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ONLINE INSTRUCTOR ROLES AND EFFECTS OF ONLINE MENTORING IN CSCL ENVIRONMENTS IN COMMUNITIES OF PRE- AND IN-SERVICE TEACHERS

Doctoral thesis

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1 INTRODUCTION

In the introduction of his book on *Education and Mind in the Knowledge Age* Bereiter (2002) claims that even though we are in the Information Age we still rely on a theory of mind that is older than the wheel. According to him, the elementary concept of viewing the mind as a container of objects (beliefs, desires, remembered events, and so on) on which it operates in cognition and learning is being challenged. He refers to novel challenges such as educating members of a society so that they become knowledge workers, transforming an organisation into a learning organisation, or the question of how a society could double its rate of knowledge production. Csapó (2001a) also argues that in our century the value of knowledge and information has gained such an importance that most of the active members of our society are occupied with knowledge production, its maintenance, transmission and usage.

These dilemmas call for a new (different) way of thinking about the mind, which works for the new demands facing education, as Bereiter (2002) proclaims. The established conception that cognition exists as internal mental representation (Hewitt & Scardamalia, 1998) presuming a focus on the individual learning in social and cultural isolation has been increasingly seen as "conceptually unsatisfying and ecologically deficient" (Salomon & Perkins, 1998, p. 2). Consequently, theories of social learning, which argue for the social aspects of learning and propose that cognition is a situated activity rooted in social, cultural contexts and interactions, are gaining ground. However, learning is not the plain assimilation and accommodation of new knowledge, but it is the process by which learners become part of a knowledge community (Jonassen & Land, 2000; Lave & Wenger, 1991; Rogoff, 1990; Scardamalia & Bereiter, 1994; Vygotsky, 1978). In this understanding, learners are seen as being active participants in the teaching and learning process in which interaction and negotiation of meaning are indispensable. Collaboration, the idea of co-construction of knowledge and mutual engagement of participants is viewed as a special form of interaction (Dillenbourg, 1999; Dillenbourg, Baker, Blaye, & O'Malley, 1996; Engeström, 1992; Lipponen, 2002, Rochelle & Teasley, 1995; So & Brush, 2008). The newly emerged field of computer-supported collaborative learning (CSCL) focuses on the use of technology as a "mediational tool" (p. 2) in collaborative pedagogical scenarios, as Koschmann (1996) argues. In addition, as Lipponen (2002) formulated, CSCL is concerned with the potential of collaborative learning supported by technology in the process of "sharing and distributing knowledge and expertise among community members" (p. 72). Csapó (2001a) adds that apparently computer-supported pedagogical scenarios model better those conditions, which enable learners to share, exchange and use knowledge jointly.

Harasim (1989; 1991) stated twenty years ago that the emergence of the new communication technologies enables new ways of designing and delivering education to learners. However, she also noted that instructors are inadequately trained and not prepared for teaching and learning in an online environment (Harasim, 1991). She suggested, as have others, that one method for designing online learning is to utilise the tenet of collaborative learning when launching online group learning projects. Accordingly, the methodological inventory in both quality teacher training and teachers' professional development has broadened to include learning communities. These communities provide for supportive interpersonal relationships, which enhance in- or pre-service teachers' professional growth. McLaughlin (1997) argues that in such communities, professionals and future professionals "learn new practices and unlearn old assumptions, beliefs and practices" (as cited in Le Cornu, 2005, p. 356). The expert-

novice transfer and the hierarchies attached to it are reduced, the relationships are more equal, symmetrical and collegial (Lieberman, 2000). Lieberman also adds that through such communities teachers are supported to engage in pedagogical practices that result in changes, which are inevitable for effective teaching and learning processes in our century.

Csapó (2007) claims that the current Hungarian educational system needs to be transformed to a more adaptive learning organisation, which is capable of efficient growth and development. He adds that teachers' personal knowledge is the chief constituent of the educational system. However, their personal and professional growth is impossible without proper feedback. (It was actually a consequence of the former decentralisation effort that teachers were left alone without a reliable system of feedback on their work and the proper skills to interpret any potential professional feedback in the decision-making process.) He suggests that teachers should be invited in educational research projects as active collaborating members, which as he stresses, could be one step towards the research-based teacher training and teachers' professional training in Hungary.

In the present study, the instructional context for the research-based training of pre-service and in-service teachers' communities is the *Mentored Innovation Model* (*MIM*). MIM is rooted in theories of social learning - more precisely it is strongly related to Vygotsky's (1978) ideas on *social mediation* and Engeström's (2001) principles on *activity theory* (see *Section 2.5*). Accordingly, it entails social mediation that encompasses both *social mediation of individual learning* and *participatory knowledge construction* (Salomon & Perkins, 1998). Social mediation of individual learning refers to the facilitating social agent who helps to create a better system for learning, while learning seen as participatory knowledge construction means the participation in a social process of knowledge construction and that knowledge is located in the relations and activities of the participation. In the MIM, these activities are the innovative educational program and professional development experience. The facilitators or e-moderators focus on various features that characterise social mediation, including intensive interaction, rapid feedback, highly personalised and situationally contingent guidance, encouragement, and the elicitation of responses from the participant in the form of explanations, suggestions, reflections etc., (Kozulin & Presseisen, 1995, p. 7).

1.1 Research problem

Interaction is an essential ingredient of online learning in CSCL environments, which provide a high potential through various interaction options. However, productive interaction that results in cognition and active learning processes does not automatically occur (Berge, 1999; De Smet, Van Keer & Valcke, 2008; Dillenbourg, 1999; Liaw & Huang, 2000; Northrup, 2001; Rourke, 2000) neither does collaboration automatically produce learning (Dillenbourg, 2002). In online settings, the dominance of „serial monologues" (Henri, 1991), which resemble the so-called IRE form of classroom discussion where the teacher initiates (I) the interaction with the learners, they respond (R) to them, and the teacher evaluates (E) the responses are typical (Lipponen et al., 2001). Since "interaction does not simply occur but must be intentionally designed into the instructional program" (Berge, 1999, p. 5), the role of online instructors offering guidance and moderation in discussion is vital (Bonk, Wisher, & Lee, 2004). In theories of social learning such as Vygotsky's (1978) zone of

proximal development or Rogoff's (1990) guided participation, the role of human mediation is vital, so are online scaffolding and guidance provided by the online instructor in a CSCL environment. Accordingly, enhancing the quality of online interaction and increasing the learners' satisfaction with the online experience in support of the learning process has been an important research goal.

The present study focuses on the online instructors' roles as human mediators in the online mentoring, teaching and learning process and on the effects involved in these processes in CSCL environments in communities of pre- and in-service teachers. When studying the online instructors' activity we consider their participation in the online interactions, the influence of their activity on participants' engagement and patterns of interaction, and their varying facilitating styles. Effects of online mentoring, teaching and learning processes refer to the investigation of pre- and in-service teacher communities' perceptions of the learning experience and the analyses of the interrelation of crucial elements in the online mentoring, teaching and learning events in the CSCL environments.

In order to elucidate aspects of the research problem, as suggested by current CSCL research, a *mixed method* strategy was employed. Qualitative and quantitative data due to their different nature can shed light on the same problem from different perspectives thus allowing for a more refined answer and increased validity of the study (Creswell, 2007). Accordingly, one methodological approach was not favoured over another. Following the mixed method strategy, we relied on hypothesis testing i.e. theoretical assumptions were formulated *a priori*, and hypothesis generating i.e. data-driven findings based on *a posteriori* analyses. The employed research instruments contributed to the collection and analyses of quantitative data however, as an overarching research design, the multiple case study approach was used. In order to maintain validity data source and methodological triangulation were applied. (*Chapter 5* describes the research questions, hypotheses and research instruments in detail.)

1.2 Significance of the study

When the present study started, in Spring 2007, various international empirical studies devoted to online instructor roles in CSCL environments were available and a number of notions, such as mentoring, coaching, tutoring and facilitating, have appeared and been utilised simultaneously to describe online teacher roles (cf. *Section 3.5*). Research topics encompassed the various facilitator roles (Anderson, Garrison & Archer, 2001; Berge, 1995; Goodyear, Salmon, Spector, Steeples, & Tickner, 2001; Green, 1998; Hootstein, 2001; Mason, 1991; Salmon, 2003; White, 2004); the relation of instructor behaviour to the efficacy of the learning process (Hiltz & Turoff, 2002; Sherry, Fulford & Zhang, 1998; Vonderwell, 2003), the effects of 'direct instruction' (Finegold & Cooke, 2006), the facilitator's role in creating a sense of community (Rovai, 2001), and the facilitative approach in online discussions (Shea, Li & Pickett, 2006; Gilbert & Dabbagh, 2005). As regards the impact of online interaction and the facilitator's impact (e.g. communication skills, encouragement, content knowledge, and so on) on student satisfaction various international studies were conducted (Arbaugh, 2001; Bolliger, 2004; Fulford & Zhang, 1993; Gunawardena & Zittle, 1997; Kitchen & McDougall, 1998; Lin, Lin, & Laffey, 2008; Northrup, 2002; Picciano, 2002; Richardson & Swan, 2003).

In the Hungarian context, the topic had scarcely been researched. In the group of Hungarian practitioners and educational researchers, there were a number of studies

investigating the effects of different CSCL environments and their application (Dancsó, 2007; Főző, 2006; Hunya, 2005a, 2005b; Hunya, Dancsó & Tartsay, 2006; Kárpáti & Ollé, 2007) however, only a few focused on mentoring and instructor activity (Tartsay-Németh, 2004; Turcsányi-Szabó 2001; 2003; 2005; Dorner & Kárpáti, 2008; Kárpáti & Dorner, 2008). Even less studies relied on the usage of research methods applied in the present study (Horváth & Jókai, 2007; Kovács, 2007; Molnár, 2009). At the date of the empirical study, the combination of participant satisfaction survey, social network analysis and content analysis in one evaluation model could not be traced in any of the studies.

The present study builds on the foundations of previous *international* studies, and explored the above-described research problem with pre- and in-service teacher communities at two sites of a Hungarian university where the MIM (or its adjusted form) was maintained in various CSCL environments. Based on the novelty of the study in the Hungarian context, our aim was also to develop and test new methodologies, which allow for an in-depth multi-perspective analysis and for fine-tuning survey results.

1.3 Summary of the main findings

Results of the study revealed that online communication, the facilitator's activity, participants' perceived social presence and their global satisfaction were interrelated phenomena in the online mentoring, teaching and learning process. Online communication was identified both as the most influential indicator of the participants' global satisfaction and a central criterion of the online processes maintained in the framework of the MIM in the CSCL environments.

The facilitators' activity was recognised as a component having direct impact on participants' global satisfaction and a relevant indicator of self-perceived learning success. Teaching presence was thus described as an overarching magnitude in the context of educational presence, which involved course design and organisation, facilitating interactions and direct instruction. Scaffolding (help) offered by the online instructor proved the strongest indicator of satisfaction in the variable group referring to the facilitator's activity.

The study also showed that perceived social presence and online communication were strongly interrelated phenomena. However, the facilitator's activity and perceived social presence were only indirectly linked. Thus, the facilitator through its social director role (depending on the extent to which it was maintained) influenced the degree to which participants perceived each other and their instructors as real in the CSCL environments.

The quality of the teaching and learning experiences (an indicator of perceived cognitive presence) also proved a crucial indicator of satisfaction. Results showed that the participants were highly satisfied with the quality of learning that took place in the framework of the MIM in the CSCL environments.

With the Kano model, we established the relative priority of the components of the MIM. We identified the online communication component as a one-dimensional attribute, and we recognised the participants' general computer usage and their Internet abilities as must-be attributes.

In line with previous findings in the field, we set up the profile of the 'guide on the side' and the 'resource provider' or 'master teacher' facilitators, and differentiated between directive and interactive facilitation. We also considered the potential

causalities between facilitator approach, network interaction structure, tie strength and group mechanisms. Accordingly, we identified drivers and barriers of participants' cognitive engagement and social presence in the communities of pre- and in-service teachers with special attention to the effects of the instructors' teaching presence.

All in all, the study showed that agents involved in the conduction of online mentoring, teaching and learning processes should plan purposeful online communication which contributes to participants' growing understanding of the course content and knowledge building. Additionally, since ICT skills and competencies are must-be attributes in the online mentoring and learning experience, it is a must for facilitators that beyond their pedagogical or instructional roles, and social director roles, they are efficient in their technical roles or technical assistant roles as well.

1.4 The organisation of the thesis

The chapters and appendices in this dissertation are organised in the following way. Chapter 2 reviews various theories of social learning, which are considered as the theoretical roots of CSCL practice and research. Chapter 3 outlines the definition and the methodological implication of the paradigm and research field of CSCL. It also contains various definitions and interpretations of online (pedagogical) interaction, the notion of collaboration seen as a special form of interaction, and a detailed description of online instructor roles in CSCL environments. Chapter 4 gives an overview of the literature on research methodologies used in CSCL research with the intent to provide the background of methodologies used in the data collection and analyses of the study. Chapter 5 outlines the research methodology used in the present study with special focus on research design, participants, data collection instruments and procedures.

Chapter 6 contains the results of the study and their discussion. It consists of six main sections. They are organised around the research tools, which were utilised in the process of data provision and analysis. Accordingly, the first two main sections focus on the results of the participant satisfaction survey and their discussion. The third and fourth main sections discuss results of the social network analyses. The last two main sections examine the results of the content analyses of the online interactions. The results are placed into the context of the findings of the previous main sections.

In Chapter 7, the conclusions and implications of the study are discussed and suggestions are given for further research. The Appendices include the ICT metrics, the participant satisfaction and communication questionnaire, the coding scheme for cognitive, social and teaching presence, and also numerous tables with data on the statistical analyses (second phase of regression analyses and model building), participants' online activity analyses and content analysis reliability measures.

2 THEORETICAL ROOTS

In the present chapter, numerous theories of learning, which claim that cognition is a situated activity rooted in social practices, and that the study of individuals' learning is embedded in social, cultural contexts and interactions, are reviewed. The aim is to clarify the meaning of social learning vis-à-vis individual learning, and to examine the theoretical and empirical grounds that underline the existence of social learning as a distinctive phenomenon and an important way of looking at learning. Theories of social learning provide the theoretical roots for the study and research of CSCL (Koschmann, 2002; Stahl, Koschmann & Suthers, 2006). Accordingly, instead of giving a broader overview of learning theories, we outline the most influential concepts that contributed to the foundations of the newly emerged field of CSCL to which *Chapter 3* of the present study is devoted.

2.1 Theories of social learning

In the process of conceptual clarification Salomon and Perkins' (1998) framework is used, which distinguishes *six meanings of social learning* – out of which the first four investigate the dynamics of learning. Due to the focus of the present study, respective theories and models will be assigned to the first two interpretations. They will be elaborated in detail in later sections of the present chapter (*Section 2.2, 2.3, 2.4, 2.5* and *2.6*) however, for the sake of logical completeness the whole map of territory i.e. all the six perspectives, will be briefly described.

Active *social mediation of individual learning* refers to the most fundamental social mode of learning in which an individual is helped by another one or a group of individuals. Scenarios such as a teacher teaching reading and writing; parents correcting children's misuse of words; a master guiding his apprentices; children working together on solving a task in Maths all underpin the general idea that in order to create a better system for learning a facilitating social agent is brought in who helps to meet the conditions (Salomon & Perkins, 1998). Social set-ups may vary from one-to-one (tutor, parent or teacher to learner) and one-to-many (teacher to class or group) to many-to-one (pair, trio or group of learners with the learner as a participant). Vygotsky 's (1978) *theory of mediated activity* and *socio-cultural theory* extended by Bakhtin's *theory of utterance* (1986) and *the notion of dialogue* (1981); and Rogoff's (1990) *guided participation* will be briefly presented as models reflecting this first perspective.

Social mediation as participatory knowledge construction entails less the socially mediated knowledge acquisition but it rather means that cognition and (jointly created) learning products are distributed over the individuals and their social context (and not being preserved by the individuals) (Salomon & Perkins, 1998). Thus, learning is seen as a participation in a social process of knowledge construction, and is located in the relations and activities of the participation. As Sfard (1997) puts it "talk about the 'stand-alone learner' and 'decontextualised learning' becomes as pointless as the attempt to define lungs or muscles without a reference to the living body within which they both exist and function" (p. 6). She states this in her essay on two metaphors of learning. The *acquisition metaphor* refers to the passive reception of knowledge and the internalisation of concepts, while the *participation metaphor* claims that learning is conceived as a process of becoming a member of a community. This entails communication with the members of that community, and that the learner participates in processes and activities that are based on the dialectic nature of learning interaction.

Theories that propose this paradigm for the study of learning in the social context are strongly related to the neo-Vygotskian sociocultural school of thought. The concept of *legitimate peripheral participation* (Lave, 1988; Lave & Wenger, 1991; Wenger, 1998), the *activity theory* and the *expansive learning theory* (Engeström, 1987; Engeström, 2001; Engeström, Miettinen & Punamäki, 1999), and the *knowledge-building approach* (Bereiter, 2002; Scardamalia & Bereiter, 1994) are to be discussed in detail later on in *Section 2.4, 2.5* and *2.6*. In a freshly emerging conception represented by Hakkarainen and his colleagues (Hakkarainen, Palonen, Paavola & Lehtinen, 2004; Paavola & Hakkarainen, 2004; 2005) the latter two models (Engeström's and Scardamalia and Bereiter's models) are also examples of the third metaphor of learning, the trialogic learning or *knowledge-creation metaphor*. This third approach of learning possesses both characteristics of the acquisition and the participation views (Sfard, 1997) but in the case of trialogic learning "the emphasis is not only on individuals or on community, but on the way people collaboratively develop mediating artefacts" (Paavola & Hakkarainen, 2005, p. 539).

The perspective of *social mediation by cultural scaffolding* can be demonstrated by a scenario in which the individual does not receive direct help (adjusted to her/his needs) from another person but she/he is scaffolded by cultural artefacts in the form of tools and information sources according to Salomon and Perkins (1998). In their understanding "artifacts are themselves culturally and historically situated, carrying the wisdom and hidden assumptions that went into their design" (p. 5). Research focusing on the role of tools and symbol systems as social mediators of learning is connected to the Russian sociocultural tradition, and represented by the studies of Vygotsky (e.g. 1978), Luria (1981) and Leont'ev (1981).

The fourth meaning of social learning, *social entity as a learning system*, refers to learning involving teams, organisations, cultures, or other collectives. In scenarios in which a sport team achieves effective coordination among the members (that the members individually would not make use of); or companies develop their own internal practices, a collective learning system is created. The efficacy of the system depends on how well its structures are prepared for the crucial conditions of learning (Salomon & Perkins, 1998). In the framework of 'the social entity as a learning system' Cole and Engeström (1993), Engeström et al. (1999) and Engeström (1987, 2001) offer analyses of the application of *expansive learning at work*. Nonaka and Takeuchi (1995) present a model of knowledge creation that aims at innovation in organisations, while Argyris and Schon (1996) focus on stable changes in organisational behaviour (as cited by Salomon & Perkins, 1998).

Learning to be a social learner concerns 'learning to learn' which is one of the main research foci connected to contemporary cognitive science. As opposed to referring to the learner as functioning individually i.e. learning presupposing a solitary activity, learning to be a 'social learner' means participating and making good use of the social surrounding (Salomon & Perkins, 1998).

Finally, *learning social content* is another possible meaning of social learning however, somewhat different than the previous interpretations since it does not introduce any new way of understanding (Salomon & Perkins, 1998). Accordingly, when referring to learning based on social content one should rely on the previously discussed learning systems. This perspective covers additional issues such as how to get along with others, how to maintain reasonable assertiveness, or how to collaborate in reaching decisions and taking collective actions, and so on.

2.2 The Vygotskian (1978) sociocultural approach to mediated action

Vygotsky's (1978) sociocultural approach to mediated action is a paramount model that reflects active social mediation of individual learning. Vygotsky when elaborating on the relation between speech and tool use came to the following: "the most significant moment in the course of intellectual development, which gives birth to the purely human forms of practical and abstract intelligence, occurs when speech and practical activity, two previously completely independent lines of development, converge" (p. 24). He later on continues with stating that "prior to mastering his own behaviour, the child begins to master his surroundings with the help of speech, [which] produces new relations with the environment in addition to the new organisation of behaviour itself" (p. 25). According to him, the relation between speech and action is dynamic, adding however that the structural relation may shift. First, speech *accompanies* actions but later on, it *precedes* action. Hence, learning has a social feature that is characterised by a process by which children grow into the social milieu around them. From this the assumption follows that relations to the social setting realised in the form of communication strongly determine the mental and physical processes and activities. They can thus be traced back to the interaction with the surrounding world. As Wertsch (1991a) puts it "a sociocultural approach to mind begins with the assumption that action is mediated and that it cannot be separated from the milieu in which it is carried out" (p. 18). This latter statement is part of the argumentation Wertsch delivers in support of the claim that higher mental functioning in the individual derives from social life. This is essentially one of the themes that he identified when proposing a framework in order to elucidate Vygotsky's concept on the basis of his writings. He called attention to Vygotsky's genetic law of cultural development which does not only originate mental functioning in social life but it argues that intrapsychological processes can be observed in their genetic precursors on the interpsychological plane (Wertsch, 1991b). This can be further elaborated as follows:

> Every function in the child's cultural development appears twice: first on the social level, later on the individual level; first between people (interpsychological), and then inside the child (intrapsychological)" (Vygotsky, 1978, p. 57).

Thus, when collaborating and taking part in joint activities the external processes become internalised, children acquire new strategies and schemes that contribute to a cognitive performance, which they could not reach on their own (Vygotsky, 1978). In support of this view, Vygotsky introduced the zone of proximal development (ZPD). When discussing the relationship between development and learning he identified two levels of development: the *actual developmental level* and *the level of potential development*. The ZPD is the gap between what a learner is capable of performing without adult help, and what she or he masters when provided with educational support (adult guidance or peer collaboration). Hence, from this perspective development is achieved if participating in shared activities. Investigating the influence of the processes of such an engagement on further activities has been in the focus of examining the interactions between individuals (Palincsar, 1998).

Vygotsky (1978) also claims that that tools and signs mediate human action, both on the social and the individual planes. Kozulin and Presseisen (1995) identified three major classes of mediators with respect to the tenet that higher mental processes are to be considered as mediated activity: material tools, psychological tools and other human

beings. The first two types include "language; various systems of counting; mnemonic techniques; algebraic symbol systems; works of art; writing; schemes, diagrams; maps and mechanical drawings; all sorts of conventional signs, and so on" (Vygotksy, 1981, p. 137).

The above described theory of the ZPD demonstrates one possible approach to address the issues of mediation. The other approach, according to Kozulin and Presseisen (1995), is to focus on the role of the *other individual as a mediator of meaning* since as they argue, "the meaning of one's own activity is formed by mediation through another individual" (Kozulin & Presseisen, 1995, p. 69). In this context, Salomon and Perkins (1998) refer to various features that characterise social mediation, including intensive interaction, rapid feedback, highly personalised and situationally contingent guidance, encouragement, and the elicitation of responses from the student in the form of explanations, suggestions, reflections etc., (p. 7). According to them, the Vygotskian idea of learning through social mediation also appeared in the *constructivist concept of scaffolding* that involves internalisation and creation of new knowledge with the help of expert guidance (Hakkarainen, 2003; Lepper, Drake & O'Donnell-Johnson, 1997; Scardamalia & Bereiter, 1994; Wood, Bruner & Ross, 1976; Wood & Wood, 1996). Accordingly, in Rogoff's (1991) interpretation mediation is not just internalisation, she rather considers it as "*appropriation*" (Rogoff, 1990) in which "through participation, children transform their understanding and skill in solving the problem" (p. 362). Rogoff's model of guided participation will be elaborated later in this chapter (*Section 2.3*).

The third (and last) theme Wertsch (1991a) highlighted on the basis of the Vygotskian writings is *the reliance on genetic, or developmental analysis*. Genetic analysis is motivated in Vygotsky's approach, says Wertsch, by the assumption that the study of mental functioning is dependent on understanding its origins and the changes it has undergone. Palincsar (1998) refers to four levels of developmental analysis on the basis of the Vygotskian perspective: (1) phylogenetic (what distinguishes humans from other animals); (2) cultural/historical (cultural practices play over time in development); (3) ontogenetic (ways in which individual characteristics and individual history influence development); and (4) the microgenetic analysis that investigates interactions between the individual and his or her surrounding.

At this point one should refer to Bakhtin's contribution that extends the Vygotskian perspectives. Even though there is no evidence that the two experts ever met, Bakhtin's notion of "voice" share three basic ideas that make a case (Wertsch, 1991a). First, the term suggests that semiotic devices are used to mediate human mental actions. Secondly, it reflects that various aspects of human mental functioning are substantially linked to communicative processes. Thirdly, both Vygotsky and Bakhtin thought that mental functioning is rooted in social and communicative processes. Bakhtin (1986) investigated the notion of "utterance" that he considered as "the real unit of speech communication" (p. 71). He argued that "any utterance is a link in the chain of speech communication" (p. 84), utterances "mutually reflect on another" (p. 91), and that "the utterance is filled with dialogic overtones" (p. 102). According to Wertsch (1991b), Bakhtin possessed keen interest in the form of *dialogicality* or *ventriloquation* (Bakhtin, 1981) i.e. the process whereby one voice speaks through another voice that comes to surface in connection with "social languages". Therefore, he further claimed that "instead of defining mediational means in terms of linguistic units abstracted away from voices and communicative contexts, researchers should define these means in terms of phenomena that are by their very nature socioculturally situated" (p. 96).

2.3 Guided participation (Rogoff, 1990)

Rogoff's (1990) concept of *guided participation* is grounded in Vygotsky's ideas. His theory according to which interaction in the ZPD enables children to participate jointly in active cognitive processes, and gain knowledge and skills that would have been impossible for them on their own, served as a source of inspiration (Rogoff, 1991). However, Rogoff takes the effort to extend Vygotsky's theory since as she argues:

> Ironically, the sociohistorical school's formulation of the relation between individual, social, and cultural processes is not only its strength but its weakness. Despite the theory's emphasis on context and society, it nonetheless maintained assumptions regarding the contexts and societal approaches that are most valuable. Vygotsky focused on the sort of language and analysis that characterize *academic learning*, consistent with the agenda of his nation at the time he wrote (…). (Rogoff, Mosier, Mistry & Göncü, 1993, p. 228, emphasis added)

By proposing the concept of guided participation, Rogoff et al. (1993) presented a more inclusive framework, which had the aim to focus on children's everyday activities and develop their understandings of the social setting around them. Rogoff and her colleagues stressed the importance of guidance from more skilled people in the active engagement that is based on "tacit forms of communication in the verbal and non-verbal exchanges of daily life and the distal arrangements involved in the regulation of children's activities, material goods, and companions" (p. 229). Communication also includes dialogue that strives at assisting children's cognitive advancement, casual conversation that is not directly instructional.

In Rogoff's (1991) concept, *mediation* is not just internalisation where a social agent transmits the information to the learner who then incorporates them within herself or himself. She rather considers it as *appropriation* (Rogoff, 1990) in which through joint activities learners take possession of and assign purpose to properties, ideas, activities etc., in problem solving. Hence, opposed to a two-stage process i.e. first social engagement and second personal internalisation, Rogoff et al. (1993) underline that "they [children] already function within the activities as they learn to manage them" (p. 229). They are of the view that children when encountering new situations involving cognitive engagement rely on their understandings and schemes obtained during previous activities.

Findings (Ellis & Rogoff, 1982, 1986; Gardner & Rogoff, 1990; Radzieszwska & Rogoff, 1988; Rogoff et al., 1993) support the claim according to which there is no generic development that is independent of communities and their practices (Rogoff, Radziewska & Masiello, 1995 cited in Palincsar, 1998); and that in the processes triggered by guided participation "shared thinking is a central feature of social interaction that allows children to take advantage of the bridging, structuring, and transfer of responsibility" (Rogoff, 1991, p. 362).

2.4 Legitimate peripheral participation and the communities of practice (Lave & Wenger, 1991)

Strongly related to the neo-Vygotskian sociocultural school of thought is the concept of *social mediation as participatory knowledge construction* of which Lave and

Wenger's (1991) legitimate peripheral participation is a fundamental example. Lave (1991) objects the view on the two extremes of the learning experience according to which learning is either exclusively individual or purely social. She proposes instead a "decentred view of the locus and meaning of learning" in which learning is connected to social activity but it is constituted in "the experienced, lived-in world, through legitimate peripheral participation in ongoing social practice" (p. 64). *Legitimate peripheral participation* refers to the transformation or shift from peripheral participation to a full membership within a community. As defined by Lave and Wenger (1991):

> [It is] a way to speak about the relations between newcomers and old-timers, and about activities, identities, artefacts, and communities of knowledge and practice. (…) A person's intentions to learn are engaged and the process of learning is configured through the process of becoming full-participant in a sociocultural practice. (p. 29)

Two types of production make up the process of becoming a full member according to Lave (1991): "the production of continuity with, and the displacement of, the practice of old-timers" (p. 74). Newcomers and old-timers both depend on each other: the former ones want to learn from the latter ones, the latter ones wish to preserve the continuity of community. The learning process involves the transformation of knowledgeable skills. This transformation encompasses the changes of the person's individuality which is actually a result of becoming a member in a community of practitioners i.e. *communities of practice* (CoP) (Lave, 1991). Thus, learning takes place through engagement in actions and interactions in these communities whose members share common interest in a problem or a subject; they collaborate for an extended period in order to share ideas and/or find solutions. CoPs in Lave and Wenger's (1991) interpretation imply "an activity system about which participants share understandings and concerning what they are doing and what that means in their lives and for their communities" (p. 98). Wenger (1998) refers to three dimensions that define CoPs: (1) "dense relations of mutuality" meaning that practice does exist because people are engaged "in actions whose meanings they negotiate with one another" (p.73); (2) negotiation of a joint enterprise that is "a resource of coordination, of sense-making, of mutual engagement; it is like rhythm to music" (p. 82) (the process of negotiation is thus generative and constraining at the same time, it facilitates and directs social energy); (3) shared repertoire including "routines, words, tools, ways of doing things, stories, gestures, symbols, genres, actions, or concepts that the community has produced or adopted in the course of its existence …" (p. 83). In Lindkvist's (2005) view characteristics of a CoP can be summarised as a "tightly-knit, affect-laden social structure" that is the basis of "dense relationships of mutuality", and which shows a "high degree of shared understandings and shared repertoire" (p. 1194).

Empirical studies describe contexts where these conditions prevail, such as butchers, midwives, members of Alcoholics Anonym (Lave & Wenger, 1991); medical claims processing (Wenger, 1998); and photocopier technicians (Orr, 1990). Barab and Duffy (2000) when describing the relevance of communities in the educational process, fell back on the ideas of Lave and Wenger (1991) and used them as a theoretical base for collecting the characteristics of a community. Henri and Pudelko (2003) referred to the concept of CoPs as a source of inspiration when analysing the learning activities and typology of online communities. They characterised CoPs in online settings as being high in strength of social bond and the gatherings intentionality.

2.5 Engeström's (1987) activity theory and expansive learning

The main idea that connects Engeström's principles on activity theory and Vygotsky's work is *mediation*. Engeström et al. (1999) refer to mediation by tools and signs as an idea that "breaks down Cartesian walls that isolate the individual mind from the culture and the society" (p. 29), hence the immense role of cultural artefacts in human actions and the intensive intertwining of the individual with its environment and cultural means; and vice versa. Vygotsky's (1978) model included three elements: (1) subject, (2) object, and (3) mediating artefact. A stimulus-respond relation transcended by a mediated act described the relation between the elements of this triad. Engeström (1987) proposed a more complex model that involves expansive cycles of development. He refers to learning as an "activity-producing activity" and a "mastery of expansion form action to a new activity" (p. 125).

The concept of *activity theory* is described with the help of five principles (Engeström, 2001). The first principle claims that the main unit of analysis is a "collective, artifact-mediated and object-oriented" activity system, which involves "goal-directed individuals and group actions" (p. 136). The second principle refers to the multi-voicedness of the system i.e. an activity system is constituted by multiple perspectives, voices, traditions and interests. Thus, it is a "source of trouble and a source of innovation, demanding actions of translation and negotiation" (p. 136). The third principle underlines that activity systems evolve over an extensive length of time. The fourth principle stresses the central role of contradictions as triggering events of change. However, the notion of contradiction as interpreted by Engeström (2001) differs greatly from 'problems' and 'conflicts'. Contradictions are, in his understanding, "historically accumulating structural tensions within and between activity systems" which "generate disturbances and conflicts, but also innovative attempts to change the activity" (p. 137). The fifth principle proclaims the expansive transformations within the activity system. It means that an object or artefact is reconceptualised and includes a wider range of possibilities of interpretation than previously. This involves "cycles of qualitative transformations" that peaks in a "deliberate and collective change effort" (p. 137). A full cycle of expansive transformation (as learning is understood in this theory) is described by Engeström (1987) the following way:

> It is the distance between the present everyday actions of the individuals and the historically new form of the societal activity that can be collectively generated as a solution to the double bind potentially embedded in the everyday actions. (p. 174)

The process of expansive learning ideal-typically evolves through the following stages (Engeström, 2001; Engeström et al., 1999): (1) the conflictual questioning of the existing practice; (2) the analysis of culminated contradictions; (3) modelling the new solution; (4) formation of the new model i.e. new pattern of activity; (5) the implementation of the new model in practical action; (6) reflection and evaluation of the process; and (7) consolidation of the new practice.

Engeström's model has been employed in numerous educational (including online learning as well) and workplace settings (Bellamy, 1996; Engeström & Middleton, 1996; Lompscher, 1999) since as Paavola and Hakkarainen (2005) claim the model provides a means for an individual or a community to revise their practices, which may result in changes in order to overcome tensions of the prevailing activity system.

2.6 Knowledge-building approach (Scardamalia & Bereiter, 1993)

The knowledge-building approach (Scardamalia & Bereiter, 1993) is another hallmark in the freshly emerged conceptions referring to *social mediation as participatory knowledge construction*. According to Hakkarainen (2009) Scardamalia and Bereiter produced a framework that has for a long time been the source of inspiration and point of reference among experts and practitioners of innovative education worldwide. This is not without reason, he claims, since the *knowledge-building framework* managed to grasp the important elements of engagement with knowledge in order to improve the quality of education in general. It has also strongly influenced the research field of CSCL (Koschmann, 1996).

Scardamalia and Bereiter (1993) contrast the *knowledge reproduction strategies* and the *knowledge building strategies*. Knowledge reproductions bear limited potential for knowledge advancement and for the development of understanding on which the latter one is centrally focused. It is based on "copy-delete mechanisms" meaning that learners only retain those schemes and concepts that are "judged to be important" (Scardamalia & Bereiter, p. 37), and delete those ones that are considered to be superfluous. Scardamalia and Bereiter extend the copy-delete mechanisms with the "knowledge telling" mechanism of writing which is basically a form of reproducing information. They proclaim that these two parallel mechanisms support the "low-profile work with knowledge" and are examples of the *transmission model* (p. 37). In this model presentation, recitation and the dialogic question-asking are the prevailing methods that are used in classroom practice. They stress that

> "the essence of the transmission model is the belief that learning consists of producing in the mind of the individual student some kind of reproduction of the knowledge that exists out there in the objective world. (…) The correct things have been implanted into the mind of the student" (p. 38).

International student assessment studies revealed that Hungarian students achieve better results when scholastic knowledge is concerned but they perform worse if real life knowledge is tested (Báthory, 1999; Csapó, 1999). Similarly to Scardamalia and Bereiter's (1993) claim, in Hungary as well, traditionally, school applies reproduction strategies (simple memorisation of information) instead of meaningful conceptual understanding (Csapó, 2001b). Empirical studies showed that the usage of such a strategy results in isolated blocks of knowledge which learners are not able to link to real life contexts and experience (B. Németh, 1998; Csapó & B. Németh, 1995; Korom, 1997). Accordingly, the knowledge transfer does not occur (Molnár, 2002).

As opposed to this model, *knowledge building* proposes a form of learning that is based on a process aiming at a more coherent understanding. Scardamalia and Bereiter (2006) suggest treating students as members of a *knowledge-building community* rather than learners or inquirers. They refer to six themes that underlie this idea and the concept of knowledge building. The first theme addresses the issue that knowledge advancement as a community is to be aimed at rather than individual achievement. According to their view effective knowledge creation results in the development of the actual CoP's knowledge. The knowledge-building process is centred on "conceptual artefacts" i.e. entities that support further knowledge advancement, claims Bereiter (2002). Knowledge-building pedagogy means, as Scardamalia and Bereiter state, that creative knowledge building can be maintained in the classrooms where learners are active agents in the community's joint knowledge work.

The second theme focuses on viewing knowledge advancement as idea improvement rather than as progress toward a 'licensed' belief. They claim that idea improvement is a principle that "guides the efforts of students and teachers" as opposed to "something that remains implicit in inquiry and learning activities" (p. 100).

The third theme elaborates on the contrast between "knowledge of" and "knowledge about" (p. 100). They demonstrate the difference between the two concepts through the example of knowing about sky-diving that entails declarative knowledge; and knowledge of sky-diving that consists of declarative knowledge (e.g., knowledge of equipment) and procedural knowledge (e.g., knowing how to open the parachute). 'Knowledge of' is activated when "a need for it is encountered in action" (p. 101) while 'knowledge about' is identical with declarative knowledge that is a less rich concept as compared to procedural knowledge. Traditionally, the 'knowledge about' concept dominates in educational settings, as they state, it is "the stuff of textbooks, curriculum guidelines, subject-matter tests…" (p. 101). As concerns the Hungarian schools, Csapó (1999) sees the problem in the nature and quality of transmitted knowledge. According to him, the school does not differentiate between important, valuable and irrelevant, useless information. Hence, the link between the various school subjects is also very weak.

The fourth theme deals with the idea that discourse better suits the process of knowledge advancement and collaborative problem solving than argumentation that is currently promoted in schools. There are weak and strong versions of identifying the role of *knowledge-building discourse*: according to the former version, knowledge transformation is reflected in the discourse, while the latter one claims that "there is no advance of community knowledge apart from the discourse" (p. 103). Knowledge-building discourse is thus discourse "whose aim is progress in the state of knowledge: idea improvement" (p. 103). It involves according to Bereiter (2002) three important commitments: (1) a commitment to progress; (2) a commitment to seek common understanding rather than agreement; and (3) a commitment to expand the base of accepted facts as opposed to attacking common facts.

The fifth theme focuses on the constructive use of authoritative information. Scardamalia and Bereiter (2006) state that judging the quality of information is part of the problem-solving task since information (from firsthand experience or secondary sources) contributes to knowledge-building discourse.

And in relation to the six themes, which propose emergent understanding, they bring up the issue of the 'learning paradox' that bears the fundamental question of how learners construct a cognitive structure that is more complex than the one they already possess. Scardamalia and Bereiter see the answer to the question in the connectionist models of learning in which there is a progress from a conceptually poor to a conceptually richer system.

The knowledge building approach was also taken as a theoretical ground when the two experts pursued research on technology-enhanced learning and developed a series of technology-mediated learning environments (e.g., Computer-Supported Intentional Learning Environments (CSILE) and its present version, Knowledge Forum) which support knowledge-building processes.

3 ONLINE INTERACTION AND ONLINE INSTRUCTOR ROLES IN COMPUTER-SUPPORTED COLLABORATIVE LEARNING

As demonstrated in the previous chapter, *theories of social learning* claim that learning involves social aspects and that cognition is a situated activity rooted in social practices. The study of individuals' learning is thus embedded in social and cultural contexts and interactions. Learners are seen as being active participants in the teaching and learning process in which interaction and negotiation of meaning and understanding are indispensable. However, the efficacy of interactions is modest if the teacher takes the dominant role in classroom discussions (Báthory, 1987). Under such circumstances, the role of the instructor should be more like an advising and facilitating one. Teachers are expected to rely on advanced communicative skills so that they are both effective senders and recipients of messages (Falus, 1998).

Ally (2004) claims that theories of social learning have *implications for online learning* as well. According to him, also online learning should be an active process, in which personal interpretation and the creation of personalised meaning are facilitated. He also adds that this process in an online environment is to be accompanied by "good interactive online instruction" (p. 19), so that students take the initiative to engage in meaningful discussions with each other. The underlying idea is that collaboration should be supported in online settings as well. Time and opportunity to reflect, and promoting interactivity in the process are also essential implications for online learning.

Accordingly, central to this chapter are the definition, the theoretical foundations and the methodological implications of the newly emerged paradigm and research field of CSCL of which the theoretical roots lie primarily in the social theories of learning. However, prior to discussing the complex model of CSCL theory and research for instructional design and the definition and description of online instructor roles essential to it, we present the notion of online interaction as a crucial component of online teaching and learning processes – by making the case that collaboration is a special form of interaction. Key terms such as collaborative situation, interactions, processes, and effect that contribute to a complex understanding of collaborative learning will also be elaborated.

The review on online instructor roles deals with the notion of mentoring, e-mentoring, tutoring, facilitating and e-moderating in CSCL environments, and further highlights important studies on online instructor roles and functions.

3.1 Defining online interaction

As Wagner (1994) defined it, interaction is seen as "reciprocal events that require at least two objects and two actions" (p. 8) thus interaction occurs when these two objects and actions reciprocally impact each other. Zrinszky (2002) however refers to two types of communication: (1) communication that is reciprocal (reciprocity manifests itself in the form of feedback) and (2) communication that reached the partner and by so resulted in an effect (which does not necessarily mean immediate feedback).

Pedagogical communication (or interaction) is neither a mere exchange of information nor information provision (Zrinszky, 1993, 2002). The latter one is however listed among the most common strategies used in face-to-face classroom context in the teaching and learning process according to Nagy (1993). As opposed to

this, pedagogical communication aims at long-term effects and absorption in the learning process (Zrinszky, 2002). Effective pedagogical communication (or interaction) is to a great extent a pre-designed activity dependent on the pre-defined aims of the teaching and learning process. Accordingly, teachers in the design process can adjust their communication to three interpretations of 'teaching': (1) teaching seen as a systematic knowledge transmission where pedagogical communication is tailored to the actual activity; (2) teaching interpreted as a series of interpersonal communication which allows for autonomous learning and off-task social interactions; and (3) teaching described as a complex process where on-task communication and the interactivity element are in balance. The ideal option would be to design pedagogical communication on the basis of the last interpretation.

Muirhead and Juwah (2004) described online interaction as "a dialogue or discourse or event between two or more participants and objects which occurs synchronously and/or asynchronously mediated by response or feedback and interfaced by technology" (p. 13). Moore (1989) who first discussed interactivity in terms of the participating actors, proposed that there are three most common types of interaction in online settings: (1) learner-content; (2) learner-instructor; and (3) learner-learner. The first one occurs when learners access content i.e. online course materials; the second one happens when the instructor provides the necessary scaffolding in the learning process; and the third one refers to the interaction among learners in order to collaborate and engage in active cognitive activities. Moore and Kearsley (1996) claim that due to the *transactional distance* (Moore, 1991) that separates learners from each other and their instructors, focusing on all three sorts of interactivity is indispensable. Hillam, Willis and Gunawardena (1994) added a fourth type of interaction, the learner-interface relation. Anderson and Garrison (1998) expanded this list by adding teacher-teacher, teacher-content; and content-content interaction. According to them teacher-teacher interaction provides excellent opportunities for professional development and support; teacher-content interaction entails the production of content and activities for the learning process; and content-content interaction refers to the possibility to develop content by programming it to interact with other information sources in order to refresh itself. Northrup (2001) proposed five types of interaction based on the purpose of communication: to interact with content, to collaborate, to converse, to help monitor and regulate learning, and to support performance. With reference to online learning environments Komenczi (2001) stresses the establishment and maintenance of a system of constant, generative communication. This means that the effects of the various communication tools and methods on the users' personal growth and cognitive processes should be transformed in a dynamic system in order to maximise the efficacy of the teaching and learning process. Instead of static information transmission, he refers to a dynamic activity-based system of communication where the learner, the teacher and the communication tools are the main agents.

Ally (2004) also claims that different types of interaction support learning at different levels. He proposes a model (based on studies by Berge, 1999; Gilbert & Moore, 1998; and Schwier & Misanchuk, 1993) that shows levels of interaction in online learning (*Figure 3.1*). According to the model, the most 'basic' level of interaction is the learner-interface interaction, which allows the learner to access, sense and register the information. Once there is access to information i.e. online materials, the learner-content interaction follows: "Learners navigate through the content to access the components of the lesson, which could take the form of pre-learning, learning, and post-learning activities" (p. 21). In the phase of learner-content interaction, learners apply, assess, analyse, synthesise, evaluate and reflect (Berge, 2002). In the process of

handling the content, learners rely on learner support, which according to Ally, (2004) takes the form of learner-to-learner, learner-to-instructor, instructor-to-learner, and learner-to-expert interactions. And the final level of interaction is the learner-context interaction that allows learners to apply the acquired knowledge in real life setting so that they can "contextualise" (p. 22) the information.

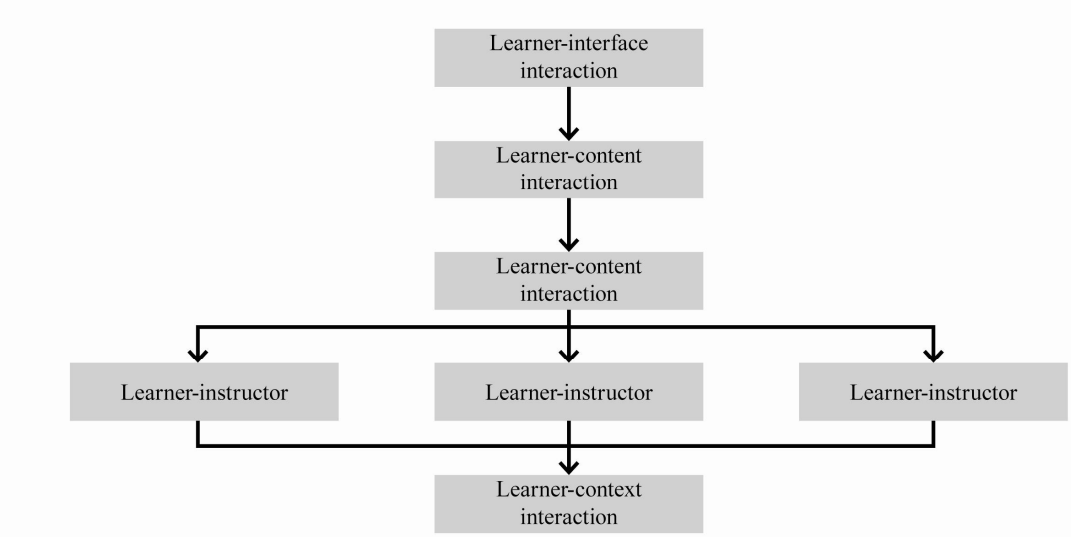

Figure 3.1 Levels of interaction in online learning (Ally, 2004)

Theorists, researchers and practitioners of educational technology and distance learning, as Hull and Saxon (2009) claim, agree that interactivity is a crucial component in online learning. Luppicini (2007) located 170 research articles (peer-reviewed empirical studies) that focused on the educational application of computer-mediated communication. As regards the potential of online interactions, numerous studies investigated the above listed types of interactivity and examined the instructional design in order to support effective online interactions (Gunawardena & Zittle, 1997; Harasim, 1987; Harasim, 1993; Henri, 1991; Hiltz, 1994; Moore & Kearsley, 1996; Strijbos, Martens & Jochems, 2004; Swan, 2002; Wegerif, 1998; Zhu, 1998).

Referring to Moore's (1991) transactional distance theory, the learner in the online learning context is likely to perceive less transactional distance if there is more dialogue and less structure. Similarly to this, Vrasidas and McIsaac (1999) found a decrease in transactional distance when learners were engaged in collaborative tasks that involved active interaction among each other (as cited in So & Brush, 2008). As So and Brush (2008) concludes collaborative learning structures reduce transactional distance since they provide for more control and dialogue among learners.

3.2 Collaboration as a special form of interaction

Lipponen (2002) when discussing the concepts and theories underlying CSCL research claimed that there are two approaches to defining collaboration. The first approach focuses on "the idea of co-construction of knowledge" and "mutual engagement of participants" (p. 73). In this view, collaboration is seen as a "special form of interaction" (p. 73). Similarly to this, Rochelle and Teasley (1995) stressed the importance of shared understanding by stating that collaboration is "a coordinated,

synchronous activity that is the result of a continued attempt to construct and maintain shared conception of a problem" (p. 70). According to So and Brush (2008), collaborative learning is a form of learner-learner interaction (may it be the communication online or face-to-face). Dillenbourg (1999) also stresses the 'interactions paradigm' (Dillenbourg, Baker, Blaye & O'Malley, 1996) in collaborative learning by stating that "collaborative learning describes a situation in which particular forms of interaction among people are expected to occur, which would trigger learning mechanisms…" (p. 5). Crook (1998) lists three characteristics of interaction that play a crucial role in productive collaboration: (1) intimacy among participants, (2) provision of external resources (e.g., computers), and (3) the quality of interpersonal relations i.e. a history of joint activity. Engeström (1992) when theorising expansive transitions (Engeström 1987, 2001; Engeström et al., 1999) proposed three modes of interaction in collaborative set-ups: (1) coordination in which "each [actor is] concentrating on the successful performance of the assigned action" (p. 66); (2) cooperation in which actors "focus on a shared problem, trying to find mutually acceptable ways to conceptualise and solve it" (p. 67); and (3) reflective communication by which "interactions in which the actors focus on reconceptualising their own organisation and interaction in relation to their shared objects" (p. 67) is meant. According to him learning involves the expansive transitions of the three modes of interaction.

The other approach stresses broader definitions of collaboration, according to Lipponen (2002), as compared to the one referring to collaboration as a special form of interaction. Collaboration is thus defined as a "process of participating in knowledge communities" (p. 73). He refers to Scardamalia and Bereiter (1993) who proposed the notion of knowledge-building communities in which "creative knowledge work may be defined as work that advances the state of knowledge within some community of practice, however broadly or narrowly that community may be defined" (Scardamalia & Bereiter, 2006, p. 98). In their concept of collaboration as well, interaction in the form of knowledge-building discourse "whose aim is progress in the state of knowledge: idea improvement" (p. 103) plays an essential role. According to Scardamalia and Bereiter (1994) knowledge-building discourse can be put into three categories: (1) focus on problems and depth of understanding; (2) decentralised, open knowledge environments for collective understanding; and (3) productive interaction within broadly conceived knowledge-building communities. The first category underlines the fact that in the process of knowledge building focus is on problems (rather than on categories of knowledge), thus "engagement is at the level of how things work, underlying causes and principles, and interrelatedness of ideas explored over lengthy periods" (p. 274). The second category refers to decentralised, open knowledge building with a view on collective knowledge. This process involves complex interactions that aim at engaging the participants, distributing work within the group, sustaining inquiry, and monitoring advances. More and less knowledgeable members are both essential to group functioning. As for the third category, they give the example of the peer review process for scientific publication in which one works with "ideas in contexts broader than one's immediate working community" (p. 275).

Regardless of the approach, Lipponen suggests that understanding the mechanisms of collaboration should be carried out both at macro (e.g., communities as interaction networks) and micro (e.g., interaction analysis) levels.

3.3 Understanding collaborative learning: situation, interactions, processes and effects

Dillenbourg (1999) proclaims that the key for understanding collaborative learning or collaborative knowledge building (cf. Stahl, 2002) is in the relation of the following four elements: situation, interactions, processes and effects. He argues that in a linear causality (which is actually not the case since most relations are mutual) the situation produces interactions, which generate cognitive processes that result in cognitive effects.

Seen from this perspective a situation is collaborative if the actors are "more or less at the same level, can perform the same actions, have a common goal and work together" (Dillenbourg, 1999, p. 7). When discussing collaborative situations Dillenbourg suggested including the notion of symmetry. He proposed three types of symmetry: (1) symmetry of action which refers to the degree to which the same variety of actions is permitted to the participants; (2) symmetry of knowledge (or skills or development) focuses on the question whether the agents possess more or less a similar level of knowledge (or skills or development); and (3) symmetry of status refers to whether the participants possess a similar position/status in their community. As to the second type of symmetry he adds that a slight knowledge asymmetry among group members is appropriate since it may cause "conflicting interaction" (p. 7).

Division of labour is another issue that is mentioned by Dillenbourg (1999) in relation to collaborative situations. Seen from the perspective of labour division, cooperative learning should be distinguished from collaborative learning. The former one refers to a division of labour among the participants where each person is responsible for a portion of the task and the results of the activity are presented individually (Dillenbourg et al., 1996), while in the latter case, participants "do the work together" (Dillenbourg, 1999, p. 8). In cooperative learning, members share the work hierarchically, and are responsible for independent sub-tasks (Roschelle & Teasley, 1995) (the same mechanism is tagged by Dillenbourg (1999) as vertical division of labour); whereas in collaboration, labour division is done in a heterarchical (Roschelle & Teasley, 1995) or horizontal (Dillenbourg, 1999) manner, i.e. division of labour into "reasoning layers" (p. 8). While in the case of cooperation, roles are stable from the beginning until the end of the learning process; in collaboration, roles may change frequently depending on the actual ongoing activity. In this latter case, permanent coordination is an essential part of the synchronous workflow.

According to Dillenbourg (1999), interactions are collaborative if agents communicate in a collaborative way. He adds several "intuitive criteria" (p. 8) that define collaborative interactions, more precisely: interactivity, synchronicity and negotiability. As regards the interactivity criterion, he claims that the extent of interactivity depends on the impact of these interactions on the agents involved (instead of the frequency of interactions). As far as synchronicity is concerned, Dillenbourg argues that it is not a technical feature but a "social rule", a "considerate meta-communicative contract" which means that "the speaker expects that the listener will wait for his message and will process the message as soon as it is delivered" (p. 8). Collaborative interactions are negotiable according to him, as the third criterion indicates, meaning that as opposed to hierarchical scenarios, collaborative interactions allow for space for a balanced structure of interaction and negotiation.

The third key element in understanding collaborative learning is the underlying processes that are specific to collaborative situations as Dillenbourg (1999) suggests. He refers to two processes: (1) internalisation and (2) appropriation. Both notions have

already been made reference to when dealing with theories of social learning. The former one is strongly tied to the Vygotskian (1978) approach i.e. when collaborating and taking part in joint activities the external processes become internalised, this way agents acquire new strategies and schemes that contribute to a cognitive performance which they could not have reached on their own. The latter one is proposed by Rogoff (1990) who claims that "through participation, children transform their understanding and skill in solving the problem" (p.362). Accordingly, appropriation is an extended form of a two-stage process of internalisation i.e. first social engagement and second personal internalisation.

The fourth element Dillenbourg (1999) considers essential in understanding collaborative learning is the effects that are specific to it. He argues that "one should not talk about the effects of collaborative learning in general, but more specifically about the effects of particular categories of interactions" (p. 12). He suggests that researchers either control *a priori* the types of interactions that will appear in the process, or analyse *a posteriori* the interactions that evolved in the process of collaboration (p. 12). Dillenbourg also adds that frequently, effects of collaborations are evaluated by "individual task performance measure" (p. 12) instead of which he proclaims assessment of group performance.

Regardless of which of the two methods of analysis a researcher chooses when treatment of data, they "zoom in the collaborative interactions in order to gain better understanding of the underlying mechanisms" (p. 12). Seen from this perspective CSCL environments proved useful since they preserve records of interactions (both the texts and the quantitative log data).

3.4 Technology for collaboration: Computer-supported collaborative learning

3.4.1 Definition and theoretical foundations

Koschmann (1996) claims that instructional technology has undergone immense change and shift of paradigms in its short life span. As results of these paradigmatic shifts, "the field has been balkanised into a number of smaller communities, each utilising different research practices and espousing largely incommensurable views of learning and instruction" (p. 2). He argues that the newly emerged field of CSCL focuses on the use of technology as a "mediational tool" (p. 2) in collaborative pedagogical scenarios. Hence, Koschmann (2002) presented the following definition of CSCL at the *CSCL'02 conference*:

> "CSCL is a field of study centrally concerned with meaning and the practices of meaning-making in the context of joint activity and the ways in which these practices are mediated through designed artefacts". (p. 20)

The first part of the definition focuses on the theoretical grounding and its implications for research in this field. As Lipponen (2002) formulates, CSCL is concerned with the potential of collaborative learning supported by technology in the process of "sharing and distributing knowledge and expertise among community members" (p. 72). Stahl, Koschmann and Suthers (2006) also claim that " it [CSCL] is concerned with studying how people can learn together with the help of computers" (p. 409); they continue with stating that "CSCL approaches explore how computers could

bring students together to learn collaboratively in small groups and in learning communities" (p. 413). Seen from a theoretical point of view, CSCL is thus based on collaborative negotiation and social sharing of group meanings of which the theoretical roots lie primarily in the work of Vygotsky (1978). At the *CSCL'02 conference* however, Koschmann (2002) also presented Dewey's (1938/1991) theory of inquiry and its contribution to the foundations of CSCL that also incorporates other influential concepts such as Lave and Wenger' (1991) legitimate peripheral participation model, Scardamalia and Bereiter's (1993) knowledge building concept and their vision of computer-supported learning communities, and Engeström's (1999) expansive learning model as stated in the studies of Stahl (2003), Stahl (2006) and Stahl et al. (2006) (For a detailed discussion of theories of social learning we refer to *Chapter 2* of the present study).

Hence, Stahl (2006) argues that CSCL by its nature does not only incorporate established theories from the past but at the same time it exceeds them. According to him collaborative learning in CSCL does not only refer to a pedagogical scenario where individual learning is supported by participation in small groups; but "it is the groups themselves that learn" (p. 220). Group meaning or *group cognition* (Stahl, 2005) is created according to him by "the interactions of the individual group members, and not by the individuals themselves" since it is "an emergent property of the discourse and interaction" and it cannot be reduced to "opinions or understandings of individuals" (p. 80). He thus concludes that meaning is a characteristic of the group dialogue that is not visible in monologues, dialogues neither in large communities, but in small-group discussions.

When reflecting on the difference between scholastic and real life knowledge Csapó (2001a) describes the social milieu as an important context for knowledge acquisition. He however adds that expert opinions differ as concerns the extent of its importance. Nevertheless, he takes Vygotsky's concept and proposes the problem whether the individuals or the community owns socially created knowledge and whether there exists individual cognition at all, or it is exclusively social cognition at hands. According to him, educational research seems to resolve these dilemmas by studying individual and social processes in a uniform manner, examining the role of the social milieu, and the careful discussion of the pedagogical advantages of joint cognitive processes.

3.4.2 Computer support

The second part of Koschmann's (2002) definition refers to technology as a mediational tool that supports the social practices of knowledge construction; CSCL thus proposes the development of applications that facilitate involvement in creative activities which aim at intellectual engagement and social interaction (Stahl et al., 2006). Current pedagogical reality (with or without technology) shows that collaboration is a catchword for practitioners, researchers and policymakers. Lipponen (2002) even goes as far as saying that "the current understanding appears to be that collaboration is a synonym for good learning and good educational technology" (p. 76). Lipponen, Hakkarainen and Paavola (2004) share the view that technology is a crucial element of CSCL development and research, but also claim that practically any technological application can be employed in order to facilitate collaboration. In this context, Lipponen (2001) argues for the distinction between "collaborative use of technology" and „collaborative technology". The former one refers to technology that

supports aspects of communication, collaborations and coordination (e.g. WebCT, Blackboard, Moodle etc.,). While the latter one, collaborative technology refers to tools designed to provide specific support such as dialogue structuring (C-HENE) (Baker & Lund, 1997); thinking types (CSILE, Knowledge Forum) (Scardamalia & Bereiter, 1991), and so on. Lipponen et al. (2004) also argue that the former type of utilisation focuses mainly on structuring collaborative activity, while in the latter case, technology is seen as a social practice.

Regardless of whichever type of tools is utilised, the "primary form of collaboration support is for a network of computers to provide a medium of communication" (Stahl et al., 2006, p. 414). According to Stahl et al. the communication support may be provided by e-mail, chat, discussion forums, videoconferencing, instant messaging, and so on. CSCL technologies (both types) offer a combination of the above functions. Additionally, pedagogical support for collaborative learning (such as alternative views on the ongoing student discussions; feedback; monitoring interaction patterns) is included in CSCL environments however, these functions do not replace but only support the human collaboration process (among students and the teacher, tutor or mentor) (Stahl et al., 2006). Stahl (2006) argues that CSCL technology should be based on the unique features of online interactions in collaborations. Accordingly, when using the tools one must focus on group interaction and collaborative learning; recognise the interplay of learning at the unit of the individual, small group and community; and conceptualise the software as a communication medium and a knowledge artifact (p. 284).

The present study focuses more on the interactivity and communication processes in CSCL environments (and the research concerning these) rather than on the historical evolution and technical aspects of CSCL environments but for the sake of logical completeness reference is made to three early influential projects, the forerunners for what is now labelled as CSCL. The ENFI project that focused on computer-aided composition (CSCWriting) (cf. Bruce and Rubin, 1993); the Computer-supported Intentional Learning (CSILE) project (later known as Knowledge Forum) which signifies a milestone in the process of restructuring classroom discourse in order to support knowledge building (Scardamalia & Bereiter, 1994); and the Fifth Dimension (5thD) (cf. Cole, 1996) Project which aimed at enhancing students' reading and problem-solving skills (Stahl et al, 2006). Lehtinen, Hakkarainen, Lipponen, Rahikanen & Muukkonen (1999) refer also to the Belvedere system, the CoVis project and the Telecommunicado project as good practices in the field.

3.4.3 Research on CSCL and online communication

Lipponen (2002) claims that CSCL relies on a wide range of research methods including the field of anthropology, communication science, and linguistics, etc. He also noted that as opposed to former research traditions (e.g., experimental design and laboratories), CSCL research is carried out in "real world contexts" (p. 74). Dillenbourg et al. (1999) also argue that there are different approaches and research designs applied in the field. They differentiate between the sociocognitive approach, which is based on the comparison/contrast of the results of a method/intervention employed parallel in an experimental and control group. In this case, they argue that collaboration is treated as a "black box" (p. 196). Opposed to this method the sociocultural way focuses on "micro genetic analyses of the social interaction" due to "the importance attached to the concept of mediation in sociocultural theory" (p. 196). Stahl et al. (2006) also stress the

multidisciplinarity of CSCL research; they categorise empirical studies into three methodological traditions: experimental, descriptive, and iterative. The first category resembles to the method Dillenbourg et al. (1999) labelled as sociocognitive approach. The second methodological tradition they make reference to, is the ethnomethodological one, which is more suited for descriptive case analyses. Iterative design is the third one which does not only entail, according to Stahl et al., that people are observed but also it is based on the need to identify new "promising features that should receive further study under the other methodological traditions" (p. 420).

Lipponen (2002) noted that there is great variety as regards the technologies involved in CSCL research (the type of technology, the aim of the use and the practice of application). To this he adds that there is a wide range of research topics and research procedures. Initial research on CSCL and online communication investigated surface-level features according to Strijbos, Martens, Prins and Jochems (2006): the participation degree defined by the number of sent messages (Harasim, 1993), the relation between the length of messages and the quality of messages (Benbunan-Fich & Hilz, 1999). However, as Lipponen (2002) claims analysing collaboration at a macro level i.e. communities as interaction network also relies on surface-level features when doing social network analysis (Cho, Lee, Stefanoe, & Gae, 2005; Fahy, Crawford & Ally, 2001; Lipponen, Rahikainen, Lallimo & Hakkarainen, 2003; Nurmela, Lehtinen & Palonen, 1999). Analysis at the micro level included research on the social construction of knowledge (Gunawardena, Lowe & Anderson, 1997; Zhu, 1996) sociocognitive effects of CSCL (Järvela, Hakkarainen, Lehtinen & Lipponen, 2000); argumentation and inquiry processes that need professional scaffolding (Hakkarainen, Lipponen & Järvela, 2002; Lipponen & Hakkarainen, 1997; Marttunen & Laurinen, 2001; Weinberger & Fischer, 2005); apprenticeship in thinking (Järvela & Häkkinen, 2002); group learning, deep learning and critical thinking (Bullen, 1997; Newman, Webb & Cochraine, 1995;) community of inquiry (Anderson, Rourke, Garrison & Archer, 2001; Garrison, Anderson & Archer, 2001; Rourke, Anderson, Garrison & Archer, 1999;); knowledge building and knowledge construction processes (Koschmann, Hall & Miyake, 2002; Lipponen, 2000; Pena-Shaff & Nicholls, 2004; Scardamalia & Bereiter, 1994); and instructor behaviours (Burge, 1994; Goodyear, Salmon, Spector, Steeples, & Tickner, 2001; Salmon, 2003, Simonson, 1995).

A group of Hungarian practitioners and educational researchers is also actively involved in investigating among other research foci the effects of different CSCL environments and their application: the effect of using FLE3 in the international ITCOLE project (Főző, 2006); the usability of virtual learning environments including national and international platforms e.g., Sulinet Digitális Tudásbázis (SDT), (Dancsó, 2007; Hunya, 2005a, 2005b; Hunya, Dancsó & Tartsay, 2006); the development of the MOVELEX software (Kárpáti, Varga & Szirmai, 2008; Varga, 2004, 2007); learning environments and the Colabs project (Turcsányi-Szabó 2001, 2003, 2005); and the Hungarian adaptation of EPICT training that involved the usage of Moodle (Kárpáti & Ollé, 2007; Tartsay-Németh, 2004) and CSCL environments applied in teacher professional development including the CALIBRATE and the KP-Lab projects (Dorner & Kárpáti, 2008; Kárpáti & Blamire, 2008; Kárpáti & Molnár, 2005; Kárpáti & Dorner, 2008).

Dillenbourg (1999), when discussing the effects of collaborative learning, argues that regardless of the methodology a researcher chooses when treatment of data, they "zoom in the collaborative interactions in order to gain better understanding of the underlying mechanisms" (p. 12). Stahl et al. (2006) also claims that there is a strong need for understanding the process of social learning or group cognition (Stahl, 2006)

that manifests itself in the form of interactions among participants. Stahl et al. also add that small groups are best for studying learning processes in CSCL environments since they "allow the full range of social interactions to play out, but are not so large that participants and researchers alike necessary lose track of what is going on" (p. 418). Seen from this perspective collaborative learning processes should be visible (Lally & deLaat, 2002; Lipponen et al, 2004; Stahl, 2006), the interactions must be made available (for both participants and researchers) for further study. In this respect, CSCL environments proved useful since they preserve records of interactions (the texts and the quantitative log data) thus they "turn communication into substance" (Stahl, 2005, p. 261). Macdonald (2003) argued that access to online interactions stored "makes the process of collaboration more transparent, because a transcript of these conference messages can be used to judge both the group collaborative process and the contribution of the individual to that process (p. 378). Henri (1992) also refers to computer-mediated communication (CMC) as a "gold mine of information concerning the psycho-social dynamics at work among students, the learning strategies adopted, and the acquisition of knowledge and skills" (p.118).

3.4.4 A model of CSCL theory and research for instructional design

Brandon and Hollingshead (1999) proposed a model that synthesised theory and research in the field of CSCL. They based their model on three different concepts of group effectiveness: (1) the input-process-output model of group effectiveness in the classroom (Webb & Palincsar, 1996); (2) O'Donnell and O'Kelly's (1994) classification of theories on collaborative learning; and (3) the input-process-output model of the impact of communication technologies on interacting groups (McGrath & Hollingshead, 1994). According to them, instructors designing activities in a CSCL environment can make use of the model when preparing and managing learning, and researchers when designing research agenda in the field of CSCL since it highlights processes that underlie CSCL (*Figure 3.2*).

O'Donnell and O'Kelly (1994) claim that *social-behavioural inputs* are based on social-motivation and social-cohesion theories (as cited in Brandon & Hollingshead, 1999). Seen from the perspective of social-cohesion theory, it is the students' identification with the group that motivates learners in group-learning processes; as opposed to the social-motivational theories, which assign motivation for joint achievement to collective goals and reward (Brandon & Hollingshead, 1999). *Positive interdependence* and *individual accountability* influence both group interaction and collaborative learning (Strijbos et al., 2004). Positive interdependence refers to the phenomenon when individual group members' achievement is dependent on the group performance and joint efforts (Johnson, 1981). While individual accountability stresses the importance of the individual responsibility of group members in the group processes e.g. assigned tasks, duties (Slavin, 1980). This latter process goes against the so-called 'free-rider effect' according to which some members are reluctant to participate actively (Stijbos et al., 2004). Promotive interaction (supportive attitude towards each other that manifests itself in interactions aiming at giving feed-back, offering help, and so on), social skills (skills to be able to interact smoothly) and group processing (reflections on group functioning) refer to the interactivity aspect of collaborative learning. The application of these elements in online settings strongly influences student participation and cognitive engagement.

According to Brandon and Hollingshead (1999) the *social-cognitive inputs* entail the "influence of social environment produced in online collaboration on individual learning" (p. 116). They also claim that the three social-cognitive theories (on the basis of O'Donnell and O'Kelly's (1994) study they refer to Vygotsky's (1978) ZPD, the Piagetian cognitive-developmental theory, and the cognitive elaboration theory) have the proposition in common that learning is a result of interaction. Thus, higher-level cognitive objectives in the process of CSCL should be aimed at elaborating subject matter in the form of discussions that encourage opinion diversity.

Course-CSCL fit aspect underlines the importance of the legitimisation of using CSCL technology and the online communication, which entails the question regarding the contribution of these tools in the given teaching and learning process.

Student variables are to be considered prior to the use of CSCL activities according to Brandon and Hollingshead (1999) since *students' individual characteristics* influence their performance in the online environment (Hiltz, 1993 as cited in Brandon & Hollingshead, 1999). In their study, they refer to student attitudes towards group work, experience and comfort in working with computers, and students' academic maturity.

As Figure 3.2 shows, inputs and processes are linked by the *moderating variables* that are grouped into two entities: communication technology and instructor influences. *Communication technology* is referred to on one hand from the *technology perspective*, on the other hand from the *communicational perspective*. The former one includes the features and reliability of the system that should entail as many groupware options as possible e.g. communication channels and the symbol-carrying capacity of these (Berge, 1995). As regards the communication perspective, Brandon and Hollingshead (1999) claim that computer-mediated communication (CMC) can change the features of group interactions (cf. McGrath & Hollingshead, 1994). In the present model as well, the *instructor influences* element entails the potential of encouraging and facilitating group processes in CSCL. Berge (1995) claims that the role of the online instructor (facilitator or moderator) becomes layered: from the role of presenter 'source of knowledge', they find themselves in the midst of multiple responsibilities that he groups as the pedagogical, social, managerial and technical roles. Berge (1995) and Harasim (1987) claim that moderators can influence student and group behaviour by relying on online moderation skills. One such technique is the instructional scaffolding that has been frequently applied in online settings (Lakkala, Muukkonen & Hakkarainen, 2005; Pifarré, 2007). Brandon and Hollingshead (1999) conclude that the strong link between inputs and processes is moderated by the features and reliability of the communication technology, and by the online instructor's role and activity.

The *CSCL processes* in the model refer to those social and cognitive processes that are desirable in a CSCL activity (Brandon & Hollingshead, 1999). The group level processes listed in Figure 3.2 entail those variables/features that the social-behavioural and -cognitive inputs, course-CSCL fit and the student variables may influence: participation and involvement, demonstration of social skills, and group processing discussions. Generating multiple points of view and patterns of reasoning are also displayed in the model as elements of the cognitive processing. The individual level processes indicated in the model are those that result in the "cognitive change within the individual – elaboration, rehearsal, and modelling, and the resolution of cognitive conflict" (p. 122). The group and individual level processes are intertwined.

As potential CSCL outputs, Brandon and Hollingshead (1999) indicate three items that they consider crucial in evaluating the teaching and learning processes in the CSCL setting: course-related knowledge, group and technology related skills, relationships,

and satisfaction with CSCL. They claim, “it is important for instructors to develop assessments of knowledge and satisfaction that students are gaining in the online collaborative environment” (p. 123).

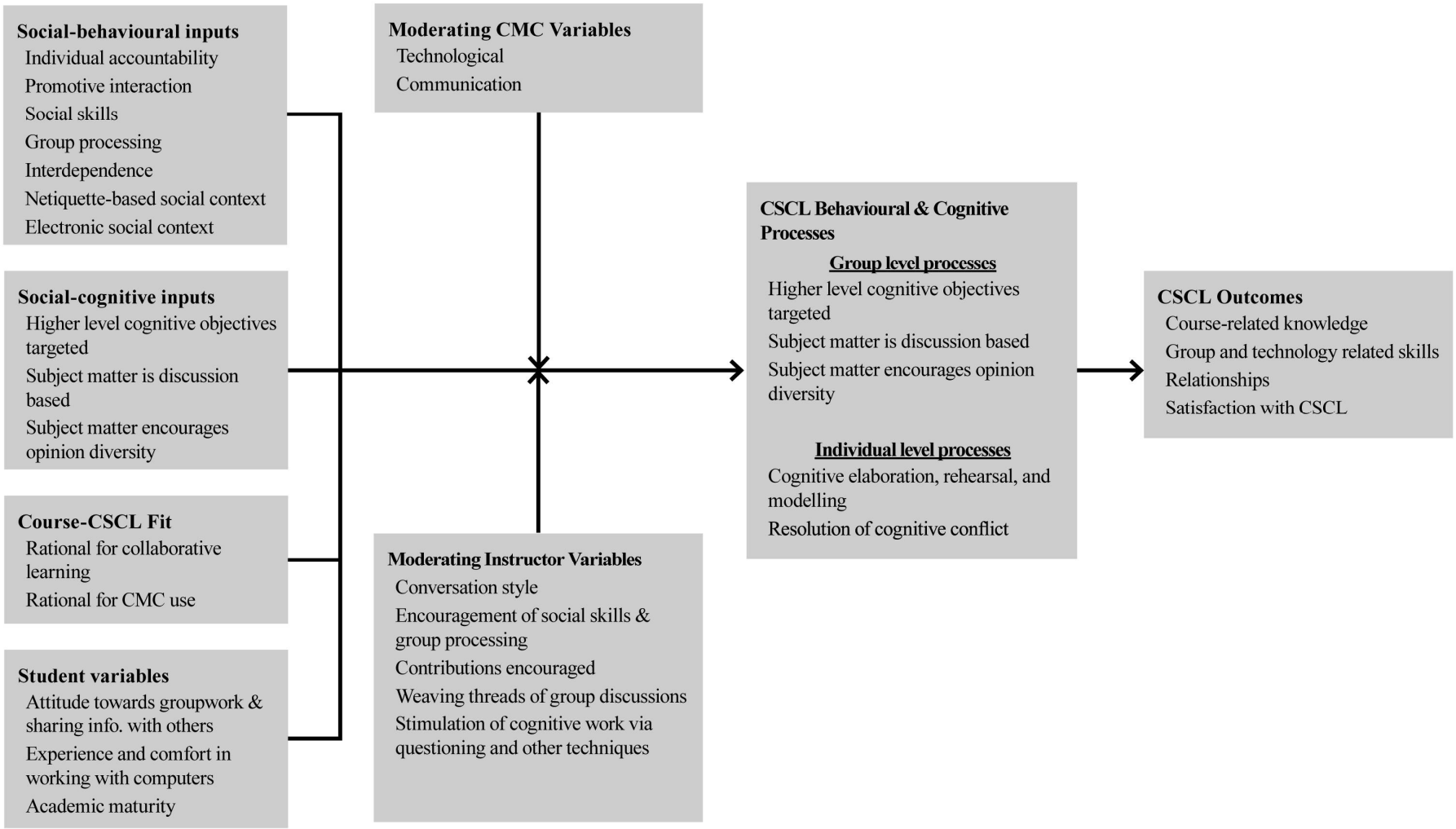

Figure 3.2 A model of CSCL theory and research for instructional design (Brandon & Hollingshead, 1999)

3.5 Online teaching roles in CSCL

As seen from the previous chapters and sections interaction is a prerequisite for social learning and collaboration. However, productive interaction that results in cognition and active learning processes does not automatically occur (Berge, 1999; De Smet, Van Keer & Valcke, 2008; Dillenbourg, 1999; Liaw & Huang, 2000; Northrup, 2001; Rourke, 2000), neither does collaboration automatically produce learning (Dillenbourg, 2002). Häkkinen, Mäkitalo & Arvaja (2004) when formulating their concerns regarding the constraints of CSCL research (despite its accomplishments and positive results), they refer to the mistake of taking social interaction for granted in CSCL settings. They add that many studies in the field found that interaction threads are short and the interactions lack deeper knowledge processing (they rather stay on the surface-level processing). Berge (1999) is of the view that interactions in CSCL settings must be organised, he states that "interaction does not simply occur but must be intentionally designed into the instructional program" (p. 5). De Smet et al. (2008) add that the current CSCL-debate concentrates largely on identifying what contributes to productive interactions. They list the need for guidance and structure (Bonk, Wisher & Lee, 2004), scaffolding (Lakkala et al., 2005; Pifarré, 2007), and facilitation as potential factors influencing evolving interactions. De Smet et al. are the view that the "explicit student need for assistance" is also a crucial factor (p. 208). They stress that guiding students in online learning scenarios is as important as it is the classroom support in face-to-face settings. Thus, the role of online instructors offering guidance and moderation in discussion is vital (Bonk et al., 2004). Hull and Saxon (2009) add, "if participants are not provided guidance in the manner in which they engage one another online, the situated definitions may become so heterogeneously distributed that semiotic mediation […] is never realised, thus preventing negotiation or co-construction from occurring …" (p. 627). (Semiotic mediation, according to their definition, occurs in online settings when new ideas evolve based on the already posted statements in the group.) In theories of social learning such as Vygotsky's (1978) ZPD or Rogoff's guided participation, the role of human mediation is vital, so are online scaffolding and guidance provided by the online instructor in a CSCL environment.

3.5. 1 Mentoring, e-mentoring, tutoring, facilitating and e-moderating in CSCL environments

In the recent decades a number of similar notions, such as mentoring, coaching, tutoring and facilitating, have appeared and been utilised simultaneously to describe instructor roles related to online teaching in CSCL environments. In the following sections, concepts linked to the above terms will be highlighted, the main parameters of the referred models of online teaching roles will be presented in Table 3.1.

Mentoring, e-mentoring

The image of the mentor has already been determined in the classic literature as being a senior, wise guide who escorts the protégé along the long way of self-development. In current professional terms, a mentor is defined as a person who "mediates experts' knowledge for novices, helping that which is tacit to become more explicit" (Dennen, 2002, p. 817). Mentoring has been traditionally seen as a formal

process in which a more experienced person offers assistance and gives advice to the less experienced for the purpose of growth and development (Hew & Knapczyk, 2007; Kram, 1983; Le Cornu, 2005; Levinson, Darrow, Klein, Levinson & McKee, 1978). It has been referred to as a "hierarchical, one-on-one" relationship in "business and industry, higher education, and schools" (Murphy, Mahoney, Chen, Mendoza-Diaz and Yang, 2005, p. 344). Thus, mentoring can be described as: "a one-on-one relationship between an expert and a novice in which the expert guides the novice by behavioural and cognitive modelling, academic and career counselling, emotional and scholarly support, advice, professional networking, and assessment" (Murphy, et al, 2005, p. 344). However, there has been a tendency of reconceptualising the mentoring process (Le Cornu, 2005). A shift from the hierarchical, one-to-one, expert-to-novice transfer into making mentoring a reciprocal and mutual process has emerged. Bona, Rinehart and Volbrecht (1995) claim that with the emergence of "co-mentoring" both parties (the mentor and the mentees) are seen as co-constructors of knowledge (p. 119). Jeruchim and Shapiro's (1992) definition also stresses the importance of the complementary relationship between mentor and mentee:

> A close, intense, mutually beneficial relationship between someone who is older, wiser, more experienced, and more powerful with someone younger or less experienced. It is a complementary relationship, within an organisational or professional context, built on both the mentor's and the protégé's needs. (p. 23)

Le Cornu (2005) argues that a mentoring attitude that is involved in this type of complementary relationship underlines the importance of growth experienced by both parties. According to her "effective mentoring relationship is underpinned by the notion of reciprocity, where each person is required to adopt the role of a learner, and needs also to be prepared to take on the role of a facilitator of someone else's learning" (p. 359). Mullen and Lick (1999) refer to synergistic co-mentoring that similarly to Le Cornu's interpretation, stresses the reciprocity element.

Young, Bullogh, Draper, Smith and Erickson (2005) identified three general patterns of moderating that characterise mentor-mentee relationships: responsive, interactive, and directive. Naturally, these patterns are closely related and fall along the continuum of responsiveness. The *responsive mentor* in the extreme case focuses mainly on direct guidance: s/he reacts to the protégé's request that manifests itself in a question, problem description, or concern. As Young et al. claim the responsive mentor "wants to be needed, but accepts that there is a time when a protégé will seek independence, an eventuality that may be greeted by either party with feelings of ambivalence" (p. 175). The *interactive mentor* is described by the protégé as a friend, colleague and trusted advisor. Mentor and mentee experience each other as a certain type of peers, each of them bringing something beneficial to their relationship. Thus, "the protégé wants to be helpful and supportive of the mentor, just as the mentor wants to be helpful and supportive of his or her protégé" (Young et al., 2005, p. 176). The *directive mentor* takes the role of a "master teacher" by setting the agenda for the mentoring process with respect to input-output requirements, strategies involved and the performance of the mentee. In the directive type of mentoring, feedback equals to strong recommendations and 'directives' (as opposed to suggestions and advise) (Young et al., 2005).

Kram and Isabella (1985) claim that mentors have two major responsibilities towards their protégés: psychosocial and instrumental. With respect to teacher training according to Ensher, Heun and Blanchard (2003) the former includes encouragement, elaborating professional expectations and outcomes, highlighting teaching practices and

standards, and so on. The latter one involves direct support such as modelling teaching methods, direct feedback and providing access to resources. In teacher training and teachers' professional development as well (with reference to the target population of the present study), the view on mentoring has included learning communities that enable supportive interpersonal relationships which enhance in- or pre-service teachers' professional growth. McLaughlin (1997) argues that in such communities they "learn new practices and unlearn old assumptions, beliefs and practices" (as cited in Le Cornu, 2005, p. 356). Le Cornu (2005) also lists various names that refer to such communities for teacher development: teacher research groups (Grimmett, 1995), learning circles (Collay, Dunlap, Enloe & Gagnon, 1998), and teacher networks (Lieberman, 2000). In such communities, the expert-novice transfer and the hierarchies attached to it are reduced, the relationships are more equal, symmetrical and collegial (Lieberman, 2000).

With the emergence of information technologies the interaction between mentor and mentees, participants of the synergistic mentoring process can be maintained at any place and time that is convenient to them. Thus, online mentoring or e-mentoring can be described as "the use of email or computer conferencing systems to support a mentoring relationship when a face-to-face relationship would be impractical" (O'Neill, Wagner, & Gomez, 1996, p. 39). Single and Muller (2001) defined e-mentoring that is facilitated by a program format as follows:

> E-mentoring that occurs within a formalised program environment, which provides training and coaching to increase the likelihood of engagement in the e-mentoring process, and relies on program evaluation to identify improvements for future programs and to determine the impact on the participants (p. 108).

Bierema and Merriam (2002) argue that e-mentoring is a computer-mediated activity from which both parties (mentor and mentee) benefit; the process involves "learning, advising, encouraging, promoting, and modelling, that is often boundaryless, egalitarian, and qualitatively different than traditional face-to-face mentoring" (p. 214). The advantages of e-mentoring over face-to-face mentoring have already been researched: it extends limitations of time and space for the participants (Ensher et al., 2003; Knapczyk, Hew Frey & Wall-Marencik, 2005); asynchronous communication channels allow for more thoughtful interactions between mentor and mentee (Wade, Niederhauser, Cannon & Long, 2001); and e-mentoring provides greater anonymity and privacy (Hew Frey & Knapczyk, 2007; Knouse, 2001).

Tutoring

Similarly to mentoring, tutoring is associated with teacher roles both in face-to-face and online settings. Burge, Howard and Ironside's (1991) definition of a tutor is based on the claim that there has been a departure from the traditional role of the teacher being the 'information supplier' or 'dispenser of knowledge'. They argue that a tutor is "the person in closest contact with the student. […] S/he may engage in telephone, computer or face-to-face contact; may give feedback on assignments or examinations; may help learners understand course materials or objectives" (p. 4) however, they also add that a tutor, when need be, assists students in solving personal education problems. Beaudoin (1990) argues that a tutor proactively mediates between program materials and the learners. Legendre (1993) claims that tutoring is a "form of support covering the entire scholastic activity of the student. (…) The tutor is a guide, an instructor who teaches one person or a small group of pupils at one time" (as cited in de Lièvre,

Depover & Dillenbourg, 2006, p. 98). Adequate subject knowledge, being able to communicate the course content clearly, and availability for advice or help are the three main tutor skills Burge et al. (1991) refer to in their extensive study. As a fourth skill they add that the tutor should be understanding about potential (student) problems. Barrows (1992) identifies tutors as online instructors particularly in collaborative platforms in which small groups of students are engaged in active processing that also includes problem-based learning. He refers to the following characteristics when describing tutors:

> The ability of the tutor to use facilitatory teaching skills during the small group learning process is the major determinant of the quality and the success of any educational method aimed at (1) developing students' thinking or reasoning skills (problem solving, metacognition, critical thinking) as they learn, and (2) helping them to become independent, self-directed learners (learning to learn, learning management) (p. 12).

De Lièvre et al. (2006) list cognitive support (by relying on subject knowledge and methodological inventory), socio-affective and relational support (encouraging and supporting the learner), motivational support (stimulating and maintaining interest), metacognitive support (facilitating reflective learning), and administrative support as the main responsibilities of online tutors. Weedon (1997) identifies the role of a tutor as a person facilitating learners' progress in knowledge advancement, which entails more than simply monitoring the process; it encompasses rather an active practical guidance. Similarly to Young et al.'s (2005) patterns of mentoring de Lièvre et al. (2006) propose modes of tutorial intervention. They differentiate between *reactive tutoring* and *proactive tutoring*. The former one refers to the case when a tutor gives immediate reaction to the learners' spontaneous demand for help. The latter one entails the tutor's own initiative for entering the learners' learning process.

As regards research on tutoring, Burge et al. (1991) managed to identify crucial tutor skills that are relevant in online teaching contexts. Sherry (2000) also investigated tutor characteristics and added to Burge et al.'s list the importance of high-quality, rapid feedback and emotional support. Schweitzer, Paechter and Weidenmann (2001) argue that tutors' social engagement enhances the length of time that students spend on communication and learners' involvement. However, the efficacy of tutors in reducing the high number of dropouts in online settings is subject to investigation among researchers. De Lièvre et al. (2006) claim that it is a complex issue involving several variables and controversial results ranging from positive scenarios (reporting a 25-44 % rate of reduction in drop-outs) to studies that only refer to modest impact. Accordingly, they suggest further empirical analysis of the effects of tutoring.

Facilitating and e-moderating

A facilitator or e-moderator (Salmon, 2003) is often labelled as a 'guide on the side' for a group of learners in an online setting (even though the concept of facilitation can be lead back to the humanistic educational movement, which underlined the importance of student-centred learning environment and learners' self-direction). The terms 'facilitating' and 'e-moderating' have been referring to the process of the online instructor's effort to help learners engage in active and meaningful interactions that contribute to their online knowledge advancement. This activity is of high importance, due to the often-formulated concern regarding CSCL environments, according to which

participants do not attach much significance to the role of online discussions in their knowledge advancement and process of online learning. In the recent decade, a number of studies have investigated the roles facilitators play in online discussions (Anderson, Rourke, Garrison & Archer, 2001; Berge, 1995; Green, 1998; Goodyear, Salmon, Spector, Steeples & Tickner, 2001; Hootstein, 2002; Mason, 1991; Salmon, 2003). They basically agree that there are four roles i.e. four pairs of shoes (Hootstein, 2002) that facilitators take in CSCL environments: (1) pedagogical/instructor role, (2) social role, (3) managerial role, and (4) technical role.

Pedagogical/instructor role

The instructor or pedagogical role of the facilitator is to offer professional help to the online learners in their growing understanding of the course content and facilitate their knowledge building in order to complete assignments and reach learning aims set prior to the process (Goodyear et al., 2001; Green, 1998; Hootstein, 2002). Rourke et al. (2001) claims that direct instruction i.e. the instructor role, relies on the subject matter knowledge and pedagogical expertise of the facilitator. Thus, as White (2004) puts it facilitators act as cybrians and topical experts who provide learners with relevant information but at the same time they suggest ideas and strategies for learning (Hootstein, 2002). Beyond providing information, learners should be aided in making sense of the course materials. Initiating questions and provoking responses from the students are effective means to add to the process of effective content provision (Berge, 1995). Focusing discussions on crucial points so that discussions progress beyond info sharing to knowledge construction, weaving together different concepts and assisting learners in connecting content with prior knowledge are crucial facilitation skills (Anderson et al., 2001; Hootstein, 2002; Mason, 1991). There are three strategies facilitators can make use of when establishing links between different concepts posted by the individual participants: (1) connecting previous and most recent comments to each other, this way indicating which messages focus on the same topic but treating it from a different perspective; (2) weaving posts by injecting information from different sources (making reference to external sources, readings by adding hyperlinks); and (3) connecting the topic of the discussion to student's experiences (Berge, 1995; Hootstein, 2002). Providing useful and creative feedback and evaluating contributions are both inevitable in the process of effective facilitation (Anderson et al., 2001; Salmon, 2003). Hootstein (2002) claims that timely informative feedback is even more critical in online learning than in face-to-face settings since learners may feel isolated due to characteristics of the communication medium. Summarising and synthesising the responses may also contribute to the efficacy of the learning process (Anderson et al., 2001).

Social role

The social director or social host role of the facilitator entails establishing a friendly and comfortable social learning environment in which learners can achieve their best while engaging with each other in effective interactions (Berge, 1995; Hootstein, 2002; Mason, 1991; White, 2004). Comfortable learning environment that is described by White (2004) as a setting where learners "feel at home", is created by establishing trust, promoting human relationships, developing group cohesiveness,

encouraging and stimulating student participation, and using emotions and solving conflicts constructively (Berge, 1995; Green, 1998; Salmon, 2003). In Goodyear et al.'s (2001) interpretation the social role includes the duties of a process facilitator and those of an advisor-counsellor. The process facilitator has six main task areas: welcoming, establishing group rules, creating community, managing communication, modelling social behaviour, and establishing own identity. The advisor-counsellor offers help and gives advice so that students profit the most from the online learning process. Anderson et al. (2001) identified the social role in the so-called 'facilitating discourse elements' that are the following: seeking consensus and understanding; encouraging, acknowledging, or reinforcing student contributions; setting climate for learning; and drawing in participants.

Managerial role

The managerial role of facilitators covers the understanding of online processes, the organisational and administrative duties such as setting the agenda, the objectives of the discussions, establishing time parameters, procedural rules and decision-making norms (Berge, 1995; Green, 1998; Hootstein, 2002; Mason, 1991). Anderson et al. (2001) adds to the above responsibilities the effective utilisation of the medium and the establishment of a netiquette for the community of learners. The duties, Anderson et al. refer to, are crucial from the point of view of demonstrating effective leadership which can help when managing group interactions (Berge, 1995). White (2004) refers to the managerial role as 'team/project manager' that implies that facilitators need to possess traditional project management skills as well. Goodyear et al. (2001) identified the managerial role as a coinage of a designer, a manager-administrator and an assessor. The latter component entails responsibilities such as grading and validating students' work.

Technical role

Taking the technical role or technical assistant (Hootstein, 2002) role as a facilitator is self-evident due to the online setting in CSCL. The primary aim of a facilitator (in this respect) is to make participants feel comfortable in the online environment. This includes transmitting knowledge and experience about how to use software facilities, manipulate e-tivities and generate online learning environments (Berge, 1995; Salmon, 2003). Mason (2001) underlines the importance of 'context', which entails making the advantages of the tool obvious for the learners by making use of the features available. Anderson et al. (2001) identified the facilitators' duty to respond to learners' technical concerns as element of direct instruction performed by her/him. Green (1998) argues that it is crucial to provide full-time technical support in the initial phase of a course (especially, if it is carried out entirely online). Salmon (2003) further adds that technical support should be maintained during the entire discussion sessions.

Table 3.1. Models of online teaching roles

	Anderson et. al. (2001)	***Berge (1995)***	***Goodyear et al. (2001)***	***Green (1998)***	***Hootstein (2001)***	***Mason (1991)***	***Salmon (2003)***	***White (2004)***
Terminology for the various online teaching roles	Instructio-nal design and organisation	Managerial	Designer, Manager-Administra-tor, Assesser	Organi-sational	Program manager	Organisatio nal	Understan-ding of online processes	Team/pro-ject manager
	Facilitating discourse	Social	Process facilitator, Advisor-Counsellor	Social	Social director	Social	Online communica -tion skills	Social host, CoP facilitators, Janitor and Referee
	Direct instruction	Pedagogical	Content facilitator, Researcher	Intellectual	Instructor	Intellectual	Content expertise	Cybrarian
		Technical	Technolo-gist		Technical assistant		Technical skills	Help desk

3.5.2 Research on online instructor roles

De Laat, Lally, Lipponen and Simons (2006) claim that participants value teachers' active engagement and involvement in the online learning process since students "find communication with the teacher constructive and encouraging" (p. 10), and the teacher is able to provide guidance by relying on the various skills of a facilitator. They underline in relation to the different online teacher roles that in the beginning of the learning process students rely more on the online instructors' help and support. This active pedagogical support however, as approaching the end stage of either the discussion sessions or the learning process, gradually transforms into a facilitative function. Levy's (2003) findings also support this view, according to which, the intensive direct contact between instructor and course participants is of high importance especially at the early period. However, later on, as Strijbos et al. (2004) argue, students themselves 'produce' leaders among themselves who then gain leadership periodically. The importance of participant interactions facilitated by the e-moderator in relation to the efficacy of the online learning process is supported by a number of studies (Hiltz & Turoff, 2002; Sherry, Fulford & Zhang, 1998; Vonderwell, 2003). As regards the pedagogical role of the facilitator numerous studies investigated the 'direct instruction' element. Finegold and Cooke (2006) found that "direction in the form of information resources, subject knowledge and discussion initiation was thought to be helpful" (p. 209). Rovai (2001) underlines the importance of creating a sense of community within the online learners. Shea, Li and Pickett (2006) found that "a strong and active presence on the part of the instructor – one in which she or he actively guides and orchestrates the discourse – is related both to students' sense of connectedness and learning (p. 185). Gilbert and Dabbagh's (2005) analyses revealed that elements of structure had a significant impact on meaningful discourse. They found that guidelines supported facilitation and evaluation of online discussions contributed to the development of understanding course content.

It can be concluded that there seems to be consensus about the online teachers' roles and competencies in the literature. As regards the empirical studies on the online teacher roles, they seem to point to the importance of effective online facilitation since as Mason (2001) put it when reflecting on the Open University experience, "simply providing an environment in which students and tutors could interact did not guarantee successful engagement" (p. 69).

4 AN OVERVIEW OF CSCL RESEARCH METHODOLOGIES

The aim of the present chapter is to review the literature on research methodologies used in CSCL research with the intent to provide the background of research methodologies used in the empirical data collection and analyses of the present study.

First, general research methodological issues are addressed by discussing features of qualitative and quantitative methods with the conclusion however, that both approaches complement each other and their integration may increase the validity of the study.

The participant satisfaction survey, a rudimentary quantitative method, is discussed extensively. Various models of participant satisfaction in CSCL environments are reviewed including the introduction of the Kano model, which is an innovative method of studying online learners' satisfaction with the learning. Social Network Analysis is introduced as a quantitative method used for investigating patterns of online interactions by referring to various recent studies in the field of CSCL research. Finally, content analysis as a research tool aiming at analysing online interactions at the micro level is described in detail. A number of definitions together with the relevant methodological issues and the development of instruments are elaborated.

4.1 Integrating quantitative and qualitative methods in CSCL

In Babbie's (2001) view, the difference between quantitative and qualitative data in social research manifests itself in the difference between numerical and nonnumerical data. He claims that *quantification* allows for aggregation, comparison and summary of data thus it enables a more objective and explicit analysis of the results. However, it has the disadvantage of a loss in richness of interpretations. *Qualitative* data categorised as nonnumerical, allow for the analysis, explanation and interpretation of the underlying processes in the actual context thus they possess the interpretative character (Creswell, 2007). Chi (1997) describes the qualitative approach as a methodology (1) used mainly in research conducted in a natural setting, (2) relying on the researcher as the main observer, hence (3) vulnerable to subjective interpretation (p. 276). Quantitative methodology, on the other hand, is referred to as (1) an approach used in experimental design, in which (2) variables are manipulated and controlled, (3) that reflects respective hypotheses being tested (p. 276). According to her, both approaches have advantages and shortcomings however, the need to integrate elements of both is legitimate. Babbie (2001) also proclaims that the two approaches demand different skills and procedures but both methods are useful and legitimate in social research. Salomon (1991) claims that in educational research "rapprochement appears to be on its way", which is linked, according to him, to the realisation that "classrooms (schools, families, therapies, cultures) are complex, often nested conglomerates of interdependent variables, events, perceptions, attitudes, expectations, and behaviours, and thus their study cannot be approached in the same way that the study of single events and single variables can" (p. 11). Similarly to Babbie, he states that it is not necessary to choose between quantitative and qualitative approaches since both are useful when studying complex or even less complex phenomena. Salomon (1991) proposes a different view by differentiating between *analytic* and *systemic* approaches. By analytic approach he refers to controlled studies in which (1) one supposes that internal events are conditional of the manipulation of external events, (2) one assumes that complex phenomena are

constituted of basic components that can be studied in isolation, and (3) that the "quality of an observed, measured, or manipulated variable […] has meaning in and of itself" (p. 13). The systemic approach is based on the idea that all events are interrelated and they "mutually define" each other (Altman, 1988, as cited in Salomon, 1991, p. 13).

According to Salomon (1991), there are four aspects when considering which approach to utilise: (1) paradigmatic assumptions, (2) phenomenon to be studied, (3) the questions to be asked, and (4) the methodology to be used. The analytic approach is based on hypothesis-testing, it is suited to study that which "can be made to happen". Studies carried out in this manner in the field of pedagogical application of technologies tested the hypothesis that "under controlled conditions computer-based expertlike guidance can be internalised to become self-guidance" (p.16). The systemic view however, contributes to see "patterns of interrelations" that change in time in a given context, and allows for studying "what happens in actuality" (p. 16). Both approaches complement each other, thus the "cohabitation is not a luxury but a necessity" (p.16), as Salomon proclaims.

In *Section 3.4.3*, it was indicated that as opposed to former research traditions (e.g. experimental design and laboratories), CSCL research is carried out in "real world contexts" (Lipponen, 2002, p. 74). It was also noted that CSCL is a multidisciplinary field that relies on a wide range of research methods including the field of anthropology, communication science, linguistics, and so on. Strijbos and Fischer (2007) underline that the respective disciplines view research on collaborative learning from a different theoretical perspective and thus rely on different research methodologies. According to their view research methods can be differentiated on the basis of the research goals, the processes under study, data sources, results and interpretation. Table 4.1 is an outline for categorising research methodology applicable in CSCL research.

Table 4.1 Strijbos and Fischer's (2007) outline for categorising research methods in CSCL

	Hypothesis testing	***Hypothesis generating***	***Different processes***
Process to be studied	Theoretical assumptions *a priori*; prospective	Data-driven and *a posteriori*, retrospective	Processes such as cognitive, social, and motivation
Data source and analyses	Quantitative methods applied	Qualitative method applied	Data collected and extracted from different data sources
Results and their interpretation	Methods e.g. statistical analyses on Likert-scale or test scores	Methods e.g. themes that emerged through interviews	Various analysis methodologies

Dillenbourg et al. (1999) also argue that there are different approaches and research designs applied in the field. They differentiate between the sociocognitive approach, which is based on the comparison/contrast of the results of a method/intervention employed parallel in an experimental and control group. In this case, they argue that collaboration is treated as a "black box" (p. 196). Opposed to this method, the sociocultural way focuses on "micro genetic analyses of the social interaction" due to "the importance attached to the concept of mediation in socio-cultural theory" (p. 196).

Stahl et al. (2006) also stress the multidisciplinarity of CSCL research. They categorise empirical studies into three methodological traditions: experimental, descriptive, and iterative. The first category resembles to the method Dillenbourg et al. (1999) label as sociocognitive approach. The second methodological tradition they

make reference to, is the ethnomethodological one, which is more suited for descriptive case analyses. Iterative design is the third one which does not only entail, according to Stahl et al., that people are observed but also it is based on the need to identify new "promising features that should receive further study under the other methodological traditions" (p. 420).

Strijbos and Fischer (2007) note that the chosen method "restricts" the data sources. It "restricts" the results that can be gained from the data and it also "restricts" the conclusions and generalisation of the results (p. 390). They stress the importance of the word 'restrict' since according to their view, the methodology in use "simultaneously excludes other possible ways in which the data can be viewed and analysed" (p. 390). At the same time, they state that current CSCL research uses *mixed method* strategies, which is based on the idea that one methodological approach is not favoured over another. Qualitative and quantitative data due to their different nature can shed light on the same problem from different perspectives thus allowing for a more refined answer and increased validity of the study (Creswell, 2007). In this context, Stijbos and Fischer (2007) refer to studies where approaches combine discourse analysis with coding, or where triangulation is applied.

4.1.1 Triangulation

Triangulation (Creswell, 2007; Seliger & Shohamy, 1989; Todd, Nerlich, McKeown & Clarke, 2004) is a basic method to ensure credibility and validity of the study. Todd et al. (2004) refer to various forms of triangulation: a setting using multiple methods, multiple datasets, multiple investigators, and multiple theories. However, the underlying principle is the same in all the settings. When triangulating, one uses two or more methods (or datasets, or investigators, or theories) to give a more precise presentation of the results and processes. If the different methods (having different strengths and shortcomings) refer to findings that converge, then the confidence in the results grows. This applies only if the methods in question have different liabilities (Todd et al., 2004).

Strijbos and Fischer (2007) note that applying mixed method strategies such as triangulation, implies that researchers are willing to use and experiment with methodologies that are not part of their repertoire. It also means that they are unbiased, and unreserved towards the method and willing to take part in projects where one of the aims is to test and develop new methodologies.

4.2 Participant satisfaction survey in CSCL environments

Brandon and Hollingshead (1999) in their model of CSCL theory and research for instructional design, identified participants' satisfaction with CSCL as one of the crucial items when evaluating teaching and learning processes (see *Section 3.4.4*). So and Brush (2008) also claim that the extent to which students (participants) are satisfied with online courses contributes to the evaluation of the efficacy of the online learning process. Accordingly, learning satisfaction is a critical factor in the development of online learning, and in improving learning achievement (Hsieh Chang & Smith, 2008; Lin, Lin & Laffey, 2008).

Focus on satisfaction is rooted in research on workplace settings, as Hayashi, Chen, Ryan and Wu (2004) claim. It is a "pleasurable or positive emotional state

resulting from the appraisal of one's job" (Locke, 1976 as cited in Hayashi et al., 2004, p. 140). Lin et al. (2008) define satisfaction as "the perception of the pleasurable fulfilment of need and wants after participating in a specific activity" (p. 2). They add that it is an "indicator used to assess the activity, service, or product quality" (p. 3). Based on Bailey & Pearson (1983), Shee and Wang (2008) conceptualise satisfaction as "the aggregate of a person's feelings or attitudes toward the many factors that affect a certain situation" (p. 896).

Early research on online participant satisfaction focused on the comparison of the online and the face-to-face learning experience, and on the impact, technology may have on learning outcomes. Hackman and Walker (1990) claimed that well-functioning technology might positively influence student learning outcomes and satisfaction. Lin et al. (2008) state that seen from the student achievement perspective online learning can be as effective as learning process in a face-to-face setting. Allen, Bourhis, Burrell and Marbry (2002) in their meta-analysis of 24 articles did not report any significant difference as regards student satisfaction in online and face-to-face settings. Smith and Ferguson (2005) in their study of comparing online and face-to-face learning from the perspective of student attrition, found that in the former case the rate was significantly higher. A group of early studies support the claim that user attitudes such as prior user experience of technology, and skilfulness positively influence student satisfaction Althaus, 1997; Hiltz, 1986). Interestingly however, So and Brush (2008) refer to studies in which no significant correlations were detected between participant satisfaction and individual characteristics such as age, gender, or computer literacy.

As regards the impact of online interaction and the facilitator's impact (e.g. communication skills, encouragement, content knowledge, and so on) on student satisfaction various studies found significant correlations (Arbaugh, 2001; Bolliger, 2004). Northrup (2002) reported that feedback is a key component of online support that contributes to the success of the online teaching and learning process. Shea, Fredericksen, Pickett, Pelz, and Swan (2002) stressed the importance of the online interaction with the facilitator in the perceived participant satisfaction (as cited by Lin et al., 2008). Fulford and Zhang (1993), in their study, proved that interaction is a predictor of satisfaction. The positive relation between perceived participant satisfaction, social interaction and collaborative learning has been investigated by many researchers (Gunawardena & Zittle, 1997; Kitchen & McDougall, 1998; Picciano, 2002; Richardson & Swan, 2003). Despite the impressive number of studies reporting elements of online learning having a positive effect on participant satisfaction, there are factors that contribute to students' feeling of dissatisfied or frustrated. So and Brush (2008) collected six factors on the basis of numerous studies that contribute to students dissatisfaction in online courses: (1) expectation not clearly communicated by the instructor, (2) tight schedule and deadlines, (3) workload, (4) low quality of software interface, (5) slow access, and (6) lack of asynchronous communication.

4.2.1 Models of online participant satisfaction

Participant satisfaction is a multidimensional and complex phenomenon. Various researchers have identified elements of it and constructed frameworks for investigating variables, which contribute to successful online learning and participant satisfaction. In the following, three frameworks will be briefly elaborated which elucidate critical factors that affect online student/participant satisfaction.

Adult Distance Study through Computer Conferencing (ADSCC) (Eastmond, 1994)

Eastmond (1994) developed the ADSCC model with the aim to understand the dynamics of successful learning by computer conferencing, and at the same time to understand the student perspectives and experiences with the computer-mediated medium. The model consists of three components: (1) readiness (internal and external factors that the learner brings with him/herself to the instructional context); (2) online characteristics (encompass the features of technology-mediatedness); and (3) learning approaches (entails the strategies learners rely on in the pedagogical setting).

Readiness is related to various personal features that impact the learners' success in the learning situation, according to Eastmond (1994). These features include learning preferences, style, array of learning strategies, and prior learning experiences, computer skills, interest in course content, prior mastery of fundamental concepts and skills in the content area. Eastmond also refers to external factors such as the learners' social network or institutional assistance.

Awareness of the *online characteristics* of the technology-mediated setting should ideally be a prerequisite for entering the online environment (Eastmond, 1994). Eastmond refers to a group of characteristics that are related to the medium, and to the ones that are brought in by the instructional setting. These characteristics include geographical separation from the instructor and students, asynchronicity, multiple simultaneous discussion, information overload, interactivity, group dynamics, potential miscommunication, and instructor style.

In Eastmond's (1994) view many *learning approaches* are directly linked to the medium itself – these are the following: learning technical procedures to participate effectively online; processing online information; deciding when to contribute and how best to present one's thoughts online; determining a frequency of reading and writing on the conferencing, primarily to follow multiple discussions, avoid information overload, and achieve maximum interactivity; inviting further interactivity through timely contributions which solicit response; and learning to express oneself accurately and concisely through text. Naturally, learners bring particular learning styles and instructional preferences with them, as Eastmond notes. Thus, they will try to make use of patterns such as seeking feedback on performance or understanding and using that to shape successive learning; establishing an attitude or instructional climate that is conducive to learning; setting personal goals during one's study; and personalising the course to meet one's own expectations, needs, and interests.

Dimensions and antecedents of perceived e-learner satisfaction (Sun, Tsai, Finger, Chen & Yeh, 2008)

Sun et al. (2008) established a framework consisting of six dimensions that are used to assess participants' perceived satisfaction based on factors including student dimension, instructor dimension, course dimension, technology dimension, design dimension, and environment dimension.

Learner dimension basically refers, in Sun et al.'s (2008) framework, to the learner attitude towards computers, more precisely, learners' impression of participating in online activities through computers. According to them, less computer anxiety contributes to a higher level of learner satisfaction and learner interest in the actual subject matter in the online settings. Sun et al. at this dimension refer to the concept of self-efficacy i.e. judging the effects and the possibility of success before carrying out

the task. The higher the learners' self-efficacy is, the better they perform the task, which effects in a higher learner satisfaction.

Instructor dimension in Sun et al.'s (2008) framework, on one hand consists of the instructor's timely response that according to them significantly enhances learner satisfaction. They define timely response as "whether students perceive that instructors responded promptly to their problems" (p. 1187). On the other hand, instructor dimension is determined by the instructor attitudes toward online learning.

The *course dimension* entails flexibility in time, location, and methods, which contribute to a more dynamic interaction that foster online learning (Sun et al., 2008). The quality of the course design (the learning model, interactive communications, multimedia presentations of content, management of learning processes etc.,) is considered also a vital factor in this dimension.

Technology dimension i.e. the quality of technology and the Internet quality significantly affect satisfaction with the online learning experience (Sun et al., 2008). They list features such as user-friendliness, reliability, variety of equipment, and network transmission speed.

In this framework, the *design dimension* refers to the perceived usefulness and perceived ease of use of the online system. Sun et al. (2008) claim that the more intensively learners perceive usefulness and ease of use in relation to the system i.e. media delivering the course, websites, file transmitting software, and so on; the more satisfied they are with the learning experience.

Environmental dimension entails two basic components: diversity in assessment and perceived interaction with others influencing learner satisfaction (Sun et al., 2008). It is claimed that the diversified assessment tools and methods have a positive impact on learners' satisfaction since this way feedback is provided in the learning process. The intensiveness of perceived interaction (among learners, learner and instructor, learner and course content) contributes to a higher level of learner satisfaction as the authors state it. Sun and colleagues also proclaim that interaction mechanisms should be designed prior to the actual scenario in order to improve frequency, quality, and promptness of interactions, which may impact learner satisfaction.

Model of success and success factors in Internet-supported learning environments (Menchaca & Bekele, 2008)

Menchacha and Bekele (2008) identified five interdependent success factor categories in their model: technology-related factors, user characteristics, course-related factors, learning approach, and support services. Success factors of this model are linked to the systematic use of human and nonhuman resources available in a technology-supported learning environment.

Technology-related factors are related to the capability or quality of the technology equipment in the online learning environment (Menchacha & Bekele, 2008). It is claimed that infrastructure and the use of multiple technologies or tools (synchronous, asynchronous, and multimedia based) are crucial for success in the online learning process.

User characteristics entail, in the model, both student and instructor roles, perceptions, and competencies. Menchacha and Bekele (2008) share the view that the more experienced the students and instructors are, the more they experience success in the context. Thus, the importance of skill with technologies is implied. Additional

success factors are student motivation, learner confidence, attitude to technologies and learning view (Menchacha & Bekele, 2008).

In the model, *course-related factors* refer to the quality of the course, more precisely, to the design that the course offers. The authors list clear expectations, activities, relevance, and structure to this category.

Learning approach includes the general design process, pedagogy, online collaboration and interaction, which contribute to a process-oriented and a social learning setting (Menchacha & Bekele, 2008).

The quality of *support services* has also an impact on learner success and satisfaction according to the authors. They list helpdesk, support teaching staff, technical training, faculty professional development opportunities, and update of the technologic pools as specific factors under the umbrella of support services.

4.2.2 The Kano model to survey satisfaction

The Kano model of consumer satisfaction was developed by Noriaki Kano and his research group in the 80s. It is a research tool to identify and classify the product criteria and attributes that create more satisfaction than others (Kano, Hinterhuber, Bailon, & Sauerwein, 1984). According to Xu, Jiao, Yang & Helander (2009) it demonstrates the nonlinear relationship between product performance and customer satisfaction. The Kano model classifies product attributes into four categories (Xu et al, 2009): (1) must-be or basic quality attributes; (2) one-dimensional or performance attributes; (3) attractive or excitement attributes; and (4) indifferent attributes. *Must-be attributes* are a must, thus they lead to extreme dissatisfaction if they are absent. *One-dimensional attributes* entail those for which better fulfilment leads to linear increase of customer satisfaction. This means according to Chen and Chuang (2008) that the higher this value is, the higher customer satisfaction grows. *Attractive attributes* are in general unexpected by the customers, their presence can lead to satisfaction (Xu et al., 2009). However, there is not a decrease in satisfaction with the lower level of attractive attributes (Chen & Chuang, 2008). *Indifferent attributes* are those that the customer is not especially interested in. Chen and Chuang (2008) add a fifth category, the reversal qualities, for which the customers will be more satisfied with the increase of a criterion performance.

Matzler and Hinterhuber (1998) claim that by using the Kano model product developers are allowed to focus more on the priorities for product development (as cited in Chen & Chuang, 2008). According to Chen and Chuang (2008), it can also be of help when weighting the importance of product attributes.

In the present study, the integration of the Kano model in the methodology of studying online learners' satisfaction with the learning experience is assumed to contribute to deciding the relative priority of improving components of the mentoring, teaching and learning process in a CSCL environment.

4.3 Investigating patterns of interaction: Social network analysis in CSCL research

Dillenbourg (1999) claimed that in the process of understanding the complex notion of 'collaborative learning' *effects* that are specific to it, should be considered. (This was discussed in detail in *Section 3.3*) He argued that instead of focusing on the effects of collaboration in general, effects of certain categories of interactions are to be investigated thoroughly. Further on he suggested two approaches: either (a) controlling *a priori* the types of interactions that will appear in the process, or (b) analysing *a posteriori* the interactions that evolved in the process of collaboration. Lipponen (2002) when making suggestions on research approaches in the field of CSCL, he opted for analysing collaborations at both the macro and micro level. Analysing collaborations at the macro level means that online learning communities are treated as interaction networks; and in the research process, surface-level features of evolving online interactions are considered. Micro level analysis may focus on various research areas including social construction of knowledge, sociocognitive effects of CSCL, argumentation and inquiry processes that need professional scaffolding, apprenticeship in thinking, and so on (*Section 3.4.3* referred explicitly to numerous studies). It may rely on various research methodologies such as interaction analysis, discourse analysis, content analysis, interviews, observations etc.

The most frequently used method for analysing collaboration at the macro level is social network analysis (SNA) (Scott, 2000; Wasserman & Faust, 1997) that is an adequate method for investigating patterns of interactions *a posteriori* in the online learning process. Thus, it allows the researcher to concentrate on the collaborative interactions and gain better understanding of the underlying mechanisms (Dillenbourg, 1999). In this context, CSCL environments are adequate tools from the researcher's perspective as well, since they preserve records of interactions (the texts and the quantitative log data) on which the method of SNA operates when analysing surface-level features of interactions (de Laat et al., 2007; Nurmela, Palonen, Lehtinen, & Hakkarainen, 2003).

Rooted in the graph theory, SNA is a method for investigating social relations among a group of actors based on the way they are connected with each other (Scott, 1991). According to Shen, Nuankhieo, Huang, Amelung, and Laffey (2008) SNA is regularly used in the field of sociology and organisational studies with the aim to explore human and social dynamics. However, it has been increasingly used in educational studies focusing on online learning in order to understand underlying patterns of participant interaction (Shen et al., 2008). Ryymin, Palonen and Hakkarainen (2008) claim that it is a method especially adequate for representing relational structures of social actors, where the relations are determined by social interactions. Relational data are "the contact, ties and connections, […], which relate one agent to another and so cannot be reduced to the properties of agents, but of *systems of agents* "(Scott, 1991, p. 3., emphasis added). De Laat and his colleagues (2007) also share this view and state that SNA may contribute to identifying patterns of relationship among people constituting a social network i.e. a structure or system that is built from relations. SNA may help in the investigation of these patterns by "illuminating the flow of information and/or other resources that are exchanged among participants" (de Laat et al., 2008, p. 89). Through the patterns of interactions, the social environment itself can be mapped (Wasserman & Faust, 1997). In this perspective, the unit of analysis is not the individual but the interactions that evolve among members of the network (de Laat et al., 2008).

Accordingly, SNA offers a *quantitative representation* of the organisation of relationships among online learners, and enables quantitative comparisons between different networks or groups of people (Shen et al., 2008). At the same time, it also provides a *visualisation of connections* among members of networks (in the form of sociograms). Thus, quantification and visualisation of connections and interaction patterns can complement research tools such as surveys, or methods traditionally used in the study of online learning: content analysis and learner feedback (Shen et al., 2008). There are two clearly distinguishable approaches to SNA: (1) egocentric (or ego network analysis) and (2) sociocentric (or complete network analysis) (Scott, 2000). The former one concentrates on the links surrounding particular members of the network; the latter one is concerned with the structural patterns of interaction between members within the network as a whole.

4.3.1 Social network measures

The two most widely used indicators of SNA are 'density' and 'centrality'. *Density* represents the overall connections between the members of the community. It is defined as the actual number of ties divided by the maximum number of possible links (Scott, 2000). The density value varies between 0 and 1. The value 1 indicates a fully dense network where all the agents are connected to each other. Density value nearing zero indicates a sparsely knit network (Shen et al., 2008). The more members are connected, the denser becomes the network thus the higher grows the density value (Scott, 1991). The density formula for an undirected graph (the direction of relations is not indicated) is $D = l/n(n-1)/2$ where l is the number of lines present, and n is the number of points in the network. The density formula of a directed graph (the direction of relations is indicated) is $D = l/n(n-1)$.

Centrality is the value that supplies us with information about the behaviour of the respective participants (de Laat et al., 2007). It shows the number of ties to other actors in the system i.e. the extent to which a participant interacts with the others. Centrality is measured by *in-degree* and *out-degree*. In-degree refers to the incoming network linkages i.e. the number of people who respond to a message. Out-degree is the amount of interaction a particular member of the network initiates with the others i.e. number of messages sent to others. An actor with high out-degree centrality value is in direct contact with others in the network, it operates as a "crucial cog" (Russo & Koesten, 2005, p. 256) since it is an important channel of information. A member with low out-degree centrality is in general located on the periphery of the network. The in-degree centrality value is often termed as *prestige* since it represents "the degree to which other seek out a particular actor in a social network" (Russo & Koesten, 2005, p. 256). Some experts are of the view that "brokerage positions" (e.g., structural holes) are in an advantageous position as compared to the actors possessing high centrality values (Cho, Gay, Davidson, & Ingraffea, 2007, p. 314). Actors having such a position link the disconnected ones with the other members of the community thus they are assumed to have "more control over diverse resources located in multiple sub-groups" (Cho et al., 2007, p. 315). The term 'centrality' refers to "the idea of point centrality", while 'centralisation' stands for "the overall cohesion or integration of the graph" (Scott, 2000, p. 82). Accordingly, there exists the *network centralisation* value that is an "expression of how tightly the graph is organised around its most central point" (Scott, 2000, p. 89). According to Ryymin et al. (2007) high degree of network centralisation is typical of networks where there is a rapid change of information since while "routine

tasks can be handled by most professionals, the newest techniques and know-how are in the hands of only a few" (p. 1266). They also claim that in school setting permanent high network centralisation may lead to serious lack of equal opportunity among learners.

The intensity of the relation between members can be represented by a numerical value. We refer to *valued graphs* if values of intensity are attached to the lines connecting the agents in a network (nodes in a graph). Experts in the field differentiate between strong and weak networking links. *Strong links* (ties) occur between participants who interact intensively with each other or work in mutual collaboration (Ryymin et al., 2007). They are a must in transmitting complex knowledge, sharing of in-depth expertise but do not mediate new information (Palonen, Hakkarainen, Talvitie & Lehtinen, 2004; Ryymin et al., 2007). *Weak links* (ties) support knowledge exchange, and are adequate for performing easily describable, simple tasks. Palonen et al. (2004) claim that weakly linked teams are assumed to search for knowledge beyond their existing contacts. However, an opposing view has emerged in the field of sociological theory that stresses the 'strength of weak ties' (Granowetter, 1973 as cited in Jones, Ferreday & Hodgson, 2008). Accordingly, weak ties have been referred to as "an enabling factor in social activism and the building of 'social capital'" (Kavanagh et al., 2003 as cited in Jones et al., 2008, p. 92). This corresponds to the idea that weak ties make a network robust. Thus, seen from the networked learning perspective a network (learning community) with various weak ties is considered to be more stable than one in which strong links domineer (interactions to teachers and professors in learning communities), since the former type will 'survive' even if maintainers of strong ties would leave the network (while the other would probably be dissolved) (Csermely, 2005).

4.3.2 Recent studies in CSCL applying SNA

As indicated previously there has been a growing interest among educational researchers to apply SNA to map group interactions in CSCL. Ryymin et al. (2007) investigated communities of teachers' networked relations of using ICT. In their study, they assigned different patterns of networking to different actors; and found that there were a few central actors in the community who dominated technical and pedagogical knowledge transfer but these participants were not necessarily the socially central people in the network. Cho et al. (2005) investigated the relationships between communication styles, social networks, and learning performance in a CSCL community. They found that both individual and structural factors impacted the advancement of collaborative learning social networks, and that central actors in such a network performed better than participants on the periphery. Daradoumis, Martínez-Monés, and Xhafa (2006) applied a holistic model that describes online collaborative learning interactions in order to investigate the participatory aspects of the learning process, and identify the most effective groups together with the most dominant actors. Both Hara, Bonk and Angeli's (2000) and de Laat et al.'s (2007) studies showed that interaction patterns change over time thus providing opportunities for all the actors to become active participants. They also concluded that full participation in one phase might involve active learning but regulating (coordinating) discourse as well. Cognitive engagement was the focus of Zhu's (2006), and Russo and Koesten's (2005) studies with undergraduate and graduate groups of students. They proved that network prestige and centrality were predictors of cognitive learning outcomes. Lipponen et al. (2001)

analysed participation and quality of discourse in the case of elementary students' CSCL. Martínez, Dimitriadis, Rubia, Gómez and de la Fuente (2003) applied a mixed method in their research and found that the density of a network is strongly impacted by the activity of the online instructor. Similarly, Shen et al. (2008) when utilising SNA to investigate and understand sense of community in online learning environments, concluded that the instructor played a pivotal role in establishing sense of community.

4.4. Content Analysis

Micro level analysis of processes in the field of CSCL may focus on various research areas including social construction of knowledge, sociocognitive effects of CSCL, argumentation and inquiry processes that need professional scaffolding, apprenticeship in thinking, and so on (*Section 3.4.3* referred explicitly to numerous studies); and it may rely on various research methodologies such as interaction analysis, discourse analysis, content analysis, interviews, observations, and so on.

Stahl et al. (2006) claim that there is a strong need for understanding the process of social learning that manifests itself in the form of interactions among participants. Accordingly, collaborative learning processes should be visible (Lally & deLaat, 2002; Lipponen et al., 2004; Stahl, 2006), the interactions must be made available (for both participants and researchers) for further study. As argued previously, CSCL environments in this respect as well proved useful since they preserve records of interactions (the texts and the quantitative log data) thus they "turn communication into substance" (Stahl, 2005, p. 261).

4.4.1 Definition of Content Analysis

Berelson (1971) defines content analysis (CA) as "a research technique for the objective, systematic, and quantitative description of the manifest content of communication" (p. 18). Berelson claims that from this definition further assumptions can be made. It is assumed that inferences can be made about the relationships between intent and content or between content and effect. This implies that CA is carried out to describe "purposes, motives, and other characteristics of communicators as they are […] reflected in the content" or "to identify the […] effects of the content upon the attention, attitudes, or acts of readers and listeners" (Berelson, 1971, p. 19). It is also assumed that the study of manifest content (as unit of study) is meaningful since among the parties involved in the discourse there is a "common universe of discourse" (p. 19). Berelson's definition also implies the assumption that the quantitative description i.e. the frequency of occurrence of the respective characteristics of the content is a legitimate factor in understanding underlying processes.

Krippendorff (1980) argues for a different definition that deviates from that of Berelson's in a number of ways. According to his interpretation CA is "a research technique for making replicable and valid inferences from data to their context" (p. 21). Berelson's definition restricts the type of data to be analysed to 'manifest', which implies according to Krippendorff that latent contents are excluded from the analysis. Berelson's requirement to be 'quantitative' is also objected since as Krippendorff puts it "qualitative considerations turned out to be fundamental for the development of suitable algorithms" (p. 22). Thus, CA refers to more than the quantitative description of the communication content i.e. counting the frequency of certain features. Seen from this

perspective Krippendorff attempts to be explicit about the focus of CA. He claims that CA is "a method of inquiry into symbolic meaning of messages" since messages do not possess one single meaning but can be studied from different aspects. Accordingly, a message conveys "a multitude of contents" (p. 22). Symbolic character of messages refers to information that is neither directly conveyed nor observable. However, all symbolic phenomena present in communication data must be related to their context thus CA "must be performed relative to and justified in terms of the context of the data" (p. 23). Both Berelson and Krippendorff agree on the requirement of the technique to be replicable, objective, and systematic.

Neuendorf (2002) in her definition also underlines the importance of meeting the standards of the scientific method, which manifests itself in the following criteria: objectivity-intersubjectivity, *a priori* design, reliability, validity, generalisability, replicability and hypothesis testing. These criteria contribute to a description or explanation of a phenomenon that is free of biases of the investigator. An *a priori* design operates with preset variables and coding rules. Reliability in the case of CA translates itself to intercoder reliability. Validity is supported by triangulation. Generalisability and replicability are supported by leaving a clear audit trail of the methodology (Guba & Lincoln, 1981). Accordingly, in Neuendorf's interpretation, content analysis is "a summarising, quantitative analysis of messages that relies on the scientific method (including attention to objectivity-intersubjectivity, *a priori* design, reliability, validity, generalisability, replicability, and hypothesis testing) and is not limited as to the types of variables that may be measured or the context in which messages are created or presented" (p. 10).

4.4.2 Quantitative vs. qualitative content analysis

The distinction between 'quantitative' and 'qualitative' content analysis has been apparent in the above-referred definitions. In Riffe, Lacy and Fico's (1998) theory quantitative content analysis is "the systematic and replicable examination of symbols of communication, which have been assigned numeric values according to valid measurement rules, and the analysis of relationships involving those values using statistical methods, in order to describe the communication…" (p. 20). In the quantitative approach to CA, the communication is coded and the results are used for statistical comparisons and testing. Qualitative approach to CA uses methods such as participant observation, case summaries, and ethnomethodology to detect underlying processes in texts (Strijbos et al., 2006).

The difference between the two approaches can be better illustrated if their characteristics are contrasted based on the three crucial concepts of classic test theory: objectivity, reliability and validity. As concerns the first category, qualitative CA is less objective since as Berelson (1971) claims, it contains a higher ratio of non-content to content statements, and the interpretations are more frequently part of the analytic process as opposed to quantitative CA where interpretations most often follow the analytic procedure. Quantitative CA places restriction on complexity by breaking complex materials into components, whereas qualitative CA relies on the assumption that meanings 'operate' in the totality rather then in measurable units (Berelson, 1971). Hence, quantitative CA is more likely to meet the requirement of reliability. Concerning validity, qualitative CA utilises less formalised categorisations, it relies more on the presence-absence type of categorisation, whereas in quantitative CA the procedure is based on the differentiation, definition, and organisation of categories. Qualitative CA is

thus a less systematic and less precise analysis due to the absence of a rigid system of categorisation (Berelson, 1971).

Strijbos and his colleagues reinforce the difference between the two approaches by claiming that the former one requires a prospective analysis orientation, which means that a hypothesis is formulated in advance; while in the case of the latter one less explicit *a priori* assumptions are needed. The issue of reliability concerns both approaches: in the quantitative version, reliability has a numeric value indicating the agreement between two independent coders; in the qualitative approach, credibility is assured by "multiple analysts, comparing two or more interpretive perspectives of independent coders and/or triangulation with external sources or quantitative data (Strijbos et al., 2006).

4.4.3 Methodological issues in content analysis

Similarly to Neuendorf (2002), Rourke, Anderson, Garrison and Archer (2001) make the case that objectivity, reliability, replicability, and systematic coherence are crucial in CA. Objectivity should be preserved and instances of subjectivity and interpretive bias ought to be reduced, or eliminated. Reliability (especially in the case of quantitative CA) is preserved by attaining interrater reliability values. Replicability is considered to be the last stage in the continuum of reliability, which begins with coder stability (the given coder agreeing with herself/himself over time), then continues with interrater reliability (two coders agreeing with each other), and arriving at replicability (researchers applying the given coding scheme reliable in further distinct studies) (Rourke et al., 2001). Systematic coherence refers to "a more or less well structured set of ideas, assumptions, concepts and interpretative tendencies, which serves to structure the data" (Reber, 1995 as cited in Rourke et al., 2006, p. 13).

Nature of content

Berelson (1971), Neuendorf (2002) and Riffe et al. (1998) in their definitions make reference to the requirement of scientific objectivity standards that can be, according to them, maintained if CA is restricted to 'manifest content'. Manifest content is "on the surface and easily observable" (Potter & Levine-Donnerstein, 1999, p. 259) such as the frequency of a particular word in a written text. Krippendorff (1980) in his definition writes about latent content that is the underlying processes and less obvious meanings located under the surface. Potter and Levine-Donnerstein (1999) differentiate between latent pattern that refers to patterns in the content itself; and latent projective variables entail elements in the content that shift the focus of CA onto the coders' interpretation of the meaning of the content. Rourke et al. (2006) contrast latent projective variables with manifest content variables and latent pattern variables, in the case of which the target variables reside on the surface.

Detecting and measuring latent content is of interpretative character (Rourke et al., 2006). With the aim to preserve objectivity and reliability, latent variables are to be defined in advance and deduced to manifest indicators (Garrison et al., 2001; Gunawardena et al., 1997; Henri, 1991; Newman et al., 1995; Pena-Schaff & Nicholls, 2004; Weinberger & Fischer, 2005; Zhu, 1996; 1998) rather than identifying latent variables during coding.

Theoretical base of the instruments

De Wever et al. (2006) reinforce Rourke et al.'s (2001) idea that a systematic coherence must prevail when processing data. They claim that a theoretical base is inevitable in the process of creating the coding instrument for CA since the results should be tested against it. Theoretical base is also a way to support validity of the methodology, as De Wever et al. argue. Internal validity relates to the relationship between the concept and the operationalisation (Neuendorf, 2002). As De Wever formulate it, it refers to the "systematic coherence" between theory and the instrument (p. 9).

Potter and Levine-Donnerstein (1999) assign to theory three different roles: deductive, inductive, and no role. According to them, a formal scientific theory can guide the development of the coding instrument by assisting researchers to focus on aspects and values that are defined in theory. This is the deductive role. Induction is carried out if first observations of the content are made, and then statements of generalisations follow. Potter and Levine-Donnerstein also make reference to the third case when neither deduction nor induction is present. They argue that the aim of such studies is to describe something in the content being analysed.

Units of analysis

Identifying the parts/segments of a text that will be analysed and coded is the process of unitising. Rourke et al. (2001) distinguish five types of units. Researchers can opt for syntactical units i.e. each sentence is considered as a unit of analysis (Fahy et al., 2000). Paragraph or section unit is the second possible option (Hara et al., 2000). This method of unitisation reduces the number of cases (decisions) as compared to relying on syntactical units. Using the message as a unit of analysis is the third option (Garrison et al., 2000). Rourke et al. argue that taking the whole message as a unit has advantages: (1) units are objectively identifiable, (2) it produces a manageable set of cases, (3) it is a unit whose parameters are determined by the author of the message. Using thematic units is based on the idea of identifying a consistent 'theme' or 'idea' in the message. This is what Henri (1991) defined as 'unit of meaning'. The fifth option Rourke et al. refer to is relying on illocutionary units (Howell-Richardson & Mellar, 1996).

Choosing the unit of analysis is strongly connected to the context and should be considered in advance, since coding decisions and the outcomes are affected by any change in the unitisation (De Wever et al., 2006). However, Chi (1997) and Schrire (2006) refer to a dynamic approach to unitisation, which means that for the initial macro coding a coarser grain size is used, then in the second round of coding a finer-grained message unit is used.

Intercoder (interrater) reliability

Intercoder reliability is a crucial concern in relation to CA (Lombard, Snyder-Duch, & Campanella Bracken, 2002). As previously indicated, Rourke et al. (2001) argue that reliability can be seen as a continuum, which begins with intracoder reliability and then continues with intercoder reliability. They thus define intercoder reliability as "the extent to which different coders, each coding the same content, come

to the same coding decisions" (p. 6). According to Neuendorf (2002) there are two reasons why studies applying CA should report intercoder reliability: (1) to provide basic validation of a coding scheme, and (2) for the practical advantage of using multiple coders. The first reason underlines the importance of validation since "without the establishment of reliability, content analysis measures are useless" (p. 141). The second reason simply refers to splitting up the coding tasks among many different coders. De Wever et al. (2006) reinforce Lombard et al.'s (2002) views on intercoder reliability being paramount in CA research methodology, but add that a transparent and clearly described coding procedure can guarantee reliability of the research.

There are a number of indexes to use when reporting intercoder reliability ranging from 'liberal' to 'conservative' measurements: percent agreement, Holsti's coefficient of reliability (CR), Scott's Pi, Cohen's kappa, Krippendorff's alpha, and so on. We refer to Lombard et al. (2002) for a more in-depth discussion of the respective intercoder reliability measures.

Despite the paramount role of intercoder reliability in CA research, many studies do not report reliability measures. Lombard et al. (2002) refer to studies of meta-analysis in the field of mass communication, which indicate that approximately half of the studies do not make reference to the issue of intercoder reliability. In those studies where intercoder reliability indexes were produced, the usage of percent agreement prevailed. Krippendorff's alpha, Holsti's CR and Scott's Pi have been also used in less than 10% each. Thus, it is not without reason that "the most commonly used measure (…) is the simple percentage of agreement" but Cohen's kappa is "the most widely used measure of interjudge reliability across the behavioural science literature" (Perrault & Leigh, 1989 as cited in Lombard et al., 2002, p. 594).

Process of CA research

A contrastive description of the processes involved in the CA research can be delivered based on the continuum of complexity, where simplified techniques represent the first stage which are followed by more complex and detailed descriptions of functional steps on the continuum.

Rourke et al. (2001) suggest a simplified version of the CA method, a process consisting of four steps: (1) compilation of selections of transcripts or entire transcripts into text files, (2) creating a protocol for identifying and categorising the target variable(s), and training coders to use this protocol, (3) after the coding, the decisions are tested for reliability, and (4) the decisions are analysed either to describe the target variable(s), or to identify relationships between variables.

Chi (1997) described a more complex structure containing eight functional steps of coding and analysing verbal data: (1) reducing or sampling the protocols, (2) segmenting the reduced or sampled protocols, (3) developing or choosing a coding scheme or formalism, (4) operationalising evidence in the coded protocols that constitutes a mapping to some chosen formalism, (5) depicting the mapped formalism (optional), (6) seeking pattern(s) in the mapped formalism, (7) interpreting the pattern(s), and (8) repeating the whole process, perhaps coding at a different grain size (optional).

The most detailed description of the procedures involved in CA research is the ideal-typical processes presented by Neuendorf (2002) that consists of nine steps: (1) theory and rational including research questions and hypotheses (What content will be examined and why?), (2) conceptualisations (What variables will be used in the study?

How are they defined conceptually?), (3) operationalisations (internal validity, unit of analysis), (4) creation of coding schemes, (5) sampling, (6) training and pilot reliability, (7) coding, (8) calculation of final reliability figure, and (9) tabulation and reporting. Even though the preceding descriptions of the various CA techniques imply linearity in order as concerns the steps of data analysis, in reality this is not the case. The researcher must assess whether the actual step, at the given stage of the processes, is adequate and meaningful.

4.4.4 The development of instruments for content analysis

Henri's (1992) analytical framework is considered as the pioneering work among content analysis methods in CSCL research. Her framework addresses five dimensions: participative, social, interactive, cognitive, and metacognitive. The participative dimension is divided into two categories: (1) overall participation (total number of messages and accesses; duration of connection for educators and learners), and (2) active participation in the learning process (number of statements directly related to learning made by learners and educators). All the statements or parts of statement that are not related to formal content of subject matter belong to the social dimension of the framework. The interactive dimension first consists of two 'opposing' categories: interactive and non-interactive (independent) statements. The interactive dimension comprises explicit and implicit interactions. She distinguishes between two types of interactive messages: responses and commentaries. Accordingly, this dimension is made up of five categories: (1) direct responses, (2) direct commentaries, (3) indirect responses, (4) indirect commentaries, and (5) independent statements. The cognitive dimension entails five categories: (1) elementary clarification (observing or studying a problem, identifying its elements, and observing their linkages in order to come to a basic understanding), (2) in-depth clarification (analysing and understanding a problem to come to an understanding which sheds light on the values, beliefs, and assumptions which underlie the statement of the problem), (3) inference (induction and deduction, admitting or proposing an idea on the basis of its link with propositions already admitted as true), (4) judgement (making decisions, statements, appreciations, evaluations and criticisms, sizing up), and (5) strategies (proposing co-ordinated actions for the application of a solution, or following through on a choice or a decision). The metacognitive dimension consists of two categories: metacognitive knowledge and metacognitive skills. The former one entails the declarative knowledge concerning the person, the task, and the strategies. The latter one refers to the procedural knowledge concerning evaluation, planning, regulation, and self-awareness.

The central concept in Henri's (1992) framework is interactivity; she referred to units of meaning as units of analysis. Later on, Henri and Rigault (1996) have further developed it. Her model has been criticised because she did not test it empirically, neither did she report reliability measures. The vaguely defined categories on the basis of which the transcripts are to be coded also contributed to its weakness. Despite its shortcomings, it is the very first CA model to focus on social learning and the interactivity of individuals, and it is the most cited instrument and a starting point for adaptations in further studies such as Gunawardena et al., 1997; Hara, Bonk & Angeli, 2000; Newman et al., 1996; Pena-Schaff & Nicholls, 2004; and Zhu, 1996.

Based on Henri's (1992) and Garrison's (1992) model, Newman et al. (1995) developed a framework to measure critical thinking in CSCL. Their model relies on Garrison's five stages of critical thinking (problem identification, problem definition,

problem exploration, problem evalutation/applicability, and problem integration); and on Henri's (1992) cognitive skills. Newman et al. developed ten categories (along which postings were coded): relevance, importance of contributions, novelty of information, ideas and solutions, bringing in outside experience and knowledge to address the problem, ambiguities, linking ideas and interpreting information, justification of statements and solutions, and critical assessment of own or others' contributions, practical utility, and width of understanding. The method of coding units of analysis (that varied from phrases to paragraphs and complete messages) was the following: for each category, positive and negative indicators were formulated and a critical thinking ratio was calculated by counting the total positive and negative indicators, and converting the counts to a –1 to +1 scale. The instrument was tested on a small sample (three seminar groups with 10-20 participants in each) however the authors did not report reliability measures. Furthermore, Newman et al.'s method has been criticised for not having defined properly the unit of analysis, and the lack of adequate description of the coding categories.

Gunawardena et al. (1997) designed an instrument for examining social construction of knowledge grounded on Vygotsky's concepts. They refer to Henri's (1992) and Newman et al.'s (1995) models as a starting point in developing the framework for interaction analysis focusing on the hierarchical phases of social construction of knowledge (both on the individual and social level). They identified five phases of knowledge construction "reflecting the complete process of negotiation which must occur when there are substantial areas of inconsistency or disagreement to be resolved" (Gunawardena et al., 1997, p. 413). The first phase is sharing and comparing of information, which entails observations, opinions, agreement of participants, examples, clarifying statements and definition, description, or identification of a problem. Phase two is the discovery and exploration of dissonance or inconsistency among ideas, concepts or statements, which comprises identifying areas of disagreement, clarifying source of disagreement, restating the participants' position, or presenting advancing arguments. Phase three is negotiation of meaning and co-construction of knowledge, which consists of negotiation of meanings, identifying agreement, negotiation of new concepts, co-construction. The fourth phase is described as testing and modification of proposed synthesis or co-construction. Testing is done against existing cognitive schema, personal experience, formal data collected, and literature. The fifth phase consists of agreement statements or applications of newly constructed meaning, which comprises summarisation of agreements, application of new knowledge, and metacognitive statements illustrating new knowledge construction. Complete messages were taken as the unit of analysis, the coding was done by two independent coders, but no inter-coder reliability index was calculated. The instrument was tested on a large sample: 554 list subscribers who participated in an international debate organised for professionals. Despite the large number of testees, the context itself contributes to the weakness of the method since messages evolved in a highly-structured, formal debate among professionals. As Pena-Schaff and Nicholls (2004) claimed "it is not clear how well their findings would apply to the more organic discussions undertaken by students, who are themselves not yet proficient in the arts of persuasion and argument" (p. 247). Despite its weaknesses, the framework has been used in a number of studies (Kanuka & Anderson, 1998; Schellens & Valcke, 2005).

Fahy et al.'s (2001) study relies on the definition of interaction provided by Gunawardena et al. (1997). At the same time however, they criticised the 'predecessors' that the communicative richness of the transcripts has not been totally revealed since they used a very few interaction categories into which a large set of data had to be

coded. Thus, Fahy et al. applied a holistic approach, which means that the communicative situation was assumed greater then the "sum of the individual postings" (p. 2). Accordingly, they used social network analysis for mapping the structural features (density, intensity), and employed Text Analysis Tool (TAT) for analysing the interactional exchange patterns. TAT is based on five categories: questions (vertical, horizontal), statements (expository and referential), reflections, scaffolding, references/authorities (quotations and citations). The authors used the sentence in a message as unit of analysis, and reported both intracoder and intercoder reliability (Cohen's kappa). However, the study has been criticised because of the small group of participants (n = 13) working during 15 weeks in a graduate course.

Rourke et al. (1999) proposed an instrument for investigating social presence – one of the elements of the 'community of inquiry' (Garrison et al., 2001). Social presence in their interpretation is "the ability of learners to project themselves socially and emotionally in a community of inquiry" (p. 54). Its main function is to support the cognitive and affective objectives of the learning process: "social presence supports cognitive objectives through its ability to instigate, sustain, and support critical thinking in a community of learners", and it supports affective objectives by "making the group interactions appealing, engaging" (p. 54). The social presence model is based on three categories: affective (expression of emotions, use of humour, self-disclosure), interactive (continuing a thread, quoting from other messages, referring to other messages, asking questions, complementing, expressing agreement), and cohesive (vocatives, addressing group by using inclusive pronouns, phatics, salutations). Sentences were the unit of analysis in this study as well. They reported intercoder reliability measures (Holsti's CR) for both scenarios (n = 11, n = 14) the study refers to.

Garrison et al. (2001) investigated the cognitive presence component of the community of inquiry concept. In their view, cognitive presence reflects "higher-order knowledge acquisition and application and is most associated with the literature and research related to critical thinking" (p. 7). They propose a model of cognitive presence (grounded in the practical inquiry process), which consists of four phases: (1) initiation phase that is considered as the triggering event, (2) exploration phase involving brainstorming, questioning, and exchange of information, (3) integration phase in which meaning is constructed from the ideas generated in the first phase, and (4) resolution phase in which the dilemma identified in the first phase is resolved. Complete messages were considered as unit of analysis, Holsti's CR and Cohen's kappa were calculated as reliability measures. Despite the acceptable levels of reliability the small sample (n = 11 in two iterations) gave grounds for criticism.

The third component of the 'community of inquiry' model is teaching presence, which was investigated by a CA instrument newly developed by Anderson et al. (2001). In their concept, teaching presence is strongly related to the roles of a teacher: (1) a designer of the educational experience, (2) a facilitator and co-creator of a social environment, and (3) a subject-matter expert (p. 2). Anderson et al. operationalised the concept of social presence by taking into consideration the three above-mentioned roles the following way: instructional design and organisation, facilitating discourse and direct instruction. The theoretical framework in relation to various online teaching roles has been referred to in *Section 3.5.1* of the present study. As concerns the CA instrument the authors tested the tool empirically (n = 139), and reported intercoder reliability value (Cohen's kappa). As unit of analysis Anderson et al. opted for complete messages. We refer to *Section 5.4.6* of the present study for the overarching theoretical concept of the community of inquiry with special focus on the detailed definition of and research on cognitive, social and teaching presence.

Table 4.2 Overview of the referred content analysis instruments

Instrument	*Theoretical background*	*Unit of analysis*	*Intercoder reliability*	*Sample size*
Henri (1992)	Social learning and interactivity of individuals	Units of meaning	Not reported	Not reported
Newman et al. (1995)	Critical thinking	Varying from phrases, paragraphs to complete messages	Not reported	3 seminar groups 10-20 participants per group
Gunawardena et al. (1997)	Social constructivism	Message	Not reported	554
Fahy et al. (2001)	Social network theory and interactivity of individuals	Sentence	Cohen's kappa	13
Rourke et al. (1999)	Community of inquiry – social presence	Sentence	Holsti's CR	11 14
Garrison et al. (2001)	Community of inquiry – cognitive presence	Message	Holsti's CR Cohen's kappa	11
Anderson et al. (2001)	Community of inquiry – teaching presence	Message	Cohen's kappa	139
Pena-Schaff & Nicholls (2004)	Social constructivism	Sentence	Not reported	35
Zhu (2006)	Social constructivism and social network theory	Message	Code-recode and interrater procedures but no reported index	22 17 16 16

Pena-Schaff and Nicholls (2004) designed a tool to investigate learners' dialogical process of knowledge construction. Social constructivist learning served as a theoretical background to the study. In their study, they relied on both qualitative and quantitative approaches when analysing patterns of participation, interaction, and meaning construction. Their CA instrument consists of 11 items: questions, reply, clarification, interpretation, conflict, assertion, consensus building, judgement, reflection, support and other. To each category, indicators were developed in order to support reliable coding. In their study, sentences within messages were the unit of analysis. The number of participants (n = 35) and lack of reliability measures contributed to less reliable data.

Zhu (2006) proposed the Analytical Framework for Cognitive Engagement in Discussion, a CA instrument that incorporates the coding system "Note Categories and Interaction Types" previously developed by Zhu (1998) based on the theoretical framework of content analysis (Henri, 1992), and Bloom's (1956) cognitive domains of learning. Her tool focuses on questions, statements, reflection, mentoring and scaffolding. Zhu categorised questions into two types: vertical (seeking information) and horizontal (initiating a conversation). The statements were classified into six categories according to Bloom's learning hierarchy: responding (direct responses to previous messages), informative (anecdotal or personal information related to the general discussion topic), explanatory (factual information with limited personal opinion), analytical (thoughtful analysis), synthesising (summary of discussion messages and related readings), and evaluative (evaluative or judgmental opinions of discussion points) statements. Messages of reflection were grouped into two categories: reflective of changes and reflective of using cognitive strategies. Mentoring posts are in her definition those that "connect readings and responses in an attempt to demonstrate

processes or steps in understanding concepts and issues" (Zhu, 2006, p. 459). Scaffolding messages reflect help and guidance offered to participants. Similarly to Fahy et al. (2001), Zhu (2006) applied social network analysis when analysing properties of the interactions as constituents of a network. Complete messages were the unit of analysis. The framework was tested empirically in two undergraduate groups (n = 22, n = 17) and two graduate groups (n = 16, n = 16). Zhu (2006) claimed that "great effort was made to avoid the subjectivity in assigning levels of cognitive engagement to discussion messages and to reach objectivity in content analysis for this study" (p. 456). Two coders participated in the coding (one of them being the researcher). Inter-coder reliability measures were not reported, the author only indicated that about 8% of the messages had to be discussed and re-coded after the two coders' consultation. Zhu also added that in order to ensure objectivity (intracoder reliability) she re-assigned codes 12 months later, this time codes of 1.2% of the messages had to be re-adjusted.

5 THE PRESENT STUDY – RESEARCH DESIGN, PARTICIPANTS, DATA COLLECTION INSTRUMENTS AND PROCEDURES

5.1 Research design – a mixed methodology approach

Research into understanding the complex phenomena of CSCL requires a methodological approach that allows for integrating multiple perspectives. As stated in the previous chapter, the application of both purely quantitative and qualitative methods has advantages and shortcomings. We claimed that quantitative and qualitative methodology and data elucidate a research problem from different perspectives.

In the present study, a combined qualitative and quantitative research approach was utilised. The reasons for the mixed methodology approach are various. Firstly, the novelty and nature of the subject matter requires a thorough description of the agents involved and the interplay of events and also an in-depth multi-perspective analysis of the underlying processes. Secondly, the multiple sources of data that are available in a CSCL environment account for and justify the application of multiple research methodologies. Thirdly, using a combination of qualitative and quantitative methods also increases the validity of the results (Creswell, 2007).

The quantitative approach prevailed in the choice of research instruments. The applied participant satisfaction and communication questionnaire is a survey instrument based on quantitative traditions. Quantitative data constituted the basis for the micro and macro level analysis of the online interactions as well. SNA was used for the macro-level analysis of quantitative surface data. In the content analysis, the latent content of the online interactions was coded into categories on the basis of a pre-defined coding scheme and indicators, and then the results were quantified. Thus, the three research instruments involved contributed to the collection and analysis of quantitative data. However, as an overarching research design the (multiple) case study approach (Creswell, 2007; Merriam, 1998; Stake, 1995; Yin, 1994) was utilised (as opposed to large-scale assessment). The reason for using a case study research design lies on one hand, in the theoretical foundations of the subject matter, and on the other hand in the characteristics of the method itself. As indicated in the previous chapters, the subject matter is grounded in the theories of social learning, central to which are the collaborative interactions. In has been also stated that understanding underlying processes in CSCL environments entails a zoom in interactions among the participants. This focus of attention on group processes and interactions can be best sustained in small group collaborations, which implies qualitative research traditions.

The case study approach allowed for a research design, which integrates multiple research perspectives zoomed in a complex phenomenon. By its nature, case study can be based on any mix of quantitative and qualitative data. It "supports and accommodates any and all methods of gathering data, from testing to interviewing" (Merriam, 1998, p. 28). It is a research strategy that "comprises an all-encompassing method – with the logic of design incorporating specific approaches to data collection and to data analysis" (Yin, 1994, p. 13). Case study supports a holistic view on processes, it is a research design suited to investigating situations in which it is impossible to separate the phenomenon's variables from their context (Yin, 1994). Thus, it offers a means of investigating complex social scenarios consisting of multiple variables in understanding the phenomenon.

It best suited the aims since it is anchored in real life; it focuses on a particular situation, event, program, or phenomenon. Its product is a rich, thick description of the phenomenon under study i.e. the complete, literal description of the incident or entity being investigated; it is heuristic in the sense that it can bring about the discovery of new meaning; and it investigates the process (Merriam, 1998). In this context, the process encompasses two interpretations: "the first meaning of process is monitoring: describing the context and population of the study, discovering the extent to which the treatment or program has been implemented, providing immediate feedback of a formative type, and the like. The second meaning of process is a causal explanation: discovering or confirming the process by which the treatment had the effect that it did" (Reichardt & Crook, 1979 as cited in Merriam, 1998, p. 33). Accordingly, it is a method appropriate for answering the research questions of 'how' and 'why' (Yin, 1994). Case study design has proven extremely useful in studying educational innovations since it can bring about understanding that may affect and improve practice (Merriam, 1998).

As indicated above multiple case study approach was utilised, which entails a study using more than one case. A multiple case study design involves collecting and analysing data from several cases. As Merriam (1998) argues "the more cases included in a study, and the greater the variation across the cases, the more compelling an interpretation is likely to be" (p. 40).

5.1.1 Issues of validity, reliability and generalisability

Due to the overarching case study approach, issues of validity, reliability, and generalisability are discussed from a qualitative research perspective. Internal validity refers to whether the research findings match reality and whether investigators really measure what they think they are measuring. However, qualitative research is based on a paradigm that reality is holistic, multidimensional, and in constant change (Merriam, 1998). Accordingly, internal validity, in case study research, is best maintained if the investigator managed to demonstrate multiple constructions of reality as thoroughly as possible. Creswell (2007), Guba (1981), and Merriam (1998) suggest various strategies to enhance internal validity, out of them triangulation was used in the present study (for the definition see *Section 4.1.1*). There are four types of triangulation according to Patton (1987): (1) data source triangulation, (2) investigator triangulation, (3) triangulation of perspectives on the same data (theory triangulation), and (4) method triangulation. Two types of triangulation were applied in the present study: data source triangulation and methodological triangulation. With such triangulation both internal validity and construct validity issues can be addressed since in the latter case multiple sources of evidence provide multiple measures of the same issue being investigated.

Reliability refers to the replicability of the study, more precisely, whether the study with the same research methodology would be conducted all over again, it would yield the same results. Merriam (1998) argues that similarly to the issue of internal validity, reliability is also problematic in social sciences since human behaviour is never static. She claims that reliability is based on the idea that there is one single interpretation of reality and investigating repeatedly would result in the same outcomes (this was followed in the concept of traditional experimental research). Nevertheless, reliability can and should be maintained in case study research. Two techniques were utilised in order to sustain reliability in the present study: the previously mentioned method of triangulation and audit trail i.e. the investigator describes as accurately as

possible the research process including the data collection methods and decisions that were made in the inquiry (Guba & Lincoln, 1981).

External validity is concerned with the generalisability of the study. In other words, the main question is whether it is feasible to make general statements from a case or from qualitative inquiry in general. Hence, generalisation of the findings in qualitative social science research has been questioned (Cronbach, 1975; Stake, 1995). Nevertheless, the researcher relied on Merriam's (1998) suggestions and provided for the possibility of generalising results of the current study. The strategy of using many cases to study the same phenomenon was utilised since the multi-case or cross-case analysis (and applying the same research procedures) enhances the generalisability of findings. In keeping with this statement, the study reported here was a multiple-case study.

5.2 Research questions and hypotheses

As indicated in the *introductory part*, the empirical study focuses on the online instructor roles and the effects of the online mentoring, teaching and learning process in CSCL environments in communities of pre- and in-service teachers. When studying the online instructors' activity we considered their participation in the online interactions, the influence of their activity on learners' engagement and patterns of interaction, and their varying facilitating styles. Effects of the online mentoring, teaching and learning process refer to the investigation of pre- and in-service teacher communities' perceptions of the learning experience and the analyses of the interrelation of the elements in the online mentoring, teaching and learning events in the CSCL environments.

Based on the previously described research problem, the following research questions were identified:

- What are the elements that influence participant satisfaction and self-perceived learning success in the online mentoring, teaching and learning process in the CSCL environment? How are these elements interrelated? What are the barriers and drivers of learner satisfaction?
- What are the effects of the online mentoring, teaching and learning process in the CSCL environment – with special focus on the facilitator's activity (their roles and facilitative approaches)? What types of mentoring functions did online facilitators provide?
- What is the nature of a model for mentoring and facilitating online learning in a CSCL environment in the communities of pre- and in-service teachers?

For the reasons described in Section 5.1, the current study uses a *mixed method* strategy as suggested by current CSCL research. We relied on hypothesis testing i.e. theoretical assumptions were formulated *a priori*, and hypothesis generating i.e. data-driven findings based on *a posteriori* analyses. The employed research instruments contributed to the collection and analyses of quantitative data however, as an overarching research design, the multiple case study approach was used. Applying mixed method strategies implies that researchers are willing to use and experiment with methodologies that are not part of their repertoire and that they are unreserved towards a method (Strijbos & Fischer, 2007). Based on this and the novelty of the study in the

Hungarian context, one of our aims was to develop and test new methodologies, which lead to the inclusion of our previous "scientific assumptions" in one of our hypotheses.

Table 5.1 Research hypotheses, data types and treatment of data

	Hypothesis	***Data type***	***Treatment***
H1	Online communication has a direct impact on participant satisfaction and self-perceived learning success experienced in the online mentoring, teaching and learning process in the CSCL environment.	Survey	Quantitative
H2	Facilitator's activity has an influence on online communication in the mentoring, teaching and learning process in the CSCL environment.		
H3	Perceived social presence and online communication are interrelated phenomena and mutually impact each other in the mentoring, teaching and learning process in the CSCL environment.	Social Network Analysis	Quantitative
H4	Facilitator's activity has an impact on perceived social presence in the mentoring, teaching and learning process in the CSCL environment.	Content Analyses	Quantified qualitative analyses
H5	Online communication in the mentoring, teaching and learning process in the CSCL environment impacts participants' cognitive presence.		
H6	Developing and testing a mixed method research strategy in a CSCL environment through in-depth multi-perspective analyses allow for fine-tuning survey results.		

5.3 Research design – general procedures and timeline

The cases involved in the present study were undertaken by using multi-site design. It involved sites provided in the framework of the international Calibrate project of which the validation team was led by the Centre for Multimedia and Educational Technology (MULTIPED), at the Faculty of Sciences, ELTE University, Budapest, Hungary, and sites provided by the Department of English Language Pedagogy (DELP) of the School of English and American Studies, Faculty of Arts, ELTE University, Budapest, Hungary. The total number of cases is eight out of which two were designed and implemented at the MULTIPED site, and six were undertaken at the DELP site. Figure 5.1 demonstrates the timeline and the sites where the research was executed.

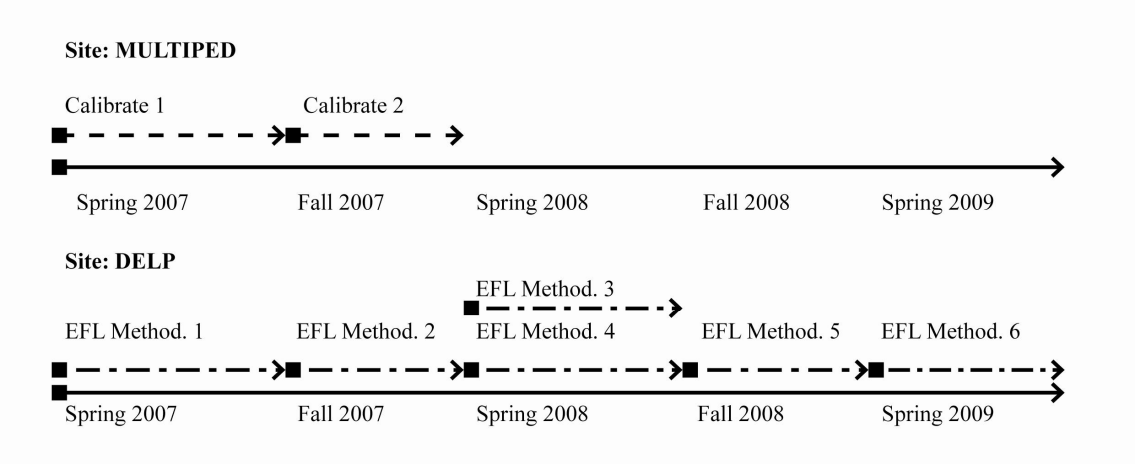

Figure 5.1 Cases involved in the study: timeline and sites

The first phase of the Calibrate project (Calibrate 1) was carried out from March until May 2007, the second phase (Calibrate 2) was undertaken in the period of October 2007 and January 2008. The DELP site cases lasted three months each, respectively either in the Spring or Fall semesters. As indicated in Figure 5.1, in Spring 2008 two cases were undertaken parallel to each other at the DELP site. Detailed description of the participants and the circumstances will be delivered in Section 5.4 of the present chapter.

5.4 Participants

5.4.1 Participants at the MULTIPED site

The Calibrate project

The Calibrate project (http://calibrate.eun.org, 2005-2008) was a European project supported by the Information Society Technologies (IST) Programme in which eight Ministries of Education linked their national digital learning content repositories, investigated new intelligent search functions like curriculum mapping of resources, and established a new multicultural and multilingual open source web community for finding, authoring and sharing learning resources. Work on the European Learning

Resources Exchange (LRE) involved the syndication of national learning resource repositories, collaborative evaluation of learning objects and resources retrieved from the repository with the help of a sophisticated search system, upload of adapted, modified or individually developed learning resources by teachers. Accordingly, users took an active part in developing the digital content repository and engaged in collaboration around shared digital objects (the resources and tools included in the federated system of national digital content repositories) that changed (improved) in the course of use, adaptation and evaluation by teachers. Instead of only evaluating digital tools and learning materials – the usual assessment method for ICT based educational innovations – teachers were asked to form discipline-based educational innovation communities, and associate educational methods best suited to the resources they found in the LRE (Kárpáti & Blamire, 2008).

Participants of the cases Calibrate 1 and Calibrate 2

In Calibrate 1 (the first iteration), 23 Hungarian in-service teachers worked in collaboration with their colleagues, pupils, facilitators and educational researchers in the framework of introducing the European Learning Resources Exchange (LRE) (The original size of the sample at the kick-off was larger however, the participants considered in the present study were those who were willing to take part in the further (more in-depth) analysis of the CSCL environments used in the project.) In Calibrate 2, 20 in-service teachers collaborated. (For information about the participants see *Table 5.2*) In Calibrate 1, the community of in-service teachers collaborated in small domain- and subject-specific groups (Mathematics, Science, Humanities and Foreign Languages), while in Calibrate 2 all the in-service teachers constituted one large group of professionals. In both iterations, the participants searched and evaluated the repository and identified learning objects (simple elements to be used flexibly in different cultural contexts) and learning assets (complex learning materials that are curriculum-related and may contain cultural characteristics to be adapted or accepted) useful for teaching practice.

Table 5.2 Basic information on the participants in the MULTIPED cases

	Male	***Female***	***Primary school***	***Secon-dary school***	***Not from the capital***	***From the capital***	***Mathe-matics/ Informa-tics***	***Science***	***Foreign languages***	***Humani-ties***	***TOTAL***
March –May 2007	3	20	9	14	16	7	5	7	7	4	23
October 2007 – January 2008	4	16	5	15	9	11	10	5	2	3	20

CSCL environments in Calibrate 1 and Calibrate 2

In Calibrate 1, activities were hosted in the Future Learning Environment (FLE3), which is an asynchronous groupware system designed for supporting collaborative knowledge building and progressive inquiry in educational settings (Lakkala et al., 2005). FLE3 is the third version of a web based, open source software to support CSCL

developed by the Learning Environments for Progressive Enquiry Research Group of the University of Industrial Arts Helsinki (http://fle3.uiah.fi). In the Hungarian cases, the software was used with a Hungarian interface (Főző, 2006). The platform consists of three main parts: Webtop (Kuckó), Knowledge Building (Tudásfa), and Jamming (Ötletház). Webtop is the registered participants' own personal 'territory' where the user profile, basic data and the personal documents are stored. However, all the information available on Webtop is public for the participants. It is Jamming where small-group brainstorming is done. The Knowledge Building module provides threaded discussions (forums) for joint activities in order to develop common ideas. In the investigated case, a new forum was founded for each question or problem. The comments and messages were visible to all members of the same group i.e. to the members of the same domain, or subject-specific group.

In Calibrate 2, the community platform and social software LeMill, newly developed for the support of the repository, was used in the process of collaboration**.** LeMill (www.lemill.net) provides a platform for collaborative knowledge building. It may be used for finding, authoring and sharing learning resources, but may also be utilised as a site for international professional co-operation among members of an international community of teachers. It is an educational version of a Web 2.0 site, where resources can be freely used, tagged, adapted and uploaded in an adjusted version and shared with the community members (Kárpáti, 2009).

Both CSCL environments played a crucial role in the collaborative processes and the mentoring events, since they served as an appropriate platform of learning and sharing ideas, materials and practices within the community that consisted of in-service teachers located in different parts of the country. Thus, communication and exchange of information was carried out exclusively on these platforms in the form of collaborative knowledge-building discourse. However, besides establishing flexible tool mediation in regard to collaborative work, the CSCL environments also proved an effective tool for providing help in the research and the data analysis processes.

Instructional context to facilitate CSCL and innovation in Calibrate 1 and Calibrate 2

We refer to the *Mentored Innovation Model* (*MIM*) as the instructional context in both iterations of the Calibrate project. As opposed to the traditional (dialogical) model for innovation (where the researcher and the teaching staff are assigned the role of the exclusive 'source of information and knowledge', and teachers, similarly to course participants, are required to acquire certain skills and pedagogical methods or content), MIM is based on the collaboration of professional teachers around shared objects which, in the case of the Calibrate project, is an innovative educational program. MIM is integrated in school practice and has a spiral structure (contrary to the traditional dialogical model that is linear) where cycles of exploration, learning and creation of new knowledge are iterated on higher levels.

MIM is a professional development experience and a competence enhancement process at the same time in which innovation is combined with training based on the following features:

1. *Identification of pedagogical and methodological issues* which require assistance from and collaboration with groups of teachers, researchers or educational developers.

2. *Creation of a joint research agenda and development plan* that is negotiated with further agents of the innovation process (school management, parents etc.)
3. *Provision of professional support* for the involved parties in the form of mentored training (*mentoring*) that constitutes the process of pedagogical innovation.
4. *Mentoring and innovation processes are intertwined* in the framework of design-based research.
5. *Cognitive tools* are applied in the realisation, documentation and assessment of the innovation. (Tools such as virtual learning environments, CSCL environments, process folio, and so on).
6. *Dissemination is processed at both research community level and local educational (institutional) fora.* It is organised in a variety of forms where both teachers and researchers may act as innovators and mentors for new adaptors of teaching programs.

In the referred cases, facilitators or e-moderators were responsible for organising the professional development experience and maintaining the MIM (for definition on mentoring, facilitator and e-moderator see *Section 3.5*). In Calibrate 1, one e-moderator facilitated the work of the four small domain-, subject-specific groups (4-7 teachers in a group), while in Calibrate 2, one facilitator took the responsibility for the mentoring and innovation processes.

5.4.2 Participants at the DELP site

At the DELP site six cases were undertaken as indicated by Figure 5.1. The participants in each case were undergraduate students of the School of English and American Studies participating in an English Language Teaching (ELT) methodology course organised in the following semesters: Spring 2007, Fall 2007, Spring 2008, Fall 2008 and Spring 2009. (For the detailed description of the participants, see *Table 5.3*)

Table 5.3 Basic information on the participants in the DELP cases

Semester	***Major***		***Sex***		
	American Studies Program	***Teacher training program***	***Male***	***Female***	***Total number of participants***
Spring 2007	8	12	1	19	20
Fall 2007	12	8	6	14	20
Spring 2008a	14	4	4	14	18
Fall 2008	18	3	6	15	21
Spring 2009	16	3	7	12	19
Spring2008b	N/A	N/A	4	14	18
TOTAL	68	30	28	88	116

In Spring 2007, Fall 2007, Fall 2008 and Spring 2009, the undergraduates attending the course came from different programs: the majority participated in the American studies program (and as an additional agenda decided to do the teacher training modules), the remainder attended a pre-Bologna college-level teacher training programme. In Spring 2008, two cases were organised parallel to each other. One of the groups involved exclusively graduates who had previously obtained their first diplomas

in the pre-Bologna college-level-program, the other group was constituted of undergraduates. The courses lasted for 12 weeks each.

CSCL environments in the ELT Methodology cases

The central Moodle platform of the Faculty of Education and Psychology, ELTE University was used in all ELT Methodology cases (https://elearning.elte.hu). The choice as regards the CSCL environment is justified by both practical and pedagogical reasons. This platform was advantageous for the practical reason that students did not have to register a second time for the Moodle course, but once they had registered for the course within the university's electronic administration system (ETR), they were automatically participants of the course on the platform as well. The pedagogical justification lies in the constructivist philosophy of Moodle, which is grounded in the theories of social learning (see *Chapter 2*). Many features are designed in line with the referred educational paradigm, which is operationalised in four 'simple' concepts in Moodle according to Rice (2007): (1) learners acquire new knowledge as they interact with their environment, (2) students learn more when they construct learning experiences for others, (3) when becoming part of a culture, students are constantly learning, and (4) freedom of choice as regards constructed behaviour (e.g. objective and factual, or more subjective approaches). Accordingly, in the cases, the most frequently used applications (besides the more static functions such as upload and download) were: the asynchronous forum and the wiki. Upload and download included all sorts of documents, from word documents to video files.

Main pedagogical characteristics of the ELT Methodology cases

The ELT Methodology cases were based on a blended design – combining online and face-to-face (F2F) instruction. More precisely, the referred cases relied on course-level blending, which is the most common way to blend by combining distinct F2F and online activities as part of a course (as opposed to the option of activity-level blending where a course activity entails both F2F and online elements) (Graham, 2005). The online component of the courses was based on modules i.e. two broader topics that were not included in the curriculum of the face-to-face seminars with a series of tasks for smaller groups within which every member was responsible for the initiation and/or the summary of a discussion or putting together a 'group product'. As a result of online collaboration, the groups prepared a 'final product' (*course object ~ learning object*) jointly. The discussions in each thread were planned to be rounded off by a summary of the main arguments and ideas (*group cognition*). At the end of the module self-evaluation and peer evaluation was requested (*reflective approach*). The subject of the online modules was connected to ELT methodology (e.g. evaluation in English as a Foreign Language (EFL) classroom context, usage of ICT tools in EFL classes). The modules were constructed of *well-structured* and *ill-structured* activities respectively (Strijbos et al., 2004) as follows:

1. Introduction to the topic of the module (e.g. reading a short, motivating text) – well-structured activity
2. Online discussion of first impressions (e.g. collecting pros/contras of a method) – ill-structured activity

3. First readings – well-structured activity
4. Open-ended questions to discuss within the group (one group member responsible for opening and closings i.e. kick-off and summary of the main arguments/ideas collected jointly) with the e-moderator 'present' in each thread – ill-structured activity
5. Discussion forum/wiki exclusively for creating the group product – ill-structured activity
6. Evaluation of the group-product, peer-evaluation, self-evaluation.

The ELT methodology cases were carried out as an addition to the established, rather rich curriculum of the course (topics of ELT methodology, microteaching, observation, etc.). The students processed modules (coherent task series) on the online platform on methodology related topics, which were not dealt with during F2F sessions. However, the aim was to maintain an effective combination of enhancing blends and transforming blends. *Enhancing blends* do not radically change the form and methodology of learning and teaching as it used to occur without the online component, and they encompass additional resources and supplementary materials added to the curriculum. *Transforming blends* allow for radical transformation of the pedagogy in use, which provides for activities in which learners are engaged in an intellectual activity that was not possible without the technology (Graham, 2005).

Each study group was divided into three-four smaller groups of 4-5 students since from a research point of view collaboration and interaction in small groups are more traceable, and intersubjective learning, knowledge building and the formation of group interactions are more observable (Stahl, 2003).

The instructional context to facilitate CSCL in the ELT Methodology cases

In the ELT Methodology cases, an adjusted form of the MIM was employed. Mentoring events in blended learning courses are organised so as to initiate novices to a professional culture, and create or share artefacts through interactions with peers and experts. It encompassed most of the previously described features of the MIM: (1) identification of pedagogical and methodological issues, (2) creation of a joint research agenda and development plan (within the small groups) (3) provision of professional support in the form of mentored training (mentoring by facilitators) (4) mentoring and innovation processes are intertwined (innovation referring to innovative ways of applying technology in EFL classrooms) (5) cognitive tools are applied and (6) dissemination in this case is done at study-group level. The adjusted MIM model involves role modelling: the roles of the practicing teacher (teacher trainer), educational researcher and the educational policy maker are modelled for pre-service teachers, who follow the process of making curricular decisions, planning for authentic teaching and learning processes, collecting, creating or adapting digital and traditional teaching aids (Dorner & Major, 2007; Dorner & Major, 2008).

In the light of the above, the pre-defined instructional aims, which according to Strijbos et al. (2004) belong to the category of 'open skills', included the following broadly formulated items: students should have the opportunity to (a) become aware of their own beliefs and attitudes to education and recognise alternatives, (b) get to know theories of online communication and collaboration, (c) discuss and argue about theories, (d) apply theory in realistic situations, (e) discover and try out the communication and collaboration possibilities offered by the online platform, (f)

experience small-group collaborations, (g) acquire and develop skills and procedures relevant and inevitable in this working mode, and (h) give reflective feedback on the online mentoring process and on the facilitators' contribution.

5.5 Data collection instruments and procedures

As indicated previously, two types of triangulation were applied in the present study: data source and methodological triangulation. The data collection instruments and methods involved are as follows: the ICT-metrics tool (Instrument 0), the participant satisfaction and communication questionnaire (Instrument 1), social network analysis (Instrument 2), and content analysis (Instrument 3). Accordingly, the various methods and instruments were utilised to investigate data from various sources. Both the ICT metrics and the satisfaction questionnaire rely on data gained by directly surveying the participants (Source 1). In the macro-level analysis of interaction patterns, SNA relies on quantitative (surface-level) data gained from the *a posteriori* analysis of evolving interactions in the online learning process (Source 2). Content analysis allows for an *a posteriori* micro-level analysis of online interactions – the texts created by the participants in the online learning process (Source 3).

The participants received the questionnaires in Hungarian, thus the versions attached are the English translations. Each survey was accompanied by instructions to assist participants in completing the questionnaires, a statement as to the purpose of the study, and a confidentiality statement informing them as to how the data would be used and reported. Anonymity of respondents (participants) was guaranteed in the case of all the three data collection instruments.

5.5.1 ICT-metrics for measuring participants' ICT-use

ICT-metrics is a research tool, which describes the (individual) participants' (teachers' and/or learners') ICT-use – originally by five indicators: ICT-access at home, ICT-access at school, ICT competence, level of involvement in ICT-use and attitudes towards ICT-use (Török, 2007) (www.infoiranytu.hu).

However, due to the focus of the present study and the objectives of utilising the tool the ICT-metrics was adjusted (*Appendix 1*). Accordingly, data only on the participants' ICT competence (how confident the participants felt performing various tasks on a computer) were considered. In the original framework, this was the third indicator. Items belonging to this indicator were divided into two categories: items focusing on (1) skills and competencies involved in the general computer usage (SZHK) and (2) Internet abilities (IHK) that were treated separately. In addition, as regards the calculation of indexes a slightly altered method was utilised. Instead of further relying on the simplified version of the computed values by rather arbitrarily creating four levels of indexes (indicating values in the low, medium, high and zero range) as suggested originally, we applied statistical means on a 1-5 scale in order to yield a single index for the two separate variables of SZHK and IHK.

The aim of involving the ICT-metrics as a data collection instrument in the present study was to create variables (attributes) that can be further used in the process of developing the Kano-model (see *Section 4.2.2*). Consequently, results will only be displayed in the model.

5.5.2 Participant satisfaction and communication questionnaire

The survey instrument (*Appendix 2*) used for investigating and developing a model of participant satisfaction consists of three parts. The first section of the survey consists of 25 Likert-type items designed to assess participants' perceptions of the mentoring, teaching and learning process. These items used a 4-point response scale (strongly disagree, disagree, agree and strongly agree), respondents were asked to rate their agreement with the statements included. Four variables were obtained from this section of the survey: (1) participants global satisfaction, (2) satisfaction with the facilitator's activity, (3) online communication in the CSCL environments, and (4) the participants' perceived social presence. The items concerning social presence were adapted from social presence scales employed by Gunawardena and Zittle (1997), Richardson and Swan (2003), Picciano (2002), and Swan and Shih (2005). The second section of the questionnaire included statements that aimed at evaluating the CSCL environment in use. (These items focused on information that was considered in the development and modification of the CSCL environments and less in modelling participant satisfaction. They were a source of feedback for developers and maintainers since both at the MULTIPED and DELP site, the CSCL environments' functions and services were constantly monitored.) The third part included questions eliciting demographic and other potential confounding variables (gender, age, previous online experience, proficiency in navigating, time spent in online discussion, and so on).

Procedure

Satisfaction was explored by relying on the perceived (subjective) values provided by the participating respondents. The questionnaire surveyed participant satisfaction by rating it with the above-named four constituents. However, variables of these constituents do not influence participant satisfaction to the same extent. Thus, instead of employing statistical means and relying on normal distributions for further analyses, multi-regression data analysis was employed. The aim was to depict the perceived importance of the constituents and their variables that have an assumed impact on participant satisfaction. During the analyses, both dependent variables that quantify the respondents' perception of the constituents of the online learning experience and mentoring events, and independent variables were created. We obtained four separate variable groups on the basis of the above constituents. Each variable group contains one dependent and various independent variables. In the first phase of the regression analyses, we focused on investigating the extent to which the independent variables affect the dependent variable.

The following procedure was carried out in the case of all the four constituents of the model. The 4-scale ratings were converted to a 0-100 scale in order to yield single scores for each variable. Regression analyses were computed and significant items were indicated – with the respective importance values. Importance value is used to calculate satisfaction indices that measure the quality of the online learning experience and the mentoring process by incorporating the participants' judgement in a weighted form. Variables of the MIM with significant impact affect satisfaction proportionate to their importance. On the basis of the importance values, global indexes were calculated referring to the four constituents. In the second phase of regression analyses, these indexes were employed to build explanatory models, which elucidate the relations between the four components, and to measure the quality of the online learning

experience and the mentoring events in the Kano model (see *Section 4.2.2*) by incorporating participants' judgement in a weighted form. Explanatory models are outputs of categorical regression by optimal scaling provided by the statistical software SPSS. Important to the series of multi-regression analyses and model building are the following values. *Adjusted R^2*, or *total variance* refers to the explanatory power of the model. It is a value ranging between 0 and 1, it is proportionate to the part of variance of the dependent variable that is explained by the independent variables. It is claimed that the higher the R^2, the "stronger" the explanatory power of the model. *Beta-coefficient (β)* refers to the extent any of the independent variables impacts the dependent variable. A higher β corresponds to a higher impact. *Importance* is the most easily interpretable coefficient of the independent variables that equals the part of R^2 explained by an independent variable. *Contribution* or *overall importance* relates to the effective importance (impact) of any independent variable on the dependent variable. It is calculated by multiplying the R^2 by the importance value. Variable groups were computed for internal consistency using Cronbach's Alpha.

In the case of the MULTIPED sites, the language of the questionnaire was modified to correspond with the framework provided by the Calibrate project.

5.5.3 Macro-level analysis of interaction patterns: Social Network Analysis

In the present study, SNA was utilised to map online interaction patterns at the macro level. Social network analysis was undertaken *a posteriori* the interactions had evolved in the process of online collaboration and the mentoring, teaching and learning processes. The aim was to identify patterns of relationship among the participants who were assumed to constitute a learning network. More precisely, the quantification and visualisation of the interaction patterns with special attention to the position and parameters of the facilitator was provided. Results of the SNA were intended to complement findings of the participant satisfaction survey and the content analysis. (For a detailed description of the method, see *Section 4.3*)

Procedure

The networks in the study included directed (direction of relations is indicated) and valued (intensity of relations is indicated) graphs. Both the egocentric and the sociocentric approach were undertaken. Egocentric approach i.e. mapping links surrounding a particular member of the network was needed to investigate the position and the impact of the facilitator. However, structural patterns of interaction between members within a *network as a whole* were also investigated, and network measures were provided. The two widely used indicators 'density' and 'centrality' measures were calculated: density referring to the overall connections of the members of the community, and centrality values providing data about the behaviour of the respective participants. In the case of each group member, in-degree and out-degree values were computed characterising the position of the participants within the network. Network centralisation was also calculated in order to study how tightly the network was organised around an individual member. Accordingly, weak and strong ties were detected respectively.

At the MULTIPED site, two networks were analysed by using SNA. In the first iteration, out of the four domain-, and subject-specific groups the network of foreign

language teachers (n = 7) was analysed in order to detect small-group-specific characteristics. As a contrast, in the second iteration the relations within the whole (large) group (n = 20) were investigated. At the DELP site, SNA was utilised in all the six cases. Participants of the six cases were further divided into small groups of 4-5 students. Interactions evolved among the members of these small groups (3-4 groups per case).

At both sites, in all cases, discussions took place in numerous threads (descriptive statistics will be provided in the *Results and Discussion* part). SNA was undertaken in the case of each discussion thread however, in order for the researcher to be able to manage a reasonable amount of data, obey paper length restrictions and keep the focus of the present study (which is not to follow the changes of interaction patterns in the case of each small-group and each thread), the *overall network patterns* that consider all the relations that evolved throughout the learning experience, mentoring events, and the respective data will be presented and analysed. The SNA software UCINET 6 was used in the process of data analysis.

5.5.4 Micro-level analysis of interaction patterns: Content Analysis

At the micro-level analysis of online interaction patterns, content analysis (CA) was employed in the present studies (for a detailed description of the method see *Section 4.4*). Micro-level analysis entails the in-depth analysis of online interactions by applying a content analysis framework, which in the current study was an adjusted version of Garrison, Anderson, and Archer's (2000) model (and indicators) of a community of inquiry. In the following, the employed CA framework will be elaborated in detail with special focus on the methodological issues such as theoretical base of the instrument, unit of analysis, intercoder reliability, and procedure.

Theoretical base of the instrument

As stated above the overarching theoretical base of the applied CA instrument is the community of inquiry (CoI), which is grounded by the many combinations of interaction among agents of the online learning (for definition and forms of online interaction see *Sections 3.1* and *3.2*). However, CoI is more than a magnitude of interactions among participants: it is a model that maps and defines educational presence (Garrison & Cleveland-Innes, 2005). Educational presence is composed of social, teaching and cognitive presence, thus the CoI considers these three presences, and integrates social, teaching and cognitive elements that exceed social exchanges and low-level cognitive interaction (Garrison & Anderson, 2003). The complete structure of the CoI has been confirmed and validated in numerous studies (Garrison, Cleveland-Innes, and Fung (2004), Arbaugh (2007), and Arbaugh & Hwang (2006)). However, in the following, the respective elements and their indicators will be reviewed separately.

Social presence

Social presence is defined as the ability of learners to project themselves socially and emotionally (Rourke et al., 1999), which means the extent to which a person is perceived as a "real person" in mediated communication (Gunawardena & Zittle, 1997;

Short, Williams, & Christie, 1976). It supports both cognitive and affective objectives. The former one by instigating, sustaining, and supporting critical thinking, the latter one by making group interactions engaging and intrinsically rewarding (Rourke et al, 1999). Two concepts are associated with the concept of presence: (1) intimacy and (2) immediacy (Gunawardena & Zittle, 1997). Social presence seen from this perspective refers to the degree to which a communication medium contributes to intimacy, while immediacy entails the distance between the communicator and the object of his/her communication (Short el al., 1976). Thus, in Short et al.'s view social presence characterises the medium, the communicators, and their presence in the interactions.

In Garrison et al.'s (2000) CA framework, social presence consists of three categories of indicators: (1) affective, (2) interactive, and (3) cohesive categories. The *affective category* further entails three indicators. *Expression of emotions* is indicated by the ability and confidence to express feelings related to the learning experience. *Use of humour* is identified as a contributive factor to social presence and to learning. *Self-disclosure* is the third indicator that is also an example of emotional expression contributing to the development of social presence in a community. The second category of indicators, the *interactive category* entails five further indicators: *continuing a thread, quoting from others' messages, referring explicitly to others' messages, asking questions,* and *complementing, expressing appreciation and agreement*. The five indicators support open communication, mutual awareness and recognition, which fuel the development and maintenance of interactions (Garrison et al., 2000). The third category of indicators, *cohesive categories,* is exemplified by activities that build and sustain group cohesion and commitment. This category entails the *use of vocatives, addressing the group using inclusive pronouns,* and the *use of phatics, salutations.* (For a detailed description of the coding template with the definitions of the indicators, see *Appendix 3*)

Teaching presence

In Garrison et al.'s (2000) interpretation, teaching presence refers to the role of the online instructor "to design and integrate the cognitive and social elements of a community of inquiry for educational purposes" (p. 92). (For various models on online instructor roles see *Section 3.5*) The interactions (both social and content-related) need to have clearly set parameters and focus, which is done by the instructor. Accordingly, teaching presence is "the design, facilitation, and direction of cognitive and social processes for the purpose of realising personally meaningful and educationally worthwhile learning outcomes" (Garrison & Arbaugh, 2007, p. 163). Therefore, teaching presence, according to Anderson et al. (2001), begins before the course commences since the teacher plans and prepares the course, and it is maintained throughout the course as the teacher facilitates the interactions and collaborations.

Teaching presence in Garrison et al.'s (2000) CA framework is characterised as having three components: (1) course design and organisation, (2) facilitating discourse, and (3) direct instruction. The first component entails five indicators: *setting curriculum, designing methods, establishing time parameters, utilising medium effectively,* and *establishing netiquette*. These refer to issues of planning and designing the course, process, interaction and evaluation aspect of the online learning (Garrison & Arbaugh, 2007), which are an imperative in online courses since robust course structure, engaged instructors and dynamic discussions have been found crucial predictors of successful online courses (Arbaugh & Hwang, 2006). The second component comprises

six indicators: *identifying areas of agreement/disagreement, seeking to reach consensus/understanding, encouraging, acknowledging, or reinforcing student contributions, setting climate for learning, drawing in participants, prompting discussion,* and *assessing the efficacy of the process*. Anderson et al. (2001) conceptualised this second component as the means to maintain the interest, motivation and engagement of students in the online learning process, and to share responsibility with the individual learner for attainment of learning objectives previously set. According to them, the teacher thus supports and encourages participation by modelling appropriate behaviours, moderating the online discourse by commenting on and encouraging learner responses. As opposed to the first component (done prior the learning process), facilitating discourse must be maintained in collaboration with the learners. The third component, direct instruction refers to the teacher making use of the subject-matter and pedagogical expertise (Anderson et al., 2001). Accordingly, the indicators include those ones that assess the discourse and the efficacy of the educational process (Garrison et al, 2000). These are as follows: *present content/questions, focus the discussion on specific issues, summarise the discussion, confirm understanding through assessment and explanatory feedback, diagnose misconceptions, inject knowledge from diverse sources,* and *responding to technical concerns* (Anderson et al., 2001). (For a detailed description of the coding template with the definitions of the indicators, see *Appendix 3*)

Cognitive presence

Garrison et al. (2001) defined cognitive presence as the extent to which learners are able to construct and confirm meaning through reflection and discourse. The concept is based on Dewey's (1938/1991) theory of inquiry and critical thinking. Cognitive presence was operationalised as a practical inquiry model consisting of four phases: (1) triggering event (issue or dilemma emerges and is identified), (2) exploration (treatment of the issue through reflective discourse by using techniques such as brainstorming, questioning, and so on), (3) integration (meaning is constructed), and (4) resolution (application of new knowledge to educational contexts).

In the present study, the concept of cognitive presence as part of the CoI model, which served as the theoretical base for the instrument, was utilised. However, in the process of coding online interactions with respect to participants' cognitive engagement Zhu's (2006) CA framework was adapted, which was assumed to better suit the aim of investigating patterns of interaction in the online mentoring, teaching and learning processes in the CSCL environments with special focus on the role of the facilitator.

Zhu's (2006) Analytical Framework for Cognitive Engagement in Discussion, a CA instrument, incorporates the coding system "Note Categories and Interaction Types" (previously developed by Zhu, 1998), the theoretical framework of content analysis (Henri, 1992), and Bloom's (1956) cognitive domains of learning. Her tool differentiates between questions, statements, reflection, mentoring and scaffolding. In the present study however, we omitted the categorisation of interactions into mentoring and scaffolding messages since a separate coding scheme that of social presence with distinct and more detailed structure of indicators focused on these aspects. The questions were categorised into two types: *vertical* (seeking information) and *horizontal* (initiating a conversation). Most of the criticism concerning Bloom's taxonomy focuses on its hierarchical structure, which relies on the behaviourist approach (Ballér, 1978; Báthory, 1987; Kádárné, 1979; Ormell, 1974). Nevertheless, taking into consideration

the advantage of the framework, the statements were classified into six categories according to Bloom's learning hierarchy: *responding* (direct responses to previous messages), *informative* (anecdotal or personal information related to the general discussion topic), *explanatory* (factual information with limited personal opinion), *analytical* (thoughtful analysis), *synthesising* (summary of discussion messages and related readings), and *evaluative* (evaluative or judgmental opinions of discussion points) statements. On the basis of Zhu's framework, also in the present study, messages of reflection were grouped into two categories: *reflective of changes* and *reflective of using cognitive strategies*. (For a detailed description of the coding template with the definitions of the indicators, see *Appendix 3*)

Methodological issues and procedure

Complete messages served as *unit of analysis,* which had the advantage that the units were objectively identifiable, there was a manageable set of cases. This way also the complications of defining (and agreeing on) less clearly formulated units of analysis such as thematic units or illocutionary units, were eliminated. The strategy of assigning one single message exclusively to one category was not maintained, the possibility that one message exhibits characteristics of more than one category was allowed. However, the number of decisions was pre-determined, the maximum was three decisions per message. This way, it was possible to easily determine the totals for each category, and report the percentage of postings that contains each of the categories.

Two independent coders did coding. Holsti's coefficient of reliability (CR) was utilised as *intercoder reliability* measure, which was calculated as follows: $CR=2m/n_1+n_2$, where m is the number of coding decisions on which the two coders agree, and n_1 and n_2 refer to the number of coding decisions made by coder 1 and coder 2 respectively (Rourke et al., 2001).

The CA method suggested by Rourke et al. (2001) was followed, which is a process consisting of four steps: (1) compilation of selections of transcripts or entire transcripts into text files, (2) creating a protocol for identifying and categorising the target variable(s), and training coders to use this protocol, (3) after the coding, the decisions are tested for reliability, and (4) the decisions are analysed either to describe the target variable(s), or to identify relationships between variables. As regards the first step the entire transcripts were coded, similarly to the SNA results, due to the immense amount of data, the CA results will be presented at group level (including all the interactions that evolved in the group in the course of the learning experience), instead of reporting data on each thread in each group in all the cases.

6 RESULTS AND DISCUSSION

6.1 Results of the Participant Satisfaction Survey at the MULTIPED site: cases Calibrate 1 and Calibrate 2

In the following sections, results of the participant satisfaction survey are presented. First, data on the four components of the MIM and their variable groups (obtained in the first round of multi-regression analyses) are demonstrated in detail. This is followed by the analysis of the results gained from the second round of multi-regression analyses (an explanatory model) concerning the relations of the components and their effects on each other. Finally, the discussion and interpretation of the results will be delivered.

6.1.1 Participant satisfaction concerning the components of the MIM

In-service teachers' global satisfaction

In the Calibrate 1 case, four variables had a significant impact on the in-service teachers' global satisfaction (with the online mentoring process in general in the CSCL environment): *benefits* (affective rather than cognitive nature) ($p < .001$); *the usefulness of the experience* ($p < .001$) and *the quality of learning* ($p < .001$) (residual 29%). The two variables focusing on the experience and the benefits gained in the online mentoring events and the collaborations were considered almost equally important (values 69 and 70) (for detailed results see *Table 6.1* and *Table 6.2*).

Similar results were found concerning the in-service teachers' global satisfaction with the added participants' data of the Calibrate 2 case. This time again, the same three variables showed significant impact on the participants' global satisfaction however, the importance values slightly changed. The *benefits* gained ($p < .001$) influenced the most global satisfaction, i.e., the importance value of this variable was also the highest. The *usefulness of the experience* ($p < .001$) and *the quality of learning* ($p < .001$) impacted global satisfaction as a criterion of the mentored innovation to a different extent however, their satisfaction indexes were the same (74-74).

Among the satisfaction indexes related to the three variables, the one referring to *the quality of learning* was the highest (72 and 76) thus the participants were the most satisfied with the quality of learning that took place in the CSCL environments.

The facilitator's role

Regarding the evaluation of the facilitators' role, two variables showed significant impact in the Calibrate 1 case: *feedback provided by the facilitator* ($p = .002$), and the *help offered by the facilitators* ($p < .001$). Feedback provided by the facilitators within the mentoring process on the participants' activity in the CSCL environment proved just as important as the constant help i.e., the professional scaffolding offered by them. As regards the participants' satisfaction with the facilitator's role, both variables were rated with the same values (78-78) i.e., the participants were satisfied with the feedback provided by the facilitators and the help offered by them to the same extent.

In Calibrate 2, a third variable *the facilitator created a feeling of online community* referring to the facilitator's role as a social director was added to the two previously mentioned ones (p = .01). The importance values of the two other variables increased: the *feedback provided by the facilitator* (p < .001) and the *help offered by the facilitator* (p < .001). As regards the satisfaction indexes, an unforeseen transformation took place: the variable *help offered by the facilitator* (which had the same satisfaction index as the *feedback provided by the facilitator*) now had a higher satisfaction index (78); the participants were more satisfied with the facilitators' role as a social director (76) than with the feedback provided by her/him (75). Since the in-service teachers were located in different parts of the country and worked purely online, the facilitator's role as a social director was of high importance. Thus, a case has to be made for the process of creating a sense of online community.

Table 6.1 Results of the survey in Calibrate 1

Components of the model	***ß***	***Df***	***F***	***Significance***	***Importance after transformation***	***Importance***	***Index of satisfaction (0-100)***
Participants' global satisfaction *(R^2 = .71) (α = .86)* *Global index (70)*				***N = 23***			
„benefits gained"	.42	3	12.85	p < .001	.43	.30	69
„usefulness of the experience"	.32	2	7.85	p < .001	.30	.22	70
„quality of learning"	.34	2	14.83	p < .001	.26	.19	72
The facilitator's (e-moderator's) role *(R^2 = .64) (α = .95)* *Global index (73)*							
„facilitator's feed-back'"	.35	2	7.36	p = .002	.38	.25	78
„help provided by the facilitator"	.53	2	16.60	p < .001	.61	.40	78
Social presence *(R^2 = .25) (α = .77)* *Global index (27)*							
„participant's point of view was acknowledged by the facilitator"	.47	2	12.07	p < .001	.64	.16	81
„distinct impressions of the group members were created"	.35	3	6.72	p < .001	.35	.09	73
Online communication in the MIM *(R^2 = .78) (α = .83)* *Global index (83)*							
„participating in on-task discussions"	.48	3	32.94	p < .001	.44	.34	75
„individual opinions acknowledged by group members"	.47	1	37.87	p < .001	.34	.27	78
„conversing through the medium"	.32	2	15.68	p < .001	.21	.17	74

Perceived social presence

In Calibrate 1, in respect to the perceived social presence two variables proved as significant: *participants' point of view was acknowledged by the facilitator* ($p < .001$) and *distinct impressions of the group members were created* ($p < .001$). The residual percentage in the case of social presence was high (75%). However, this phenomenon can be considered as normal from the research methodological point of view, since only little is known about the characteristics of the form, the content and the effects of social presence as articulated by Lombard and Ditton (1997).

The structure of the variables and their explanatory power in the social presence variable group changed with the added participants' data from the Calibrate 2 case. The variable *distinct impressions of the facilitator* ($p = .016$) had also a significant impact on participants' satisfaction regarding social presence. The variable *participants' point of view was acknowledged by the facilitator* had the highest index (80). By having a third significant variable the residual part decreased to 59% but this value was still high.

Table 6.2 Results of the survey in Calibrate 2

Components of the model	***ß***	***Df***	***F***	***Significance***	***Importance after transformation***	***Importance***	***Index of satisfaction (0-100)***
Participants' global satisfaction ***(R^2 = .81) (α = .78)*** *Global index (74)*					***N = 20***		
„benefits gained"	.45	3	12.85	p < .001	.45	.37	74
„usefulness of the experience"	.36	2	7.80	p < .001	.33	.27	74
„quality of learning"	.39	2	14.83	p < .001	.28	.23	76
The facilitator's (e-moderator's) role ***(R^2=.83) (α = .89)*** *Global index (78)*							
„facilitator's feed-back"	.37	3	9.58	p < .001	.43	.26	75
„help provided by the facilitator"	.64	3	18.77	p < .001	.75	.46	78
„facilitator created a feeling of online community"	.24	2	4.88	p = .01	.18	.11	76

In a CSCL environment, the concept of presence manifests itself through the interactions among the participants and the instructor, and is thus a social phenomenon. A person is perceived as 'real' in mediated communication if they fail to realise the existence of a medium in their communication, and interact as if it were not there. Accordingly, focus on social presence should be imperative since as Picciano (2002) puts it, "students who feel that they are part of a group or 'present' in a community will wish to participate actively in group and community activities" (p. 24).

Online communication in the mentored innovation model

The following three variables had significant effect on the participants' satisfaction with the online communication: *feeling comfortable with participating in on-task discussions* ($p < .001$), *individual opinions acknowledged by group members* ($p < .001$) and *feeling comfortable conversing with the facilitator through the medium* ($p < .001$). With the added participants' data collected in Calibrate 2, satisfaction with the online communication and the importance values of the variables changed: the importance of the variable *feeling comfortable with participating in on-task discussions* slightly grew ($p < .001$); the impact of the variable *individual opinions acknowledged by group members* considerably decreased ($p = .007$); while the importance of the variable *feeling comfortable conversing with the facilitator through the medium* grew ($p < .001$). The drastic decrease of the second variable's importance can be explained by the fact that the variable referring to the facilitator's role as a social director now had an impact on the satisfaction within the variable group concerning the facilitator's activity. In the case of the social presence variable group, the variable *distinct impressions of the facilitator* influenced the participants' satisfaction. Since the two new variables are associated with the 'activity' of the decreased variable, it is assumed that the values were transformed and rearranged.

This rearrangement of values is directly linked to the increase of the residual part from a low value of 22% to a relatively high one of 42% in the case of the online communication criterion of the MIM.

Part II of Table 6.2

Components of the model	***ß***	***Df***	***F***	***Significance***	***Importance after transformation***	***Importance***	***Index of satisfaction (0-100)***
Social presence *(R^2 = .41) (α = .82)* *Global index (78)*					***N = 20***		
„participant's point of view was acknowledged by the facilitator"	.34	2	11.13	p < .001	.43	.18	80
„distinct impressions of the group members were created"	.23	3	4.64	p = .005	.26	.10	76
„distinct impressions of the facilitator were created"	.25	2	4.33	p =. 016	.31	.13	73
Online communication in the MIM *(R^2 = .59) (α = .84)* *Global index (75)*							
„participating in on-task discussions"	.53	3	33.04	p < .001	.64	.38	74
„individual opinions acknowledged by group members"	.13	1	3.20	p = .007	.05	.03	77
„conversing through the medium"	.29	2	10.14	p < .001	.31	.18	76

The satisfaction index is high in the case of all the three variables (74-77-76), but the participants were the most satisfied with the experience that group members acknowledged individual opinions. Fostering a supportive and fertile learning environment, facilitating and scaffolding collaborative work are important tasks of the mentor (facilitator). In the MIM, help and feedback provided by the facilitators and their

openness towards the participants' previous professional experience, practice and knowledge were indispensable conditions of the in-service teachers' efficiency in knowledge-building communities. Facilitators were expected to have an attitude of collaborating with the teachers as a community of professionals rather than simply 'test dummies' with mainly receptive skills in the process of pedagogical innovation.

6.1.2 Effects of online mentoring on the in-service teacher participants' satisfaction in CSCL environments

With the reported participant activity analyses, an extensive number of variables of the participating in-service teachers' satisfaction with the MIM were revealed by focusing specifically on four major variable groups: *global satisfaction, the facilitator's activity*, *perceived social presence* and *online communication*. Our analyses identified statistically significant values and showed variables of the four basic criteria of the online mentoring processes.

The results of this study showed that out of the four components of the MIM the participants were satisfied with the *facilitator's role* and the *social presence experience* to an equal extent (global indexes: 78-78). These two were immediately followed by the *online communication* component (75). Thus, according to the survey, the participants were highly satisfied with the vibrancy of discussions and interactions that took place in the online environments facilitated by the e-moderators.

The facilitator's activity or their *teaching presence* (Anderson et al., 2001) as a crucial component of the MIM was investigated through numerous variables focusing on her/his three main areas of responsibility: (1) course design and organisation, (2) facilitating discourse, and (3) direct instruction. Components of the latter two areas were also covered by the variables constituting the 'facilitator's role' variable group. The results showed that the facilitator's *pedagogical role* (Berge, 1995) or *instructor role* (Hootstein, 2002) (as a consultant, guide and resource provider) was highly relevant. This role encompasses *professional scaffolding* offered to the online participants in their growing understanding of the (course) content, and the facilitation of their knowledge building in order to complete assignments and reach learning aims set prior to the process (Goodyear et al., 2001; Green, 1998; Hootstein, 2002). This is maintained by initiating questions and provoking responses from the participants, and focusing discussions on crucial points so that discussions progress beyond info sharing to knowledge construction, weaving together different concepts and assisting participants in connecting content with prior knowledge (Anderson et al., 2001; Hootstein, 2002; Mason, 1991).

Significant results concerning the online communication component of the MIM, more precisely, the independent variable *participation in on-task discussions* (which covered the above referred activities and strategies employed by the facilitator), revealed that facilitating discourse and skilful direct instruction had a strong explanatory power concerning participants' satisfaction with the online communication within the variable group and thus was a strong indicator of satisfaction.

Providing *useful and creative feedback* and *evaluating contributions* are both effective techniques applied by the online instructor maintaining the *pedagogical* or *instructor role* (Anderson et al., 2001; Salmon, 2003) and preserving *teaching presence*. Especially in online environments, timely informative feedback is critical as compared to face-to-face settings since learners may feel isolated due to the characteristics of the

communication medium (Hootstein, 2002). Significant results showed that participants of the present survey were highly satisfied with the quality of *the feed-back offered by the facilitator* and the *help (professional scaffolding) provided by the facilitator* which both had a strong explanatory power in the variable group investigating the facilitator's activity.

We considered the quality of the teaching and learning experiences in the MIM as an indicator of perceived *cognitive presence*, which referred to the extent to which participants were able to construct and confirm meaning through reflection and discourse. Satisfaction regarding the variable received the highest rate in the variable group concerning the participants' global satisfaction. Accordingly, participants were the most satisfied with the quality of learning that took place in the CSCL environments in the framework of the MIM. Based on these significant results (even if self-perceived cognitive presence was surveyed), we can claim that in the presented scenarios effective online communication contributed to the online participants' growing understanding of the content. It also managed to contribute to the facilitation of their knowledge building so that discussions progressed beyond info sharing to knowledge construction (**H5**).

The *social presence* (Rourke et al., 1999) or the *social director role* (Berge, 1995; Hootstein, 2002) that involved the establishment and facilitation of personal relationships within the collaborating community was also identified. Beyond the facilitators' activities linked to its *professional scaffolding*, the participant's ability to *create distinct impressions of the facilitator* was revealed as being of high explanatory power in the evaluation of their role. Thus, evolving social presence, the "illusion of nonmediation" is also essential to developing participants' satisfaction with the online experience. Establishing a comfortable and effective work-relationship between group and mentor, acting authentically both as a reliable human being and a professionally competent colleague, are likewise a must in online collaborations.

Significant results revealed that the variable *individual opinions acknowledged by group members* had a strong explanatory power within the online communication variable group. However, the social presence variable group became tangible to a limited extent. Despite the fact that the participants managed to *form distinct impressions of each other and the facilitator* and felt that *their opinions were acknowledged both by the facilitator and their peers*, a fundamental part of the social presence-element has not been made visible yet. However, significant results showed that the in-service teachers *felt comfortable conversing through the medium* (in the presented scenarios the CSCL environments). Thus, the "illusion of nonmediation" as Lombard and Ditton (1997) characterised the concept of social presence, i.e. interacting as if we were not using a digital medium of transmitting information, was successfully maintained. Participants perceived each other and their facilitators as a "real person" in the mediated communication (Gunawardena & Zittle, 1997; Short et al., 1976), communication through the medium contributed to the intimacy among the communicators and eventually reduced the distance between the participants. Accordingly, it was found that well-structured and focused online interactions facilitated by the online instructor could also contribute to a strong and more intensive (participant and instructor) social presence that characterises the medium, the communicators and their presence in the interactions at the same time.

6.1.3 Relations between the components of the MIM

In the second phase of regression analyses, the relations between the four components of the MIM were mapped. Thus, potential relations and effects were investigated between the participants' global satisfaction, the facilitator's activity, the perceived social presence and the online communication in the MIM. In this phase, in the first round of the regression analyses the participants' global satisfaction was considered as the dependent variable, and its potential relation to the other three constituents was analysed. The only component that had statistically significant impact on the participants' global satisfaction was *the online communication in the MIM* with an extremely high importance value demonstrating a strong explanatory power ($p < .001$) (.94) (*Figure 6.1*). Accordingly, in the cases Calibrate 1 and Calibrate 2, we found that online communication in collaborations maintained in the framework of the MIM moderated by a facilitator directly impacted participants' satisfaction and the success of the online mentoring process (**H1**).

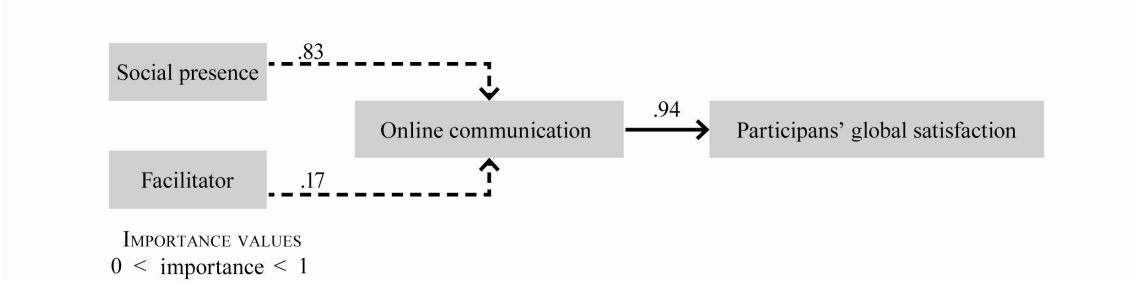

Figure 6.1 Explanatory model for the Calibrate 1 and Calibrate 2 cases

In the next round of regression analyses (when the online communication component was considered as the dependent variable), we found that the other two components (individually) – *facilitator's activity* ($p = .013$) (.17) and *perceived social presence* ($p < .001$) (.83) – had statistically significant influence on the participating in-service teachers' online communication, and through it on the global satisfaction. Consequently, we claim that the facilitator's activity (her/his teaching presence) and social presence directly impacted online communication in the CSCL environment in the mentoring, teaching and learning process **(H2) (H3).** However, between the two components (social presence and facilitator's role) there were not any significant relations detected. Hence, the claim regarding the facilitator's influence on participants' social presence was not supported by the analyses **(H4)**. (For the detailed results, see *Appendix 4.*)

In the present evaluation framework, claiming that in-service teachers' satisfaction was significantly impacted by the online communication component refers to satisfaction with the *participation in on-task discussions*, the experience of *individual opinions being acknowledged by the fellow group members* and the comfortable way of *conversing through the medium*. Statistically, the referred independent variables are part of the variable group describing 'online communication in the MIM' (see Cronbach-alfa measures for each variable group) but in real-life online mentoring events online communication cannot be considered without the facilitator's activity (teaching presence), the participants' social presence and the communication medium. This is supported by the above reported results, which clearly demonstrated that there is a

statistically significant relation among the components, and also an indirect impact of them on the participants' global satisfaction.

6.2 Results of the Participant Satisfaction Survey at the DELP sites: cases ELT Methodology 1, ELT Methodology 2, ELT Methodology 3-4, ELT Methodology 5, and ELT Methodology 6

6.2.1 Participant satisfaction concerning the components of the adjusted form of the MIM

Pre-service teachers' global satisfaction

In the ELT Methodology 1 case, in Spring 2007, three variables had a significant impact on the pre-service teachers' global satisfaction. The variable *benefits gained* ($p < .001$), *usefulness of the experience* ($p < .001$) and *quality of learning* ($p < .001$). Out of the three variables, we found that the benefits pre-service teachers gained in the online, mentoring, teaching and learning process influenced the most their global satisfaction. This is represented by the highest importance value (.30) as compared to *the usefulness of the experience* (.23) and *the quality of learning* (.20). This latter variable (quality of learning) had the least explanatory power within the variable group regarding participants' global satisfaction in the first iteration. However, results concerning the extent to which participants were satisfied with the respective variables (this is represented by the satisfaction index), this latter variable maintained the highest value (63), the other two variables *benefits gained* (56) and the *usefulness of the experience* (57) were rated with lower measures.

In the ELT Methodology 2 case with the added participants' data gained in the Fall 2007 semester, the same three variables impacted significantly the pre-service teachers' global satisfaction. The *benefits gained* variable still preserved the highest importance value (.35). This value grew as compared to the previous semester, similarly to *the usefulness of the experience* variable (.27). The impact of the third variable, *quality of learning* slightly decreased. However, its satisfaction index grew, and still maintained the highest value (65) among the variables. Satisfaction indexes of the other two variables showed a slight increase in their measures (62) and (60). (See *Table 6.3*) The groups of pre-service teachers were thus the most satisfied with the quality of learning that took place in the CSCL environments by employing the adjusted from of the MIM in the framework of the ELT Methodology course.

In the third iteration, Spring 2008, where two cases were undertaken parallel, again the so far referred three variables impacted the pre-service teachers' global satisfaction. What changed however was that instead of the *benefits gained* variable, the one encompassing the *usefulness of the experience* proved to have the strongest significant impact on the participants' global satisfaction (.33). There was a drastic drop of the importance value concerning the *quality of learning* (.07). However, the satisfaction index, which represents the degree to which the participants were satisfied with the component, was still the highest in the case of the quality of learning (64). Participants were more satisfied with the usefulness of the experience (57) than with the benefits gained (43). Hence, the *quality of learning* independent variable influenced the least the dependent variable global satisfaction but as indicated by the satisfaction

index, the participants were the most satisfied with it as compared to the benefits they could gain and the usefulness of the experience in the online mentoring, teaching and learning process.

Table 6.3 Results of the survey on global satisfaction at the DELP site

Components of the model	***ß***	***Df***	***F***	***Significance***	***Importance after transformation***	***Importance***	***Index of satisfaction (0-100)***
Participants' global satisfaction *(R^2= .73) (α =.85)* *Global index (56)*					***DELP ELT Methodology 1***	***Spring 2007***	***N = 20***
„benefits gained"	.42	3	12.91	p < .001	.41	.30	56
„usefulness of the experience"	.38	2	7.23	p < .001	.32	.23	57
„quality of learning"	.36	2	14.05	p < .001	.27	.20	72
Participants' global satisfaction *(R^2= .80) (α =.89)* *Global index (59)*					***DELP ELT Methodology 2***	***Fall 2007***	***N = 20***
„benefits gained"	.44	3	12.42	p < .001	.44	.35	62
„usefulness of the experience"	.30	2	7.12	p < .001	.34	.27	60
„quality of learning"	.36	2	14.35	p < .001	.22	.18	65
Participants' global satisfaction *(R^2= .74) (α =.86)* *Global index (57)*					***DELP ELT Methodology 3***	***Spring 2008***	***N = 18***
„benefits gained"	.44	2	23.54	p < .001	.39	.29	43
„usefulness of the experience"	.44	3	22.41	p < .001	.51	.33	57
„quality of learning"	.12	2	2.42	p = .042	.09	.07	64

In the ELT Methodology 5 case, the *benefits gained* variable impacted the most pre-service teachers' global satisfaction with the online experience (p < .001) (.42). The *quality of learning* variable influenced the least the participants' satisfaction (p < .001) (.07) – there was even a slight decline as compared to the previous iteration. Interestingly, its satisfaction index did not change, maintained the highest value (82). The satisfaction index grew in the case of the *benefits gained* variable (80) to a large extent. Accordingly, participants in the fourth iteration were the most satisfied with the *quality of learning* and the *benefits gained* as part of their global satisfaction during the online experience.

In the last iteration, in the ELT Methodology 6 case, the *benefits gained* component preserved its most dominant position as the variable having a significant impact within the variable group (p < .001) (.49). The other two variables reached their lowest values as compared to all the previous iterations. The *usefulness of the experience* variable's importance value was .15, while the *quality of the learning* that took place even went down to .04. Similarly, there was a general decrease in the

satisfaction indexes in the case of all the three variables: *benefits gained* (66), *usefulness of the experience* (61), and *the quality of learning* (70). Despite the general drop in the values, the quality of the teaching and learning experience was the strongest indicator of satisfaction concerning the participants' global satisfaction.

Part II of Table 6.3

Components of the model	***ß***	***Df***	***F***	***Significance***	***Importance after transformation***	***Importance***	***Index of satisfaction (0-100)***
Participants' global satisfaction *(R^2= .71) (α =.88)* *Global index (61)*				***DELP ELT Methodology 4***		***Spring 2008***	***N = 18***
„benefits gained"	.45	2	23.42	p < .001	.41	.29	50
„usefulness of the experience"	.35	3	22.41	p < .001	.49	.35	58
„quality of learning"	.11	2	2.42	p = .025	.10	.07	62
Participants' global satisfaction *(R^2= .69) (α =.83)* *Global index (75)*				***DELP ELT Methodology 5***		***Fall 2008***	***N = 21***
„benefits gained"	.52	3	37.20	p < .001	.60	.42	80
„usefulness of the experience"	.33	2	14.67	p < .001	.29	.20	59
„quality of learning"	.32	1	15.50	p < .001	.10	.07	82
Participants' global satisfaction *(R^2= .76) (α =.84)* *Global index (65)*				***DELP ELT Methodology 6***		***Spring 2009***	***N = 19***
„benefits gained"	.52	2	38.52	p < .001	.73	.49	66
„usefulness of the experience"	.23	2	7.71	p < .001	.22	.15	61
„quality of learning"	.06	2	0.57	p = .047	.05	.04	70

The facilitator's role

Concerning the facilitator's role two independent variables proved to have a significant effect on the pre-service teachers' satisfaction in the first iteration: *feedback provided by the facilitator* (p < .001) and *the help offered by the facilitator* (p < .001). As seen from the importance values, the latter one (.43) impacted participants' satisfaction with the facilitator's activity twice as much as the former one (.21). Similarly, the satisfaction index of the *help offered by the facilitator* variable is somewhat higher (83) than that of the *feedback offered* (74). Thus, participants were more satisfied with the help offered by the online instructors than the feedback provided by them.

In the second iteration, besides the two previously referred variables, a third variable impacted participant satisfaction concerning the facilitator's role. The *help offered by the online instructor* (p < .001) (.33) and the *feedback provided* (p < .001) (.32) had a strong 'influential' character but the facilitator's role as a social director *creating a feeling of online community* had also explanatory power in the variable group

– even if its influence was only a modest one (p = .01) (.15). Interestingly, this variable had a higher satisfaction index (70) than the variable *feedback provided by the facilitator* (61). The highest satisfaction index indicated that the groups of pre-service teachers were the most satisfied with the help offered by the online instructor in the course of online learning (76).

Table 6.4 Results of the survey on the facilitator's role at the DELP site

Components of the model	***ß***	***Df***	***F***	***Significance***	***Importance after transformation***	***Importance***	***Index of satisfaction (0-100)***
The facilitator's role *(R^2= .64) (α = .85)* *Global index (73)*				***DELP ELT Methodology 1***		***Spring 2007***	***N = 20***
facilitator's feedback"	.36	2	7.31	p < .001	.33	.21	74
„help provided by the facilitator"	.53	2	16.65	p < .001	.67	.43	83
The facilitator's role *(R^2= .81) (α = .89)* *Global index (70)*				***DELP ELT Methodology 2***		***Fall 2007***	***N = 20***
„facilitator's feedback"	.35	3	10.14	p < .001	.40	.32	61
„help provided by the facilitator"	.71	3	17.63	p < .001	.41	.33	76
„facilitator created a feeling of online community"	.26	2	5.09	p = .01	.19	.15	70
The facilitator's role *(R^2= .70) (α = .89)* *Global index (74)*				***DELP ELT Methodology 3***		***Spring 2008***	***N = 18***
„facilitator's feedback"	.44	3	13.83	p < .001	.34	.24	70
„help provided by the facilitator"	.41	3	40.42	p < .001	.50	.42	77
„facilitator created a feeling of online community"	.14	1	4.54	p = .039	.05	.04	61

In the case of the added participant data of the third iteration, the three variables with significant impact on the satisfaction concerning the facilitator's role remained the same: *feedback provided by the facilitator* (p < .001), *help offered by the facilitator* (p < .001), and *the facilitator created a feeling of online community* (p = .039). In this phase as well, the help offered by the online instructor proved to have the strongest influence on the pre-service teachers' satisfaction with their facilitators' activity (.42). The facilitator's role as a social director exercised the least influential power (.04). The same was mirrored by the satisfaction indexes: participants were the most satisfied with the help offered by their facilitators (77) and (73), and the least with their social director role (61) and (52).

In the fourth iteration, in the ELT Methodology 5 case, a surprising transformation of the impact of the variables was detected. The most dominant variable proved to be *the feedback provided by the facilitator* (.55). The so far strongest variable *help offered by the facilitator* was transformed to the weakest one (.03), and the importance of the *facilitator creating a feeling of online community* variable grew (.20). However, the satisfaction indexes mirrored the same architecture as it was described in

the previous iterations. Thus, the pre-service teachers were the most satisfied with the *help offered by the facilitator* (68), the *feedback offered* by the online instructors preserved its 'second place' in the context of participant satisfaction (63). The pre-service teachers were the least satisfied with the *facilitator creating the feeling of online community* (58).

Part II of Table 6.4

Components of the model	***ß***	***Df***	***F***	***Significance***	***Importance after transformation***	***Importance***	***Index of satisfaction (0-100)***
The facilitator's role *(R^2= .81) (α =.89)* *Global index (76)*				***DELP*** ***ELT Methodology 4***		***Spring 2008***	***N = 18***
„facilitator's feedback"	.44	3	13.34	p = .043	.35	.23	68
„help provided by the facilitator"	.41	3	40.42	p = .003	.59	.39	73
„facilitator created a feeling of online community"	.14	1	4.54	p = .034	.06	.04	52
The facilitator's role *(R^2= .77) (α = .89)* *Global index (67)*				***DELP*** ***ELT Methodology 5***		***Fall 2008***	***N = 21***
„facilitator's feedback"	.58	3	48.23	p < .001	.71	.55	63
„help provided by the facilitator"	.09	1	1.77	p < .001	.04	.03	68
„facilitator created a feeling of online community"	.28	2	12.22	p < .001	.25	.20	58
The facilitator's role *(R^2= .76) (α = .77)* *Global index (68)*				***DELP*** ***ELT Methodology 6***		***Spring 2009***	***N = 19***
„facilitator's feedback"	.38	2	22.54	p < .001	.44	.32	74
„help provided by the facilitator"	.24	1	10.50	p = .002	.15	.11	68
„facilitator created a feeling of online community"	.40	2	26.83	p < .001	.41	.29	65

The added participants' data in the last iteration again reflect the same architecture of variables as described in the case of the third iteration – with the only difference that the values are somewhat lower. In this phase as well, the *help offered by the online instructor* proved to have the strongest influence on the pre-service teachers' satisfaction with their facilitators' role (.32). The *feedback offered by the facilitators* was the second strongest variable (.29), and the facilitator's ability to *create a feeling of online community* was the weakest (.11) out of the three variables. However, as regards the participants' perceived satisfaction with this latter variable received higher rating (68) than the variable *feedback offered by the facilitator* (65). Thus, participants were more satisfied with creating the feeling of an online community than the feedback provided by the online instructor.

Perceived social presence

In the first iteration, importance values concerning the perceived social presence variable group were very low. Two independent variables proved to have a significant impact on the participants' satisfaction: the *participants' point of view was acknowledged by the facilitator* (p < .001) (.17) and the variable *distinct impressions of group members were created* (p = .002) (.09). The residual part in the case of this variable group was considered high with a value of 74%. We thus had a reason to believe that the items included in the survey did not manage to investigate the phenomenon in depth – at least not yet in this phase.

Table 6.5 Results of the survey on the perceived social presence at the DELP site

Components of the model	***ß***	***Df***	***F***	***Significance***	***Importance after transformation***	***Importance***	***Index of satisfaction (0-100)***
Social presence *(R^2= .26) (α = .55)* *Global index (26)*				***DELP*** ***ELT Methodology 1***		***Spring 2007***	***N = 20***
"participant's point of view was acknowledged by the facilitator"	.48	2	11.11	p < .001	.64	.17	74
"distinct impressions of the group members were created"	.36	3	4.71	p = .002	.36	.09	70
Social presence *(R^2= .44) (α = .65)* *Global index (67)*				***DELP*** ***ELT Methodology 2***		***Fall 2007***	***N = 20***
"participant's point of view was acknowledged by the facilitator"	.41	2	11.48	p < .001	.44	.19	73
"distinct impressions of the group members were created"	.22	3	4.55	p = .005	.26	.11	69
"distinct impressions of the facilitator were created"	.26	2	4.44	p = .021	.30	.13	67

In the next iteration, in the ELT Methodology 2 case, a third variable proved to have a significant impact on the participants' satisfaction with the social presence experience during the online work. Thus, besides the variables *participants' point of view was acknowledged by the facilitator* (p < .001) (.19) and *distinct impressions of group members were created* (p = .005) (.11) the variable *distinct impressions of the facilitator were created* (p = 021) (.13) impacted satisfaction. Interestingly, this newly added independent variable influenced the dependent variable stronger than the previously detected variable *distinct impressions of group members were created.* The value of the residual part reduced to 56% - due to the appearance of the third, newly detected variable, as it is assumed. The satisfaction indexes mirror almost the same architecture of the variables with the difference that the new variable demonstrated the least satisfactory experience (67).

In the third phase however, the residual part grew again to 65%. Parallel to this, there was a slight transformation of the importance values of the three variables. The importance value of the variable *participants' point of view was acknowledged by the facilitator* (p < .001) (.13) slightly decreased. Similarly to this, the *distinct impressions of the facilitator were created* variable's importance value dropped to (.10). However, the variable *distinct impressions of group members were created* grew in its importance (.15). The satisfaction indexes reflect the same relations: the pre-service teachers were the most satisfied with experiencing that their point of view was acknowledged by the

facilitator. Concerning the questions whether distinct impressions of the facilitator and the group members were created, the two cases did not differ. In the ELT Methodology 4 case, the pre-service teachers were more satisfied with the impressions they managed to get from their group members (72), and less satisfied with the extent to which they managed to gain impressions of the facilitator (53). Similarly to this in the ELT Methodology 3 case, the latter variable was rated lower (52), while the index of the former one was a bit higher (56).

Part II of Table 6.5

Components of the model	***ß***	***Df***	***F***	***Significance***	***Importance after transformation***	***Importance***	***Index of satisfaction (0-100)***
Social presence *(R^2= .39) (α = .65)* *Global index (73)*				***DELP*** ***ELT Methodology 3***		***Spring 2008***	***N = 18***
"participant's point of view was acknowledged by the facilitator"	.24	2	3.04	p < .001	.33	.13	79
"distinct impressions of the group members were created"	.44	3	14.22	p = .002	.41	.15	56
"distinct impressions of the facilitator were created"	.24	3	5.52	p < .001	.25	.10	52
Social presence *(R^2= .36) (α =.64)* *Global index (65)*				***DELP*** ***ELT Methodology 4***		***Spring 2008***	***N = 18***
"participant's point of view was acknowledged by the facilitator"	.24	2	3.04	p < .001	.33	.13	74
"distinct impressions of the group members were created"	44	3	14.22	p = .01	.41	.15	72
"distinct impressions of the facilitator were created"	24	3	5.52	p < .001	.25	.10	53

In the next iteration, we noticed a striking change in the architecture of the variable group. The variable *distinct impressions of the facilitator were created (*that previously had a modest impact on satisfaction with social presence) was the most influential (p < .001) (.23). The importance and thus the influence of the variable *distinct impressions of group members were created* slightly grew (p = .013) (.17). However, the so far strongest variable lost its dominance, and was transformed to the weakest item having significant impact on the participants' social presence (p = .021) (.13). This variable had the lowest satisfaction index thus participants were the least satisfied with the way their point of view was acknowledged by their facilitator (65). They were the most satisfied with being able to create distinct impressions of their fellow group members (79) and (74). This presumably indicates a horizontal work mechanism at the group level referring to group members maintaining symmetry of status, which as Dillenbourg (1999) claimed are typical of collaborative situations.

In the last iteration, the residual part in the variable group reduced to 47%. We assume this reduction is due to the increase of the importance value, which reflects the influential character of the variable *participants' point of view was acknowledged by the facilitator* (p < .001) (.37). By this variable having the strongest influence on satisfaction with social presence, the variable group's structure was rearranged. The variable *distinct impressions of group members were created* (p = .049) (.06) had the least influential character. The importance value of the variable *distinct impressions of the facilitator* dropped (p = .041) (.10). The pre-service teachers were the most satisfied

with *the facilitator acknowledging the participants' point of view* (71), and the least satisfied with the *creation of distinct impressions of the facilitator* (64). Participants being the most satisfied with the facilitator acknowledging their point-of-view signals, as opposed to the processes indicated by the results in the previous iteration, a vertical structure of the workflow and a hierarchical architecture concerning the status of the group members – the facilitator and eventually a few participants obtaining the 'top positions'.

Part III of Table 6.5

Components of the model	***ß***	***Df***	***F***	***Significance***	***Importance after transformation***	***Importance***	***Index of satisfaction (0-100)***
Social presence *(R^2= .53) (α = .64)* *Global index (71)*				***DELP ELT Methodology 5***		***Fall 2008***	***N = 21***
"participant's point of view was acknowledged by the facilitator"	.21	2	4.03	p = .022	.24	.13	65
"distinct impressions of the group members were created"	.23	2	4.55	p = .013	.33	.17	79
"distinct impressions of the facilitator were created"	.32	2	10.95	p < .001	.44	.23	70
Social presence *(R^2= .53) (α = .63)* *Global index (69)*				***DELP ELT Methodology 6***		***Spring 2009***	***N = 19***
"participant's point of view was acknowledged by the facilitator"	.43	2	23.86	p < .001	.69	.37	71
"distinct impressions of the group members were created"	.16	2	2.60	p = .049	.12	.06	70
"distinct impressions of the facilitator were created"	.17	2	2.88	p =.041	.19	.10	64

Online communication in the adjusted version of the MIM

As regards online communication in the first iteration, three variables had a significant impact on the participants' satisfaction: *participating in on-task discussions* (p < .001) (.36), *individual opinions acknowledged by group members* (p < .001) (.25), and *conversing through the medium* (p < .001) (.19). Based on the importance values, it can be claimed that the strongest variable within the variable group was the one referring to the comfortable experience of participating in on-task discussions. The weakest variable proved to be the one focusing on the impact of the medium of communication. Interestingly, the variable that had the most influential character gained the lowest satisfaction index. Thus, *participating in on-task discussion* had the lowest satisfaction index (54), as opposed to the variable *conversing through the medium*, which had a relatively high index (71). This indicated that the participants were less satisfied with participating in the online discussions than using the respective medium for communication. On one hand, the medium of communication in online teaching and learning processes is related to the technology component or technology-related factors in various models of online learners' satisfaction as an indicator of success (Sun et al, 2008; Menchacha & Bekele, 2008). On the other hand, the medium of communication contributes to the intimacy and immediacy and thus to social presence experienced by the online learners (Gunawardena & Zittle, 1997). From the high satisfaction index of

the variable, we can derive that this variable was a strong indicator of participants' satisfaction (and success) that supports social presence, the 'illusion of nonmediation' in the CSCL environment.

Table 6.6 Results of the survey on the online communication in the MIM at the DELP site

Components of the model	***ß***	***Df***	***F***	***Significance***	***Importance after transformation***	***Importance***	***Index of satisfaction (0-100)***
Online communication in the MIM *(R^2= .81) (α = .72)* *Global index (70)*				***DELP ELT Methodology 1***	***Spring 2007***		***N = 20***
„participating in on-task discussions"	.54	3	33.04	p < .001	.45	.36	54
„individual opinions acknowledged by group members	.49	1	38.91	p < .001	.31	.25	70
"conversing through the medium"	.30	2	16.02	p < .001	.24	.19	71
Online communication in the MIM *(R^2= .58) (α = .73)* *Global index (64)*				***DELP ELT Methodology 2***		***Fall 2007***	***N = 20***
„participating in on-task discussions"	.55	3	34.41	p < .001	.67	.39	59
„individual opinions acknowledged by group members	.15	1	3.56	p = .045	.06	.03	70
"conversing through the medium"	.29	2	11.07	p < .001	.27	.16	67
Online communication in the MIM *(R^2= .53) (α = .73)* *Global index (65)*				***DELP ELT Methodology 3***		***Spring 2008***	***N = 18***
„participating in on-task discussions"	.40	3	40.02	p = .019	.41	.24	66
„individual opinions acknowledged by group members	.22	3	22.45	p < .001	.21	.12	77
"conversing through the medium"	.43	3	23.44	p = .008	.33	.22	64

In the next phase with the added participants' data, the same variables proved to influence participant satisfaction with the online communication in the learning and mentoring experience. The strongest variable was still the one referring to the *participation in on-task discussions* (p < .001) (.39). However, the influence of the variable indicating that *the individual opinions were acknowledged by group members* dropped extremely (.03). This drastic decrease of the explanatory power of the variable is assumed to be directly linked to the sudden growth of the residual part in the variable group: in the first iteration a very low value of 19% to a high value of 42%. The satisfaction measures however, indicate that despite the weak influential character of the referred variable, the participants were highly satisfied with experiencing *individual opinions being acknowledged by group members* (70).

In the third phase, Spring 2008, the same variable structure was preserved thus the least impact was exercised by the variable *the individual opinions were acknowledged by group members* (p < .001) (.12). However, this time the values were higher in the case of all the variables as compared to the previous iteration. Accordingly, the residual

part of the variable group slightly decreased (39%). Concerning the satisfaction indexes the variable referring to whether the individual opinions were acknowledged by the group members was rated the highest in both cases (77) and (79). The community of the ELT Methodology 4 case experienced the least satisfaction in relation to the medium of communication (53).

Part II of Table 6.6

Components of the model	***ß***	***Df***	***F***	***Significance***	***Importance after transformation***	***Importance***	***Index of satisfaction (0-100)***
Online communication in the MIM *(R^2= .51) (α =.69)* *Global index (67)*				***DELP*** ***ELT Methodology 4***		***Spring 2008***	***N = 18***
„participating in on-task discussions"	.40	3	40.02	p < .001	.41	.24	53
„individual opinions acknowledged by group members	.22	3	22.45	p < .001	.21	.12	79
"conversing through the medium"	.43	3	23.44	p < .001	.33	.22	53
Online communication in the MIM *(R^2= .68) (α = .67)* *Global index (73)*				***DELP*** ***ELT Methodology 5***		***Fall 2008***	***N = 21***
„participating in on-task discussions"	.32	2	13.25	p < .001	.39	.26	74
„individual opinions acknowledged by group members	.26	1	9.71	p = .002	.18	.12	64
"conversing through the medium"	.38	2	17.58	p < .001	.43	.29	76
Online communication in the MIM *(R^2= .69) (α = .70)* *Global index (67)*				***DELP*** ***ELT Methodology 6***		***Spring 2009***	***N = 19***
„participating in on-task discussions"	.31	2	14.79	p < .001	.35	.35	64
„individual opinions acknowledged by group members	.25	1	11.44	p = .001	.17	.12	71
"conversing through the medium"	.41	2	26.16	p < .001	.48	.33	68

In the ELT Methodology 5 case with the added participants' data, the results mirrored a twist of events. The variable *conversing through the medium* that was previously rated as the least satisfactory item, this time proved to be the most influential variable within the variable group (p < .001) (.29). It had a strong explanatory power *and* the highest satisfaction index (76). As regards the other two variables no significant changes were detected: *participating in on-task discussions* (p < .001) (.26) and *individual opinions acknowledged by group members* (p< .002) (.12).

In the last iteration, a general stability concerning all the importance values was visible, and thus a stability of the explanatory power relations was maintained. The importance value of the variable *participating in on-task discussions* did not change significantly (p < .001) (.25), neither did the values of the other two variables *individual opinions acknowledged by the group members* (p = .001) (.12) and *conversing through the medium* (p < .001) (.33). However, the satisfaction indexes indicate some difference in the way participants experienced satisfaction concerning this criterion of the MIM. Participants were the most satisfied with the experience of *individual opinions*

acknowledged by the group members (71) thus a development was identified (previously it received the lowest satisfactory index 64). They perceived *participating in on-task discussions* as the least satisfactory (64) (although in the previous iteration this item was rated with (74)). The satisfaction index of the variable *conversing through the medium* dropped to (68).

6.2.2 Effects of online mentoring on pre-service teacher participants' satisfaction in CSCL environments

Similarly to the in-service teachers, satisfaction regarding the *quality of the teaching and learning experiences* – as an indicator of perceived *cognitive presence* – was rated with the highest values in the variable group concerning *global satisfaction* in all the iterations at the DELP site. This variable was the strongest indicator of satisfaction demonstrating that participants were the most satisfied with the quality of learning that took place in the CSCL environments in the framework of the adjusted form of the MIM. Accordingly, it was supported that in the presented scenarios effective online communication contributed to the participants' cognitive presence, and thus to the facilitation of their knowledge advancement. The second strongest indicator of participant satisfaction was the variable acknowledging that the benefits (affective rather than cognitive) gained during the learning experience justified their efforts.

Concerning the *facilitator's role* or *teaching presence* (Anderson et al., 2001) *scaffolding (help) offered by the facilitator* proved the strongest indicator of satisfaction in most of the iterations at the DELP site (four out of the six cases). Significant results concerning the facilitator's teaching presence showed that the pre-service teachers were the most satisfied with the facilitators' activity focusing on scaffolding. Scaffolding – as it was previously indicated – is part of the responsibilities linked to the facilitator's *pedagogical* (Berge, 1995) or *instructor role* (Hootstein, 2002). Thus, the facilitator as a consultant, guide and resource provider scaffolds online participants' knowledge building by initiating questions and provoking responses, focusing discussions on crucial points so that discussions progress beyond info sharing to knowledge construction, weaving together different concepts and assisting learners in connecting content with prior knowledge (Anderson et al., 2001; Hootstein, 2002; Mason, 1991). As opposed to this, participants were the least satisfied with the facilitator's role as a *social director*. Hence, it is assumed that the facilitators did not perform satisfactorily as regards creating a feeling of online community at the DELP site. This shows that successful professional scaffolding and the facilitator's pedagogical or instructor role aiming at effective 'instruction', which contribute to a quality learning experience, were not necessary accompanied by a socially active facilitator behaviour. Consequently, the *responsive facilitators* or the *directive facilitators* (Young et al., 2005) who aimed at mainly direct instruction, reacted exclusively to the online learners' requests, and thus maintained *reactive tutoring or facilitation* (de Lièvre et al., 2006) were differentiated from those who as *interactive facilitators* facilitated in a *proactive manner* (de Lièvre et al., 2006). This entailed the facilitator's own initiative for entering the participants' learning process by not exclusively supporting on-task professional discussions, but also providing a comfortable learning experience by acting as a socially engaged member of the learning community.

Social presence **(**Rourke et al., 1999) to which the facilitator's role as a *social director* (Berge, 1995; Hootstein, 2002) is strongly linked, involves the establishment and facilitation of personal relationships within the collaborating community.

Participants' (including the online instructors) social presence was identified by the variables of the variable group 'social presence' and 'online communication'. As opposed to the in-service teachers' community, in the case of the pre-service teachers, in almost all iterations (four out of the six), participants were the most satisfied with their point of view being acknowledged by the facilitator. This variable proved as the strongest indicator of satisfaction concerning perceived social presence.

These results suggest a teaching presence where the facilitator's instructional manner was strongly supported by a vertical structure of workflow and hierarchical group architecture. In such a community, participants' performance being acknowledged by the facilitator had a strong impact on their satisfaction of the learning experience, as opposed to a 'socially perceived' facilitator who maintained symmetry of status among participants and a horizontal workflow within the group. Accordingly, results concerning the perceived social presence revealed that establishing a comfortable *and* effective work-relationship between group and facilitator, acting authentically both as a reliable human being and a professionally competent colleague, that were likewise a must in online collaborations, could not always be executed by the facilitator at the same time at the same quality. What indicated tangible group-level mechanisms and evolving collaborations (even if accompanied by a strong instructor presence) was that participants managed to create distinct impressions of their fellow group members, and as part of the evaluation of the *online communication in the MIM* they were satisfied with the way individual opinions were acknowledged by each other.

Similarly to the results concerning the in-service teachers, also the pre-service teachers *felt comfortable conversing through the medium.* The relevant satisfaction indexes showed a high degree of participant satisfaction. Thus, the "illusion of nonmediation" (Lombard and Ditton, 1997) was successfully maintained. However, as indicated above social presence, which according to Short et al. (1976) characterises the medium, the communicators and their presence in the online interactions, was not maintained at the same time at the same satisfactory level in all the iterations.

Significant results showed that in the presented scenarios the facilitators' strong instructional role and a directive or responsive facilitation (mentoring) resulted in a quality learning experience. Hence, it contributed to the online participants' growing understanding of the content and to the scaffolding of their knowledge building. However, it was found that successful teaching presence or the instructional role was not necessarily accompanied by the facilitator's visible social presence or active social director role. At the same time, results also revealed that participants' social presence and evolving collaborative interactions could be supported by the *medium of communication* (in the present cases the CSCL environments). It contributed to the intimacy among the communicators and eventually reduced the distance between the participants and thus raised participants' satisfaction concerning the learning experience.

Similarly to other models of online learners' satisfaction (Sun et al, 2008; Menchacha & Bekele, 2008) in this evaluation framework as well, the *medium of communication* in online teaching and learning processes was identified as a crucial means contributing to participant satisfaction and success.

The reported participant satisfaction analyses (of the data taken at both the MULTIPED and the DELP site) showed that the type of facilitation differed in the communities of in-service and pre-service teachers. While in the Calibrate 1 and Calibrate 2 cases, the 'guide on the side' facilitator attended to a socially active community of professionals and maintained horizontal group architecture, in the ELT Methodology cases in general, the facilitator acted more like a 'resource provider' and a

'master teacher' rather than a social director. The Calibrate 1 and Calibrate 2 cases were based on communities of professionals collaborating in processes of pedagogical innovation where collaborative activities were based on their professional (teaching) experience. The scope of their activities was more of a pedagogical innovator rather than that of an active course participant. In the ELT Methodology cases, groups of pre-service teachers were actively involved in their teacher training process, which constituted part of their curriculum. This, even if applying collaborative instructional design, relied on a stronger instructor presence and a more directive facilitation.

6.2.3 Relations between the components of the adjusted form of the MIM

As indicated previously, in the second phase of regression analyses the relations between the four components of the MIM were further investigated. Potential relations and effects were mapped between the participants' global satisfaction, the facilitator's role (teaching presence), the perceived social presence and the online communication in the adjusted form of the MIM. The analyses were carried out on a semester-base (included added participants data in each semester at the DELP site). In the third iteration, Spring 2008 data from the two parallel cases were integrated into one explanatory model. The importance measures and satisfaction indexes had to be re-calculated for one 'new' model including participant data from both groups, and we used these measures in the explanatory model building-phase.

When building the explanatory models, in the first round of the regression analyses the participants' global satisfaction was considered as the dependent variable, and its potential relation to the other three constituents was analysed. In the next round of analyses, one of those variables was considered as dependent variable, which had a significant impact on the participants' global satisfaction. The same procedure was maintained until the potential impact of all the four components was statistically mapped. (For the tables with data on the models see *Appendix 5*.)

As the first explanatory model (*Figure 6.2*) indicates, the online communication component had a direct significant impact on the participants' global satisfaction ($p <. 001$) demonstrating a strong explanatory power with a relatively high (.51) importance value. The facilitator's role (teaching presence) and the perceived social presence components significantly impacted the online communication as the second round of analyses revealed. Finally, a significant relation was detected between the facilitator's activity and the perceived social presence ($p <. 001$). Accordingly, in the first semester the online communication in the MIM directly influenced the pre-service teacher participants' global satisfaction with the online mentoring, teaching and learning experience. Further analyses revealed that both the facilitator's activity (their teaching presence) (.11) and the participants' perceived social presence (.12) impacted the online communication to almost the same extent. The facilitator's activity however, did not only affect the online communication but also the perceived social presence (.39).

Consequently, the role of online communication is vital in the online learning and teaching experience, and it is thus a strong predictor of participant (learner) satisfaction. However, online communication depends on the facilitator's activity, the online instructor's teaching presence. This has a strong influence on the extent to which participants experience social presence and perceive each other as 'real' on the online surface.

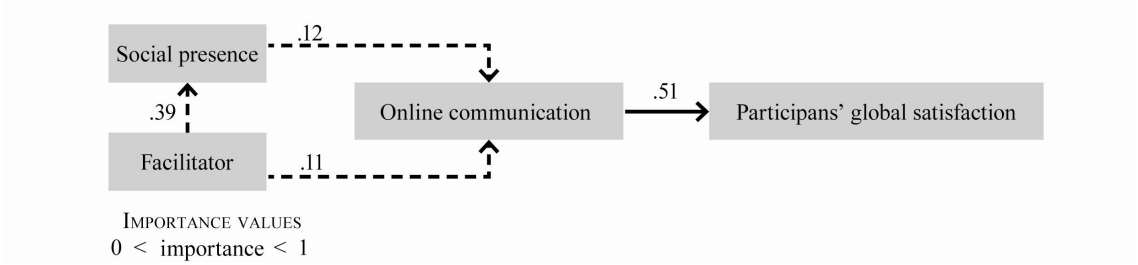

Figure 6.2 Explanatory model for the ELT Methodology 1 case

The second explanatory model (*Figure 6.3*) revealed that it was not only the online communication that had a significant direct impact ($p < .001$) on the participants' global satisfaction but the facilitator's activity, her/his teaching presence as well ($p < .001$). The former one however, preserved its stronger explanatory character with a higher importance value (.54) as compared to the latter one (.16). Hence, the facilitator's activities directly influenced the participants' satisfaction and perceived success in the online mentoring, teaching and learning process. Further analyses revealed that the facilitator's activity was in relation with both the online communication ($p = .008$) and the perceived social presence ($p < .001$) components. The latter one maintained a higher importance value (.56) and a stronger explanatory power. Consequently, it can be restated that the facilitator's teaching presence was crucial for various reasons. Firstly, it had a *direct* influence on participants' global satisfaction. Secondly, it also had an *indirect* effect on participants' perceived success (satisfaction) through the online communication maintained on the platforms – regardless of whether it was on-task or off-task communication, or took the form of one-to-one, one-to-many or group-level interactions. Thirdly, social presence experienced by the participants was tightly interwoven with the online instructor's teaching presence as the importance measure suggested. Due to this relation between the two components and the fact that social presence also 'on its own' had a strong significant impact on the online communication ($p < .001$) (.47), it was reconfirmed that the facilitator's activity strongly linked to perceived social presence impacted online communication maintained in the CSCL environments.

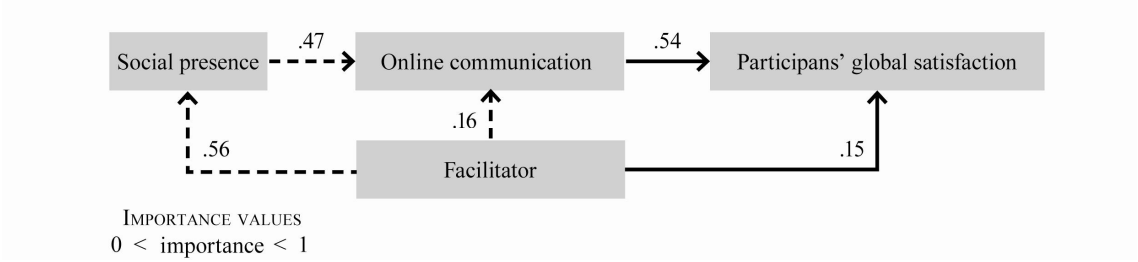

Figure 6.3 Explanatory model for the ELT Methodology 2 case

As the explanatory model from Spring 2008 (*Figure 6.4*) demonstrates, online communication ($p < .001$) and the facilitator's activity ($p < .001$) had a significant direct effect on the participants' global satisfaction. The importance measures slightly decreased but supported findings from the previous iteration: online communication had a strong explanatory power in the model and was an influential indicator of participant satisfaction and perceived success (.50). Similarly to the earlier results, the facilitator's teaching presence even if with less explanatory power (.13), impacted directly

satisfaction, it emerged this time again as a predictor of participant satisfaction. Also in this iteration, social presence (on its own) directly effected online communication ($p < .001$) (.41). The facilitator's strong relation to perceived social presence was again verified ($p < .001$) (.50). The link between the facilitator's activity and the online communication was reconfirmed ($p = .038$) (.20).

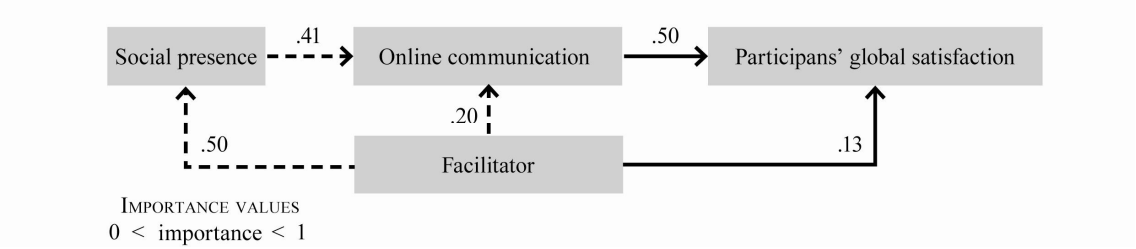

Figure 6.4 Explanatory model for the ELT Methodology 3-4 case

The same relations were identified in the last two iterations as well, as indicated by the explanatory models (*Figures 6.5* and *6.6*). However, beyond the fact that the components displayed the same architecture there was a drop of measures in general. This affected more the impact of the facilitator's activity. The facilitator's direct influence was still significant but its explanatory power decreased thus its role as an indicator of satisfaction lessened. Similarly to this, the relation between social presence and the facilitator's activity became less prevailing in both Fall 2008 ($p < .001$) (.12) and Spring 2009 ($p = .008$) (.08). However, the relation between the facilitator's activity and the online communication on the platforms intensified ($p < .001$) (.22).

Nevertheless, the role of online communication as the component maintaining the strongest explanatory power in the models prevailed. In the presented scenarios, it preserved its position as the strongest indicator of participant satisfaction and perceived learning success. The interrelatedness of the facilitator's activity, their teaching presence with the online communication was again proved. Hence, the online instructor's activity through the online interactions had an effect on participants' satisfaction.

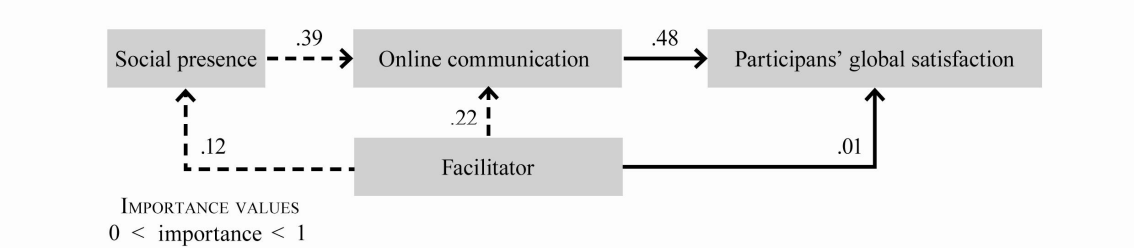

Figure 6.5 Explanatory model for the ELT Methodology 5 case

Finally, social presence preserved its strong influence on online communication; it actually grew to the second most influential component of the explanatory models (following online communication). Its role as a powerful indicator of satisfaction was verified.

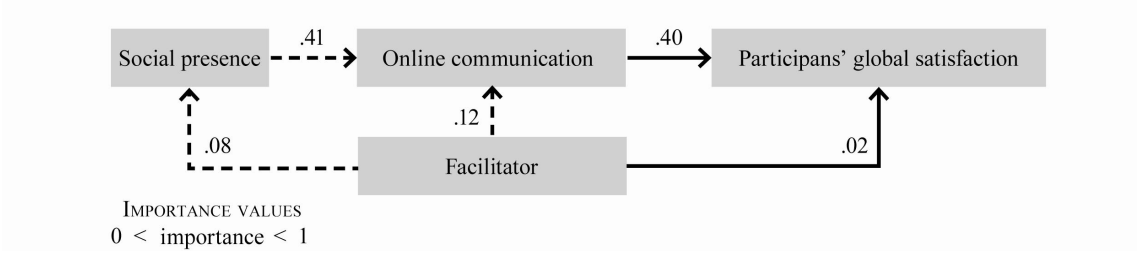

Figure 6.6 Explanatory model for the ELT Methodology 6 case

The explanatory model building revealed that relations among the investigated components of the MIM were not static, their explanatory power changed, intensified and decreased. However, even if the explanatory power of the respective components changed, the overall architecture of the models and the general interplay of the four components remained. The strongest direct significant impact was exercised by the online communication component of the MIM by constantly preserving the highest importance values. Consequently, our claim that online communication had a direct impact on participants' global satisfaction was verified **(H1).** Online communication was identified both as the most influential indicator of the participants' global satisfaction and as a central criterion of the online mentoring, teaching and learning processes maintained in the framework of the adjusted form of the MIM in the CSCL environments. Participants' global satisfaction encompassed values referring to participants' self-perceived cognitive presence. The impact of the online communication component on the participants' self-perceived cognitive presence was this time again identified (**H5**).

The facilitator's role i.e. teaching presence was identified as a component having direct significant impact on participants' global satisfaction and a relevant indicator of satisfaction and perceived success. The analyses also revealed that similarly to the online communication, it was related to all the elements of the explanatory models. Hence, it had a relation to all the components of the MIM. This has various implications. Firstly, evaluating global satisfaction with the course referred to self-perceived cognitive presence. Thus the significant impact of the facilitator's role on the global satisfaction indicated an effect on participants' self-perceived cognitive presence. Accordingly, the facilitator's activities were assumed to have an effect on the participants' cognitive presence. Secondly, since the facilitator's activity was linked to all the components of the MIM, it directly impacted the other two components: social presence and online communication (**H2**) (**H3**). *Through these two components*, it indirectly effected global satisfaction.

When analysing the relations of the variables within the variable groups, we found that scaffolding and feedback were a must in online mentoring, teaching and learning processes. However, we saw that the facilitator's instructor role was not always accompanied by the social director role. Consequently, we differentiated between responsive or directive facilitators providing reactive tutoring and interactive facilitators working in a socially proactive manner. This categorisation depended on the extent to which the social director role was maintained. Nevertheless, the relevance of acting as a social director and the importance of aiming at supporting socially active facilitator behaviour were not contested. On the contrary, with the explanatory model building as well, a case was made that since the facilitator's activity, the participants' perceived social presence and the online communication were intertwined, online facilitation in the mentoring, learning and teaching process should be more than mere direct instruction focusing on on-task communication and knowledge advancement. It should

also encompass a comfortable learning experience and the online instructor's social engagement. Thirdly, it was previously claimed that there existed at least two different manners of facilitation, a 'guide on the side' and a 'resource provider' or 'master teacher' type of facilitation. The former version implied less facilitator involvement and a horizontal workflow with symmetry of status among group members (which are characteristics of collaborative situations and interactions). Even if one opts for this, the facilitator's activity influenced online processes due to its central position as revealed by the explanatory model building.

Social presence was identified as a powerful element of the MIM. It had immediate relations to the online communication and the facilitator's teaching presence. One way of looking at these relations is that social presence evolved in the course of online interactions. Thus, participants became visible for each other in the evolving (collaborative) situations and interactions. This was the case at both the MULTIPED and the DELP sites in those scenarios when participants were satisfied with creating distinct impressions of each other and their facilitators. The other way of viewing the relations is through the facilitator's activity, which as indicated above, was linked to all the components. The facilitator through her/his social director role influenced the degree to which participants perceived each other and their instructors as 'real' (**H4**). The explanatory models verified the previous claim that the medium of communication was a means contributing to participant satisfaction and perceived success. It is the online surface, the medium of communication that provides flexible tool mediation through which facilitation was provided, participants collaborated and/or communicated with each other, and social presence was maintained and could be made visible. Seen from this perspective, it was verified that the medium, the communicators and their presence in online interactions were interwoven.

6.2.4 Criteria impacting participants' perceived satisfaction in the CSCL environments in the framework of the MIM – Results of the Kano model

The integration of the Kano model in the methodology of studying online learners' satisfaction with the learning experience was assumed to contribute to deciding the relative priority of improving components of the mentoring, teaching and learning process in a CSCL environment.

In the present study, the Kano model of participant satisfaction was based on two sources of data: (1) results from the ICT-metrics that measured participants' ICT use, and (2) results from the participant satisfaction and communication questionnaire. Values from both sources were partitioned into two entities 'satisfied' and 'unsatisfied' on the basis of satisfaction indexes concerning participants' global satisfaction (generated in the previous phases of model building). Regression analyses were done in the case of both entities (for detailed results see *Appendix 6*).

Results of the regression analyses were used to classify components (criteria) of the online mentoring, teaching and learning process into four categories: (1) must-be or basic quality attributes; (2) one-dimensional or performance attributes; (3) attractive or excitement attributes; and (4) indifferent attributes.

We clearly identified the *online communication* component as a *one-dimensional attribute*, which leads to linear increase of participant satisfaction (*Figure 6.7*). This means according to Chen and Chuang (2008) that the higher this value is, the higher customer (participant) satisfaction grows. Accordingly, also the Kano model verified our previous claim that online communication in the CSCL environments in the

framework of the MIM was the strongest indicator and predictor of participant satisfaction and perceived success.

Results concerning the participants' skills and competencies involved in the general computer usage (SZHK) and their Internet abilities (IHK) were clearly identified as *must-be attributes.* They are a must, thus their absence would lead to extreme dissatisfaction. Hence, our claim that online communication and effective facilitation were inevitable constituents of the online mentoring, teaching and learning process and that they would lead to higher participant satisfaction was complemented by stating that successful participation was also dependent on the participants' skills and competencies concerning general computer usage and their Internet abilities.

In the present study, there were neither *attractive attributes* (that are in general unexpected by the participants, their presence could lead to satisfaction but there would not be a decrease in satisfaction with their lower level) nor *indifferent attributes* (those that the participants would not especially be interested in) identified.

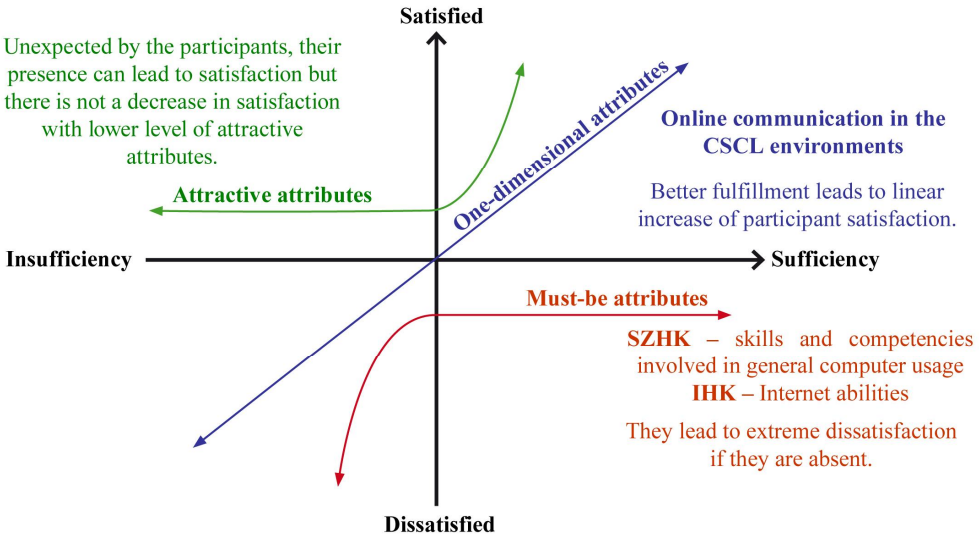

Figure 6.7 Kano model: Criteria impacting participants' perceived satisfaction in the CSCL environments in the framework of the MIM

6.3 Results of the social network analysis at the MULTIPED site: cases Calibrate 1 and Calibrate 2

As the previous sections revealed, online instructors' activity (including scaffolding learning and facilitating discourse) is a significant indicator of participants' satisfaction and learner success. Thus, it has a central role in the mentoring, teaching and learning process. A common pattern of classroom discourse is often referred to as the IRE form (initiation-reply-evaluation) where the teacher initiates the interaction with the students, they respond to them and the teacher evaluates the students' response (Lipponen et al., 2001). However, from the perspective of social theories of learning this type of interaction pattern and participation process is rather insufficient, since social theories of learning consider learning as participation in a social process of knowledge construction (Vygotsky, 1978) where knowledge evolves through meaningful interaction among participants (Dillenbourg et al., 1996) (for further details we refer to *Chapter 2* and *Chapter 3*). CSCL environments provide a medium of communication through which interactions among participants may emerge.

Accordingly, the investigation of participant activities in the online mentoring, teaching and learning process should involve the macro-level analysis of the interaction patterns within the interacting community.

In the following sections, results of the Social Network Analysis (SNA) are presented. On the basis of the sent and received messages, the interactions among participants were described in the form of a valued case-by-case matrix, which indicates on one hand, the relationships within the group and on the other hand, the strength of these relations. It is to note that no inferential statistical tests were done on the data; the quantitative results were used to make comparisons in relative terms, but not for inferential purposes. Furthermore the reported SNA did not focus on whether the participation and interaction patterns were related to learning outcomes.

The reported results concern participants' activity level in participation, their position in the online interactions and the description of interaction patterns by using SNA measures such as density, network centrality, individual in-degree and out-degree centrality.

6.3.1 Participants' activity level – descriptive statistics

In the present study, the total number of participant notes was considered as an indicator of participation (see *Appendix 7*). In Calibrate 1, the subject specific group of language teachers produced 240 messages (the facilitator wrote 46 notes), which shows a high activity level within the group. Participants created between 8 and 71 notes with an average of 34.28 (SD = 19.76). Together with the facilitator's notes the total number of messages was 286 (with an average of 35.75 (SD = 18.89)). The facilitator's messages constituted 16% of the total. Due to high level of participant activity a reduced number of discussion threads was included in the SNA analyses. The decision on which threads to include was based on professional arguments by taking into consideration the overall research goals of the Calibrate project. The idea was to include the 'pre-set' guided discussion topics but also spontaneously evolved discussion thread(s). In the macro-level analysis of interaction patterns, six threads were included. These threads focused on guided discussion topics on the prerequisites of the School of the 21st Century, best pedagogical and methodological practices for the classroom, and free discussion topics on exchanging impressions concerning the Calibrate project. Accordingly, 109 messages were considered in the analysis – the average number of notes was 13.63 (SD = 11.25). Based on the surface statistics the participants were categorised into three groups: highly active, active and passive participants. In the Calibrate 1 case, the small community of in-service teachers consisted of two highly active members, two active and two passive participants. The facilitator was described as one of the highly active members of the group.

In Calibrate 2, the large group of in-service teachers produced 985 notes (the facilitator wrote 70 messages). Participants made between 18 and 104 notes with an average of 51.84 (SD = 25.67). Together with the facilitator's messages the total number of messages was 1055 (M = 52.75; SD = 25.31). The facilitator's messages made up 7% of the total notes. In the macro-level analysis of interaction patterns, five threads were included. Consequently, 215 messages were analysed – the average number of notes was 10.75 (SD = 7.88). Following the procedure of Calibrate 1, threads focusing on guided discussion topics on the usability of the international digital repository and the LeMill social platform, teacher competences and pedagogical best practices, and finally free discussion topics on personal experiences were included. As

per descriptive statistics, participants were grouped into the category of highly active, active and passive participants. Accordingly, in Calibrate 2 seven highly active, six active and seven passive participants worked together. Also the facilitator belonged to the group of highly active group members.

In both iterations (small-group and large-group collaborations), all the in-service teachers participated in the discussions and produced a high number of messages. On the basis of the above surface-level data, we can claim that participation was broad based in the communities. The facilitator's activity (16% and 7% of the total number of messages) demonstrated a stabile and continuous instructor presence.

6.3.2 Patterns of interaction within the network as a whole: density and network centrality

Density provides measures to indicate structural patterns of interaction between members within a network as a whole. It refers to the overall connections between the members of the community. The denser the network is, the more participants have connections with each other. In a network of 8 (as in the Calibrate 1 case), there are 28 (8 x 7/2) possible connections. The density of the subject specific foreign language in-service teachers' group was .48, which means that 48% of the group members got into interaction with each other. However, this value decreased to 36% when the facilitator was excluded from the analysis (see *Table 6.7*).

Table 6.7 Density of the interactions in the Calibrate 1 and Calibrate 2 cases

	With facilitator (%)	***SD***	***Without facilitator (%)***	***SD***
Calibrate 1	48	.50	36	.48
Calibrate 2	31	.46	28	.45

This decrease of measures (11%) indicates that the facilitator played an active role in the activity of the network. In Calibrate 2, in the network of 20, there are 190 (20 x 19/2) possible connections to be realised. The network density in this case as well was relatively high .31, meaning that 31% of the participants were connected to each other during the project. This value somewhat decreased when excluding the facilitator in the analysis. In both cases, the extent to which the network density decreased corresponded to the ratio of the number of facilitator notes as compared to the total amount of messages. As stated above, the number of facilitator messages was higher in Calibrate 1, so was the extent to which the network density decreased when excluding the facilitator in the analysis. However, in neither of the cases was the decrease drastic, which indicates that the online instructor had an impact on the community but even without its presence, the members were actively involved. Nevertheless, in a smaller network the density value tends to be higher since it is much easier to maintain connections among a few participants. With further network measures, we intended to investigate whether connections centred on particular members of a community, and whether the networks had a centralised structure. For this purpose, in-degree and out-degree network centralisation measures were computed. Table 6.8 shows the in-degree and out-degree network centralisation when including and excluding the facilitator. In-degree measures refer to the incoming network linkages i.e. the number of people who respond to messages, while out-degree is the amount of interaction network members

produce i.e. the number of messages sent to each other. If in-degree and out-degree measures are balanced, indicating that the number of incoming and outgoing linkages is more or less equal, then the particular network is balanced. Accordingly, in Calibrate 2, the community of in-service teachers (including the facilitator as well) constituted a well-balanced network – the in- and out-degree values were identical. When excluding the facilitator, the network centralisation value did not change significantly: the out-degree value increased 1%, while the in-degree values decreased 2%. The decrease of in-degree network centralisation value showed that a person with prestige (recipient of a substantial amount of messages) was excluded in the network. This meant that in Calibrate 2, the facilitator was the addressee of these messages, but since the extent of decrease is very low, we can claim that the instructor's presence did not cause imbalance in the communication patterns within the network.

Table 6.8 Network centralisation in the Calibrate 1 and Calibrate 2 cases

	Network centralisation out-degree		***Network centralisation in-degree***	
	With facilitator (%)	*Without facilitator (%)*	*With facilitator (%)*	*Without facilitator (%)*
Calibrate 1	20	12	24	21
Calibrate 2	14	15	14	12

As opposed to this in Calibrate 1, the higher in-degree measures signify that the number of incoming linkages was higher, which means that there were certain members in the network who were contacted more often than the others were. Since the out-degree was lower, it is assumed that these group members were not addressees and senders at the same time. The 4% difference between the in- and out-degree measures in the network (including the facilitator) does not signal an unbalanced interaction pattern within the community in general. When excluding the facilitator, the in-degree measures were still higher; there was a considerable drop of out-degree values (8%) and a slight decrease of in-degree values (3%), which indicated that the facilitator was most probably one of the prestigious members of the community. However, in both Calibrate cases the network centralisation values were considered to be low indicating a balanced interaction pattern and equality of status among community members.

6.3.3 Interactions at the individual level: participants' in-degree and out-degree centrality values

With including the individual participants' in-degree and out-degree centrality values in the SNA, we maintained the egocentric approach so that links surrounding particular members of the network could be mapped, and findings concerning the network-level patterns be tested. Table 6.9 shows the in- and out-degree values computed for each member in Calibrate 1 – both when including and excluding the facilitator.

As the network centralisation results suggested, three central participants dominated communication in the Calibrate 1 group. One of them was the facilitator with the highest in- and out-degree values. However, this did not necessarily mean that these participants controlled the communication by excluding the others, since all the rest of the group was also involved in establishing incoming and outgoing linkages (see *Figure 6.8*). The fact that in the case of all participants the amount of established outgoing and incoming relations was almost equal suggested a well-balanced and even pattern of

communication among the participants (where less contribution was not necessarily an indicator of exclusion but simply a decision to make fewer contributions to the discussion).

Table 6.9 In- and out-degree values for the participants of the Calibrate 1 case

Calibrate 1						
	With facilitator			***Without facilitator***		
	Degree D	*Out-degree* D_{od}	*In-degree* D_{id}	*Degree* D	*Out-degree* D_{od}	*In-degree* D_{id}
	M=21.5 SD=17.17	M=10.75 SD=8.06	M=10.75 SD=9.15	M=10.00 SD=8.18	M=5.00 SD=3.46	M=5.00 SD=5.24
Facilitator 1	51	24	27	-	-	-
Participant 1	13	8	5	6	4	2
Participant 2	38	19	19	20	11	9
Participant 3	3	2	1	1	1	0
Participant 4	4	2	2	3	2	1
Participant 5	39	19	20	24	8	16
Participant 6	10	5	5	5	2	3
Participant 7	14	7	7	11	7	4

As for the facilitator's activity, the high in-degree values showed that the other members most often contacted the online instructor. Also, the high out-degree values leaned towards the facilitator's central position in the network. The decrease of the participants' out-degree values when excluding the online instructor in the analysis supported this, which meant that a considerable amount of notes was directed towards the instructor. When considering the data column for in-degree values without the facilitator, we saw that there was a participant with the highest in- and out-degree measures (*Participant 5*). She/he maintained prestige within the group. This implied that even when excluding the facilitator in the communication process, the individual members of the community would maintain the interactions. Also Figure 6.8 suggested this: the strongest ties made up a triangle, which consisted of the facilitator, *Participant 5* and *Participant 2*. As it is clearly visible, all the participants were connected in the network.

The sociogram excluding the facilitator (*Figure 6.9*) revealed that mostly weak ties connected the participants, which characterised less intensive relations. There was one strong tie in the network. This was maintained by the two most dominant participants (*Participant 5* and *Participant 2*) who formed a 'triad' with the facilitator. There were not any participants excluded in the network, but there was one person located on the periphery (*Participant 3*) with one outgoing linkage. It is important to note that besides the facilitator's role of a 'crucial cog' (Russo & Koesten, 2005, p. 256), and the other two dominant members obtaining 'prestige' within the community, there were two participants (*Participant 7* and *Participant 1*) who even though did not possess high centrality values, maintained 'brokerage positions' (Cho et al., 2007, p. 314). They linked disconnected participants, and thus were valuable members of the small community.

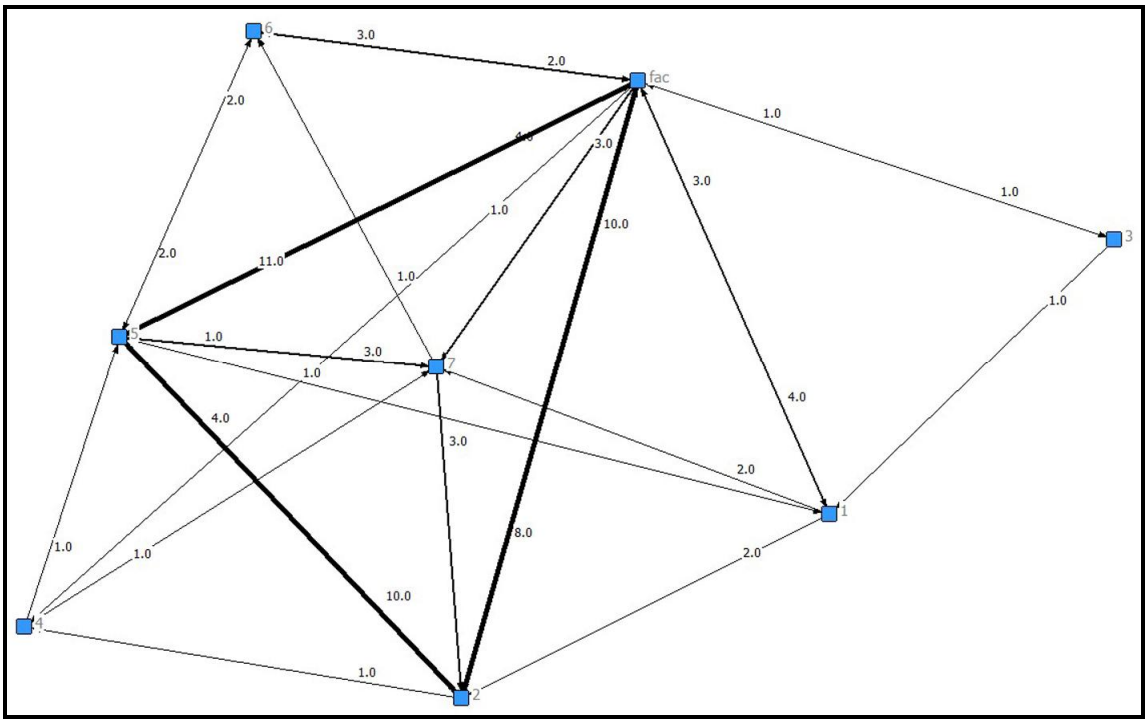

Figure 6.8 Sociogram of the interactions in the Calibrate 1 case (including the facilitator)

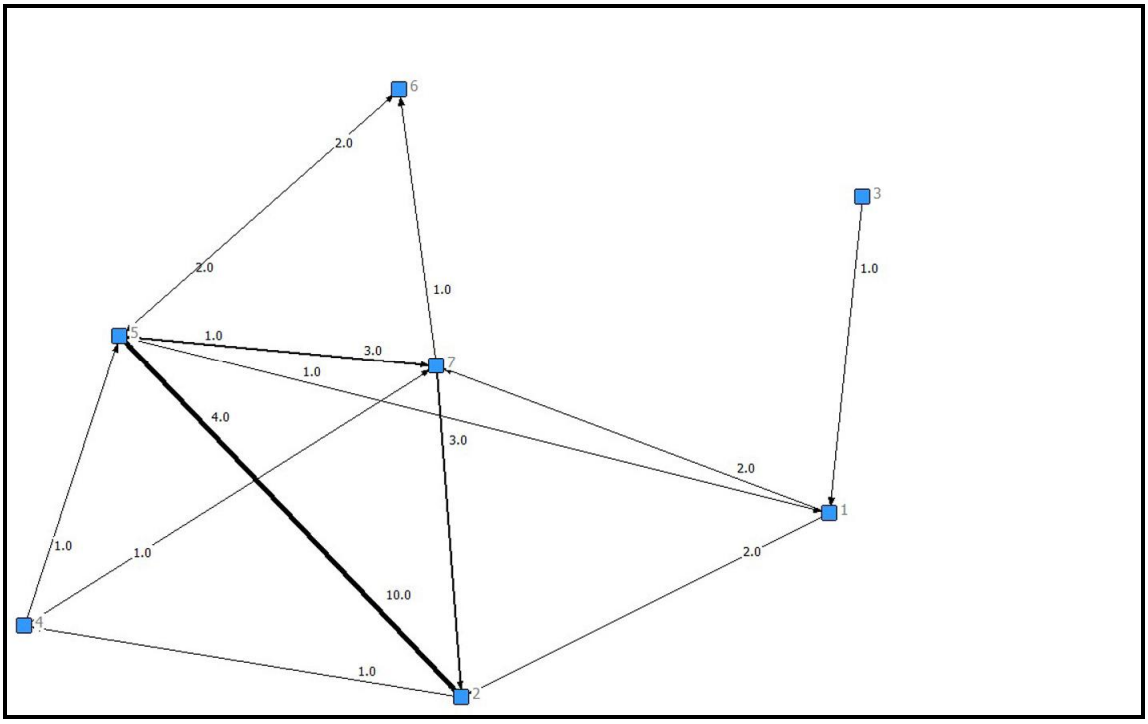

Figure 6.9 Sociogram of the interactions in the Calibrate 1 case (excluding the facilitator)

The in-degree and out-degree centrality values of the individual participants supported the previous finding (based on the network centralisation values) that in Calibrate 2 the community of in-service teachers constituted a well-balanced network. The in-degree and out-degree values for the majority of the participants (with and without the facilitator) were equal, thus the interaction pattern consisting of incoming and outgoing linkages was balanced.

As Table 6.10 shows, one of the participating in-service teachers maintained the highest in- and out-degree values, the facilitator was the second most active member of the community. The most active participant (*Participant 17*) was the most prestigious member of the community with the highest in-degree value. This person also acted as the so-called 'crucial cog', he/she was the important channel of information (with the highest out-degree value). However, there were a number of participants who similarly to *Participant 17* operated as important nodes within the network, and maintained central role in the communication.

Table 6.10 In- and out-degree values for the participants of the Calibrate 2 case

	Calibrate 2					
	With facilitator			***Without facilitator***		
	Degree D	*Out-degree* D_{od}	*In-degree* D_{id}	*Degree* D	*Out-degree* D_{od}	*In-degree* D_{id}
	M=18.90 SD=14.68	M=9.45 SD=7.18	M=9.45 SD=7.59	M=14.84 SD=10.79	M=7.42 SD=5.23	M=7.42 SD=5.72
Facilitator 1	48	21	27	-	-	-
Participant 1	10	5	5	10	5	5
Participant 2	13	7	6	12	7	5
Participant 3	8	4	4	7	4	3
Participant 4	9	4	5	9	4	5
Participant 5	6	3	3	6	3	3
Participant 6	6	3	3	5	2	3
Participant 7	1	1	0	1	1	0
Participant 8	5	3	2	5	3	2
Participant 9	13	7	6	11	6	5
Participant 10	7	3	4	4	2	2
Participant 11	18	9	9	17	9	8
Participant 12	29	15	14	24	13	11
Participant 13	28	13	15	28	13	15
Participant 14	16	8	8	15	7	8
Participant 15	16	8	8	15	7	8
Participant 16	30	16	14	24	11	13
Participant 17	59	30	29	47	22	25
Participant 18	30	16	14	25	10	15
Participant 19	26	13	13	17	7	10

As Figure 6.10 demonstrates, these were *Participants 11, 13, 16, 18* and *19*. Together with the facilitator, they formed an 'inner circle' or a sub-group of highly active members in the community. They were all linked to each other with strong ties, as the

size of the lines and the values indicate. The sociogram shows that the network had a large number of participants (approximately 11 in-service teachers) who were also active members of the community. They were linked by weak ties, though. (Only one participant was located on the periphery of the network.) *Strong links* (ties) occur between participants who interact intensively with each other or work in mutual collaboration (Ryymin et al., 2007). They are a must in transmitting complex knowledge, sharing of in-depth expertise but do not mediate new information (Palonen, Hakkarainen, Talvitie & Lehtinen, 2004; Ryymin et al., 2007). *Weak links* (ties) support knowledge exchange, and are adequate for performing easily describable, simple tasks. Palonen et al. (2004) claim that weakly linked teams are assumed to search for knowledge beyond their existing contacts. However, according to an opposing view weak ties are "an enabling factor in social activism and the building of 'social capital' (Kavanagh et al., 2003 as cited in Jones et al., 2008, p. 92). This corresponds to the idea that weak ties make a network robust. Thus, seen from the networked learning perspective, a learning community with various weak ties is considered to be more stable than one in which strong links domineer (interactions to teachers and professors in learning communities), since the former type will 'survive' even if maintainers of strong ties would leave the network (Csermely, 2005).

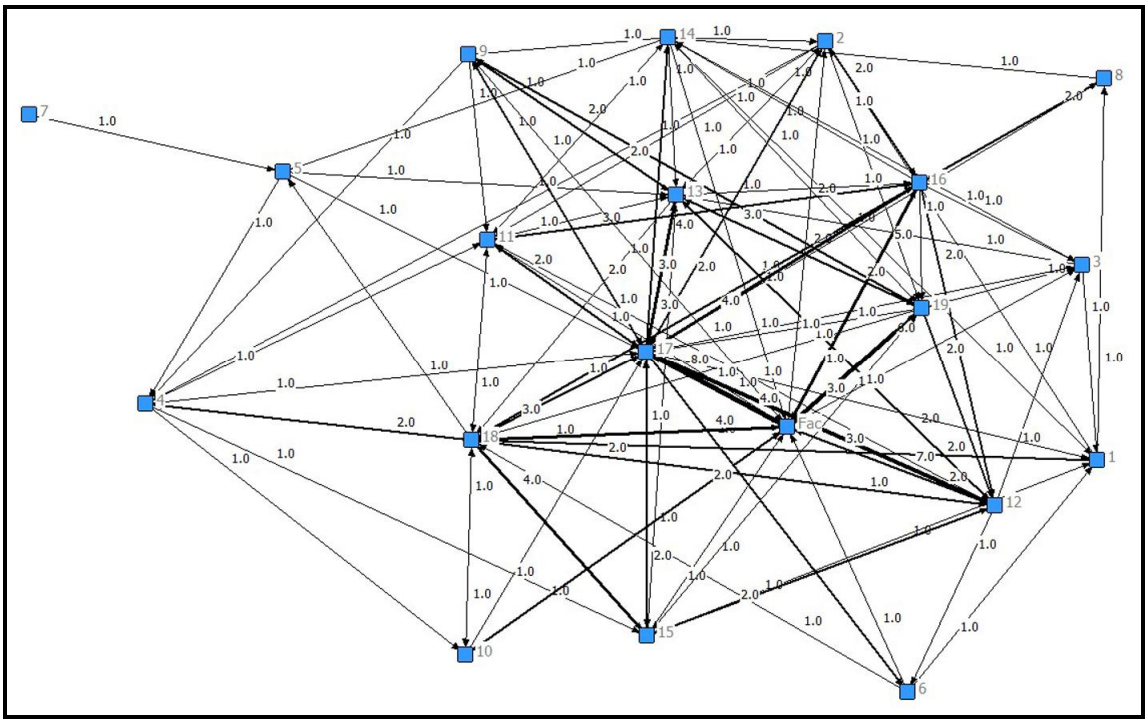

Figure 6.10 Sociogram of the interactions in the Calibrate 2 case (including the facilitator)

If we consider the data columns without the facilitator (*Table 6.10*), it becomes obvious that the participants' activity (incoming and outgoing linkages) was not intensively connected to the facilitator's presence. Accordingly, the participants maintained the interactions without the involvement of the facilitator as the 'crucial cog' (as opposed to Calibrate 1).

As Figure 6.11 demonstrates, the sub-group of the above-referred participants still existed (without including the facilitator's activity), and the rest of the group was connected to them and to each other by weak ties. Consequently, we argue for the idea that weak ties make a network robust. Hence, a network such as the in-service teachers'

community in Calibrate 2 with various weak ties is considered more stable than one, in which strong links domineer such as Calibrate 1. The former type is more likely to 'survive' on the long run with the help of the less dominant but active participants, even if maintainers of strong ties would leave the network.

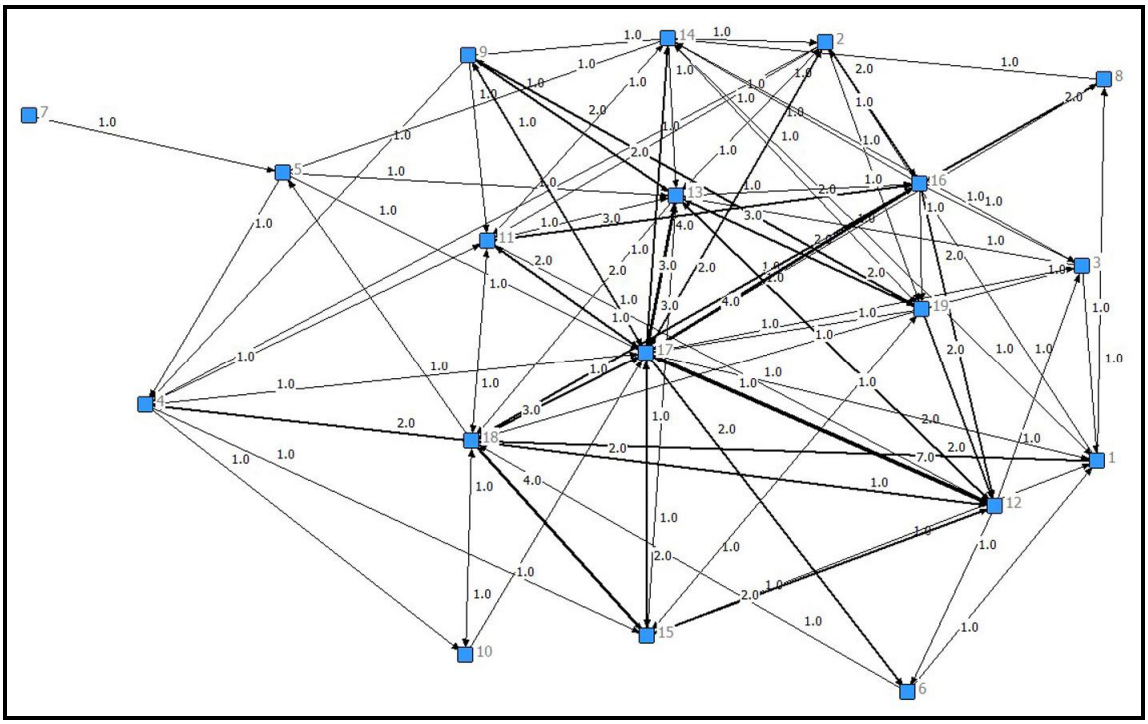

Figure 6.11 Sociogram of the interactions in the Calibrate 2 case (excluding the facilitator)

6.3.4 Effects of online mentoring in CSCL environments in the community of in-service teachers

The SNA revealed that a fair amount of incoming and outbound participant interaction was linked to the facilitator. This was especially the case in the community in Calibrate 1. We identified the facilitator as the 'crucial cog' channelling information to other members of the network. The facilitator as a central community member established strong ties to the other two most dominant and prestigious participants, this way they formed a triad within the network. Besides these two dominant members obtaining 'prestige', there were participants who did not possess high centrality values. They maintained important 'brokerage positions' by linking disconnected participants to each other and thus constituted valuable members of the community. The rest of the group was connected to each other by weak ties. None of the members was excluded in the interactions. In the case of all participants (except for the facilitator), the amount of established outgoing and incoming relations was equal. The findings concerning the facilitator's position within the Calibrate 2 network differ somewhat from the above results. It was confirmed in this case as well that the facilitator as the second most active participant, maintained a central position within the network, but there were a number of participants, who similarly to the most central participant, operated as important nodes within the network and maintained pivotal role in the communication. Together with the facilitator they constituted a sub-group of highly active members in the

community. They were all linked to each other with strong ties. But at the same time, they were not separated from all the rest of the group. Results also revealed that a large number of participants were also active members of the community. They were connected to each other and the sub-group of more intensive communicators by weak ties. When we considered the data columns without the facilitator, we saw that the participants' activity was not intensively connected to the facilitator's presence. The participants interacted without the increased involvement of the facilitator as opposed to Calibrate 1. Consequently, we argued for the idea that weak ties make a network robust. Hence, a network such as the in-service teachers' community in Calibrate 2 was considered as more stable than Calibrate 1 in which strong links domineered.

With the participant satisfaction survey and explanatory model building online communication was identified as the most influential indicator of participants' satisfaction and a central criterion of the online mentoring, teaching and learning processes in the MIM in the CSCL environments. Facilitating discourse and skilful direct instruction had a strong explanatory power concerning participants' satisfaction with the online communication that took place. The SNA results revealed that a higher frequency of interaction (in Calibrate 2 participants communicated more as compared to Calibrate 1) contributed to a higher level of sense of community: the information flow was horizontal rather than hierarchical, and a closed small sub-group of members did not dominate the interactions. In Calibrate 2, we found that the network was more robust than the one in Calibrate 1. Accordingly, this supported the hypothesis that active online communication impacts the online mentoring, teaching and learning processes, which contributed to participants' global satisfaction **(H1)**. The relation between higher frequency of communication and a higher level of sense of community supported the assumption that social presence and online communication were strongly interrelated phenomena (**H3**).

The participant satisfaction survey and explanatory model building also revealed that the facilitators' activity had a direct significant impact on participants' global satisfaction and online communication, and thus was a relevant indicator of satisfaction and perceived success in the CSCL. Feedback and professional scaffolding provided by the facilitator had a strong explanatory character in the online instructor's facilitation. Responsive and directive facilitation were differentiated and described as facilitator roles such as 'guide on the side' and 'resource provider' or 'master teacher'. It was claimed that even if the former characterised the facilitator's activity, it impacted the mentoring, teaching and learning processes. Also the SNA results verified this above finding. The facilitators, in both cases, obtained a key position in the interactions, they were among the most active and prestigious group members. The decrease of network density measures and out-degree values when we excluded the facilitator in the analysis supported this. However, while in Calibrate 1, the network density was substantially formed around the instructor, in Calibrate 2, a less intensive instructor involvement was identified. With this the facilitator's social director role in fostering interaction was not contested, but the previous finding according to which in both Calibrate cases the facilitator's role was more like a 'guide on the side' attending to a socially active community of professionals who maintained a horizontal workflow typical of collaborative situations, needs to be altered. Consequently, based on the SNA data, the facilitator in Calibrate 2 was identified as a 'guide on the side' who acted like an *interactive mentor*. Due to her/his status as the 'crucial cog' in the network, the facilitator in Calibrate 1 was characterised as a 'guide on the side' who operated like a *directive mentor*. This role however, bears the danger of hampering group communication, and on the long run without such an intensive teaching presence group

interactions would cease to evolve. Even though the amount of communication produced in the Calibrate 2 network was substantially larger than in Calibrate 1, the fact that the two facilitators of the two cases had almost identical in- and out-degree values (they established almost the same amount of incoming and outgoing linkages within their networks) supported the above finding. Consequently, the different communication structure and 'reaction' of the two communities of in-service teachers were taken as indirect evidence for the facilitator's impact on the online communication in the mentoring, teaching and learning process (**H2**), which contributed to participants global satisfaction. However, more insight concerning the characteristics and effects of the interactive or directive mentoring including the facilitator's impact and social presence shall be gained with the help of content analysis.

Since the SNA did not provide specific additional data related to cognitive presence, the findings of the participant satisfaction survey and explanatory model building on the perceived cognitive presence will be revisited when discussing results of the content analyses **(H5)**.

6.4 Results of the social network analysis at the DELP site: cases ELT Methodology 1, ELT Methodology 2, ELT Methodology 3-4, ELT Methodology 5, and ELT Methodology 6

6.4.1 Participants' activity level – descriptive statistics

Descriptive statistics concerning the participant notes were considered as an indicator of participation in the ELT Methodology cases as well (see *Appendix 8*). In the ELT Methodology 1 case, the pre-service teachers produced 148 notes (the facilitators wrote 64 messages), which showed a high activity level in the group. Participants made between 1 and 35 notes with an average of 8.22 (SD = 7.64). The total number of threads was 14. These data showed that all the group members contributed to group discussions at least once. However, they also suggested that participants could be clearly characterised as passive, active and highly active members. Two students were considered as highly active (one of them produced 35 notes, the other wrote 15 messages), 13 students who wrote between 5-11 messages were categorised as active members, while the rest (5 students who produced 1-4 messages) was considered as passive. Together with the facilitators' notes the total number of messages was 212 (with an average of 10.6 (SD = 10.36)). The distribution of messages produced was unequal; certain participants presumably dominated the online conversations (2 students). The facilitators' messages constituted 43% of the total, which indicates very active instructor behaviour and an intensive instructor presence.

In the ELT Methodology 2 case, the pre-service teachers created 136 messages with an average of 6.8 (SD = 5.02), and produced altogether 13 discussion threads. All the participants wrote at least 1 message, the maximum number of notes was 17. There were 4 students belonging to the group of highly active students (messages between 11 and 17), 7 students who wrote 5-10 messages, were described as active participants, while 8 students (messages between 1 and 3) were categorised as passive. Together with the instructor messages the participants produced 180 messages with an average of 8.2 (SD = 6.57). The two facilitators created 44 notes that were 24% of the total, which signified an active instructor presence. The descriptive statistics showed that there were 6 participants acting as intensive communicators – including the two facilitators.

In the third iteration, in ELT Methodology 3, the participants produced 220 messages with an average of 14.23 (SD = 15.25), and created 19 threads. They produced between 1 and 41 messages. The 7 highly active participants created between 20 and 41 messages, there were 4 active members who produced 5-6 messages, and there were 6 passive group members who wrote between 1 and 4 contributions in the discussions. Together with the facilitators' notes the total number of messages was 290 (with an average of 15.25 (SD = 14.76)). The facilitators posted altogether 70 notes that were 24% of the total, which indicated an active online instructor presence. As per descriptive statistics, 9 highly active group members (including the facilitators) led the group discussions.

In the ELT Methodology 4 case, pre-service teachers created 158 messages (the average number of messages was 11.06 (SD = 7.09)) in 16 threads. Participant messages were between 1 and 21. Accordingly, all of them contributed to the discussions at least once. The number of passive members (those writing between 1 and 4 notes) was 5. The active participants (those who wrote 5-11 messages) were 5, while there were 7 group members whose presence was highly active (number of messages between 12-21). The total number of messages created (including the facilitator notes) was 200 (M = 11.06) (SD = 7.09). The facilitators posted 21% of the messages (42 notes), which demonstrated a stabile and active instructor presence. Both facilitators belonged to the group of highly active participants.

The participants in the ELT Methodology 5 case created 155 notes with an average of 7.75 messages (SD = 5.30), and produced altogether 19 discussion threads. The participants wrote at least 1 message, the maximum number of messages was 24. The passive, active and highly active members were clearly identifiable on the basis of the surface data. There were 6 passive participants (number of messages was between 1 and 4), there were 11 active group members who made 7-9 contributions, and 3 highly active people posting between 11-24 notes. The total number of messages including the 32 facilitator notes was 187 (with an average of 8.5 (SD = 6.12)). The amount of instructor notes made up 17% of the total, which demonstrated a stabile and continuous facilitator presence. Only one of the facilitators (with 24 notes) belonged to the group of highly active participants.

In the last iteration, in ELT Methodology 6, the pre-service teachers made altogether 76 contributions with an average of 4.47 (SD = 2.83). They created 9 discussion threads. The participants produced between 1 and 13 messages however, there was 1 inactive student who did not participate in the discussions. In the current group, there was only one person who was considered as active compared to the other group members (with 13 notes posted). The rest of the group was characterised as less active or passive. The group of less active members consisted of those 9 participants who made between 1 and 4 contributions; the group of passive participants was made up of 6 group members who wrote between 5-7 notes. Together with the facilitator messages, the total number of online contributions was 120 with an average of 6.05 (SD = 5.50). The facilitators wrote 44 messages, which were 37% of the total contributions. Taking the low participation rate and the ratio of facilitator notes into consideration, we can claim that the instructor performance prevailed and the instructor's presence was dominant.

Based on the surface statistics, we can state that participation was broad based in the communities of the ELT Methodology cases – except for the last iteration, ELT Methodology 6. The total number of messages created by the group members was treated as an indicator of participation, on the basis of which participants were categorised into three groups: highly active, active and passive group members. In all

iterations, the study group of pre-service teachers was divided into groups of 4-6 participants (for further details we refer to *Section 5.4.2*). These small groups included highly active, active and passive participants. The case ELT Methodology 6 was an exception due to the low participation rate. As concerns the facilitators' role, the instructor presence was considered as stabile and continuous. In two cases (ELT Methodology 1 and ELT Methodology 6) however, the amount of instructor notes was higher as compared to the participant contributions. Consequently, the ratio of facilitator-participant contribution was not balanced, which indicated extremely active instructor behaviour and an intensive (in ELT Methodology 6 even dominant) online instructor presence.

6.4.2 Patterns of interaction within the network as a whole: density and network centrality

Density measures, which refer to the overall connections between the members of a community, were computed for the small groups of 4-6 participants, the two facilitators participated in all the small group discussions.

In ELT Methodology 1, the study group was divided into five small groups. In the small groups consisting of 6 participants (as in Group 1,2,3, and 4) there were 15 (6 x 5/2) possible connections. In a group of 7 members (as in Group 5) the total number of possible connections was 21 (7 x 6/2). The density values for this case signal rather mixed structural patterns of interaction among the members of the small groups (*Table 6.11*). The densest group was Group 2 with a value of .53, meaning that 53% of the participants were connected to each other. The loosest structure was that of Group 3 (13% of the participants were connected to each other), where the density value even dropped to zero when excluding the facilitator in the analysis. This presumably means that the participants within the group were not connected to each other, they communicated only with the facilitators.

Table 6.11 Density of the interactions in the ELT Methodology 1 case

DELP cases		***With facilitator (%)***	***SD***	***Without facilitator (%)***	***SD***
ELT Methodology 1	Group 1	37	.48	50	.50
	Group 2	53	.50	58	.49
	Group3	13	.34	0	0
	Group 4	23	.42	42	.49
	Group 5	38	.49	45	.49

In ELT Methodology 2, the study group of 20 pre-service teachers was divided into four small groups consisting of 5 members and 2 facilitators. The total number of possible connections was 21 (7 x 6/2). The density values in this case as well were high, signalling that a substantial part of the participants interacted with each other (*Table 6.12*). This means in the most connected group (Group 2) that 41% of the possible connections was established. When not considering the facilitator's activity (by decreasing the number of participants) the network density values grew. In Group 1 and Group 3, the difference in values (with and without the facilitator) was minimal, signalling that these networks did not 'rely' heavily on the facilitators' contribution.

Table 6.12 Density of the interactions in the ELT Methodology 2 case

DELP cases		***With facilitator (%)***	***SD***	***Without facilitator (%)***	***SD***
ELT Methodology 2	Group 1	31	.46	35	.48
	Group 2	41	.49	35	.48
	Group3	36	.48	35	.48
	Group 4	29	.45	35	.48

In the third iteration, ELT Methodology 3 and ELT Methodology 4, both study groups were divided into 3-3 groups of 6 pre-service teachers. In all the small groups, two facilitators participated in the discussions. Similarly to the previous iterations, the density values were very high, which could be a sign of an extremely dense network (*Table 6.13*). But it is a fact that in a smaller network the density measures tend to be higher, thus based on these values, neither far-reaching consequences nor generalisations concerning structural patterns of interactions were to be concluded.

Table 6.13 Density of the interactions in the ELT Methodology 3-4 cases

DELP cases		***With facilitator (%)***	***SD***	***Without facilitator (%)***	***SD***
ELT Methodology 3	Group 1	50	.50	47	.50
	Group 2	63	.48	57	.50
	Group3	41	.49	40	.49
ELT Methodology 4	Group 1	41	.49	30	.46
	Group 2	57	.49	70	.46
	Group 3	48	.49	47	.50

In the fourth iteration, in the ELT Methodology 5 case, 5-5 pre-service teachers formed four small groups with their facilitators and participated in the online discussions. As Table 6.14 shows, the density of the small networks was high, and the values grew when the group size shrank to 5 after excluding the facilitators in the analysis.

Table 6.14 Density of the interactions in the ELT Methodology 5 case

DELP cases		***With facilitator (%)***	***SD***	***Without facilitator (%)***	***SD***
ELT Methodology 5	Group 1	38	.49	50	.50
	Group 2	57	.49	75	.43
	Group 3	38	.49	50	.50
	Group 4	50	.50	60	.49

Similarly to the previous iterations, in the ELT Methodology 6 case, the larger study group was divided into smaller units: three small groups consisting of 6-6 pre-service teachers and their facilitators.

As compared to the other ELT Methodology cases, in these small groups the density values were lower, the distribution of contributions, as the standard deviation shows, was rather unequal (*Table 6.15*). If we consider the data column without the facilitator, the density values dropped, which supported the above finding. Hence, without the facilitators' contributions the interaction structure got looser, which suggests that either the online instructors provided a substantial part of the communication or the group interactions went 'through' them.

Table 6.15 Density of the interactions in the ELT Methodology 6 case

DELP cases		***With facilitator (%)***	***SD***	***Without facilitator (%)***	***SD***
ELT Methodology 6	Group 1	34	.47	20	.40
	Group 2	34	.47	20	.40
	Group 3	46	.47	43	.49

Concerning all the ELT Methodology cases and the density measures it should be noted that in a smaller network the values tend to be higher since it is much easier to maintain connections among a few participants. With contrasting the density values *with* and *without* online instructor data, the facilitators' presence was identified to a limited extent. Only in three cases was the facilitators' activity captured in a numerical form. In the rest of the cases, the calculation of density values did not provide sufficiently powerful and sophisticated results with regard to the details of interaction patterns and the facilitator's role within the network. Consequently, with further network measures it was intended to investigate the interaction patterns in detail.

In the ELT Methodology 1 case, in all the five groups, the out-degree centralisation value of the network was high, thus more outgoing linkages were established. This indicated that there were certain members in the network who were more eager to make connections than the others. They eventually had more influence than the others did. When considering the data column without the facilitator, the in-degree centralisation values dropped in three groups, showing that a very popular 'receiver' was excluded from the network (*Table 6.16*). Parallel to this, the out-degree centralisation values grew substantially in all groups, supporting the assumption that the participants' activity was not well proportioned. The imbalance concerning the distribution of contributions was also confirmed in those groups where the in-degree values grew. This reflected that most probably the highly active participants 'raked in' a substantial part of the contributions. *Group 3* was the most prominent example for the immense role of the facilitator: there were not any connections established without the facilitators.

Table 6.16 Network centralisation in the ELT Methodology 1 case

DELP site	***Network centralisation out-degree***		***Network centralisation in-degree***	
ELT Methodology 1	*With facilitator (%)*	*Without facilitator (%)*	*With facilitator (%)*	*Without facilitator (%)*
Group 1	24	33	16	19
Group 2	42	58	12	14
Group 3	34	0	22	0
Group 4	52	85	12	11
Group 5	41	47	31	26

In the second iteration, in the ELT Methodology 2 case, out of the four groups, in two (Group 1 and Group 3), the in- and out-degree network centralisation was balanced. This meant that the amount of outgoing and incoming messages was equal (*Table 6.17*). However, if we consider the data column without the facilitators, in Group 1, the in-degree measure dropped, which indicated that despite our assumptions (based on the descriptive statistics and density measures), the interactions strongly relied on the presence of the instructor. Network centrality values showed that a substantial bit of online conversion was directly linked to the facilitators i.e. they were the recipients. In Group 3 however, the values did not change significantly. As concerns the other two

groups (Group 2 and Group 4), the in-degree centralisation values were considerably higher than the out-degree measures. This suggested that there were certain group members within the network, who were more often contacted by the others thus had more prestige. When excluding the facilitators, the in-degree measures grew even higher, verifying the imbalance in the interaction patterns.

Table 6.17 Network centralisation in the ELT Methodology 2 case

DELP site	***Network centralisation out-degree***		***Network centralisation in-degree***	
ELT Methodology 2	*With facilitator (%)*	*Without facilitator (%)*	*With facilitator (%)*	*Without facilitator (%)*
Group 1	30	42	30	21
Group 2	26	17	29	48
Group 3	20	21	20	21
Group 4	14	13	27	54

In the third iteration, in both ELT Methodology 3 and ELT Methodology 4, the network centralisation values were low (as compared to the previous cases), which indicated that there was not any sign of a serious lack of equal opportunity among participants concerning participation in online interactions.

In ELT Methodology 3, in two groups (Group 1 and Group 3), the out-degree centralisation values were higher than the in-degree centralisation. This implied that there were participants who were more eager to establish linkages than the others, thus they potentially exercised more influence on the other group members. As opposed to this, in Group 2, the in-degree centralisation measures were higher, which reflected that certain participants were more 'popular' than the others since they were contacted more often as compared to the rest of the group. When considering the data columns without the facilitators, the in-degree values substantially dropped. This demonstrated that the facilitator was one of these popular group members. As the other two groups are concerned, when excluding the instructor data, the in-degree values did not show considerable changes (*Table 6.18*).

Table 6.18 Network centralisation in the ELT Methodology 3-4 case

DELP site	***Network centralisation out-degree***		***Network centralisation in-degree***	
ELT Methodology 3	*With facilitator (%)*	*Without facilitator (%)*	*With facilitator (%)*	*Without facilitator (%)*
Group 1	22	17	20	20
Group 2	21	25	28	20
Group 3	13	18	7	6
	Network centralisation out-degree		***Network centralisation in-degree***	
ELT Methodology 4	*With facilitator (%)*	*Without facilitator (%)*	*With facilitator (%)*	*Without facilitator (%)*
Group 1	24	24	24	24
Group 2	23	18	19	21
Group 3	13	20	21	26

In the ELT Methodology 4, case the so far most balanced network was identified. In Group 1, both the in-degree and out-degree values were equal, demonstrating that participants established the same amount of incoming and outgoing connections. Both when including and excluding the facilitator the measures did not change, which showed that the network was stabile even without the facilitators' involvement, the patterns of interactions were balanced (*Table 6.18*). In Group 2, the relations seemed to

be more or less equal. However, when excluding the instructor the out-degree centralisation measure (that were somewhat higher than the in-degree) decreased by 5%, implying that the instructor triggered a considerable amount of outgoing linkages. In Group 3, the in-degree network centrality values were substantially higher than the out-degree measures, which clearly showed that the conversation was centred on a limited number of participants. The facilitator was identified as one of the most active group members. When the facilitator's activity was not considered the in-degree values grew, which signalled that interactions were even more centred on particular members of the community.

As concerns the network centralisation of the ELT Methodology 5 case, the values were low in general, and the changes in the measures when excluding the facilitators in the analyses were accountable – except for Group 3 (*Table 6.19*). Group 1 was considered as the most balanced network out of the four. The in-degree and out-degree centralisation measures were identical. This demonstrated that the amount of incoming and outgoing connections was balanced. When excluding the facilitators, both values grew to the same extent, which signalled on one hand that a part of the communication was linked to the facilitators. This was also supported by the descriptive statistics. On the other hand, this also showed that even without the instructor the ratio of incoming and outgoing messages was in balance. Accordingly, there was no sign of a serious dominance exercised by the online instructor concerning participation in online interactions.

As opposed to this, in the other three groups, either the in-degree or the out-degree centralisation values were higher. When the facilitator was not considered, the changes in the values reflected imbalance in the distribution of connections established. In Group 2 and Group 4, the in-degree centralisation values were higher, suggesting that group members contacted certain members more often than the others, thus these members had more prestige in the network. In Group 2, there was a substantial drop (10%) in the in-degree values, which indicated that the facilitators were popular receivers of messages within the network. Interestingly, in Group 3, when considering the facilitators, the out-degree values were substantially higher than the in-degree centralisation, which showed that some of the participants were more ambitious to establish linkages with others. When excluding the instructors, we found that the in-degree dropped from 29% to 6%. This decrease demonstrated that most probably in this group as well, the facilitator operated as the most popular addressee of messages.

Table 6.19 Network centralisation in the ELT Methodology 5 case

DELP site	***Network centralisation out-degree***		***Network centralisation in-degree***	
ELT Methodology 5	*With facilitator (%)*	*Without facilitator (%)*	*With facilitator (%)*	*Without facilitator (%)*
Group 1	18	27	18	27
Group 2	26	27	32	22
Group 3	39	22	29	6
Group 4	13	21	18	21

In the final iteration, in the ELT Methodology 6 case, the network centralisation values implied rather imbalanced relations and patterns of interaction (*Table 6.20*). Hence, in two groups, Group 1 and Group 3, the in-degree and out-degree values were equal when including the instructors in the analyses. This should indicate that the amount of incoming and outbound relations was identical. However, when excluding the facilitators, this supposed ideal status was destroyed. The changes in both the in-

degree and the out-degree values signalled that most probably both networks were centred on the online instructors. In Group 2 as well, the network relations were uneven (when including the facilitators). The out-degree centralisation was considerably stronger, indicating that there were certain members who had more influence by sending more messages to the rest of the group. These members were assumed to be the instructors, since when excluding them in the analyses, the in-degree and out-degree centralisation of the networks decreased and settled to the same values.

Table 6.20 Network centralisation in the ELT Methodology 6 case

DELP site	***Network centralisation out-degree***		***Network centralisation in-degree***	
ELT Methodology 6	*With facilitator (%)*	*Without facilitator (%)*	*With facilitator (%)*	*Without facilitator (%)*
Group 1	9	19	9	25
Group 2	32	17	18	17
Group 3	20	35	20	19

As compared to the density results, with the analyses of network centralisation values we managed to gain more fine-tuned and powerful results in the description of network structures. Concerning consistency with descriptive statistics, in the majority of cases the network centralisation measures corresponded to (and also refined) the results. The network centralisation in-degree and out-degree values also revealed that only a minority of networks at the DELP site were balanced: we found one small group in the ELT Methodology 2, 4 and 5 cases. The majority of the networks displayed an imbalance in the patterns of interactions. On one hand, the in-degree values were higher, which indicated that certain participants were more prestigious than the others by being recipients of more messages as compared to the rest of the group. On the other hand, out-degree measures were also higher, demonstrating that some of the communicators were more eager to establish connections with the others, thus trying to gain more control of the interactions in the network. The imbalance of contributions and interaction patterns was related to the facilitator, since when excluding the online instructor in the analyses, centralisation measures (considerably) shifted.

The role of the facilitator was captured in a numerical form in all the networks. Her/his presence manifested itself in various transformations of the in-degree and out-degree centralisation measures. The most common form of manifestation was the drop of the in-degree centralisation value in the network when we excluded the instructor in the analyses. This transformation demonstrated that a participant, who was the addressee of an extensive number of messages and thus a prestigious member of the group, was eliminated from the network. Another manifestation was when the difference in in-degree and out-degree centralisation measures resolved when excluding the instructor in the analyses. This meant that most probably the facilitators' contributions and status were accountable for the shift of measures. A third potential numerical manifestation of the instructor's presence in the network was, when the imbalance that was signalled by the in-degree and out-degree centralisation measures even got worse. Thus, the network centralisation values grew – transmitting a sign of a serious lack of equal distribution among participants concerning participation in online interactions. Finally, with the network centralisation analyses, we managed to identify those networks, which on the surface seemed to display stability and balance, but when eliminating the online instructor, they went through a considerable shift of centralisation measures.

6.4.3 Interactions at the individual level: participants' in-degree and out-degree centrality values– summary of the main results

Similarly to the Calibrate cases, when computing the in-degree and out-degree centrality values of the individual participants an egocentric approach was maintained. Our aim was to map the links surrounding particular members, and test the findings of the network-level analyses. Due to character limitations of the paper, in the following section only a summary of the main findings will be delivered. For the detailed results of the in-depth analyses and graphical representations, we refer to Appendix 9. The tables in Appendix 10 show the in- and out-degree values calculated for each member of the groups present in the ELT Methodology cases. The analyses were carried out both when including and excluding the facilitators.

As the network density measures suggested, in the ELT Methodology 1 case, the structural patterns of the interactions were mixed: ranging from a dense (Group 5) to a totally dissolved network (Group 3). The distribution of contributions was thus unequal as the descriptive statistics revealed. The SNA showed that group-level interactions, which provide the appropriate ground for collaborations, did not evolve during the online mentoring, teaching and learning process. Only participants in Group 2 and Group 5 made the attempt to interact intensively at the group-level instead of working in pairs or triads. The facilitators produced a substantial bit of communication however, the amount of instructor actions and reactions was not equal in all the small groups. In the small groups, the facilitators' presence was intensive and as the patterns suggested they performed merely reactive or responsive mentoring. In Group 5, the instructors' presence was more intensive. This however, was most probably due to the most active students' performance who pushed for more intensive discussions.

As the network density and centralisation measures suggested, in the ELT Methodology 2 case, the structural patterns of the interactions did not substantially differ from each other. We saw that group-level collaborations did not evolve during the online mentoring, teaching and learning process. Only participants in Group 3 attempted to interact and work more intensively – in a triad. The facilitators produced a substantial bit of communication in the groups however, the amount of instructor actions and reactions was not equal in all the small groups. As opposed to the previous case, in this one (especially in Group 3), the facilitators' in- and out-degree centrality values were almost equal, thus the amount of incoming and outbound communication was the same. This suggests that the instructors did not over-dominate the online discussions; neither did they acquire pivotal positions such as the 'crucial cog' (either by influencing the others by sending substantially more messages, or by being the most prestigious members and receiving most of the messages). This however, did not contest our previous finding that more often the interactions (interacting pairs or triads) leaned towards the facilitators' central role in the interactions.

In the ELT Methodology 3 case, the network density values showed that there was some difference in the structural patterns of the interactions in the small groups. With the descriptive statistics and the density value analyses the facilitators' activity was clearly captured. They were identified as highly active participants in the networks. The descriptive statistics revealed that participants of this iteration communicated considerably more as compared to the previous ones.

Based on the individual in- and out-degree values, we saw certain group members attempting to communicate intensively and collaborate mutually during the online mentoring, teaching and learning process. In Group 1, four participants formed a quadrangle, in Group 2, five members created a pentagon. Only one of the facilitators

participated more actively in the interactions and maintained the same activity level throughout the online mentoring process. The individual in- and out-degree centrality values showed that in all cases the facilitator provided more outgoing linkages, which meant that she/he proactively initiated discussions with other group members and maintained a pivotal role in the communication. The other one demonstrated more 'interest' in participating interactions exclusively in Group 2, while in the other two groups her/his activity level stayed very low. Consequently, even if only one of the instructors impacted substantially the interaction patterns in the community, the two above referred groups still managed to build a network of intensive communicators. In this network, mutual relationships were established, which could serve as a ground for collaboration. As opposed to this, in Group 3, despite the efforts of Student 2 and Facilitator 1, the activity level stayed low, and instead of building a collaborating small network, participants formed three working pairs in the course of interactions. The rest of the group was connected either by one incoming or by one outgoing link to the participants on 'brokerage positions'.

The ELT Methodology 4 case was identified as the most balanced community. However, the most unexpected result of the analyses of individual measures turned out to be, as opposed to what the results of the network centralisation suggested, that instead of Group 1, Group 2 was a more balanced community. We thus claim that in Group 1 the sub-group of active, collaborating communicators demonstrated a balanced interaction pattern (both with and without the facilitator), but as a whole group consisting of eight members the network failed to exhibit equal opportunity to contribution. Contrary to this, in Group 2, even though the facilitators maintained a pivotal role in the network (but not at the costs of the other participants' willingness to participate), the strongest ties were established without including the facilitators. Accordingly, the pre-service teachers created a network of their own. In the ELT Methodology 4 case, as compared to the previous three iterations, in all the three small groups, signs of evolving collaborations were identified.

The groups of the ELT Methodology 5 case maintained similar activity levels as described in the first two iterations. However, as concerns the instructors, only one of them was considered as an active participant in the course of the online mentoring, teaching and learning process. In three out of the four groups, weak ties dominated the interaction patterns. Weak ties in these groups referred to linkages that were either one-directional, or which were the result of a limited number of mutual interactions. Unfortunately, in these groups (Group 2, Group 3 and Group 4) participants did not engage in group-level interactions that could be the basis for group collaboration. Instead of all members being involved in the interactions, pre-service teachers (and occasionally) their instructors formed triads or pairs, and only this way they were able to establish stronger ties. As opposed to these trends, in Group 1, where the contributions were equally shared among the participants, a micro-network based on reciprocal interaction patterns gradually developed without the active involvement of the facilitators.

As the descriptive statistics revealed, in the last iteration, in the ELT Methodology 6 case, the participants' general activity level was very low (the average of contributions was way below the amounts produced in the previous iterations). Accordingly, the participation was limited. Nevertheless, the facilitators took the trouble to trigger and maintain discussions, which had the effect that their presence prevailed in the interactions. The group members' attempts to establish linkages among themselves were modest. In all the three groups, either the facilitators or one of the group members took the initiative to trigger and maintain interactions. Unfortunately, with not much

success. The most active participants formed working pairs or a triad, which were characterised by low participation rate and weak ties. Consequently, in the last iteration, network-level interactions, which were supposed to serve as the appropriate ground for group-level collaborations, did not evolve in any of the groups.

6.4.4 Effects of online mentoring in CSCL environments in the community of pre-service teachers

In all the six ELT Methodology cases, the network density results were identified as insufficient measures. In a smaller network, the density values tend to be higher since it is much easier to maintain connections among a few participants. Hence, we found that due to the small network size, computing network density did not provide robust data. In fact, in all the small groups, the density values were high, and even when we contrasted network density measures calculated *with* and *without* instructor data, the facilitators' presence was captured to a limited extent. We identified the facilitators' activity in a numerical form only in three cases. In the rest of the cases, the calculation of density values did not provide sufficiently powerful and sophisticated results with regard to the details of interaction patterns and the facilitator's role within the network. Consequently, with further network measures we intended to investigate more thoroughly interaction patterns and participant roles in the communities.

As compared to the density results, with the analyses of network centralisation in-degree and out-degree values, we managed to gain more fine-tuned results in the description of network structures. Concerning consistency with descriptive statistics, in the majority of the cases the network centralisation measures corresponded to (and also refined) the results of the surface data. The network centralisation in-degree and out-degree values revealed that only a minority of networks at the DELP site was balanced. The majority of the networks displayed an imbalance in the patterns of interactions, which was related to the facilitator, since when excluding the online instructor in the analyses, centralisation measures (considerably) shifted. The role of the facilitator was clearly identifiable in a numerical form in all the networks. Her/his presence manifested itself in various transformations of the in-degree and out-degree centralisation measures (for the forms of manifestations we refer to *Section 6.4.2*). Importantly however, with the network centralisation analyses we identified those networks, which on the surface seemed to display stability and balance, but when eliminating the online instructor, they went through a considerable shift of centralisation measures.

With the analyses of the participants' individual in- and out-degree centrality, we managed to collect further sophisticated results that allowed us to provide a detailed description of the interaction patterns and roles of participants in the networks. We found that intensive group-level interactions, based on the active involvement of all the group members establishing strong ties to each other, did not evolve in the majority of the cases/small groups during the online mentoring, teaching and learning process. In these groups (lacking group-level discussions), the most intensive communicators spontaneously formed working pairs or triads. Facilitators were most often members of these triads. They did not get involved in working pairs with the pre-service teachers, though. Nevertheless, in the Methodology 3 and Methodology 4 cases we witnessed attempts of intensive online communication and mutual collaboration. Members of these networks provided for information exchange by forming a quadrangle or a pentagon. We also have to note that even in these groups there was at least one passive and/or inactive participant. Strong ties were typical of the spontaneously evolved pairs,

triads or sub-networks of the most intensive communicators, while the less active participants got connected to them by weak ties with the help of group members on the 'brokerage positions'.

We assume that in the presented pedagogical scenarios the weak ties were not adequate for transmitting complex knowledge and mediating new information. However, this finding does not necessarily contest the paradigm according to which weak ties make a network robust (Csermely, 2005), but based on our results we would like to add that especially in the case of small networks (with 5-8 members) defining the minimum requirement concerning the strength of weak ties is vital. In the presented scenarios, one-directional linkages and links providing for one-time information exchange were identified as the 'minimum' strength, which according to our claims were inadequate for sharing in-depth expertise or knowledge. Consequently, we also argue that the higher activity level of the participants and more intensive communication may contribute to evolving group-level discussions, and presumably provide the 'backbone' for collaborations. As concerns coherence with the findings of the participant satisfaction survey and explanatory model building, in the above paragraph, we formulated our findings in relative terms regarding the success of knowledge transmission and mediation of information in the observed and mapped networks. However, these results did not provide specific additional data related to the cognitive presence of the pre-service teachers, thus we hope to revisit these claims when discussing findings from the content analysis of the online interactions (**H5**).

Nevertheless, the various results of the SNA indirectly support our previous finding that online communication impacts processes in the learning networks, which contribute to participants' global satisfaction and perceived success (**H1**). Accordingly, with the current analyses of discussions we found evidence for the hypothesis that active online communication does play a vital role in the online mentoring, teaching and learning processes.

As concerns the facilitator's activity, in the current analyses, we found that she/he produced a substantial bit of communication in the groups however, the amount of instructor actions and reactions was not equal in all the small groups. Thus, even if the facilitator in question was the same in all the small groups, she/he did not maintain an identical level of activity and 'mode' of facilitation in all communities. Accordingly, we do not wish to formulate over-generalised claims but intend to find evidence for our hypotheses regarding the facilitator's role as based on the survey results, and we intend to fine-tune them by the thick description of further data.

In the present pedagogical scenarios, we found that more facilitator messages, a more intensive participation in the online interactions did not necessarily guarantee balanced group-level communication patterns and a mutual, intensive, community-level interaction, which may provide the appropriate ground for group collaborations. However, neither did reduced facilitator activity hamper intensive communication and evolving collaboration within a network. Instead, we argue that if the amount of incoming and outbound facilitator relations was in balance i.e. the instructor received and created the same amount of messages, or the facilitator's activity was characterised by slightly more outgoing linkages than incoming ones, then in these networks more intensive and broad-based participation may evolve. This generated mutual interactions and a higher level of sense of community, which were assumed prerequisites of group collaborations. Accordingly, interactive facilitators provided better for the preconditions of collaborations since they facilitated in a proactive manner i.e. the amount of incoming and outgoing linkages was in balance, or the outbound communication was slightly more intensive than the incoming.

If however, the facilitator's activity shifted to either extremes – the facilitator took the role of the 'crucial cog' in the network i.e. facilitator outbound communication dominated participant contributions, or the instructor was the recipient of most of the incoming linkages, thus she/he was the most prestigious member in the network – then most probably this hampered the development of balanced interaction patterns and the horizontal flow of information among participants. Hence, the preconditions of collaboration were not met. Analogously, least ideal conditions were created when even though the incoming and outbound facilitator communication was in balance, but the facilitator established bi-directional strong links exclusively with the same (in most cases a limited number of) participants. This type of interaction pattern was characteristic of reactive or responsive mentoring, where online instructors mainly reacted to the online learners' requests and aimed at direct instruction.

Consequently, based on the interaction patterns and participant roles, we claim that in the majority of small groups and cases (except for the small groups of Methodology 3 and Methodology 4 cases where we witnessed attempts of intensive communication and mutual collaboration) reactive or responsive mentoring prevailed, which most often generated working pairs or triads of which the instructor was member. The facilitator maintained interactive facilitation in a slightly proactive manner only in the minority of small groups (the groups where mutual collaboration presumably evolved). We must however note for the sake of completeness and validity, that in those groups where participant activity stayed low throughout the mentoring, teaching and learning process, the facilitator's mentoring efforts of any kind did not result in an interactive mentoring event. Thus, we assume that a case has to be made for the importance of group composition (the ratio of active communicators and rather passive communicators) in online scenarios.

When contrasting the above claims with the survey results, we argue that the previous findings concerning the participants' satisfaction with the facilitator's teaching presence were verified. The survey revealed that pre-service teachers were the most satisfied with the help and scaffolding provided by the instructors. This, we believe, the findings of the SNA support. The interaction patterns of the networks demonstrated that even if in the majority of small groups reactive mentoring was maintained, both the evolved working pairs and triads with strong ties, and the interactions based on weak ties, provided an adequate platform for helping and scaffolding participants when needed.

As per survey results, pre-service teachers were the least satisfied with the facilitator's ability to create a sense of community. The analyses of interaction patterns and individual roles in the network supported this finding. Based on the analyses, we found that a balanced group-level communication, which relied on densely knit mutual linkages among a substantial part of the participants evolved only in a minority of groups. In these communities, the investigation of the facilitators' interactions and their role suggested that interactive mentoring with proactive facilitation was provided. Only a minority of pre-service teachers had the opportunity to experience this. This claim is thus analogous to the findings of the survey. Consequently, with the SNA results we found evidence for the claim that the facilitator's activity impacts online communication (**H2**).

As concerns the survey results on pre-service teachers' satisfaction with the perceived social presence and aspects of online communication, we found partial correspondence. Participants were the most satisfied with the way the instructor acknowledged their point of view, and least satisfied with the extent to which they managed to gain distinct impressions of the facilitator. The above described results

rightly support these findings. Again, in the majority of small groups where interaction patterns suggested reactive or responsive mentoring, the facilitation included the instructor's immediate reaction to the learners' spontaneous demand for help and request for mentoring feedback (which very often manifested itself in strong recommendations or 'directives'). Thus, participants' needs in this respect were met. However, gaining distinct impressions of the facilitator presupposes interactive mentoring with proactive facilitation, which entails the instructor's own initiative for entering the learner's learning process and their role as a trusted colleague and advisor. This type of mentoring and facilitation was identified in a limited number of groups. Accordingly, the instructor answered this demand only in the case of a minority of pre-service teachers.

SNA provided only partial results concerning the finding of the survey in the fourth iteration, which claimed that pre-service teachers were the most satisfied with being able to create distinct impressions of their fellow group members. We assume that the more intensive links (even if they manifested themselves in working pairs, triads or small group-based reciprocal interactions) were adequate for transmitting personal impressions of each other. Thus, those members who were included in more intensive communication with each other, which was in fact the majority of the participants (regardless of the number of communicators involved at the same time and the role of the facilitator) managed to get to know each other better and created distinct impressions of each other. The same assumption is applicable regarding the finding of the survey according to which pre-service teachers were satisfied with the way individual opinions were acknowledged by group members. Thus, those members who were included in more intensive communication and formed strong ties with each other, which was in fact the majority of the participants, managed to devote time for meaningful interactions that allowed for mutual information exchange. Accordingly, findings of the SNA support the claim that there is an interrelation between perceived social presence and online communication (**H3**), and that the facilitator's activity impacts participants' social presence (**H4**). However, results of the content analyses may contribute to fine-tuning these assumptions in order to generate a robust argument that either supports or contests these and additional findings of the survey.

As per participant satisfaction analyses, we argued that in the ELT Methodology cases groups of pre-service teachers were actively involved in the process of their teacher training as participants of a blended type of university course constituting part of their curriculum. This pedagogical context even if applying collaborative instructional design relied on a stronger instructor presence and a more directive facilitation. The reported analyses of interaction patterns and communicator roles in the networks of pre-service teachers supported the claim. As the interaction patterns revealed, more often the strongest ties were established with including the facilitators, which demonstrated that interactions (interacting pairs or triads) more often leaned towards the person of the facilitator. Consequently, the majority of pre-service teachers more often experienced reactive or responsive mentoring, where the facilitation included the instructor's immediate reaction to the learners' spontaneous demand for help and request for mentoring feedback but the need for a socially active 'social director' facilitator was not met.

6.5 Results of the content analysis at the MULTIPED site: cases Calibrate 1 and Calibrate 2

At the micro-level analysis of online interaction patterns content analysis was employed. Micro-level analysis entails the in-depth analysis of online interactions by applying a content analysis framework, which in the current study was an adjusted version of Garrison et al.'s (2000) model (and indicators) of a community of inquiry (for a detailed description of the method see *Section 4.4*).

In the current study, complete messages served as *unit of analysis,* which had the advantage that the units were objectively identifiable. Thus, there was a manageable set of cases, and this way also the complications of defining (and agreeing on) less clearly formulated units of analysis such as thematic units or illocutionary units, were eliminated. The strategy of assigning one single message exclusively to one category was not maintained, the possibility that one message exhibits characteristics of more than one category was allowed. However, the number of decisions was pre-determined: the maximum was three decisions per message. This way it was possible to easily determine the totals for each category, and report the percentage of postings that contains each of the categories. Coding was done by two independent coders. Holsti's coefficient of reliability (CR) was utilised as *intercoder reliability* measure (for the detailed measures see *Appendix 11*). Discrepancies in the raters' coding were discussed by the raters and the investigator until consensus was reached. The reliability of the data was found sufficient.

In the following, results of the content analysis of in-service teachers' online interactions will be elaborated. Results and findings concern participants' cognitive engagement (presence), their social presence and facilitators' teaching presence. It is to note that no inferential statistical tests were done on the data; the quantitative results were used to make comparisons in relative terms, but not for inferential purposes.

6.5.1 Cognitive, social and teaching presence in the communities of in-service teachers in Calibrate 1 and Calibrate 2

Cognitive engagement (cognitive presence)

The analyses revealed varied levels of cognitive engagement in the Calibrate 1 case. Table 6.21 shows that the majority of in-service teachers responded to discussion topics by providing factual information. Thirty-three percent of the messages belonged to the first (basic) type of statements. Six percent of the messages were informative and only two percent belonged to the category of messages that gave explanations. Thirteen percent of the notes were analytical. In Calibrate 1, no messages were synthesising or evaluative. Accordingly, we derived from the results that most of the communication was of responsive nature and offered factual information, feedback or sometimes opinions. However, even though in Calibrate 1 low cognitive engagement prevailed, we perceived also elementary manifestations of higher levels of cognitive presence. During the online mentoring, teaching and learning process, in-service teachers also provided information (anecdotal or personal) related to the general discussion topic. These informative types of messages demonstrated comprehension of the issues under discussion and often involved in-depth clarification. In Calibrate 1, the highest cognitive engagement manifested itself in the explanatory and analytical messages. Thus, a minority of statements presented factual information with limited personal opinions

about responding messages, or related information derived from external materials such as readings, and they demonstrated thoughtful analysis. Despite the higher levels of cognitive presence, discussions did not generate synthesising or evaluative statements hence in-service teachers neither demonstrated a synthesis of knowledge nor developed understanding from facts to reasoning. What is however, leaning towards a growing understanding of the content and knowledge building (instead of mere information sharing), is that in one fourth of the messages in-service teachers reflected on their own learning or use of strategies during the online mentoring, teaching and learning process. (In this case however, no messages revealed reflections of changes as concerns individual learning strategies.)

Table 6.21 Distribution of communication that reflects cognitive engagement in the Calibrate cases

Category	***Indicator***	***Calibrate 1***	***Calibrate 2***
Question	Seeking information (Vertical)	15%	4%
	Inquiring or starting a discussion (Horizontal)	6%	4%
Statement	Responding (knowledge or elementary classification)	33%	62%
	Informative (comprehension or in-depth clarification)	6%	19%
	Explanatory (application or application for strategies)	2%	6%
	Analytical (analysis)	13%	2%
	Synthesis (synthesis or inferencing)	0%	0%
	Evaluative (evaluation or judgment)	0%	0%
Reflection	Reflective of changes	0%	1%
	Reflective of using cognitive strategies	25%	2%

Table 6.21 suggests that vertical questions that had a direct answer prevailed. Most often, questions seeking information were directed towards the facilitator; whereas horizontal questions were asked either by the participants of their group mates, or by the facilitator to trigger a discussion on a certain topic. Accordingly, in Calibrate 1, in-service teachers more often turned to the facilitator for clarification and information.

Also in the Calibrate 2 case, cognitive presence involved four types of cognitive engagement. However, they demonstrated lower levels of cognitive presence. Sixty-two percent of the messages belonged to the first (basic) category of statements hence a substantial part of the communication was responsive, offering factual information, feedback and opinions. Nineteen percent of the messages were informative types, which demonstrated comprehension of the issues under discussion and often involved in-depth clarification. The two categories referring to higher levels of cognitive presence, explanatory and analytical, accounted for altogether 8%. Thus, only a small minority of in-service teachers presented factual information with limited personal opinions about responding messages or related information, and demonstrated thoughtful analysis of the issues under investigation. No messages demonstrated the highest levels of cognitive engagement (aiming at a synthesis and/or evaluation of the contents and information). As compared to Calibrate 1, in the second iteration, the in-service teacher participants' level of cognitive engagement was lower. This was also suggested by the extremely low percentage of messages reflective of changes, and the usage of cognitive strategies in the mentoring, teaching and learning process. The amount of vertical and horizontal questions was equal, which demonstrated that neither the questions focusing on information seeking nor the ones aiming at triggering discussions prevailed.

Social presence

The most frequent manifestations of social presence in the online discussions of the Calibrate 1 case were the messages belonging to the cohesive category (*Table 6.22*). Messages of this type included most often phatics and salutations, vocatives, and reference to the group by using inclusive pronouns. These elements of (written and spoken) language serve to confirm sociability rather than information provision or transmission of ideas and knowledge. Accordingly, participants most often relied on communication in which social presence had predominantly manifestations of linguistic nature (55%). Interactive messages accounted for altogether 19% of the communication. Messages of this type were "evidence that the other is attending" (Short et al., 1976), which is a must in the socially meaningful interactions.

Hence, participant contributions aiming at reinforcement that supports developments and maintenance of social interaction prevailed as compared to the other realisations of interactivity. Accordingly, complimenting, expressing appreciation and acknowledging were exemplified forms of reinforcement in the online interactions. However, only 4% of the messages expressed participants' agreement or disagreement, and even less (3%) made explicit reference to the others' messages or quoted from each other's contributions. As the results showed, the total amount of messages of the affective type was higher than the number of interactive responses. These contributed to the expression of feelings, emotion and mood that are also manifestations of social presence in online interactions. In 6% of the messages in-service teacher participants expressed their emotions, and 9%-9% of the responses included elements of humour and self-disclosure. Consequently, only a minority of participants disclosed and exchanged personal information, which could have contributed to the formation of individualised impressions of each other.

Table 6.22 Distribution of communication that reflects social presence in the Calibrate cases

Category	***Indicator***	***Calibrate 1***	***Calibrate 2***
Affective	Expression of emotions	6%	4%
	Use of humour	9%	8%
	Self-disclosure (present details of life outside of class, or express vulnerability)	9%	22%
Interactive	Continuing a thread (using reply function of software rather than starting a new thread)	1%	15%
	Quoting from others' messages Referring explicitly to somebody's message	3%	10%
	Asking questions (students ask questions of other students)	1%	4%
	Complementing, expressing appreciation	10%	4%
	Expressing agreement	4%	8%
Cohesive	Vocatives (referring to participants by name)	0%	0%
	Addresses or refers to the group using inclusive pronouns (addresses group as we, us, our group)	2%	1%
	Phatics, salutations (communication that serves purely social function)	55%	24%

As concerns social presence in the second iteration, in Calibrate 2, we derived from the table that manifestation of social presence was wide-ranged, thus this time messages of the cohesive category with only signs of linguistic nature did not prevail. In fact, in this iteration only half as many messages contained this sort of indicators as it

was found in Calibrate 1 (altogether 25%). Table 6.22 shows high percentage of interactive communication, half of the messages contained indices of participants attending to each other in socially meaningful interactions. Twenty-five percent of the messages demonstrated clearly the continuation of a thread – not exclusively by using the reply feature but also by directly quoting from each other's messages, or by referring explicitly to another response. In 4%-4% of the contributions participants asked questions of another, complemented and expressed appreciation to each other. Expressing agreement accounted for 8% of the communication. When comparing the amount of messages referring to the content rather than the person, we found that similarly to the first iteration, only a small minority of interactive responses accounted for socially *meaningful* interaction. As opposed to this, data on the affective type of responses revealed that a considerable amount of messages indicated exchange of personal information, emotions and expression of vulnerability. In-service teacher participants expressed emotions in 4% of the responses, they relied on using sense of humour in 8% of the messages, and self-disclosure prevailed in 22% of the communication.

Based on the fact that social presence manifested itself in the most various forms and demonstrated numerous indices of its existence, we perceived that in Calibrate 2, social interactions allowed for the formation of individualised impressions of the group members and the creation of a higher level of sense of community than in Calibrate 1.

Teaching presence

The analyses revealed that teaching presence in Calibrate 1 involved skills and tasks related to the instructional design and organisation of the online processes, facilitation of discourse and direct instruction. Indicators of the instructional design and organisation refer to the facilitator's managerial role (*Section 3.5.1*), which in the current case demonstrated high percentage (altogether 44%). Twenty-four percent of the facilitator messages referred to designing methods. In 14% of their contributions, they established time parameters, and in 5% of the messages they made reference to the establishment of a netiquette in the online interactions. However, no communication referred to setting the curriculum and utilising the medium effectively.

The facilitator's pedagogical or instructional role encompassed the skills concerning facilitating discussions and direct instruction. Table 6.23 shows that the facilitator relied only on two facilitation skills: she/he encouraged, acknowledged, or reinforced participant contributions (19%) and set climate for learning (10%). As concerns the methods of direct instruction the facilitator most often presented content and raised questions (19%), confirmed understanding through assessment and explanatory feedback (5%), injected knowledge from diverse sources e.g. articles, personal experiences and alike (10%). Only 5% of the instructor messages responded to technical concerns, which illustrated a less prevailing technical role.

Consequently, in the Calibrate 1 case, the online instructor's activity most often focused on the pedagogical or instructor role. This included that she/he as a consultant and resource provider offered scaffolding to the participants in their growing understanding through direct instruction and facilitating discourse by initiating questions and provoking responses, and focusing discussions on crucial points so that discussions progressed beyond information sharing to knowledge building. Activities related to the facilitator's managerial role were the other type of activity that prevailed in the online interactions. Consequently, a considerable effort was made in order to

design instructional methods, negotiate time lines for activities and tasks, and provide guidelines, tips for the appropriate use of the medium.

Table 6.23 Distribution of communication that reflects teaching presence in the Calibrate cases

Category	***Indicator***	***Calibrate 1***	***Calibrate 2***
Instructional Design and Organisation	Setting curriculum	0%	10%
	Designing methods	24%	5%
	Establishing time parameters	14%	5%
	Utilising medium effectively	0%	5%
	Establishing netiquette	5%	0%
Facilitating Discourse	Identifying areas of agreement/disagreement	0%	0%
	Seeking to reach consensus/understanding	0%	0%
	Encouraging, acknowledging, or reinforcing student contributions	19%	15%
	Setting climate for learning	10%	5%
	Drawing in participants, prompting discussion	0%	5%
	Assess the efficacy of the process	0%	0%
Direct Instruction	Present content/questions	19%	25%
	Focus the discussion on specific issues	0%	15%
	Summarise the discussion	0%	5%
	Confirm understanding through assessment and explanatory feedback	5%	10%
	Diagnose misconceptions	0%	5%
	Inject knowledge from diverse sources, e.g. textbook, articles, internet, personal experiences	10%	0%
	Responding to technical concerns	5%	0%

In Calibrate 2 as well, the facilitator's activity covered the three fields of responsibility. However, she/he made use of a wider scale of skills, which manifested in a wider range of indices in the instructor communication. We derived from Table 6.23 that a quarter of the facilitator's messages included issues related to the instructional design and organisation of the online processes. Designing methods and establishing time lines accounted for 5%-5% of the messages however, instead of establishing netiquette, in the second iteration the facilitator referred to the effective usage of the medium (5%). In the majority of messages related to the managerial role of the instructor, communication on setting the curriculum prevailed (10%). No messages referred to the appropriate use of the medium. As opposed to Calibrate 1, the facilitator's pedagogical or instructional role predominantly defined their teaching presence. Altogether 85% of the instructor communication focused on facilitating online discussions (25%) and maintaining direct instruction (60%). Facilitating discussions and managerial activities were present in an equal percentage in the facilitator's messages. In the process of facilitating online interactions, the instructor encouraged, acknowledged, or reinforced student contributions (15%), provided for a comfortable learning climate (5%), and drew in participants and prompted discussions (5%). Regarding the manifestations of the instructional activity, the facilitator presented content and raised questions in 25% of the messages, focused discussion on specific topics in 15% of the contributions. Five percent of the messages were a summary of the interactions, in 10% of the instructor communication, the facilitator confirmed

understanding through assessment and explanatory feedback, and in 5% of the contributions she/he diagnosed misconceptions.

The data revealed that the facilitator in her/his pedagogical or instructional role made use of a wider scale of facilitator assets in the second iteration. Consequently, the online instructor providing direct instruction and scaffolding online discussions made more use of her/his subject matter and pedagogical expertise, and less often adopted the role of a manager and organiser of online processes. As the table illustrated, when facilitating online discussions the facilitators neither in the first nor in the second iteration relied on skills and methods of identifying areas of agreement and disagreement, seeking to reach consensus and understanding, and assessment of the efficacy of the process.

6.5.2 Effects of online mentoring in CSCL environments in the community of in-service teachers

As indicated, we utilised the micro-level analysis of interactions as the third research tool (and source of data) in order to find support for or against our previously formulated hypotheses, and findings of the survey and the SNA. Accordingly, in the following we present the main results of the content analyses together with the findings of the SNA at the MULTIPED site in a table form in order for us to be able to detect possible relations, draw the necessary conclusions, and confront them with our previous claims (*Table 6.24*).

In both Calibrate cases, the in-service teacher participants relied mostly on elementary levels of *cognitive engagement*. They most often made responding contributions that were a direct response to a previous message, in which they offered feedback and opinion, or gave a description or a definition of a problem. Participants produced a considerable amount of informative statements, which most often contained anecdotal or personal information related to the general discussion topic. These informative types of messages demonstrated comprehension of the issues under discussion, and often involved in-depth clarification. The highest cognitive engagement manifested itself in the explanatory and analytical messages. However, despite these types of messages, discussions did not generate synthesising or evaluative statements hence the in-service teachers neither demonstrated a synthesis of knowledge nor developed understanding from facts to reasoning. Only a minority of statements presented factual information with limited personal opinions about responding messages or related information derived from external materials, and demonstrated negotiation of meanings, or thoughtful analysis. What was leaning towards a growing understanding of the content and knowledge building (instead of mere information sharing), was that in Calibrate 1, in one-fourth of the messages in-service teachers reflected on their own learning or use of strategies during the online mentoring, teaching and learning process. The lower level of cognitive engagement found in these cases shows similarities with findings of previous research (Garrison et al., 2001; Kanuka & Anderson, 1998; Zhu, 2006), which revealed that an extensive part of online communication was of sharing and comparing kind. Analysis and dissonance in the discourse did not prevail. Thus, content analyses of interactions did not support our claim based on the significant results of the survey concerning self-perceived cognitive presence that online communication contributed to the participants' growing understanding of the content, and to their knowledge building so that discussions progressed beyond info sharing to higher levels of knowledge construction (**H5**). When lower cognitive engagement,

participants may not profit much from the discussions, but this does not necessarily apply to the whole mentoring, teaching and learning experience in the framework of the Calibrate project, since moderated online interactions captured only part of the online activities in-service teachers were involved. Consequently, results of the content analyses did not contest our previous finding that as significant results verified, in-service teachers were the most satisfied with the quality of learning that took place in the CSCL environments in the framework of the MIM – as their global satisfaction with the mentoring, teaching and learning process was concerned. (As indicated previously SNA did not provide specific additional data related to cognitive presence.)

The content analyses revealed that in the Calibrate 1 case the online instructor's *teaching presence* most often focused on the pedagogical or instructor role. The facilitator thus as a consultant and resource provider offered scaffolding to the participants in their growing understanding through direct instruction and facilitating discourse by initiating questions and provoking responses from them, and focusing discussions on crucial points. Actions related to the facilitator's managerial role also clearly manifested themselves in the online interactions. Consequently, a considerable effort was made in order to design instructional methods, negotiate time lines for activities and tasks, and provide guidelines, tips concerning the appropriate use of the medium. In Calibrate 2, the facilitator's pedagogical or instructional role predominantly defined her/his teaching presence. As the data revealed, the facilitator in her/his pedagogical or instructional role made use of a wider scale of facilitator assets in the second iteration. Accordingly, the online instructor in Calibrate 2 when providing direct instruction and scaffolding online discussions made more use of their subject matter and pedagogical expertise, and less often adopted the role of a manager and organiser of online processes.

The most frequent manifestations of *social presence* in the online discussions of the Calibrate 1 case were the messages belonging to the cohesive category. Messages of this type included most often phatics and salutations, vocatives, and reference to the group by using inclusive pronouns. In Calibrate 1, participants most often relied on communication in which social presence had predominantly manifestations of linguistic nature. Hence, only a minority of participants disclosed and exchanged personal information, which could have contributed to the formation of individualised impressions of each other. In the second iteration, in Calibrate *2*, manifestations of social presence were of the most different kind. Thus, this time messages of the cohesive category with only linguistic indices did not prevail. Based on the fact that social presence manifested itself in the most various forms, and demonstrated numerous indices of its existence, in Calibrate 2 social interactions allowed for the formation of individualised impressions of the group members and a creation of a higher level of sense of community than in Calibrate 1.

Consequently, in a network such as Calibrate 1, where network activities were more intensively connected to the facilitator (the community's 'crucial cog') and the manner of facilitation exemplified the directive mentor. The facilitator's teaching presence focused considerably on the design of instructional methods, negotiation of time lines for activities and tasks, and provision of guidelines, tips concerning the appropriate use of the medium. While in a network with more weak ties and with participants less dependent on the facilitator's involvement, such as Calibrate 2, the facilitator's teaching presence was predominantly defined by her/his pedagogical or instructional role where facilitation of discussion was usually integrated within direct instruction and *in situ* design of instructional activity. Accordingly, the online instructor in Calibrate 2 when providing direct instruction and scaffolding online discussions

made more use of her/his subject matter and pedagogical expertise, and less often adopted the role of a manager and organiser of online processes. With the two different facilitator behaviours the facilitators' impact on the development of online communication and network structure was verified (**H2**).

Table 6.24 Main findings of the content analysis and the SNA in the Calibrate cases

Type of analysis	***Calibrate 1***	***Calibrate 2***
CONTENT ANALYSIS Cognitive presence	Increasing tendency of cognitive engagement towards higher levels of cognitive presence Reflective of individual learning	Low-level cognitive engagement Surface-level of information processing
CONTENT ANALYSIS Social presence	Interpersonal interactions with socially appreciative nature Intensive group commitment Less emotional presence Manifestation mainly of linguistic nature	Formation of individualised impressions of group members Sense of community, emotional presence
CONTENT ANALYSIS Teaching presence	Pedagogical/instructional role Managerial role Limited variety of facilitator assets	Pedagogical/instructional role Wide range of facilitator assets, usage of pedagogical expertise Managerial role the least intensive
SNA	'Guide on the side' facilitator with directive mentoring Facilitator as the 'crucial cog' Group-level interactions in general Network structure more centred on the facilitator – strong ties with the facilitator	'Guide on the side' facilitator with interactive mentoring Group-level interactions Less intensive facilitator behaviour A network consisting of strong and weak ties respectively

As concerns social presence, content analyses showed that in Calibrate 2 social presence manifested itself in the most various forms and demonstrated numerous indices of its existence. As opposed to this, in Calibrate 1, manifestations of linguistic nature prevailed. Thus, social interactions in Calibrate 2 where the facilitator maintained an interactive mentor behaviour and the network displayed a more balanced and horizontal interaction pattern, allowed for the formation of individualised impressions of the group members, and the creation of a higher level of sense of community than in Calibrate 1. Consequently, with the content analyses, the relation between the facilitator's teaching presence and the participants' social presence detectable in the online interactions was proved (**H4**). Not at all independent of the above, but as a surprising additional finding, the results of the content analyses revealed that the cognitive engagement in Calibrate 1 was higher than in the second iteration, in the Calibrate 2 case. Accordingly, interactive mentoring where the facilitator adopts the pedagogical and instructional role that generates a robust network consisting of strong and weak ties respectively, but the network itself is not centred on the involvement of the facilitator, does not necessarily result in higher cognitive engagement. In fact, the present pedagogical scenarios revealed that in a socially less active network of participants with a more directive type of 'guide on the side' facilitation, higher cognitive level was reached.

6.6 Results of the content analysis at the DELP site: cases ELT Methodology 1, ELT Methodology 2, ELT Methodology 3-4, ELT Methodology 5, and ELT Methodology 6

Results of the content analyses concerning the DELP site cases are presented in a similar manner as it was done in the case of the MULTIPED iterations. Results and findings will be reported on participants' cognitive engagement (presence), their social presence and facilitators' teaching presence.

Also in the MULTIPED cases, complete messages served as *unit of analysis*, which had the advantage that the units were objectively identifiable. Two independent coders did coding. Holsti's coefficient of reliability (CR) was utilised as *intercoder reliability* measure (for the detailed measures see *Appendix 12*). Discrepancies in the raters' coding were discussed by the raters and the investigator until consensus was reached. The reliability of the data was found sufficient.

6.6.1 Cognitive, social and teaching presence in the communities of pre-service teachers in the cases ELT Methodology 1, ELT Methodology 2, ELT Methodology 3-4, ELT Methodology 5, and ELT Methodology 6

Cognitive engagement (cognitive presence)

The in-depth analyses of the online interactions revealed varied levels of cognitive engagement in the ELT Methodology 1 case. Table 6.25 showed that the majority of the pre-service teachers responded to discussion topics by providing factual information. Twenty-two percent of the messages belonged to the elementary type of statements exemplifying cognitive presence. Nine percent of the communication was informative, 4% were of explanatory nature, and only 2% belonged to the category of messages that provided analysis. No messages were synthesising but 1% of the contributions provided evaluation or judgement. In the ELT Methodology 1 case, even though elementary low-level cognitive engagement prevailed, the activities of explanation, analysis and evaluation relied on higher levels of cognitive presence. Participants of this case only modestly reflected on changes and on the usage of cognitive strategies in the mentoring, teaching and learning process. They raised a limited amount of questions. The ratio of vertical and horizontal types was almost equal. The majority of the vertical questions were directed towards the facilitator, while horizontal types were asked either by the pre-service teacher participants of their group mates, or by the facilitator to trigger a discussion on a certain topic. Accordingly, the participants slightly more often turned to the facilitator for clarification and information.

We derived from Table 6.25 that in the ELT Methodology 2 case cognitive engagement was higher than in the previous case. Here again, cognitive engagement involved five types: responding (27%), informative (14%), explanatory (6%), analytical (4%), and evaluative (1%). Participants of this case as well responded most often to previous messages and provided anecdotal or personal information related to the topic under discussion.

Nevertheless, as the higher percentage of explanatory and analytical messages indicated, the participants were more involved in deeper levels of information processing and negotiation of concepts. Interestingly however, parallel to the increase of

statements demonstrating higher levels of cognitive presence, the amount of questions and reflections stayed very low.

6.25 Distribution of communication that reflects cognitive engagement in the ELT Methodology cases

		ELT Methodology cases					
Category	***Indicator***	***Case 1***	***Case 2***	***Case 3***	***Case 4***	***Case 5***	***Case 6***
Question	Seeking information (Vertical)	5%	3%	1%	1%	0%	0%
	Inquiring or starting a discussion (Horizontal)	4%	3%	7%	6%	7%	13%
Statement	Responding (knowledge or elementary classification)	22%	27%	39%	16%	34%	28%
	Informative (comprehension or in-depth clarification)	9%	14%	22%	27%	26%	41%
	Explanatory (application or application for strategies)	4%	6%	10%	15%	13%	13%
	Analytical (analysis)	2%	4%	7%	14%	3%	1%
	Synthesis (synthesis or inferencing)	0%	0%	6%	13%	7%	1%
	Evaluative (evaluation or judgment)	1%	1%	5%	4%	2%	0%
Reflection	Reflective of changes	3%	1%	1%	0%	3%	3%
	Reflective of using cognitive strategies	3%	1%	2%	3%	5%	0%

In the ELT Methodology 3 case, still the responding (39%) and informative (22%) communication domineered. Hence, pre-service teacher participants were most often engaged in providing or retrieving factual information, which demonstrated low levels of cognitive engagement and surface level of information processing. However, we perceived an increase in the amount of communication that showed higher levels of cognitive presence. Explanatory statements accounted for 10% of the communication, 7% of the contributions were analytical, 6% belonged to the synthesising statements and in 5% of the messages participants offered evaluative or judgmental opinions. In this case, higher-level cognitive engagement already included all the five stages, which was not the case in the previous two iterations. Consequently, participants more frequently engaged in offering analytical opinions, negotiation of meanings, providing a summary and judgment of the key points in the discussions. The higher percentage of horizontal questions (7%) aiming at inquiring or starting a discussion also supported the above. However, participants were still not reflective of changes and of using cognitive strategies in the mentoring, teaching and learning process.

The analyses revealed higher levels of cognitive engagement in the ELT Methodology 4 case. As the table illustrated, the majority of statements demonstrated higher-level cognitive presence. Sixteen percent of the messages was responding type, 27% percent of them belonged to the informative category. Thus, even in the elementary cognitive activities, the second type prevailed, which presupposed comprehension and clarification by providing anecdotal or personal information related to the topic under discussion. Messages displaying higher levels of cognitive engagement included all four types: explanatory (15%), analytical (14%), synthesis (13%), and evaluative (4%). Accordingly, in the communication that relied on deeper level of processing, participants most often presented factual information with limited personal opinion, offered analytical opinions about responding messages and attempted to provide a summary of discussion messages. They however, already presented judgmental evaluations. In this case as well, the percentage of horizontal questions (6%)

was considerably higher than that of the verticals (1%). But the participants were reflective of using cognitive strategies (3%) only to a limited extent.

In the ELT Methodology 5 case again, the responding (34%) and informative (26%) type of statements prevailed but did not dominate as concerns the general level of cognitive engagement. A considerable amount of communication implied higher levels of cognitive presence: 13% of the messages were explanatory, 3% belonged to the analytical types, 7% provided a synthesis, and 2% of the contributions offered evaluative opinions. Consequently, the analyses revealed varied levels of cognitive engagement, which most often relied on elementary, surface level of information processing, but frequently included deeper levels of processing and elaborating of concepts. Pre-service teacher participants of this case raised exclusively horizontal questions (7%) aiming at inquiring or starting discussions, and they were more active in reflecting on changes (3%) and on the usage of cognitive strategies (5%) in the mentoring, teaching and learning process.

The analyses revealed low-level cognitive engagement in the ELT Methodology 6 case. The majority of communication was of responding and informative nature. Twenty-eight percent of the statements belonged to the category of responding, and 41% was informative type of message. This showed that participants demonstrated mostly low-level cognitive engagement and they were predominantly engaged in surface-level information processing. We also perceived manifestations of higher levels of cognitive presence but as data showed these types of activity were in minority as compared to the elementary or basic level cognitive presence. Thirteen percent of the messages were explanatory, in which participants presented factual information with limited personal opinions. Analytical and synthesising types accounted altogether for 2% of the messages. No messages offered evaluation or judgmental opinion. Exclusively horizontal questions were raised in the interactions, the percentage (13%) showed that there was an effort in order to trigger discussions. However, the messages focusing on reflection were in minority.

We derived from the content analyses that the ELT Methodology 4 case displayed the highest cognitive engagement, while in the ELT Methodology 6 case the cognitive presence stayed the lowest. We perceived a decreasing tendency in cognitive engagement in ELT Methodology 3 and 5, whereas in ELT Methodology 1 and 2 cognitive engagement was predominantly surface-level.

Social presence

Content analyses revealed that in the ELT Methodology 1 case the manifestation of social presence was of the cohesive character. Table 6.26 shows that messages in which phatics, salutations, the usage of inclusive pronouns and vocatives indicated participants' social experience and sense of group commitment, prevailed (altogether 47% of the contributions demonstrated these indices). Interactive responses were the other type of messages that frequently occurred. In the majority of the interactive responses (15%) group members complemented each other and expressed appreciation. In 13% of the messages pre-service teachers asked questions of each other. In an equal amount of responses they quoted from the others' messages or referred explicitly to somebody's messages (3%), and expressed agreement (3%). Three percent of the messages clearly demonstrated continuation of a thread. Altogether 25% of the interactions exemplified the affective category. In 13% of the responses, participants expressed emotions. Self-disclosure by which they presented details of life outside of

class, or expressed vulnerability prevailed in 7% of the responses. We found indices of the usage of humour in only 5% of the messages. We thus perceived from the above that the members made a considerable effort to sustain interactivity, which we interpreted as evidence for the participants attending to each other. Complementing and acknowledging, expression of appreciation was judged as manifestations of reinforcement.

6.26 Distribution of communication that reflects social presence in the ELT Methodology cases

		ELT Methodology cases					
Category	***Indicator***	***Case 1***	***Case 2***	***Case 3***	***Case 4***	***Case 5***	***Case 6***
Affective	Expression of emotions	13%	12%	7%	2%	3%	1%
	Use of humour	5%	6%	9%	1%	5%	3%
	Self-disclosure (present details of life outside of class, or express vulnerability)	7%	6%	20%	25%	14%	18%
Interactive	Continuing a thread (using reply function of software rather than starting a new thread)	3%	3%	1%	1%	9%	20%
	Quoting from others' messages Referring explicitly to somebody's message	3%	3%	12%	7%	2%	5%
	Asking questions (students ask questions of other students)	13%	13%	7%	1%	4%	3%
	Complementing, expressing appreciation	15%	11%	19%	12%	12%	11%
	Expressing agreement	3%	14%	5%	15%	26%	17%
Cohesive	Vocatives (referring to participants by name)	11%	9%	0%	1%	0%	2%
	Addresses or refers to the group using inclusive pronouns (addresses group as we, us, our group)	5%	1%	8%	1%	5%	0%
	Phatics, salutations (communication that serves purely social function)	31%	29%	12%	34%	20%	20%

A quarter of the contributions demonstrated affective responses, thus as compared to the interactivity, the participants less frequently exchanged personal information. As opposed to this, almost half of the total communication included some sort of cohesive element. Accordingly, even if predominantly indices of linguistic kind demonstrated social presence based on the interactive character of responses a sense of group commitment was perceived. However, due to the limited exchange of emotions, personal details and experiences, formation of individualised impressions was maintained only to a limited extent.

In the ELT Methodology 2 case, the interactive responses prevailed, thus most frequently indices of interactivity and reinforcement were found. Among the interactive type of contributions, the highest percentage (14%) referred to the responses in which participants expressed agreement. Thirteen percent of the messages included questions, which the pre-service teachers directed towards each other. In 11% of the responses, they complemented and expressed their appreciation. Equally small amount of messages (3%-3%) demonstrated clearly interactivity - quoting from others' responses or making explicit reference to somebody's message. Despite the strong interactive character of the social presence, the cohesiveness prevailed overwhelmingly in the communication. Altogether 39% of the responses included cohesive elements through which social presence was detectable. These elements were mainly of linguistic nature such as phatics, salutations, vocatives, and so on. Almost the quarter of the messages

demonstrated affective elements, which contributed to the expression of feelings, emotion and mood in the online interactions. The majority of these responses (12%) referred to the socioemotional experience, half as many messages demonstrated the use of humour. Similarly to the latter indicator of social presence, participants disclosed themselves only in 6% of the responses. We can derive from the above that in the second iteration, social presence most often became detectable through the interactive character of communication, on which the interpersonal interaction was based. With the prevalent indices of cohesiveness, we perceived the evolving sense of community. However, due to the limited exchange of emotions, personal details and experiences, formation of individualised impressions was maintained only to a limited extent.

Table 6.26 shows that in the ELT Methodology 3 case interactive responses prevailed. Thus, social presence became most tangible through the interactive character of communication among the participants. Pre-service teacher group members most often complemented and expressed their appreciation (19%), and they often quoted from each other's messages or made explicit reference to a member's response (12%). In a lower percentage of contributions, they referred to each other by asking questions (7%), and even in less messages (5%) they expressed agreement concerning the issues under investigation. The distribution of affective and cohesive responses was equal. However, in this case again the usage of phatics, salutations, inclusive pronouns, and so on, prevailed (29%). At the same time, in a considerable amount of messages the participants presented details of their lives, expressed emotions and vulnerability (7%), thus exchanges personal information and experience (20%), and used their sense of humour (9%). Accordingly, communication in the present case was of a strongly interactive character, which allowed for the development of sense of community and the formation of individualised impressions of each other.

In the ELT Methodology 4 case, both the interactive and the cohesive type of communication were prevalent. Hence, social presence manifested itself through purely linguistic cues (altogether 36%) (phatics, salutations, vocatives etc.,) indicating cohesiveness, and most often latent content of interactive character. The latter type of responses included the expression of agreement (15%), and complementing and appreciation (12%), but also contained reference to each other's contributions (7%), continuation of a thread (1%) and asking questions from each other (1%). The affective category accounted for altogether 28% of the communication. In 25% of the messages, hints of self-disclosure were found. In only 3%, the participants expressed their emotions, and in 1% they used their sense of humour. Accordingly, threaded interchanges with socially appreciative nature prevailed in this case as well. Hence, social presence in the ELT Methodology 4 case manifested itself in the open communication (high interactivity) and group cohesion (cohesive responses), even though emotional presence was less dominant in the online interactions.

The content analyses revealed a strong interactive character of interactions in the ELT Methodology 5 case. Altogether 53% of the messages included cues of interactivity. Most often participants expressed agreement concerning the issues under discussion (26%) – this percentage was so far the highest as concerns this indicator. Complementing and appreciation, ways of communicating reinforcement accounted for 12% of the responses. Eleven percent of the messages demonstrated clearly the continuation of a thread – not exclusively by using the reply feature but also by directly quoting from each other's messages, or by referring explicitly to another response. In 4% of the messages, participants asked questions of each other. Approximately an equal amount of communication demonstrated elements of affective and cohesive nature. The highest percentage (20%) indicated the most frequent occurrence of purely linguistic

cues such as phatics or salutations. As for the affective responses, 14% of the messages demonstrated self-disclosure where participants presented details of their life or expressed vulnerability. Only a low amount of responses contained the expression of emotions (3%) and sense of humour (5%). Hence, in the ELT Methodology 5 case, interactive responses, threaded interactions with socially appreciative nature prevailed. The cohesiveness and emotional presence were less tangible.

In the last iteration, in ELT Methodology 6, interactive responses maintained the highest percentage (total 56%). Accordingly, more than half of the communication contained some sort of indicator of interactivity. The prevailing cue of interactive character proved to be the continuation of a thread (20%). However, the socially appreciative nature of messages (expressing agreement) was also detectable in a considerable percentage of responses (17%). Complementing and reinforcement accounted for 11% of the contributions. The affective and cohesive communication was displayed in an equal amount of responses (22%-22%). While in the affective dimension self-disclosure domineered (18%), in the cohesive category the purely linguistic manifestations of cohesiveness (20%) prevailed. As the table illustrated, only a few messages contained expression of emotions (1%) and somewhat more responses demonstrated the use of humour (3%). Based on the above, indices of threaded interchanges with socially appreciative nature were characteristic of the ELT Methodology 6 case. This was supported by cohesive elements – predominantly linguistic and formal cues. However, emotional presence, which could have contributed to the formation of individualised impressions of each other, was tangible to a limited extent.

We derived from the results that the ELT Methodology 3 and 4 cases allowed for socially meaningful interactions and evolving sense of group commitment. ELT Methodology 6 was perceived as the least active community as concerned the socioemotional experience, while in ELT Methodology 1, 2 and 5 cases the interpersonal interactions with socially appreciative nature allowed for a more intensive group commitment, with less emotional presence, though.

Teaching presence

Table 6.27 shows the distribution of communication that reflects teaching presence in the ELT Methodology cases as discriminated by Anderson et al. (2001). We derived from the table that in all cases the facilitator's activities covered the field of instructional design and organisation, facilitating discourse and direct instruction. The first field of tasks and responsibilities is most often referred to as the managerial role (*Section 3.5.1*), facilitating discourse is directly associated with direct instruction and is most often integrated *in situ* design of instructional activity. These two categories of activities thus belong to the facilitator's pedagogical or instructional role.

In the present framework, direct instruction entails an indicator related to technical concerns, which are associated with the facilitator's technical assistant role. (The facilitator's social director role was investigated in the context of social presence.)

As the content analyses revealed, the facilitators in the ELT Methodology 1 case demonstrated a strong teaching presence based on a wide range of activities in their pedagogical or instructional, managerial and technical assistant roles. However, as data showed the most prevailing among the field of responsibilities was the facilitation of discourse. Altogether 77% of the instructor messages contained elements referring to these activities. Reference to encouraging, acknowledging, or reinforcing participant

contributions was made in 22% of the messages, in a similar amount of responses (22%) the facilitator aimed at drawing in participants and prompting discussions. Assessing the efficacy of the process and setting climate for learning accounted for an equal percentage of the facilitator messages (11%-11%). In 7% of her/his, contributions she/he attempted to identify areas of agreement/disagreement, and in 4% intended to reach consensus among the differing parties.

The amount of responses referring to the instructional design and organisation (63%), and direct instruction (60%) was approximately the same. However, half of the messages inhabiting indices of direct instruction concerned the technical assistant role of the instructors (30%). The rest of these types of messages referred to presenting content (7%), focusing discussion on specific issues (4%), summarising interactions (4%), explanatory assessment and feedback (4%), diagnosis of misconceptions (7%), and injecting knowledge from diverse sources (4%). As concerns the organisation and design of instruction, the facilitator most often made reference to designing methods (33%) and established time parameters (15%). Less frequently, she/he modelled the appropriate etiquette (7%), and even less often she/he set the curriculum (4%) and provided guidelines for the effective use of the medium (4%).

Accordingly, in this case, the facilitator most often adopted the pedagogical or instructional role, which was dominated by the use of skills of moderating online discussions, the managerial role and technical assistant role. Direct instruction as content provision was less prevalent but since facilitating discourse is most often integrated in the design of instructional activity the assistive (directive) role for the facilitator to provide instructional support was clearly identifiable.

In the ELT Methodology 2 case, as Table 6.27 illustrates, the percentage of the distribution of messages reflecting elements of teaching presence were extremely high, which indicated an intensive instructor presence. In this case again the facilitator's activities focusing on stimulating and moderating online discussions prevailed however, this time she/he only relied on three techniques as opposed to making use of a wider range of pedagogical and methodological skills. Hence, she/he most often tried to draw in participants (90%), encouraged, acknowledged or reinforced student contributions (70%), and assisted in identifying areas of agreement/disagreement (20%). Very frequently the instructor adopted the managerial role, in 70% of the messages she/he designed methods, in 50% of the messages made reference to the time lines, 20% of the facilitators' contributions indicated the effective use of the medium and 5% aimed at establishing netiquette in the online discussions.

Direct instruction was also intensively maintained however, less content provision and more reinforcement domineered in the instructor messages. This field of responsibility was managed by applying a limited number of strategies thus the performance of the instructor in this sense was rather 'flat'. In 50% of the messages, the instructor confirmed understanding through assessment and explanatory feedback. In a lower amount of responses, she/he tried to summarise the discussions (10%) and diagnosed misconceptions (10%). In 10% of the messages, she/he reacted to technical concerns. Accordingly, in the ELT Methodology 2 case, we perceived a very strong instructor presence, which relied on a rather poor inventory of skills. Among the various facilitator roles, the managerial 'identity' prevailed.

The content analyses revealed a less intensive but a 'well-proportioned' teaching presence in the ELT Methodology 3 case. In these communities again, the facilitator's moderating and discourse facilitating skills domineered. In 45% of the instructor messages some sort of indices of these types of activities occurred. Encouraging, acknowledging or reinforcing student contributions accounted for 25% of the instructor

messages, 13% demonstrated the inclusion of participants and prompting discussions. In 3% of the reactions, the facilitator aimed at setting the climate for learning, in 2% she/he made reference to identifying areas of agreement/disagreement, and in 2% of the responses she/he sought to reach consensus and understanding.

6.27 Distribution of communication that reflects teaching presence in the ELT Methodology cases

		ELT Methodology cases					
Category	***Indicator***	***Case 1***	***Case 2***	***Case 3***	***Case 4***	***Case 5***	***Case 6***
Instructional Design and Organisation	Setting curriculum	4%	0%	5%	0%	0%	14%
	Designing methods	33%	70%	5%	13%	17%	3%
	Establishing time parameters	15%	50%	10%	10%	3%	8%
	Utilising medium effectively	4%	20%	5%	0%	0%	0%
	Establishing netiquette	7%	5%	0%	3%	0%	0%
Facilitating Discourse	Identifying areas of agreement/disagreement	7%	20%	2%	0%	0%	0%
	Seeking to reach consensus/understanding	4%	0%	2%	0%	0%	0%
	Encouraging, acknowledging, or reinforcing student contributions	22%	70%	25%	10%	14%	16%
	Setting climate for learning	11%	0%	3%	0%	7%	14%
	Drawing in participants, prompting discussion	22%	90%	13%	6%	10%	3%
	Assess the efficacy of the process	11%	0%	0%	13%	7%	3%
Direct Instruction	Present content/questions	7%	0%	2%	0%	3%	0%
	Focus the discussion on specific issues	4%	0%	10%	3%	14%	3%
	Summarise the discussion	4%	10%	2%	3%	0%	0%
	Confirm understanding through assessment and explanatory feedback	4%	50%	5%	19%	21%	27%
	Diagnose misconceptions	7%	10%	7%	6%	3%	5%
	Inject knowledge from diverse sources, e.g. textbook, articles, internet, personal experiences	4%	0%	3%	13%	0%	3%
	Responding to technical concerns	30%	10%	2%	0%	0%	3%

The facilitator relied on the most varied inventory of skills and techniques as concerns direct instruction. In most of this type of communication, she/he tried to focus the discussion on specific issues (10%), diagnose misconceptions (7%), and confirmed understanding through assessment and feedback (5%). In 3% of the contributions, she/he aimed at injecting knowledge from diverse sources and 2% of the messages offered a summary of discussions. Only a very small amount of communication focused on the technical role (2%). The managerial role was the least prevalent in the facilitator's activities. In 10% of her/his messages she/he made reference to time parameters, in equally 5% of the contributions she/he focused on setting the curriculum, designing methods and modelling the effective use of the medium. Based on the above, we claim that in the ELT Methodology 3 case teaching presence manifested itself most often in the pedagogical or instructional role. This was based on a wide range of facilitator assets and the usage of pedagogical expertise where direct instruction and content provision were maintained by the skilful scaffolding of online discussions.

In the ELT Methodology 4 case, a similar type of teaching presence outlined itself however, with more elements of reinforcement and content provision. Hence, messages

of direct instruction relied mainly on confirming understanding through assessment and explanatory feedback (19%) and injecting knowledge from diverse sources (13%). In 6% of the messages, the instructor aimed at diagnosing misconceptions, in an equal amount she/he focused the discussion on specific issues (3%) and provided a summary of the interactions (3%). The facilitation of discourse was also based on reinforcement: encouraging and acknowledging student contributions (10%), assessing the efficacy of the process (13%), and drawing in participants and prompting discussions (6%). Instructional design and organisation i.e. the managerial role, included most often reference to designing methods (13%) and establishing time parameters (10%), but occasionally guidelines for netiquette were included (3%). Accordingly, in this case the facilitator most often adopted the pedagogical or instructional role with a more concentrated effort to provide reinforcement and content through skilful scaffolding of online instructions.

In the ELT Methodology 5 case, elements of direct instruction and facilitating discourse domineered, thus teaching presence most often manifested itself in the pedagogical and instructional role of the facilitators. In general, we did not perceive the percentage of distributions high. This indicated a less intensive instructor presence, which however did not demonstrate a variety of skills and methods. In altogether 41% of the messages we identified cues referring to direct instruction, which encompassed messages of confirming understanding through assessment and feedback (21%), responses focusing the discussions on specific issues (14%), and 3% diagnosing misconceptions and presenting content. As concerns the activities connected to facilitating discourse, the instructor most often aimed at reinforcement (14%) and drawing in participants (10%). The distribution of messages focusing on setting the climate and assessing the efficacy of the progress was equally 7%. The technical role was not adopted in this case. The managerial role was based on two activities: designing methods (17%) and establishing time parameters (3%). Accordingly, the results illustrated that the facilitator in her/his pedagogical or instructional role focused more on reinforcement, encouraging participants and less on content provision, and they relied on a limited use of her/his facilitator assets.

In the last iteration, in the ELT Methodology 6 case, teaching presence was not perceived ‘strikingly’ intensive, but similarly to the previous iteration, neither did it rely on a wider range of facilitator assets. Most often facilitator messages demonstrated indices of direct instruction: the instructor most frequently confirmed understanding through assessment and feedback (27%), she/he occasionally aimed at diagnosing misconceptions (5%) and very rarely focused the discussions on specific issues (3%), injected knowledge from diverse issues (3%), and in her/his technical assistant role responded to technical concerns (3%). Facilitating discourse encompassed four types of activities: encouraging, acknowledging or reinforcing participant contributions (16%), setting climate for learning (14%), drawing in participants (3%), and assessing the efficacy of the process (3%). Hence, direct instruction and facilitation of discourse relied more on reinforcement rather than content provision or scaffolding knowledge development. In her/his managerial capacity, the facilitator most often attended to setting the curriculum (14%), establishing time parameters (8%), and designing methods (3%). As results revealed, in the last iteration teaching presence encompassed mainly pedagogical or instructional activities, which relied on a limited variety of facilitator assets. Most often direct instruction and discourse facilitation concentrated on reinforcement rather than content provision in a skilful manner.

Based on the results of the content analyses, teaching presence in the ELT Methodology 3 and 4 cases was identified as reliant on a wide range of facilitator assets

and the usage of pedagogical expertise where direct instruction and content provision were maintained by the skilful scaffolding of online discussions. Also, less intensive teaching presence was detected in the cases ELT Methodology 5 and 6. This encompassed mainly pedagogical or instructional activities, which relied on a limited variety of facilitator assets. Most often direct instruction and discourse facilitation concentrated on reinforcement rather than content provision in a skilful manner. Teaching presence was very intensive in the ELT Methodology 1 and 2 cases where the assistive (directive) role of the facilitator to provide instructional support was clearly identifiable.

6.6.2 Effects of online mentoring in CSCL environments in the community of pre-service teachers

As indicated, with the content analyses of online interactions we aimed at an in-depth study of processes and effects. In the following, we present the main results of the content analyses together with the findings of the SNA at the DELP site in a table form so that we are able to detect possible relations and draw the necessary conclusions (*Table 6.28*).

Results revealed that online communication had a clearly identifiable effect on participants' cognitive presence (which we claimed on the basis of the survey results but with the SNA did not manage to find relevant data) (**H5**). In the present pedagogical scenarios, low-level cognitive engagement and surface-level information processing were linked to loosely knit networks where participants formed working pairs or triads (mostly together with the facilitator). Responsive or reactive behaviour was characteristic of these interactions. As opposed to this, increasing cognitive engagement or high levels of cognitive presence and deeper levels of information processing evolved in densely knit networks where discussions were maintained on a group-level with 5-6 participants. These groups did not necessarily include the facilitator. Interactivity (mutually established relations) and a proactive manner of communication prevailed in these networks. Interestingly, we found increasing cognitive engagement in loosely knit networks with working pairs or triads. In their case however, the social presence and the facilitator's teaching presence resembled that of the densely knit communities.

Accordingly, in densely knit networks, less intensive teaching presence relied on a wide range of facilitator assets and on the usage of pedagogical expertise. In these networks, direct instruction and content provision were maintained by skilful scaffolding of online interactions. Increasing or higher levels of cognitive engagement and deeper levels of information processing were also characteristic of such communities.

Social presence in such communities manifested itself in socially meaningful interactions, a sense of community and emotional presence, which allowed for a formation of individualised impressions. As opposed to this, in loose networks, very intensive teaching presence based on an assistive (directive) role prevailed. In these cases, social presence was characterised by interpersonal interactions with socially appreciative nature where despite group commitment less emotional presence was typical. Based on the above, we claim that both social presence and the facilitator's teaching presence had a clearly identifiable effect on the online communication in the mentoring, teaching and learning processes (**H2**) (**H3**). However, as concerns the

relationship between the facilitator's role (teaching presence) and social presence we found a less obvious relationship (**H4**).

Table 6.28 Main findings of the content analysis and the SNA in the ELT Methodology cases

Type of analysis	***Group1***	***Group 2***	***Group 3***	***Group 4***	***Group 5***	***Group 6***
CONTENT ANALYSIS Cognitive presence	Low-level cognitive engagement Surface-level of information processing	Low-level cognitive engagement Surface-level of information processing	Increasing tendency of cognitive engagement towards higher levels of cognitive presence	High levels of cognitive engagement Deeper levels of information processing and elaborating concepts	Increasing tendency of cognitive engagement towards higher levels of cognitive presence	Very low levels of cognitive engagement
CONTENT ANALYSIS Social presence	Interpersonal interactions with socially appreciative nature Intensive group commitment Less emotional presence	Interpersonal interactions with socially appreciative nature Intensive group commitment Less emotional presence	Socially meaningful interactions, Sense of community, emotional presence Formation of individualised impressions	Socially meaningful interactions, Sense of community, emotional presence Formation of individualised impressions	Socially meaningful interactions, Sense of community, emotional presence Formation of individualised impressions	Socioemotionally passive
CONTENT ANALYSIS Teaching presence	Very intensive teaching presence Assistive (directive) role in order to provide instructional support	Very intensive teaching presence Assistive (directive) role in order to provide instructional support	Less intensive teaching presence, wide range of facilitator assets, usage of pedagogical expertise, direct instruction and content provision maintained by skilful scaffolding of online interactions	Less intensive teaching presence, wide range of facilitator assets, usage of pedagogical expertise, direct instruction and content provision maintained by skilful scaffolding of online interactions	Less intensive teaching presence, limited variety of facilitator assets, direct instructions and discourse facilitation focusing on reinforcement, rather than content provision in a skilful manner	Intensive teaching presence, limited variety of facilitator assets, direct instructions and discourse facilitation focusing on reinforcement, rather than content provision in a skilful manner
SNA	Loose networks Working pairs or triads Reactive/ responsive facilitator behaviour	Loose networks Working pairs or triads Reactive /responsive facilitator behaviour	Predominantly densely knit networks Group-level interactions (groups of 4-5) Interactive facilitation in a proactive manner	Predominantly densely knit networks Group-level interactions (groups of 4-5) Interactive facilitation in a proactive manner	Loose networks Working pairs or triads Reactive/ responsive facilitator behaviour	Loose networks Working pairs or triads Reactive /responsive facilitator behaviour

Results revealed that less intensive teaching presence characterised by a wide range of facilitator assets or a limited variety of facilitator assets either resulted in direct instruction and content provision maintained by skilful scaffolding of online interactions, or generated facilitation focusing on reinforcement. Both approaches favoured the evolving of socially meaningful interactions. The effect of an intensive teaching presence focusing on reinforcement was reciprocal. This type of instructor presence was associated with social passivity and the lowest level of cognitive engagement. Consequently, limited evidence was found as concerns the facilitator's impact on social presence.

Finally, we claim that the above described interconnectedness of agents and phenomena were indirect evidence of our primary claim (and hypothesis) that online communication that was related to teaching presence, social presence and cognitive

presence, had an effect on participants' global satisfaction with the mentoring, teaching and learning process and on their learning success (**H1**).

The SNA results showed that the majority of pre-service teachers experienced merely reactive or responsive mentoring, where the facilitation included the instructor's immediate reaction to the learners' spontaneous demand for help and request for mentoring feedback but the need for a socially active 'social director' facilitator was not met. Results of the content analyses also verified that the majority of participants experienced intensive or very intensive teaching presence associated with directive-instructional character. However, the less obvious relationship between the facilitator's activity and social presence neither contested nor supported the latter claim according to which such an instructor presence necessarily generated a socially less active behaviour.

7 CONCLUSIONS AND IMPLICATIONS

The present study was conducted in order to shed light on the online instructor roles and the effects of the online mentoring, teaching and learning process in CSCL environments in communities of pre- and in-service teachers. We focused on the online instructors' activity, more precisely on their participation in the online interactions, the influence of their activity on learners' engagement, the patterns of interaction, and their varying facilitating styles. When investigating the effects of online mentoring, teaching and learning processes we considered pre- and in-service teacher communities' perceptions of the learning experience and the interrelation of the elements in the online mentoring, teaching and learning events. In the following sections, the main findings of the study will be summarised with respect to the research questions and hypotheses.

7.1 Elements and their relations impacting participant satisfaction and self-perceived learning success in the online mentoring, teaching and learning process in the CSCL environment

H1 Online communication has a direct impact on participant satisfaction and self-perceived learning success experienced in the online mentoring, teaching and learning process in the CSCL environment.

Results, based on data source and methodological triangulation, revealed in both communities that online communication impacted processes in the learning networks and thus had a direct effect on participants' global satisfaction. Hence, online communication that is related to teaching presence, social presence and cognitive presence, was identified both as the most influential indicator of the participants' global satisfaction and as a central criterion of the online mentoring, teaching and learning processes maintained in the framework of the MIM in the CSCL environments.

H2 Facilitator's activity has an influence on online communication in the mentoring, teaching and learning process in the CSCL environment.

H3 Perceived social presence and online communication are interrelated phenomena and mutually impact each other in the mentoring, teaching and learning process in the CSCL environment.

The facilitator's activity i.e. teaching presence was identified as a component having direct significant impact on participants' global satisfaction and as a relevant indicator of satisfaction and learner success. The analyses revealed that similarly to online communication, it was related to all the components of the MIM. Based on the results we also claimed that the facilitator's activity, her/his teaching presence had a clearly identifiable effect on the online communication in the mentoring, teaching and learning processes.

Results also showed that the communities of pre-service and in-service teachers were the most satisfied with the facilitators' activity focusing on scaffolding. Scaffolding (help) offered by the facilitator thus proved the strongest indicator of satisfaction in the variable group referring to the facilitator's activity. Accordingly, effective scaffolding and provision of feedback were a must in online mentoring, teaching and learning processes.

Analyses of data gained from all the three sources revealed that higher frequency of communication and a higher level of sense of community were related. This

supported the assumption that social presence and online communication were strongly interrelated phenomena.

H4 Facilitator's activity has an impact on perceived social presence in the mentoring, teaching and learning process in the CSCL environment.

As concerns the relationship between the facilitator's activity (teaching presence) and perceived social presence, we found a less obvious relationship. The findings of the study only partially supported this hypothesis. In the in-service teachers' community, only the results of the content analyses supported the facilitator's impact on perceived social presence. In the case of the pre-service teachers, results based on only two tools, the survey and the SNA, demonstrated that the facilitator through her/his social director role influenced the degree to which participants perceived each other and their instructors as 'real', and thus she/he contributed to experiencing the feeling of 'nonmediation'.

H5 Online communication in the mentoring, teaching and learning process in the CSCL environment impacts participants' cognitive presence.

Satisfaction regarding the quality of the teaching and learning experiences – as an indicator of perceived cognitive presence – was rated with the highest values in the variable group concerning global satisfaction in both communities. This variable was the strongest indicator of satisfaction demonstrating that participants were the most satisfied with the quality of learning that took place in the CSCL environments in the framework of the MIM. In the presented scenarios, survey results thus supported that effective online communication contributed to the participants' cognitive presence, and to the facilitation of their knowledge advancement.

Based on the results of the SNA and descriptive statistics, we formulated our findings in relative terms regarding the success of knowledge transmission and mediation of information in the observed and mapped networks. The SNA did not provide specific additional data related to the pre-service teachers' cognitive presence. Content analyses of interactions in the in-service teachers' community did not support our claim that online communication contributed to the participants' growing understanding of the content, and to their knowledge building so that discussions progressed beyond info sharing to higher levels of knowledge construction. Nevertheless, we added that when lower cognitive engagement, participants might not profit much from the discussions. However, this did not necessarily apply to the whole mentoring, teaching and learning experience in the framework of the Calibrate project, since moderated online interactions captured only part of the online activities in-service teachers were involved. Consequently, results of the content analyses did not contest our previous finding that in-service teachers were the most satisfied with the quality of learning that took place in the CSCL environments in the framework of the MIM. As opposed to this, results revealed that in the communities of pre-service teachers, online communication had a clearly identifiable effect on participants' cognitive presence. Based on the above, evidence of online communication impacting participants' cognitive presence was limited.

7.1.1 Barriers and drivers of participant satisfaction

We utilised the Kano model in the study of participants' satisfaction with the online learning experience in order to decide the relative priority of improving components of the MIM.

We clearly identified the online communication component as a one-dimensional attribute, which leads to linear increase of participant satisfaction. Results concerning the participants' skills and competencies involved in the general computer usage (SZHK) and their Internet abilities (IHK) were identified as must-be attributes. Hence, online communication and effective facilitation are inevitable constituents of the online mentoring, teaching and learning process, and they lead to higher participant satisfaction and perceived learner success. At the same time however, successful participation is also dependent on the participants' skills and competencies concerning general computer usage and their Internet abilities. Their absence would lead to extreme dissatisfaction.

In the present study, there were neither attractive attributes (that are in general unexpected by the participants, their presence could lead to satisfaction but there would not be a decrease in satisfaction with their lower level) nor indifferent attributes (those that the participants would not especially be interested in) identified.

7.2 The effects of the online mentoring, teaching and learning process in the CSCL environment – with special focus on the facilitator's roles and facilitative approaches

7.2.1 'Guide on the side' vs. 'resource provider' or 'master teacher'

In the first round of analyses, we differentiated between 'guide on the side' and 'resource provider' or 'master teacher' facilitator approaches. We identified the 'guide on the side' facilitator as an online instructor who attended to a socially active community and maintained horizontal group architecture. The 'resource provider' or a 'master teacher' facilitator even if she/he applied collaborative instructional design, relied on a stronger instructor presence and a more directive facilitation. This approach was characterised by a vertical structure of the workflow and a hierarchical group architecture where the socially less active facilitator and eventually a few members obtained the 'top positions'. Under such circumstances, the participants' performance or activity acknowledged by the facilitator had a strong impact on participants' satisfaction with the learning experience.

7.2.2 Directive facilitation vs. interactive facilitation

Based on further participant activity analyses, we claimed that since the facilitator's activity, the participants' perceived social presence and the online communication were directly/indirectly interrelated, online facilitation in the mentoring, teaching and learning process should be more than mere direct instruction focusing on on-task communication. It should also encompass providing a comfortable learning experience and the online instructor's social engagement. However, we found that successful professional scaffolding and the facilitator's pedagogical or instructor role

aiming at effective ‘instruction’ were not necessary accompanied by socially active facilitator behaviour.

Consequently, in line with previous research findings, we differentiated between directive facilitators who aimed at mainly direct instruction, and interactive facilitators. The former approach was based on reactive tutoring or facilitation where the instructor reacted exclusively to the online learners’ requests, whereas the latter type of instructor facilitated in a proactive manner. Proactive facilitation encompassed the facilitator’s own initiative for entering the participants’ learning process by not only supporting on-task professional discussions, but also providing a comfortable learning experience by acting as a socially engaged member of the learning community.

7.2.3 Facilitation approach and network interaction structure

In the present study, we found that more facilitator messages, a more intensive participation in the online interactions did not necessarily guarantee balanced group-level communication patterns and a mutual, intensive, community-level interaction. Neither did reduced facilitator activity hamper intensive communication and evolving collaboration in a network. Instead, we argued that if the amount of incoming and outbound facilitator relations was in balance i.e. the instructor received and created the same amount of messages, or the facilitator’s activity was characterised by slightly more outgoing linkages than incoming ones, then in these networks more intensive and broad-based participation would evolve. This generated mutual interactions and higher level of sense of community that were prerequisites of group collaborations. Accordingly, interactive facilitators, who facilitated in a proactive manner provided better for the preconditions of collaborations. If however, the facilitator’s activity shifted to either extreme – facilitator outbound communication dominated participant contributions, or the instructor was the recipient of most of the incoming linkages – then this most probably hampered the development of balanced interaction patterns and the horizontal flow of information among participants. Hence, the preconditions of collaboration were not met. Analogously, the case when the incoming and outbound facilitator communication was in balance but the facilitator established strong links exclusively with the same (in most cases a limited number of) participants would not have been ideal either. This type of interaction pattern was characteristic of reactive or responsive facilitation. We must however note for the sake of completeness and validity, that in those groups where participant activity stayed low throughout the mentoring, teaching and learning process, the facilitator’s mentoring efforts of any kind did not result in an interactive mentoring event. Thus, we assumed that the importance of group composition (the ratio of active and rather passive communicators) was a success factor in online scenarios.

We also found that in densely knit networks, less intensive teaching presence reliant on a wide range of facilitator assets and on the usage of pedagogical expertise was associated with increasing or higher levels of cognitive engagement and deeper levels of information processing. Social presence in such communities manifested itself in socially meaningful interactions, sense of community and emotional presence, which allowed for a formation of individualised impressions. As opposed to this, in loose networks, very intensive teaching presence based on an assistive (directive) role in order to provide instructional support, prevailed. In these cases, social presence was characterised by interpersonal interactions with socially appreciative nature where despite group commitment less emotional presence was typical.

Less intensive teaching presence characterised by a wide range of facilitator assets or a limited variety of facilitator assets either resulted in direct instruction and content provision maintained by skilful scaffolding of online interactions, or generated facilitation focusing on reinforcement. Both approaches supported the evolving of socially meaningful interactions. Intensive teaching presence focusing on reinforcement was however associated with social passivity and the lowest level of cognitive engagement.

Cognitive engagement and network ties

In the present pedagogical scenarios, low-level cognitive engagement and surface-level information processing were linked to loosely knit networks where participants formed working pairs or triads (mostly together with the facilitator). Responsive or reactive facilitator behaviour was characteristic of these interactions. As opposed to this, increasing cognitive engagement or high levels of cognitive presence evolved in densely knit networks where discussions were maintained on a group-level with 5-6 participants. Interactivity (mutually established relations) and a proactive manner of communication prevailed in these networks. Interestingly, we found increasing cognitive engagement in loosely knit networks with working pairs or triads. In their case however, the social presence and the facilitator's teaching presence resembled that of the densely knit communities.

We also claimed that in the presented pedagogical scenarios, the weak ties were not adequate for transmitting complex knowledge and mediating new information. However, this finding did not necessarily contest the paradigm according to which weak ties make a network robust (Csermely, 2005), but based on our results we added that especially in the case of small networks (with 5-8 members) defining the minimum requirement concerning the strength of weak ties was vital. In the presented scenarios, one-directional linkages and links providing for one-time information exchange were identified as the 'minimum' strength. These, according to our claims, were inadequate for sharing in-depth expertise or knowledge. Consequently, we also argued that the higher activity level of the participants and the more intensive communication would contribute to evolving group-level discussions, and presumably provide the 'backbone' for collaborations.

7.2.4 Tool mediation

Similarly to other models of online learners' satisfaction (Sun et al, 2008; Menchacha & Bekele, 2008), in this evaluation framework as well, the medium of communication in online mentoring, teaching and learning processes was identified as a crucial means contributing to participant satisfaction and learner success. It is the online surface, the medium of communication that provides flexible tool mediation through which facilitation was provided, participants collaborated and/or communicated with each other. Hence, the medium, the communicators and their presence in online interactions were interwoven.

Significant results of the survey and explanatory model building showed that in the presented scenarios participants' social presence and evolving collaborative interactions could be supported by the medium of communication (in the present cases the CSCL environments). We found that tool mediation contributed to the intimacy

among the communicators, eventually reduced the distance between the participants and thus raised participants' satisfaction concerning the learning experience.

7.3 The nature of a model for mentoring and facilitating online learning in CSCL environments in the communities of pre- and in-service teachers

We found different models for mentoring and facilitating online learning in the in-service and pre-service teachers' communities. In the in-service teachers' communities, the 'guide on the side' facilitator attended to a socially active community of professionals and maintained horizontal group architecture, whereas in the pre-service teachers' communities in general, the facilitator acted more like a 'resource provider' or a 'master teacher'. The difference in the facilitation manner lies in the character of the pedagogical scenarios. In the Calibrate 1 and the Calibrate 2 cases, communities of professionals collaborated in processes of pedagogical innovation. Collaborative activities were based on their professional (teaching) experience, and the scope of their activities was more of a pedagogical innovator rather than that of an active course participant. Nevertheless, the analyses of interaction patterns showed that also the structure of the two Calibrate groups differed. In Calibrate 1, network density was substantially formed around the facilitator, in Calibrate 2, a less central role was identified. Accordingly, in the latter case a 'guide on the side' facilitator was identified who acted like an interactive mentor, while in the former community, due to the facilitator's role as the 'crucial cog', she/he was characterised as a 'guide on the side' facilitator who operated in a directive manner.

In the ELT Methodology cases, teacher trainees participated in a blended type of university course as part of their curriculum. The course applied collaborative instructional design but in general, relied on a stronger instructor presence and a more directive facilitation. The reported analyses of interaction patterns and communicator roles in the networks of pre-service teachers supported this claim. As the interaction patterns revealed, participants established the strongest ties with the facilitator. This demonstrated that interactions (interacting pairs or triads) leaned towards the facilitator's central role. Consequently, the majority of pre-service teachers experienced more often reactive or responsive mentoring, where the facilitation included the instructor's immediate reaction to the participants' demand for help and request for mentoring feedback, but the need for a socially active 'social director' facilitator was not met. Results of the content analyses also verified that the majority of participants experienced intensive or very intensive teaching presence based on a directive-instructional approach. However, we provided limited proof for the claim that such an instructor presence necessarily generated a socially less active behaviour.

7.4 Pedagogical implications of the findings

Online communication is a crucial element, which may be on-task or off-task, and could take the form of one-to-one, one-to-many, or many-to-many interactions. Agents involved in the design and conduction of online mentoring, teaching and learning processes should devote attention to well-designed, purposeful online communication that aims at facilitating interactions which contribute to participants' growing

understanding of the course content and knowledge construction. Facilitators' teaching presence is thus an overarching magnitude in the context of educational presence in the online mentoring, teaching and learning processes which involves course design and organisation, facilitating discourse (including social aspects of communication and community building) and direct instruction at the same time (Anderson et al., 2001). Accordingly, online instructors shall be trained and prepared in the framework of formal education in order to be able to utilise the tenet of collaborative learning when launching online group learning projects.

Beyond facilitators' teaching presence flexible tool mediation provided by the actual means of communication – in the present study CSCL environments – are to be considered since it is the online communication tool, which supports various sorts of online activities. Being able to operate the tool itself is strongly related to the participants' skills and competencies involved in the general computer usage and their Internet abilities. Consequently, we claim that ICT skills analyses and sufficient (formal or informal) preparation for the online mentoring, teaching and learning process are indispensable. Their lack would contribute to participants' dissatisfaction and an unsuccessful and inefficient learning experience, which would lead to a high number of dropouts. Finally, since ICT skills and competencies are crucial prerequisites for the online mentoring and learning experience it is a must for facilitators that beyond their pedagogical or instructional roles and acting as social directors they are efficient in their technical roles or technical assistant roles (Hootstein, 2002) as well.

7.5 Research methodological implications of the findings and suggestions for further research

The utilisation of the evaluation model consisting of the participant satisfaction survey, the SNA and the content analysis in order to study the online instructor roles and the effects of the online mentoring, teaching and learning process in CSCL environments in communities of pre- and in-service teachers encompassed the excitement of testing and adopting this tool in the Hungarian context.

As already indicated, in the present paper, network density results were identified as insufficient measures. It is generally acknowledged that in a smaller network the density values tend to be higher since it is much easier to maintain connections among a few participants. Hence, we found that due to the small network size, computing network density did not provide robust data. In fact, in all the small groups the density values were high, and even when we contrasted network density measures calculated with and without instructor data, the facilitators' presence was captured to a limited extent. Consequently, with further network measures (network centralisation and individual in- and out-degree centrality values) we gained more reliable data on interaction patterns and participant roles in the communities. Nevertheless, triangulating data sources and methodologies proved an effective way of investigating the referred research topic and questions. Results of the SNA and content analysis provided assistance in the further thick description and validation of the results of the survey on participant satisfaction and self-perceived learning success. Accordingly, our hypothesis that developing and testing a mixed method strategy in a CSCL environment through in-depth multi-perspective analyses allow for fine-tuning survey results was supported (**H6**).

As regards further research suggestions for the current study, course objects or learning objects (e.g. in the form of pre- and post-tests) should also be considered in

order to see whether results of the self-perceived learning success, the participation, the interaction patterns and the content of the interactions were related to learning outcomes. However, instead of individual task performance measure, assessment of group performance is suggested (Dillenbourg, 1999) by eventually employing control group studies.

In general, more studies conducted in the Hungarian teacher-training and teacher professional development context are needed to investigate on one hand, the online instructor roles and the effects of the online mentoring, teaching and learning processes, on the other hand, the applicability of these research tools and the mixed method strategy. Analogously to the international studies in the field of CSCL research, such pedagogical scenarios should be based on case studies involving smaller study groups or small-groups, which are suitable for the in-depth analyses of underlying mechanisms involved in online experiences. On the basis of these robust data best practices and strategies should be integrated in the formal training of online instructors i.e. university teacher training curricula.

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APPENDICES