen University. In E. Oktay & M. Boyaci (Eds.). *Proceedings of the 17th European Seminar on Extension Education, ESEE 2005,* (pp. 272-279). Izmir, Ege University.

Mahdizadeh H., Mulder M. & Biemans H. (2007). *Experiences of on-campus students in performing tasks in asynchronous computer-supported collaborative learning environments*. Unpublished manuscript submitted for publication, Wageningen University, the Netherlands.

Marra, R. M., Moore, J. L. & Klimczak, A. K. (2004). Content analysis of online discussion forums: A comparative analysis of protocols. *Educational Technology Research and Development.*52 (2), 23-40.

Martınez, A., Dimitriadis, Y., Rubia, B., Gomez, E. & Fuente, P. (2003). Combining qualitative evaluation and social network analysis for the study of classroom social interactions. *Computers and Education. 41 (4)*, 353-368.

Martinez, A., Y. Dimitriadis, B. Rubia, E. Gomez & P. de la Fuente (2003). Combining qualitative evaluation and social network analysis for the study of classroom social interactions. *Computers & Education, 41*, 353-368.

Marttunen, M., & Laurinen, L. (2001). Learning of argumentation skills in networked and face-to-face environments. *Instructional Science, 29(2),* 127-153.

Masiello, I., Ramberg, R., & Lonka, K. (2005). Attitudes to the application of a Web-based learning system in a microbiology course. *Computers & Education*, *45(2),* 71–185.

Mayer, R. (1999). Designing Instruction for Constructivist Learning. In C.M. Reigeluth (Ed.) *Instructional -Design Theories and Models: A New Paradigm for Instructional Theory, Vol. II.* Mahwah, New Jersey: Lawrence Erlbaum Associates(pp. 141-161).

Mazur, j. (2004). Conversation analysis for educational technologists: theoretical and methodological issues for researching the structures, processes and meaning of online talk. In D. H. Jonassen (Ed.), Handbook for research in educational communications and technology, second edition. Mahwah, NJ: Lawrence Erlbaum Associates.

McCombs B. L. (2000). Assessing the role of educational technology in the teaching and learning process: A learner centered perspective. In *The Secretary's Conference on Educational Technology 2000*. Retrieved December 22, 2006 from http://www.ed.gov/rschstat/eval/tech/techconf00/mccombs_paper.html

McConnell, D. (1994). Managing open learning in computer supported collaborative learning environments. *Studies in higher education, 19*(3), 341-358.

Mory, E. H. (2004). Feedback research revisited. In D. H. Jonassen (Ed.). *Handbook of research on educational communications and technology*. Mahwah, NJ: Lawrence Erlbaum (pp. 745-783).

Muir-Herzig, R. G. (2004). Technology and its impact in the classroom. *Computers & Education. 42(2),* 111–131.

Murphy, E. & Ciszewska-Carr, J. (2005). Contrasting syntactic and semantic units in the analysis of online discussions. *Australasian Journal of Educational Technology*, *21(4)*, 546-566. Retrieved April 20, 2007 from (http://www.ascilite.org.au/ajet/ajet21/murphy2.html)

Muukkonen, H., Hakkarainen, K., & Lakkala, M. (1999). Progressive inquiry with a networked learning environment FLE-tools. In C. Hoadley (Ed.), *Proceedings of CSCL '99: The third international conference on computer support for collaborative learning*. Mahwah, NJ: Erlbaum (pp. 406–415).

Newman, D.R., Webb, B. & Cochrane, C. (1995). A content analysis method to measure critical thinking in face-to-face and computer supported group learning. *Interpersonal Computing and Technology,* 3 (2), 56–77.

Newman, D.R., Johnson, C., Webb, B. & Cochrane, C. (1999). Evaluating the quality of learning in Computer Supported Co-operative Learning. *Journal of the American Society for Information Science, 48, 484-495*. Retrieved November 15, 2003, from http://www.qub.ac.uk/mgt/papers/jasis/jasis.html.

Nurmela, K., Lehtinen, E., & Palonen, T. (1999). Evaluating CSCL log files by social network analysis. In C. Hoadley (Ed.), *Proceedings of CSCL '99: The third international conference on computer support for collaborative*. Mahwah, NJ: Erlbaum *learning* (pp. 434–444).

Ong, C., & Lai, J. (2006). Gender differences in perceptions and relationships among dominants of e-learning acceptance. *Computers in Human Behaviour*, *22(5*), 816–829.

Orvis, K.L., Wisher, R.A., Bonk, C.J. & Olson, T.M. (2002). Communication patterns during synchronous web-based military training in problem solving. *Computers in Human Behaviour*. 18 (?) 783–795.

Paniz, T. 1996. A definition of collaborative versus cooperative learning. Retrieved April15, 2005 from http://home.capecod.net/~tpanitz/tedsarticles/coopdefinition.htm

Paris, P. G. (2004). E-Learning: A study on Secondary Students' Attitudes towards Online Web Assisted Learning. *International Education Journal, 5(1)*, 98-112.

Passig H. & Levin H. (2000). Gender preferences for multimedia interfaces. *Journal of Computer Assisted Learning, 16,* 64-71.

Pilkington, R. M., & Walker, S. A. (2003). Facilitating debate in networked learning: reflecting on online synchronous discussion in higher education. *Instructional Science*, 31(1-2), 41-63.

Prabhu, N. (1987). *Second Language Pedagogy*. Oxford: Oxford University Press.

Pena-Shaff, J. B. & Nichollsb, C. (2004). Analyzing student interactions and meaning construction in computer bulletin board discussions. *Computers & Education*, 42 (3), 243–265.

Puntambekar, S. & Luckin, R. (2003). Documenting collaborative learning: what should be measured and how? *Computers & Education, 41 (4)*, 309–311

Qin Z., Johnson D.W. & Johnson R.T. (1995). Cooperative versus competitive efforts and problem solving. *Review of Educational Research*, *2,* 129-143.

Race K.E.H. (2003). Confirming the Factor Structure of a Survey to Gauge Teacher Attitudes toward Instructional Strategies and Classroom Pedagogy. In *Annual Meeting of American Evaluation Association*, Reno. Retrieved December 29, 2006 from http://www.raceassociates.com/2AEA2003.pdf

Rijlaarsdam, G. & Couzijn, M. (2000). Writing and learning to write: a double challenge. In: P.R.J. Simons, J. van der Linden & T.M. Duffy (Eds.) *New learning* Dordrecht: Kluwer Academic Publishers (pp. 157-189).

Roberts, T. (2004). *Online collaborative learning: Theory and practice*. Hershey, PA: Information Science Publications.

Roschelle, J. (1992). Learning by collaborating. Convergent conceptual change. *The Journal of the Learning Sciences, 2(*3), 235-276.

Rourke, L., Anderson, T., Garrison, D. R., & Archer, W. (2001). Methodological issues in the content analysis of computer conference transcripts. *International Journal of Artificial Intelligence in Education*, *12,* 8–22.

Scardamalia, M. & Bereiter, C. (1994). Computer Support for Knowledge-Building Communities. *The journal of the learning sciences, 3*, 265-283.

Scardamalia, M., Bereiter, K. & Lamon, M. (1994). The CSILE project: Trying to bring the classroom into world 3. In Kate McGilly (Ed.). *Classroom lessons: Integrating cognitive theory and classroom practice.* Cambridge, MA: Bradford Books/MIT Press (pp. 201-228).

Scardamalia, M., & Bereiter, C. (2003). Knowledge Building. In *Encyclopedia of Education. (2nd ed., pp. 1370-1373).* New York: Macmillan, USA.

Schellens T. & Valcke M (2004). Fostering knowledge construction in university students through asynchronous discussion groups. *Computers & Education*, 46*,* 349-370.

Scott, J. (2nd ed.) (2000). *Social Network Analyses: a handbook*. London: Sage Publications.

Selim, M. H. (2003). An empirical investigation of student acceptance of course websites. *Computers & Education, 40 (4),* 343–360.

Simons, P.R.J., Linden, J. van der & Duffy, T.M. (2000). New Learning. In: P.R.J.Simons, J. van der Linden & T.M. Duffy (Eds.), New Learning. Dordrecht: Kluwer Academic Publishers (pp. 119-140).

Slavin, R.E. (1995). *Cooperative learning: Theory research and practice*. Boston: Ally & Bacon.

Sfard, A. (1998). On two metaphors for learning and the dangers of choosing just one. *Educational Researcher, 27*(2), 4-13.

Slavin, R.E. (1997). Research on co-operative learning and achievement: A quarter century of research. In *Annual meeting of Pedagogical Psychology*, *September*. Frankfurt.

Spellman G. (2000). Evaluation of CAL in higher education Geography. *Journal of Computer Assisted Learning, 16,* 72-82.

Sorensen, E. & Takle, E. (2002). Collaborative Knowledge Building in Web-based Learning: Assessing the Quality of Dialogue. *International Journal on E-Learning,* 1 (1), 28-32.

Stahl, G. (2002) Rediscovering CSCL. In T. Koschmann, R. Hall, & N. Miyake (Eds.). *CSCL2: Carrying forward the conversation.* Mahwah, NJ: Lawrence Erlbaum Associates (pp. 169-181).

Stahl, G. (2003). Knowledge negotiation in asynchronous learning networks. In *Hawaii International Conference on System Sciences 36 (HICSS 2003)*, *January 6-9, 2003*. Hawaii, USA.

Strijbos, J. W. & Kirschner, P. A. and Martens, R. l. (2004). What we know about CSCL. In J. -W. Strijbos, P. Kirschner & R. Martens (Eds.). *What we know about CSCL and implementation it in higher education.* Amsterdam: Kluwer Academic Publisher (pp. 245-259).

Strijbos,J. W., Martens, R. L., Jochems, W. M. G., & Broers, N. J. (2004). The effect of functional roles on group efficiency: Using multilevel modeling and content analysis to investigate computer-supported collaborative in small groups. *Small Groups Research, 35*, 195-229.

Suthers, D. (1998). Representations for Scaffolding Collaborative Inquiry on Ill-Structured Problems. In *American Educational Research Association Annual Meeting*, *April*. San Diego. Retrieved January 15, 2003 from http://lilt.ics.hawaii.edu/suthers/sample-pubs.html.

Terenzini, P.T., Spinger, L., Pascarella, E.T. & Nora A. (1995). Influences affecting the development of students' critical thinking skills. *Research in Higher Education, 36(1)*, 23–39.

Thornburg D.D. (1999). *Technology in K-12 education: Envisioning a new future:. White paper commissioned for the Forum on Technology in Education: Envisioning the Future*, Washington, DC.

Topping, K. (1998). Peer assessment between students in colleges and universities. *Review of Educational Research, 68,* 249-276.

Turcotte, S. (2004). Integration of an Online Discussion Forum in a Campus-based undergraduate Biology Class. *Canadian Journal of Learning and Technology*, *30(2)*. Retrieved April 20, 2007 from http://www.cjlt.ca/content/vol30.2/cjlt30-2_art-4.html

Veerman A.L. (2000). *Computer supported collaborative learning through argumentation.* Ph.D. dissertation, Utrecht University, Ipskamp, Enschede.

Veerman, A. (2003). Constructive discussions through electronic dialogue. In J. Andriessen & M. Baker and D. Suthers (Eds.). *Arguing to learn.* The Netherlands: Kluwer Academic Publishers(pp.117-143).

Veldhuis-Diermanse A.E. (2002). *CSCLearning? Participation, learning activities and knowledge construction in computer-supported collaborative learning in higher education.* Ph.D. Dissertation, Wageningen University, Wageningen.

Veldhuis-Diermanse, A. E., Biemans, H.J.A., Mulder, M. & Mahdizadeh, H. (2006). Analysing Learning Processes and Quality of Knowledge Construction in Networked Learning. *Journal of Agriculture Education and Extension, 12(1)*, 41-58.

Vonderwell, S. (2003). An examination of asynchronous communication experiences and perspectives of students in an online course: a case study. *Internet and Higher Education*, 6(1), 77–90.

Vygotsky, L. (1978). *Mind in Society*. Ed. M. Cole et al. Cambridge, MA: Harvard University Press.

Wen, M.L., Tsai, C., Lin, H., & Chuang, S. (2004). Cognitive–metacognitive and content-technical aspects of constructivist Internet-based learning environments: a LISREL analysis. *Computers & Education*, *43(3),* 237–248.

De Wever, B., Schellens, T., Valcke, M. & Van Keer, H. (2006). Content analysis schemes to analyze transcripts of online asynchronous discussion groups: A review. *Computers & Education, 46 (1)*, 6–28.

Weinberger, A. and Fischer, F. 2006. A framework to analyze argumentative knowledge construction in computer-supported collaborative learning. *Computers & Education,* 46 (1), 71-95.

Weiss, R. & Morrison, G. (1998). Evaluation of a graduate seminar conducted by listserve. In *Proceedings of Selected Research and Development Presentations for Educational Communications and Technology (AECT).*

Wever, B., Schellens, T., Valcke, M. & Van Keer, H. (2006). Content analysis schemes to analyze transcripts of online asynchronous discussion groups: A review. *Computers & Education, 46 (1)*, 6–28.

Whelan, R. & Plass, J. (2001). Is e-learning effective? A Review of Literature from 1993-2001. *AACE, Volume 2002, Issue 1*, 1026-1028.

Williams, S. & Pury, C. (2002). Student Attitudes Toward and Participation In Electronic Discussions. *International Journal of Educational Technology*, *3(1)*. Retrieved November 21, 2003 from http://www.ao.uiuc.edu/ijet/v3n1/williams/index.html

Wu, D., & Hiltz, S. R. (2004). Predicting learning from asynchronous online discussions. *Journal of Asynchronous Learning Network*, *8(2),* 139-152.

Young, A. & Norgard, C. (2006). Assessing the quality of online courses from the students' perspective. *Internet and Higher Education*, *9(2),* 107–115.

Zhu, E. (1996). Meaning negotiation, knowledge construction, and mentoring in a distance learning course. In *Proceedings of Selected Research and Development Presentations at the 1996 National Convention of the Association for Educational Communications and Technology* (18th National Convention, Indianapolis).Available from ERIC documents: ED397849.

Appendices

Appendix 1

Aims, content and descriptions of courses involved in the study

Appendix 1 Course aims, content, descriptions and tasks and activities done by students in the asynchronous CSCL environment of the courses

	Course title	Aims	Course content	Tasks and activities done in the asynchronous CSCL environment of the course
1	Education in Developing and Changing Societies	-to improve the participants' ability to analyze and review systems of education; -to acquaint the participants with functions and effects of education in development processes and with present conceptual trends concerning the relations between the educational system and economical, cultural, social, political, and technological aspects of development; -to give the participants an opportunity of comparing their own national experiences with those of other countries.	The course aims at supplying the participants, at an introductory level, with knowledge of, and insight into, the functioning of education within processes of development, especially with regard to the complex relations between education and its socio-cultural, political, economical and technological context in order to determine the possibilities and limits within which education can exercise its influence on development. The international setting of this course promotes discussion about the cultural background of knowledge and information exchange.	-Students conducted an asynchronous online debate and discussion on three different themes which were taken from the 47th session of the International Conference on Education (ICE), which was held in Geneva, 8-11 September 2004. -Students were asked to write a paper in small groups on the debated themes based on their own experiences, opinions, ideas, attitudes or they could elaborate one of the themes and apply it to a particular country or region, or a comparison of two countries or regions.
2	Applied Environmental Education and Communication (AEE&C)*	-an improved understanding of the role of education and communication in environmental policy making, systemic environmental innovation, stimulating awareness, action and a change in lifestyle, and other sustainable development initiatives. -the ability to develop and critique an environmental education and/or communication strategy or a specific strategy for an environmental innovation process of their own choice. -knowledge of a range of evaluative tools and methods available for 'measuring' the	During the course students explore the instrumental and the emancipatory use of environmental education, communication, participation and whole system re-design in moving towards sustainable lifestyles, organizations and systems. Special attention is paid to the methodological aspects of environmental education and communication. Students are exposed to and involved in the design, implementation and evaluation of a public environmental awareness campaign, a community-based social environmental learning project and a series of education for sustainable living learning activities for both formal and non-formal educational settings.	-Each week students were asked to discuss an article about the main topic of the course. -Each group of students was asked to summarize 2-3 articles or book chapters about the topic of the course and formulate 1-2 questions about them and take the lead in a group discussion about the questions. -Each group was asked to conduct a mini case study on an environmental issue in three steps: first exploring and defining an environmental issue and challenge then exploring different strategies to cope with the challenge and selecting and advising the best and most appropriate strategy and a way to evaluate the impact of the strategy.

	Course title	Aims	Course content	Tasks and activities done in the asynchronous CSCL environment of the course
		impact of the strategies used and the activities employed, as well as an understanding of when to use them.		- Participants were asked to give feedback on different steps of other groups' mini case study as the period (semester) progressed via asynchronous CSCL environment of the course and help them to improve their solution
3	Human Resource Development/ Learning and Career Development (HRD)	After completing this course students will have developed a thorough understanding of: - contemporary developments, theories, concepts and issues with regard to lifelong learning and human resource development; - the role of education and training in competence development and performance improvement of organisations. -Students can apply this understanding in writing and defending an essay on a specific human resource development issue related to an organisational challenge of their own interest and within their own field. -will have insight into their own ambitions and intentions relating to their learning after graduation -will have insight into the relationship between policy and learning in the role of an employee, team member, project-leader, manager, entrepreneur and executive.	This course focuses on the theory and practice of human resource development in profit and non-profit organizations. Special attention is given to concepts of lifelong learning, organizational learning, learning in teams, and individual learning. Organizational development is seen as a combination of individual and collaborative learning. Human resource development is viewed from the micro (individual), intermediate (institutional) and macro (societal) level.	-Students were asked to do a mini case study in three steps: first they were supposed to select an organization and explore major and radical changes which might affect it, and to choose one of the major changes, and explore its consequences for the selected organization. In the second step they were asked to investigate different HRD strategies that can help the organization to face the chosen major change and suggest a key HRD strategy as the strategic solution for the selected organization to prepare itself to face the chosen major change and when actually facing the chosen major change. Finally in the third step they were asked to finalize their strategic solution based on the feedback that they received from other students. -Participants were asked to give feedback on different steps of other groups' mini case studies as the period (semester) progressed via asynchronous CSCL environment of the course and help them to improve their solution.

	Course title	Aims	Course content	Tasks and activities done in the asynchronous CSCL environment of the course
		-can analyse problems in relation to learning and development in practice -can develop solutions for these problems		
4	Human Resource Management (HRM)*	After the course students: - will have insight into their own ambitions and intentions relating to human resource management after graduation; - will have insight into the relationship between organisational strategy and managing human resources; - can evaluate the added value of competence and performance management as a specific form of HRM; - can develop solutions for human resource problems.	This course focuses on the theory and practice of human resource management (HRM) in profit and non-profit organizations. Special issues addressed during the course are managing diversity, performance analysis and management, employee relations, and managing an intercultural workforce.	-For three weeks students were asked to discuss an article about the main topic of the course. -Each group of students was asked to read 1-2 articles or book chapters about the topic and then formulate 2 questions about them. Other students were supposed to discuss the questions. -Students were asked to conduct a SWOT (strengths, weaknesses, opportunities, and threats) analysis on a real organization through the asynchronous CSCL environment of the course. -Each week students were asked to discuss a theme related to the topic of the course on that specific week. -Students were asked to do a mini case study on a real HRM-related crisis of a company which was introduced by the HRM department of the company itself; in three steps: first they were supposed to investigate and analyze the HRM approaches of the company and explore different aspects of the crisis. In the second step they were asked to investigate and discuss different solutions for the crisis and suggest a key HRM strategy as the strategic solution for it. Finally in the third step they were asked to finalize their strategic solution based on the feedback that they received from other students. -Participants were asked to give feedback on different steps of other groups' mini case study as the period (semester) progressed via asynchronous

	Course title	Aims	Course content	Tasks and activities done in the asynchronous CSCL environment of the course
				CSCL environment of the course and help them to improve their solution
5	Didactic Skills (DS)	This course focuses on didactic and communication skills. Skills that are necessary for (preparing) presentations, colloquia, lessons and workshops. Not only are individual presentations practised, but also interactive presentations and short workshops. Introductory exercises prepare the students for the so-called micro-teaching: three short lessons for their fellow students.	-the student has received knowledge about various didactic and communication skills, more specifically in relation to teaching; -the student has gained experience in several forms of knowledge transfer (presenting, interacting and delegating) by means of at least four practical exercises; -the student is able to adequately use audio-visual aids; -the student is able to give feedback to his fellow students about their performance in front of the group; - the student is able to reflect on his own performance in communicating and teaching.	Students were asked to discuss problem-based learning as a teaching and learning method and write and develop guidelines and a tutorial about problem-based learning for teacher students and teachers.

English Summary

Since we moved into the third millennium, there has been a gradual shift from the so-called information society to a networked society. One of the main characteristics of this new society is working in distributed companies and teams. The big challenge for educational systems in a networked society is preparing students for living, working and enjoying themselves in such a society. New advanced information and communication technology (ICT) influences all aspects of human life. One of the main applications of e-learning which captivates and fascinates so many researchers in the field of education is "Computer-Supported Collaborative Learning (CSCL)". According to Stahl (2003), CSCL environments are tools designed to support the building of shared knowledge and knowledge negotiation. In CSCL environments students try to learn collaboratively through the Web and they practice working in distributed teams which seems to be a crucial competency for living in a networked society. Although, theoretically, e-learning and CSCL environments are seen as powerful tools for learning processes, the results of empirical research in the field are contradictory. While some research in the field reported low levels of participation, interaction and depth of learning, many studies described and concluded positive effects of CSCL environments, positive effects of face-to-face teaching supported by CSCL applications, and positive effects of CSCL environments applied in combination with face-to-face learning situations.

This dissertation reports a PhD study which concentrated on performing tasks in asynchronous computer-supported collaborative learning environments as a blended learning approach for on-campus students. The blended learning approach, which aims at integrating e-learning techniques and traditional teaching methods, is seen as a way to improve the quality of education and reduce the costs of education for all students. The blended learning approach in higher education is a combination of regular, conventional, face-to-face and individual learning activities with web-based learning

activities. It aims at integrating different learning approaches and modes of course material delivery into education.

The current PhD project was designed to investigate students' processes of learning (knowledge construction) and learning outcomes (quality of constructed knowledge) while performing different study tasks in university courses in which CSCL has been implemented. More specifically, the main objective of the study was to investigate the implementation of ACSCL environments in conventional face-to-face and on-campus higher education following a blended learning approach. The following research questions were addressed:

1. What is the current use of e-learning environments in general and CSCL environments in particular in higher education?
2. What is the opinion of teachers about e-learning environments in general and CSCL environments in particular in higher education?
3. What is the opinion of students about implementing tasks in ACSCL environments in higher education?
4. How do students participate in learning processes and knowledge construction while performing tasks in ACSCL environments?
5. How can peer group feedback, supported by ACSCL, improve learning quality and facilitate learning processes?

The dissertation is composed of four different studies which address several specific research questions to investigate different aspects of implementing ACSCL in higher education. The first two studies concern two main parties involved in the process of learning: teachers and students. The third study aims at exploring the process of knowledge construction and quality of learning outcomes while performing tasks in ACSCL environments, and finally, the fourth study is designed to investigate the effect of PGF supported by ACSCL on the process of learning.

Study 1: teachers' use of e-learning environments

The purpose of the first study was to investigate teachers' use of e-learning environments as teaching and learning tools in higher education and to explore factors which explain teachers' use of those e-learning environments. In the study the following research questions were formulated:

1. Which functions of e-learning environments do teachers most often use?
2. What added value do teachers perceive of e-learning environments?
3. Which factors influence teachers' use of different functions and capabilities of e-learning environments?
4. What are the barriers for implementing e-learning environments in the learning process?

In e-learning environments, general course information functions (like course calendar and schedule and course announcement and news), content management functions (like presenting course material and literature and PowerPoint presentations) and non-interactive communication functions (like mail and mailing lists) are used most frequently. Other communication functions (like video conferencing, chatting, and voice conferencing) and collaboration functions (like online discussion, online collaboration, shared whiteboard, and application sharing) are the least used features of the e-learning environments.

Comparable to the pattern of the actual use of e-learning environments mentioned above, results indicate that teachers believe that presentation of course materials and literature, presentation of information about the courses, PowerPoint presentations, and E-mail have the most added value for teaching and learning processes. Voice conferencing, shared whiteboard, videoconferencing and net-meetings are believed to have the least added value for teaching and learning processes. The assumed added value of online discussion and online collaboration is low as well. In addition, teachers believe they do not face serious technical problems when working with ICT tools and e-learning environments. Finally, teachers are satisfied with the facilities and connectivity but they feel that they do not have access to relevant software, websites and content.

Running exploratory and confirmatory factor analysis we identified different factors like Knowledge Construction Teaching and Learning Approach (KC), Teachers' Opinion about Computer-Assisted Learning (CAL), Teachers' Opinion about Web-based Activities (WA), Ease of Use (perceived difficulty), and Time which might contribute to the explanation of teachers' actual use of e-learning environments (USE). We found that a teacher's previous experience with e-learning environments, WA,

CAL, and ease of use can help us to explain teachers' perceptions of the added value and usefulness of e-learning environments and their actual use of these environments. At the end, we were able to introduce the Teachers' Use of E-learning Environments Model (USE Model) which consists of Teachers' Opinions about Web-based Activities (WA) and Teachers' Opinions about Computer-Assisted Learning (CAL) as predictors, and Teachers' Perceived Added Value of E-learning Environments (AV) as the mediating variable.

Study 2: Student satisfaction with, and perceived learning effects of, performing tasks in ACSCL environments

The second study was aimed at investigating student satisfaction with, and perceived learning effects of, performing asynchronous online collaborative learning tasks in courses in higher education. The specific questions addressed in this study were:

1. Are on-campus students satisfied with performing learning tasks in this asynchronous computer-supported collaborative learning environment (ACSCLE)?
2. Do on-campus students perceive any added value of performing learning tasks in an asynchronous computer-supported collaborative learning environment (ACSCLE)?
3. What factors influence student satisfaction with, and perceived learning in, this asynchronous computer-supported collaborative learning environment (ACSCLE)?

Overall, 61.5% of the students were satisfied with their learning experiences with ACSCLE in their courses and, on average, 43.5% of the students agreed with all the items concerning their satisfaction with different aspects of performing tasks in the ACSCLE; with 45.7% of the students taking a neutral position. From the students' points of view there were no differences between F2F and asynchronous online collaboration in terms of difficulty of performing tasks and perception of learning. These results led to the conclusion that students evaluate the quality of asynchronous online collaborative learning as equal to the quality of F2F learning. In total, 30.35% of

the students positively agreed with all the statements meant to capture their opinions about the learning effects of performing tasks in ACSCLE and 50.35% of them were neutral (Mean=3.12).

Study 3: Students' learning activities and quality of knowledge construction while performing tasks in ACSCL environments

The third study was conducted to explore how on-campus university students in the context of green (food, animal, plant, social and environmental) sciences collaborate and construct knowledge in asynchronous CSCL environments. Therefore, attention was paid to learning activities during the process of knowledge construction. Moreover, we analysed students' participation and quality of knowledge construction while performing collaborative tasks in asynchronous CSCL environments. The following research questions were addressed with respect to students performing collaborative tasks in asynchronous CSCL environments:

1. To what extent do on-campus students participate in the process of knowledge construction?
2. How can on-campus students' learning and how can knowledge construction processes be characterised in terms of cognitive, affective, and meta-cognitive learning activities?
3. What is the quality of the constructed knowledge?
4. Are there any changes in on-campus students' learning activities over time and what are the patterns of those changes?
5. Are there any differences in students' learning activities in different courses and settings?

Considering the fact that, on average, students wrote two notes and read fifty five notes per week, we concluded that students' active participation in the learning environment was rather/fairly successful and their passive participation was quite successful. We also found that while, on average, each note was read 26.7 times and those contributions written in the first week were read more (Mean =60.4) than notes written in the last weeks (Mean = 5.17). Through content analysis of the students' written notes and learning activities by means of a coding scheme developed by

Veldhuis-Diermanse, 89.2 % of students' contributions were coded as cognitive learning activities, 8.4 % as meta-cognitive and 2.1 % as affective learning activities. Looking at the subcategories of the coding scheme, we found that 'debating' in the cognitive category and 'keeping clarity' in the meta-cognitive category appeared more. Another coding scheme was used to assess the quality of students' contributions. For each of the four quality levels (levels increasing from D to A) corresponding verbs were identified and described. Our findings showed that 75.1 % of students' contributions were assessed as level B, which is reasonably high, 6.1 % as Level D (lowest quality) and 7.7 % as level A (highest quality) and 11.1 % as level C.

Conducting in-depth interviews and focus groups with participants and looking at the open questions of the questionnaire, we concluded that task structure, level of support that students receive, teacher's role, task complexity, and group composition, which can all be discussed under the term 'scripting CSCL', are the main factors that students believed to be important for their learning activities and the quality of their contributions to ACSCL environments.

Study 4: Asynchronous Computer-Supported Peer Group Feedback in Higher Education

In the forth study we concentrated on the application of peer group feedback in face-to-face class meetings and asynchronous computer-supported collaborative learning (ACSCL) environments. More specifically, we surveyed student participation in, satisfaction with, and perceived learning effects of, participating in peer group feedback and studied functions and quality of student contributions to the PGF processes in both F2F and ACS conditions.

For this purpose the following research questions were formulated:

1. To what extent do students participate in Peer Group Feedback (PGF) in both Asynchronous Computer-Supported (ACS) and Face to Face (F2F) conditions?
2. What are students' perceptions of the value of Peer Group Feedback (PGF) in both Asynchronous Computer-Supported (ACS) and Face to Face (F2F) conditions?
3. What is the function of the students' feedback in both Asynchronous Computer-Supported (ACS) and Face to Face (F2F) conditions during Peer Group feedback (PGF)?

4. What is the quality of the students' feedback in both Asynchronous Computer-Supported (ACS) and Face to Face (F2F) conditions during Peer Group feedback (PGF)?

Our findings revealed that students in the ACS-PGF condition participated more in the process of feedback and all students were active (the distribution was better). In F2F conditions some students took over the discussions and teachers contributed more. The minimum amount of contributions under ACS conditions was much higher than under F2F conditions.

We also found that students in both conditions were satisfied with participating in group feedback and perceived PGF as effective for learning. Students in ACS groups were positive, to a higher level, about the quality of PGF and its added value. However, there was no significant difference between students' perceptions of the effect of PGF on motivation, interaction, and satisfaction.

We found that both ACS and F2F conditions differed with respect to students' contributions. For example, the students' notes posted in the ACS groups were significantly clearer, more structured, and more to the point than students' utterances in F2F groups. Students in ACS conditions posted more notes that were encoded as "evaluation/criticism" and as "motivate/praise" than students in F2F conditions.

Concluding remarks

From the study the conclusion can be drawn that although well-arranged technical support and reliable infrastructure are important for teachers' use of e-learning environments, they are not enough. A teachers' first experience with using e-learning environments and their attitude toward ICT are more important. Moreover, those who use e-learning environments most frequently use non-interactive and superficial features and functions. Interactive features, like CSCL, are rarely used. It seems that, in practice, more attention has been paid to the technological aspects of e-learning than to the pedagogical aspects and, as a result, these advanced learning environments have only been considered as tools to facilitate traditional learning and teaching approaches.

Tasks in CSCL environments need more attention than in face to face collaborative learning. In order to integrate CSCL effectively into the learning process characteristics/issues like structure and the level of structuring of the task, complexity of

the learning process, task complexity, the formulation of the task, support that learners receive, and the way that they receive that support are very important.

Based on our study the conclusion is justified that, as a blended learning approach, integrating asynchronous CSCL environments can effectively engage students in the process of learning. Implementing tasks in CSCL environments increases students' participation in learning activities and their interaction with each other and with their teachers outside of class time. We also conclude that asynchronous CSCL does not only foster more students' participation, but more equal participation, in the learning process and might be used successfully to encourage and engage the silent side of the class into the processes of discussion and collaboration.

The results of the study lead us to the conclusion that ACSCL environments can foster higher-order learning skills. However, we should remember that the quality of discussion was significantly related to the design and setting of the course. Learning to work in distributed teams is one of the main competencies that should be developed in higher education to prepare students for working in a knowledge and network society. The findings of this study revealed that performing tasks in asynchronous CSCL environments has the potential to increase the level of participation and interaction among students and to foster processes of shared and social knowledge construction. Performing these kinds of tasks has the potential to provide a meaningful supplement to conventional teaching and learning approaches and can help teachers to overcome the limitations of face-to-face collaboration and discussion.

We conclude that following a blended learning approach and taking course objectives into consideration, we can benefit from the added value of e-learning and CSCL environments. For example, our fourth study revealed that ACSCL can enable teachers to successfully embed 'formative assessment' and 'process-oriented feedback' (which aims at learning rather than assessment) into the learning process. As stated before, the quality of students' contributions in groups operating under ACS conditions was significantly higher than in F2F groups and they posted more critical comments. This allows us to conclude that asking students to conduct tasks in CSCL environments and combining these activities within the learning process can improve depth of learning and critical thinking.

It is commonly expected that in ACSCL environments students benefit from "asynchronicity" of the environment. By reading background literature in the field and written course material, and thinking deeply about the topic, students can provide in-depth and well-grounded "delayed feedback". However our study showed that this is not the normal strategy followed by students. In other words, first we need to learn how students work in ACSCL environments, which is not necessarily as we expect, and second to develop an instructional design and script CSCL activities in a way that persuades students to take advantage of the power of ACSCL environments. Without doing so CSCL environments will lose one of their main advantages over conventional F2F conditions.

Samenvatting

Sinds we het derde millennium zijn ingegaan, heeft er een geleidelijke verschuiving plaatsgevonden van de zogenaamde informatiemaatschappij naar een netwerkmaatschappij. Een van de belangrijkste kenmerken van deze nieuwe maatschappij is het werken in verspreide bedrijven en teams. De grote uitdaging voor het onderwijs in een netwerkmaatschappij ligt in het voorbereiden van studenten op het leven en werken in en het genieten van een dergelijke maatschappij. Nieuwe geavanceerde informatie- en communicatietechnologie (ICT) beïnvloedt alle aspecten van het menselijk leven. Een van de belangrijkste toepassingen van e-learning die zoveel onderwijsonderzoekers fascineert, is computerondersteund collaboratief leren (CSCL). Volgens Stahl (2003) zijn CSCL-omgevingen hulpmiddelen die zijn ontworpen om het opbouwen van gedeelde kennis en het onderhandelen over kennis te ondersteunen. In CSCL-omgevingen proberen studenten al samenwerkend te leren via het internet en oefenen zij het werken in verspreide teams, hetgeen een cruciale competentie lijkt te zijn voor het leven in een netwerkmaatschappij. Hoewel e-learning en CSCL-omgevingen in theorie gezien worden als krachtige hulpmiddelen voor leerprocessen, zijn de resultaten van empirisch onderzoek in het veld tegenstrijdig. Terwijl in een aantal studies lage niveaus van participatie, interactie en diepte van het leren zijn gerapporteerd, zijn in veel studies positieve effecten van CSCL-omgevingen, face-to-face(F2F)-onderwijs ondersteund door CSCL-toepassingen, en CSCL-omgevingen toegepast in combinatie met face-to-face-leren beschreven en aangetoond.

Dit proefschrift beschrijft een onderzoek dat zich richtte op het uitvoeren van taken in asynchrone CSCL-omgevingen als onderdeel van een gemengde leerbenadering voor studenten aan een universiteit. Deze gemengde leerbenadering, die de integratie van e-learningtechnieken en traditionele onderwijsmethoden omvat, wordt gezien als een manier om de kwaliteit van het onderwijs te verbeteren en de kosten van het onderwijs voor alle studenten te reduceren. De gemengde leerbenadering in het hoger onderwijs is een combinatie van veelgebruikte, conventionele, face-to-face en

individuele leeractiviteiten met internetondersteunde leeractiviteiten. Het doel is om verschillende leerbenaderingen en manieren van presentatie van cursusmateriaal in het onderwijs te integreren.

Dit onderzoek is opgezet om de leerprocessen (kennisconstructie) en de leeruitkomsten (kwaliteit van de geconstrueerde kennis) van studenten te onderzoeken terwijl zij verschillende studietaken uitvoeren in vakken waarin CSCL is geïmplementeerd. Specifieker gesteld, het belangrijkste doel van deze studie was om de implementatie van ACSCL-omgevingen in conventioneel, face-to-face hoger onderwijs gebaseerd op een gemengde leerbenadering te onderzoeken. De volgende onderzoeksvragen zijn geformuleerd:

1. Wat is het huidige gebruik van elektronische leeromgevingen in het algemeen en CSCL-omgevingen, in het bijzonder in het hoger onderwijs?
2. Wat is de mening van docenten over elektronische leeromgevingen in het hoger onderwijs in het algemeen en CSCL-omgevingen in het bijzonder?
3. Wat is de mening van studenten over het implementeren van taken in ACSCL-omgevingen in het hoger onderwijs?
4. Hoe nemen studenten deel aan leerprocessen en kennisconstructie, terwijl zij taken uitvoeren in ACSCL-omgevingen?
5. Hoe kan feedback van medestudenten (peer group feedback: PGF), ondersteund door ACSCL, de kwaliteit van leren verbeteren en het leerproces bevorderen?

Het proefschrift bestaat uit vier studies die betrekking hebben op verschillende specifieke onderzoeksvragen om diverse aspecten van de toepassing van ACSCL in het hoger onderwijs te bestuderen. De eerste twee studies richten zich op twee belangrijke partijen die betrokken zijn bij het leerproces: docenten en studenten. De derde studie richt zich op het onderzoeken van het proces van kennisconstructie en de kwaliteit van leeruitkomsten wanneer studenten taken uitvoeren in ACSCL-omgevingen. De vierde studie, tenslotte, is ontworpen om het effect van feedback van medestudenten oftewel peer group feedback (PGF) ondersteund door ACSCL op het leerproces te onderzoeken.

Studie 1: Het gebruik van elektronische leeromgevingen door docenten

Het doel van de eerste studie was om het gebruik door docenten van elektronische leeromgevingen als instrumenten voor onderwijzen en leren in het hoger onderwijs te bestuderen en om factoren te onderzoeken die het gebruik van elektronische leeromgevingen door docenten verklaren. In deze studie werden de volgende onderzoeksvragen geformuleerd:

1. Welke functies van elektronische leeromgevingen gebruiken docenten het meest?
2. Welke toegevoegde waarde ervaren docenten van elektronische leeromgevingen?
3. Welke factoren beïnvloeden het gebruik door de docenten van verschillende functies en mogelijkheden van elektronische leeromgevingen?
4. Wat zijn de knelpunten voor het implementeren van elektronische leeromgevingen in het leerproces?

In elektronische leeromgevingen worden algemene informatiefuncties (zoals cursuskalender en -schema, cursusaankondiging en nieuws), content managementfuncties (zoals het presenteren van cursusmateriaal en literatuur en PowerPoint presentaties) en niet-interactieve communicatiefuncties (zoals mail en adressenlijsten) het meest gebruikt. Andere communicatiefuncties (zoals video conferencing, chatten en voice conferencing) en samenwerkingsfuncties (zoals online discussie, online samenwerking, shared whiteboard en het delen van applicaties) zijn de minst gebruikte elementen van elektronische leeromgevingen.

Vergelijkbaar met het patroon van het huidige gebruik van elektronische leeromgevingen zoals hierboven beschreven, tonen de resultaten aan dat docenten geloven dat presentatie van cursusmateriaal en literatuur, presentatie van informatie over de cursussen, PowerPoint presentaties en email de grootste toegevoegde waarde hebben voor onderwijsleerprocessen. Voice conferencing, shared whiteboard, video conferencing en internetontmoetingen worden verondersteld de minste toegevoegde waarde te hebben voor onderwijsleerprocessen. De veronderstelde toegevoegde waarde van online discussie en online samenwerking is eveneens laag. Docenten geloven verder dat ze geen serieuze technische problemen tegenkomen wanneer ze werken met ICT-hulpmiddelen en elektronische leeromgevingen. Tenslotte zijn docenten tevreden met de faciliteiten en de kwaliteit van de verbinding, maar hebben zij wel het gevoel dat ze geen toegang hebben tot relevante software, websites en inhoud.

Op basis van exploratieve en bevestigende factoranalyses zijn verschillende factoren geïdentificeerd zoals Knowledge Construction Teaching and Learning Approach (KC), Teachers' Opinion about Computer-Assisted Learning (CAL), Teachers' Opinion about Web-based Activities (WA), Ease of Use en Time die zouden kunnen bijdragen aan de verklaring voor het huidige gebruik van elektronische leeromgevingen door docenten (USE). De eerdere ervaring van een docent met elektronische leeromgevingen, WA, CAL en Ease of Use kunnen helpen om de percepties van docenten van de toegevoegde waarde en de bruikbaarheid van elektronische leeromgevingen en hun huidige gebruik van deze omgevingen te verklaren. Tenslotte is het Teachers' Use of E-learning Environments Model (USE Model) geïntroduceerd dat bestaat uit Teachers' Opinions about Web-based Activities (WA) en Teachers' Opinions about Computer-Assisted Learning (CAL) als voorspellende variabelen en Teachers' Perceived Added Value of E-learning Environments (AV) als de mediërende variabele.

Studie 2: Studenttevredenheid over en waargenomen leereffecten van het uitvoeren van taken in ACSCL-omgevingen

De tweede studie was gericht op het onderzoeken van studenttevredenheid over en waargenomen leereffecten van het uitvoeren van ACSCL-taken in vakken in het hoger onderwijs. De specifieke onderzoeksvragen waren:

1. Zijn studenten tevreden met het uitvoeren van leertaken in deze asynchrone computerondersteunde collaboratieve leeromgeving (ACSCLE)?
2. Zien studenten een toegevoegde waarde van het uitvoeren van leertaken in een asynchrone computerondersteunde collaboratieve leeromgeving (ACSCLE)?
3. Welke factoren beïnvloeden de tevredenheid van de studenten over en de waargenomen leereffecten van deze asynchrone computerondersteunde collaboratieve leeromgeving (ACSCLE)?

Over het geheel genomen was 61.5% van de studenten tevreden over hun leerervaringen met ACSCLE in hun cursussen en gemiddeld stemde 43.5% van de studenten in met de items die te maken hadden met hun tevredenheid over verschillende aspecten van het uitvoeren van taken in de ACSCLE; 45.7% van de studenten nam hier een neutrale positie in. Vanuit het oogpunt van de studenten waren er geen verschillen tussen F2F en

asynchrone online samenwerking in termen van moeilijkheidsgraad van het uitvoeren van taken en perceptie van leren. Deze resultaten leidden tot de conclusie dat studenten de kwaliteit van asynchroon online collaboratief leren gelijk waarderen als de kwaliteit van F2F-leren. In totaal stemde 30.35% van de studenten in met de stellingen die bedoeld waren om hun meningen over de leereffecten van het uitvoeren van taken in ACSCLE vast te leggen en 50.35% van hen nam een neutrale positie in (Gemiddelde=3.12).

Studie 3: Leeractiviteiten van studenten en kwaliteit van kennisconstructie tijdens het uitvoeren van taken in ACSCL-omgevingen

De derde studie is uitgevoerd om te onderzoeken hoe universitaire studenten in de context van groene (voedings-, dier-, plant-, sociale en omgevings-)wetenschappen samenwerken en kennis construeren in asynchrone CSCL-omgevingen. Daarom werd aandacht besteed aan leeractiviteiten gedurende het proces van kennisconstructie. Bovendien werd de participatie van studenten en de kwaliteit van kennisconstructie terwijl ze collaboratieve taken uitvoeren in ACSCL-omgevingen geanalyseerd. De volgende onderzoeksvragen zijn geformuleerd met betrekking tot studenten die collaboratieve taken uitvoeren in asynchrone CSCL-omgevingen:

1. In welke mate nemen studenten deel aan het proces van kennisconstructie?
2. Hoe kunnen het leren en de kennisconstructieprocessen van studenten gekarakteriseerd worden in termen van cognitieve, affectieve en metacognitieve leeractiviteiten?
3. Wat is de kwaliteit van de geconstrueerde kennis?
4. Zijn er veranderingen in de tijd in de leeractiviteiten van de studenten en wat zijn de patronen van deze veranderingen?
5. Zijn er verschillen in de leeractiviteiten van de studenten in verschillende cursussen en settings?

Gezien het feit dat gemiddeld genomen studenten twee berichten per week schreven en er vijfenvijftig lazen, kan geconcludeerd worden dat de actieve deelname van studenten in de leeromgeving tamelijk succesvol was en hun passieve deelname behoorlijk succesvol. Terwijl gemiddeld genomen ieder bericht 26.7 keer gelezen werd, werden de

bijdragen geschreven in de eerste week meer gelezen (Gemiddelde=60.4) dan de bijdragen geschreven in de laatste weken (Gemiddelde=5.17). Door middel van een inhoudsanalyse van de geschreven berichten en leeractiviteiten van de studenten met behulp van een codeerschema, ontwikkeld door Veldhuis-Diermanse, werd 89.2% van de bijdragen van de studenten gecodeerd als cognitieve leeractiviteiten, 8.4% als metacognitieve en 2.1% als affectieve leeractiviteiten. Kijkend naar de subcategorieën van het codeerschema, kan geconcludeerd worden dat 'debatteren' in de cognitieve categorie en 'duidelijkheid bewaken' in de metacognitieve categorie meer voorkwamen. Een ander codeerschema werd gebruikt om de kwaliteit van de bijdragen van de studenten te meten. Voor elk van de vier kwaliteitsniveaus (waarbij de niveaus opliepen van D tot A) werden overeenkomstige werkwoorden geïdentificeerd en beschreven. De resultaten toonden aan dat 75.1% van de bijdragen van de studenten werd beoordeeld als niveau B, wat redelijk hoog is, 6.1% als niveau D (laagste kwaliteit), 7.7% als niveau A (hoogste kwaliteit) en 11.1% als niveau C.

Op basis van diepte-interviews en focusgroepen met deelnemers en de open vragen van de vragenlijst kan geconcludeerd worden dat de taakstructuur, het niveau van ondersteuning dat de studenten ontvangen, de rol van de docent, de complexiteit van de taak en de groepssamenstelling, die alle besproken kunnen worden onder de term 'CSCL-scripting', door studenten als belangrijke factoren worden aangemerkt voor hun leeractiviteiten en de kwaliteit van hun bijdragen aan ACSCL-omgevingen.

Studie 4: Asynchrone computerondersteunde feedback van medestudenten in het hoger onderwijs

In de vierde studie lag de focus op het gebruik van feedback van medestudenten (peer group feedback) in face-to-face bijeenkomsten en asynchrone computerondersteunde collaboratieve leeromgevingen (ACSCLE). Meer specifiek zijn de deelname van de studenten aan, de tevredenheid met en de waargenomen leereffecten van deelname aan peer group feedback (PGF) in kaart gebracht en de functies en kwaliteit van de bijdragen van studenten aan PGF-processen in zowel F2F- als ACS-condities bestudeerd.

Hiertoe zijn de volgende onderzoeksvragen opgesteld:

1. In welke mate nemen studenten deel aan peer group feedback (PGF) in Asynchrone Computerondersteunde (ACS) en Face-to-Face (F2F) condities?
2. Wat zijn de percepties van studenten van de waarde van peer group feedback (PGF) in Asynchrone Computerondersteunde (ACS) en Face-to-Face (F2F) condities?
3. Wat is de functie van peer group feedback van studenten in Asynchrone Computerondersteunde (ACS) en Face-to-Face (F2F) condities?
4. Wat is de kwaliteit van peer group feedback van studenten in Asynchrone Computerondersteunde (ACS) en Face to Face (F2F) condities?

De resultaten toonden aan dat studenten in de ACS-PGF-condities meer deelnamen aan het proces van feedback en dat alle studenten actief waren (de verdeling was beter). In de F2F-condities namen sommige studenten de discussie over en droegen de docenten meer bij. Het minimum aantal bijdragen in ACS-condities was veel hoger dan in F2F-condities.

Studenten in beide condities waren tevreden met de deelname aan de peer group feedback en beschouwden PGF als effectief voor het leren. Studenten in ACS-groepen waren positiever over de kwaliteit van PGF en de toegevoegde waarde ervan. Echter, er was geen significant verschil tussen de percepties van studenten van het effect van PGF op motivatie, interactie en tevredenheid.

ACS- als F2F-condities verschilden in de bijdragen van studenten. Bijvoorbeeld, de berichten van de studenten in de ACS-groepen waren significant duidelijker, meer gestructureerd en meer to-the-point dan de uitingen van de studenten in de F2F-groepen. Studenten in ACS-condities plaatsten meer berichten die werden gecodeerd als ‘evaluatie/kritiek’ en als ‘motivatie/lof’ dan studenten in F2F-condities.

Afsluitende opmerkingen

Op basis van de studie kan de conclusie getrokken worden dat goed georganiseerde technische ondersteuning en een betrouwbare infrastructuur belangrijk zijn voor het gebruik van elektronische leeromgevingen door docenten. Echter, dit blijkt niet het enige te zijn. De eerste ervaring van docenten met het gebruik van elektronische leeromgevingen en hun houding ten opzichte van ICT zijn nog belangrijker. Bovendien passen diegenen die gebruik maken van elektronische leeromgevingen in de meeste gevallen niet-interactieve en oppervlakkige kenmerken en functies toe. Interactieve

onderdelen, zoals CSCL, worden zelden gebruikt. Het lijkt erop dat in de praktijk meer aandacht wordt besteed aan de technologische aspecten van e-learning dan aan de pedagogische aspecten en als gevolg hiervan worden deze geavanceerde leeromgevingen alleen beschouwd als instrumenten om traditionele onderwijsleerbenaderingen te bevorderen.

Taken in CSCL-omgevingen verdienen meer aandacht dan in face-to-face collaboratief leren. Om CSCL effectief te integreren in het leerproces zijn kenmerken/aspecten als de structuur en het niveau van structurering van de taak, de complexiteit van het leerproces, de complexiteit van de taak, de formulering van de taak, de ondersteuning die lerenden ontvangen en de manier waarop zij die ondersteuning ontvangen erg belangrijk.

Op basis van deze studie is de conclusie gerechtvaardigd dat het integreren van asynchrone CSCL-omgevingen, als gemengde leerbenadering, studenten effectief kan betrekken bij hun leerproces. Het implementeren van taken in CSCL-omgevingen verhoogt de deelname van studenten aan leeractiviteiten en hun interactie met elkaar en hun docenten buiten lestijd. Ook kan geconcludeerd worden dat asynchrone CSCL niet alleen meer participatie van studenten bevordert, maar ook meer gelijke deelname aan het leerproces en succesvol gebruikt zou kunnen worden om het stille gedeelte van de klas aan te moedigen en te betrekken bij processen van discussie en samenwerking.

De resultaten van deze studie leiden tot de conclusie dat ACSCL-omgevingen hogere-orde leervaardigheden kunnen bevorderen. Hierbij moet aangetekend worden dat de kwaliteit van de discussie significant gerelateerd was aan het ontwerp en de setting van de cursus. Het leren werken in verspreide teams is een van de belangrijke competenties die ontwikkeld zou moeten worden in het hoger onderwijs om de studenten klaar te maken voor het werken in een kennis- en netwerkmaatschappij. De bevindingen van deze studie gaven aan dat het uitvoeren van taken in asynchrone CSCL-omgevingen de potentie heeft om het niveau van deelname van en interactie tussen de studenten te verhogen en processen van gedeelde en sociale kennisconstructie te bevorderen. Het uitvoeren van dit soort taken heeft de potentie om een betekenisvolle aanvulling op conventionele onderwijsleerbenaderingen te bieden en kan docenten helpen om de beperkingen van face-to-face samenwerking en discussie weg te nemen.

Geconcludeerd kan worden dat, wanneer een gemengde leerbenadering gevolgd wordt en de doelen van de cursus in ogenschouw worden genomen, geprofiteerd kan worden van de toegevoegde waarde van e-learning en CSCL-omgevingen. De vierde studie bijvoorbeeld liet zien dat ACSCL docenten in staat kan stellen om succesvol formatieve assessment en procesgerichte feedback (die zich meer richt op leren dan op assessment) in het leerproces toe te passen. Zoals eerder aangegeven, was de kwaliteit van de bijdragen van studenten in groepen die werkten in ACS-condities significant hoger dan in groepen die werkten in F2F-condities en plaatsten zij meer kritisch commentaar. Dit staat ons toe te concluderen dat wanneer we studenten vragen om taken in CSCL-omgevingen uit te voeren en deze activiteiten in het leerproces combineren, het kritisch denken en de diepte van het leren verbeterd kunnen worden.

Algemeen wordt verondersteld dat studenten in ACSCL-omgevingen voordeel behalen uit de asynchroniciteit van de leeromgeving. Door het lezen van achtergrondliteratuur op het betreffende domein en cursusmateriaal op schrift en diep na te denken over het onderwerp, kunnen studenten grondige en goed onderbouwde uitgestelde feedback geven. Deze studie toonde echter aan dat dit niet de normale strategie is die gevolgd wordt door studenten. Met andere woorden, we moeten eerst leren hoe studenten werken in ACSCL-omgevingen, hetgeen niet noodzakelijkerwijs is zoals we verwachten, en ten tweede moeten we een instructieontwerp vervaardigen en CSCL-activiteiten beschrijven die studenten overtuigen dat er voordeel valt te halen uit ACSCL-omgevingen. Wanneer dit niet wordt gerealiseerd, zullen CSCL-omgevingen een van hun belangrijkste voordelen verliezen ten opzichte van conventionele F2F-leeromgevingen.

Training and Supervision Plan (TSP)	**Mansholt Graduate School**	
Name: Hossein Mahdizadeh Group: Chair group of Education and Competence Studies Group, WUR Period of PhD study: September 2003- September 2007 PhD student, Mansholt Graduate School of Social Sciences (MG3S) Completed Training and Supervision Plan		
	Year	CP[1]
1. General PhD Courses		
Written English (CENTA Course)	2004	1
Scientific Writing (CENTA Course)	2005	1
Techniques for Writing and Presenting a Scientific Paper (Wageningen Graduate School (WGS))	2005	1
Research Methodology (MG3S)	2004	2
Computerized Data Collection with Author Ware (MG3S)	2003	0.5
2. Mansholt-specific Courses		
Mansholt Introduction course (MG3S)	2004	1
Mansholt Multidisciplinary Seminar (PhD day, MG3S)	2007	1
Presentations at scientific (international) conferences:		2
17th European seminar on Extension Education, Izmir, Turkey	2005	
The European Conference on Educational Research (ECER), Geneva	2006	
European Association for Research on Learning and Instruction (EARLI 2007)	2007	
3. Discipline-specific courses		
Developing PhD research proposal	2003	3
ICO introductory Course (Interuniversity research centre for educational research (ICO))	2004	5
Master class Researching instructional Media: separating media and Methods (ICO)	2004	2.5
Media and Mediators, messages and means (WGS)	2004	.7
Quantitative research methodology (MG3S)	2005	2.9
Socio-cultural field research method (MG3S)	2006	2.9
Qualitative analysis (ICO)	2006	2.5
Computer supported inquiry learning (ICO)	2006	2.5
Total (minimum 20 CP) (31. 5 CP = 44. 1 ECTS)		**31.5**

[1] CP = Credit Point; 1 CP = A study load of approximately 40 hours; 1 CP = 1.4 ECTS

About the author

Hossein Mahdizadeh (the author) was born on March 21, 1969 in Ilam, Iran. He received his high school diploma in biological science from the Razi School in Ilam in 1985. After graduation from high school he entered Tehran University to complete his BSc. He achieved his bachelors' degree in the field of agricultural extension in 1989. Soon after, in 1990, he started his MSc in the field of agricultural extension and graduated in 1992. Afterwards he worked in Ilam university as a lecturer. In 1997 he started an M-Phil degree in Tehran university which he successfully completed it in 1999. In 2002 he was awarded a scholarship from the Ministry of Science, Research and Technology (MSRT) and Ilam university to take part in a research-based PhD program. Therefore, in 2003, he came to Wageningen University to carry out his PhD within the Education and Competence Studies (ECS) group. After graduation, he will continue working for Ilam university as a lecturer and researcher. His main interest is using new high technology in education and education for sustainable development

Author's address:
Agricultural Extension and Economic Group, College of Agriculture, Ilam University, Pajouhesh Street , Ilam, Iran.
Emails: Hossein.Mahdizadeh@ wur.nl; Hossein.Mahdizadeh@gmail.com

در **مطالعه سوم** میزان و نحوه مشارکت فراگیران و مجموعه تعاملات و مذاکرات آنها در حین انجام فعالیت های گروهی در "محیط های یادگیری از طریق همیاری به کمک کامپیوتر" بررسی و تحلیل گردیده است. نتایج مشخص نمود که این محیط های یادگیری منجر به مشارکت بیشتر فراگیران در فرایند یادگیری و ساخت (تشکیل) دانش وتعامل بیشترآنها با هم و با تسریع و تسهیل کننده (آموزشگر)[1] درس می شوند. این محیط ها شرایط را برای حضور بخش خاموش کلاس (دانشجویانی که معمولا در وضعیت چهره به چهره و در محیط کلاس ساکت مانده و یا کمتر مشارکت می نمایند) فراهم کرده و دانشجویان را در خارج از ساعت درس با موضوع درس، تسریع و تسهیل کننده (آموزشگر) و همدیگر در تعامل نگه می دارد. نتـایج این مطالعه به تفصیل در فصل پنجم شرح داده شده است.

در **مطالعه چهارم** راههای بالا بردن کیفیت یادگیری و تعمیق فرایند ساخت و تشکیل دانش بررسی و اثر بازخورد برنامه ریزی شده دانشجویان به همدیگر در خصوص مراحل حل مساله و انجام پروژه به عنوان روشی برای رسیدن به این منظور بررسی شده است. نتایج این مطالعه نشان داد که دانشجویان در"محیط های یادگیری از طریق همیاری به کمک کامپیوتر" به طور معناداری بازخوردهای مرتبط تر، روشن تر و ساختارمندتری به دیگر همکلاسی هایشان داده اند. دانشجویان معتقدند که کیفیت فرایند بازخورد در"محیط های یادگیری از طریق همیاری به کمک کامپیوتر" عمیق تر و با کیفیت تربوده ودر بهبود یادگیری آنها و غنا بخشی به گزارش نهایی پروژه آنها موثرتر بوده است. نتایج این مطالعه به تفصیل در فصل ششم شرح داده شده است.

[1] Facilitator

۴) دانشجویان چگونه در "محیط های یادگیری از طریق همیاری به کمک کامپیوتر"مشارکت و فعالیت می نمایند؟
۵) فرایند یادگیری و ساخت (تشکیل) دانش[1] در "محیط های یادگیری از طریق همیاری به کمک کامپیوتر" چگونه است؟
۶) چگونه باز خورد[2] از طرف همکلاسی ها با استفاده از "محیط های یادگیری از طریق همیاری به کمک کامپیوتر" میتواند فرایند یادگیری و ساخت دانش را بهبود داده تسریع نماید؟

در این پایان نامه دکترا چهار مطالعه جداگانه انجام شده است. مطالعه اول در قالب یک تحقیق پیمایشی به نظـــرات اعضا هیات علمی و مطالعه دوم به نظرات دانشجویان پرداخته است. در مطالعه سوم تلاش شده است تا فرایند یادگیری و ســـاخت (تشکیل) دانش در"محیط های یادگیری از طریق همیاری به کمک کامپیوتر" بررسی شده و سرانجام، مطالعه چهارم تلاشـــی برای بررسی راههای بهبود فرایند یادگیری و ساخت دانش دراینگونه محیط های یادگیری است.

نتایج مطالعه اول حاکی از این است که اعضا هیات علمی در دانشگاه واگنینگن کشورهلند عمدتا از قابلیت های سطحی محیط های یادگیری الکترونیکی استفاده می نمایند. به عنوان مثال آنها بیشتر از قابلیت هایی عمومی محیط های یادگیری نظیرتابلو اعلانات، اطلاعات عمومی درس، تقویم آموزشی و ارائه محتوای آموزشی در قالب در دسترس قرار دادن فایل های متنی[3] و اســـلایدهای سخنرانی[4] استفاده می نمایند و کـــاربردهای پیشرفته نظیر قابلیتهای تعاملی[5] محیط ها چنـدان مورد اقبال قرار نگرفته اند. همچنین در این مطالعه عوامل موثر در کاربرد محیط های یادگیری الکترونیکی توسط اعضا هیات علمی بررسی و "مدل کاربرد محیط های یادگیری الکترونیکی" معرفی شده است. نتایج این مطالعه در فصل سوم شرح داده شده است.

نتایج مطالعه دوم نشان داد که حدود ٤٣ درصد دانشجویان از کار در"محیط های یادگیری از طریق همیاری به کمک کامپیوتر" اظهار رضایت کرده و حدود ۳۰ درصد آنها معتقدند که مجموعه فعالیت های آنها در محیط یادگیری منجر به یادگیری شده است. در این مطالعه همچنین عوامل موثر درمیزان و ادراک[6] یادگیری و میزان رضایتمندی از کاربرد محیط های یادگیری الکترونیکی توسط دانشجویان بررسی گردیده است . نتایج این مطالعه در فصل چهارم شرح داده شده است.

[1] Knowledge construction
[2] Feedback
[3] Word, PDF etc
[4] PowerPoint
[5] Interactive
[6] Perception

چکیده فارسی

در آغاز هزاره سوم بشریت حرکتی پرشتاب از جامعه اطلاعاتی[1] به سمت جامعه مجازی[2] (شبکه ای) را نظاره گر است. از ویژگی های بارز این حرکت، شکل گیری گروه ها و سازمان های مجازی و شبکـــــه ای است. بدون هیچ شکی نظام آموزش و پرورش می بایست شرایط لازم را برای فراگیری و کسب توانایی کار در این گونه سازمان ها ، گروه های مجازی و شبکه ای برای مخاطبان خویش فراهم کند به گونه ای که آنها بتوانند در جامعه نوین کار کرده وزندگی کنند. یکی از صلاحیت هاو قابلیت های مهمی که افراددر جامعه نوین باید یاد بگیرند توانایی کار و همیاری[3] در گروه های مجازی می باشد. از اواسط واپسین دهه هزاره دوم " یادگیری از طریق همیاری به کمک کامپیوتر[4]" به یکی از موضوعات نوین و پرطرفدار تحقیقات آموزشی و تربیتی در فن آوری آموزشی[5] و آموزش الکترونیکی[6] تبدیل شده است به گونه ای که به آن پارادایم سوم فن آوری آموزشی اطلاق می شود. "محیط های یادگیری از طریق همیاری به کمک کامپیوتر" به محیط های یاد گیری ای اطلاق می شود که در آنها فراگیران با استفاده از تکنولوژی های پیشرفته و نوین مبتنی بر کامپیوتر و شبکه به طور گروهی یک مساله را بحث و بررسی کرده نسبت به حل آن اقدام می نمایندو مبتنی بر نظریه سازندگی[7] یادگیری میباشند.

رساله ی دکترای حاضرنتایج یک تحقیق در زمینه کاربرد" محیط های یادگیری از طریق همیاری به کمک کامپیوتر" در آموزش عالی می باشد که در آن با نگرش یادگیری تلفیقی[8] تلاش گردیده است تا کاربرداین فن آوری های نوین در شرایط معمولی و رایج چـــــهره به چهره آموزشـــی(و نه لزوما آمـوزش از راه دور که این گونه فن آوری ها به گونه ای چشمگیر مورد اقبال قرار گرفته اند) مورد تحقیق و بررسی قرار گیرد. در این راستا سئوالات ذیل مورد بحث و بررسی قرار گرفته است:

۱) وضعیت کاربرد "محیط های یادگیری الکترونیکی" به طور کلی و"محیط های یادگیری از طریق همیاری به کمک کامپیوتر" به طور خاص در آموزش عالی چگونه است؟

۲) نظر اعضا هیات علمی دانشگاه واگنینگن[9] کشورهلند در خصوص کاربرد "محیط های یادگیری الکترونیکی" به طور کلی و"محیط های یادگیری از طریق همیاری به کمک کامپیوتر" به طور خاص در آموزش عالی چگونه است ؟

۳) نظردانشجویان در خصوص انجام پروژه های گروهی و فعالیت های آموزشی در"محیط های یادگیری از طریق همیاری به کمک کامپیوتر" در آموزش عالی چگونه است ؟

[1] Information society
[2] Networked society
[3] Collaboration
[4] Computer-Supported Collaborative Learning (CSCL)
[5] Instructional technology
[6] Electronic learning (e-learning)
[7] Constructivism
[8] Blended learning approach
[9] Wageningen

همیـــــاری دانشجـــــویان و یادگیـــــری

ساخت (تشکیل) دانش و مشارکت در محیط های یادگیری از طریق همیاری به کمک کامپیوتر در آموزش عالی

حسین مهدی زاده

رساله دکترای فناوری آموزشی – آموزش الکترونیکی

دانشکده علوم اجتماعی – گروه مطالعات آموزشی

دانشگاه واگنینگن

هلند

شهریور ۱۳۸۶

This study was **financially** supported by the **Ministry of Science, Research and Technology (MSRT) of the Islamic Republic of Iran** and **Ilam university** the authors want to express their gratitude for this support.

The study was conducted at Wageningen University and Research Centre, Department of Social Sciences, **Chair group of Education and Competence Studies (ECS)**, Hollandseweg 1, 6706 KN – Wageningen, the Netherlands.

The training and supervision plan was completed at the **Mansholt Graduate School (MGS)**.

]

This book was published by **Ponsen & Looijen b.v.**
Visiting address: Nudepark 142, 6702 DX Wageningen, the Netherlands.
Website: www.p-l.nl

Layout and design: Majid Vazifedoust, Mostafa Karbasioun

Front page: Shows Computer supported collaborative learning in networked society

Back page: Shows one of the collaborative learning environment used in the study and the text explains one of the findings of the study

"In the name of Allah the compassionate the merciful"