Evaluating the Organising of a Collaborative Telelearning Scenario from an Instructor Perspective – an Activity Theoretical Approach

By

Jo Dugstad Wake

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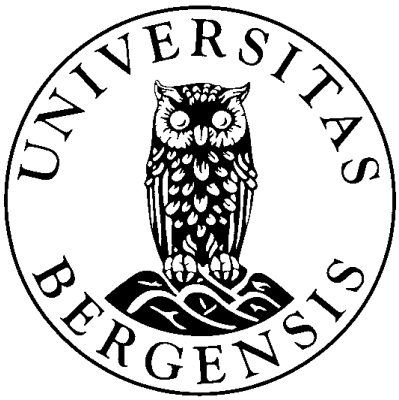

Department of Information Science

University of Bergen

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1.0 Introduction

Recently there has been a great increase in the call for the use of information and communication technology (ICT) in education, in fact ICT has become the buzz-word when it comes to designing new learning environments. The focus is typically on the technology in itself and perhaps also the pedagogical aspects of the environment. The aspect of understanding the technology in use by actors is often ignored.

In this study it is argued that learning environments where ICT mediates the interaction must be treated as a complex phenomenon, and there is no easy way of understanding the effect of the introduction of ICT in learning environments (see e.g., Säljo, 2000). The technological aspects of a learning environment are not considered unimportant in this study, but rather as embedded in the social context and a constituent part of the cultural phenomenon of computer mediated learning. When performing studies where this is investigated, there is a array of other issues to consider that may influence the learning environment, *inter alia* the communication of the actors involved, and the development of new practices in lieu of traditional roles and emergent cultural and social rules that exist in the learning environment.

In this study the focus is on the co-operation of actors in a learning environment mediated by artefacts. The actors, more specifically, are the instructors in a distributed collaborative learning environment, and the way they organise their work using technology. The context of which they are part is held as important when attempting to understand the activities in which they engage, and the way the technology alters the relationship between the instructors themselves and the relationship between the instructors and the students is of interest.

The sociocultural perspective (see e.g., Wertsch et.al. 1995), and particularly the activity theoretical perspective (Engeström, 1987) are consisered helpful tools in reaching the goal for the study – gaining an understanding of the co-operation of the instructors using artefacts in the learning scenario. The theoretical perspective taken underscores the need for not conceiving technology as an isolated phenomenon, but rather as a developmental phenomenon that can be understood when evaluating it in

use by actors in real-life situations. The research tradition of Computer Supported Co-operative Work, is a tradition that normally focuses on development of computer applications with variuos properties and characteristics (Bannon & Schmidt, 1991). It is held that before designing technological solutions an understanding of the phenomenon that is attempted to be supported must be obtained. In other words an understanding of what both work and co-operation is, is appropriate before the endaveaour of supporting it by using computer tools is made (ibid.).

The structure of the thesis is as follows. Chapter 2 is dedicated to a discussion of the theoretical issues important for the study. The chapter contains a discussion of the background and growth of Activity Theory, and it's current central tenets. Activity Theory is placed within the frame of reference of Computer Supported Co-operative Work (CSCW) and a discussion of the methodological implications of Activity Theory. Chapter 3 contains a description of the initial context for the study. The description contains three central elements. First, an account of project DoCTA, of which this study is a part is given. Second, the collaborative telelearning scenario in focus, VisArt, is briefly described. Conclusively in this chapter, a brief account of the main computer tool used for mediating the communication in VisArt – TeamWave Workplace – is given. Chapter 4 contains a discussion of the methodological considerations that has been made. The research questions are defined and specified. A discussion of qualitative methodologies and a comparison of them in relation to quantitative methodologies is undertaken. Further, the issue of performing ”digital” field work is discussed. Ultimately the methodology in practise, or the data gathering techniques specific to this study are accounted for. The analysis of the gathered data is performed in chapter 5. An initial discussion of data analysis in general is given in the opening of the chapter. The research questions are treated consecutively and the findings are discussed correspondingly. Chapter 6 contains a evaluation of the quality of the study as a whole, and the conclusive remarks.

2.0 Theoretical Foundations

The theoretical foundations for DoCTA are CSCL, Sociocultural perspectives on learning (Wertsch, del Rio & Alvarez, 1995), Salomon's (1992) concept of Genuine Interdependence, coordination theory (Malone & Crowston, 1994) and the emerging notion of distributed learning communities (Wasson, Guribye & Mørch, 2000). The theoretical approach taken to inform my study is a sociocultural perspective, more specifically an Activity Theoretical perspective, within the frame of Computer Supported Co-operative Work (CSCW).

2.1 CSCW

The acronym CSCW was coined at at a workshop at MIT in 1984 by Iren Greif and Paul Cashman, and contains the terms Computer Supported Co-operative Work. The workshop took place as a course of technical changes in the current computer systems, but most importantly, as a course of an insufficient understanding of how people work in organisations, and how the technology affects that, in relation to understanding the requirements of the future computer systems (Grudin, 1994).

> ”CSCW started as an effort by technologists to learn from economists, social psychologists, anthropologists, organisational theorists, educators and anyone else who could shed light on group activity (Grudin, 1994, p. 19-20)”.

Baecker claims that CSCW is taken to represent a wide variety of work, but that it at least ”represents a paradigm shift in computer science that emphasises human-human interaction, rather than human-machine coordination, communication and problem solving (Baecker, 1993, p.2)”. He further defines CSCW as ”computer assisted activity such as problem solving and communication carried out by a group of collaborating individuals (Baecker, 1993, p.1)”.

The “computer-supported” side of the acronym is the more explored aspect of CSCW. The applications that support co-operative work is generally labelled Groupware, but

the definitions of groupware are numerous and varied. Ellis, Gibbs and Rein (1991) claim that the term frequently is used synonymously with CSCW technology. This could be problematic, because many of the current computer applications are oriented toward communication and co-operation, and Dyson (1992) notes that the term groupware is about as useful as the term "singleware", implying that demarcation between groupware and "singleware" is difficult.

2.1.1 Computer Supported

The line dividing groupware and other computer applications can not be considered rigid. Considering this, Ellis, Gibbs and Rein (1991) propose taxonomy where computer systems can be classified as belonging to different areas of a spectrum. According to Baecker (1993), a common taxonomy of groupware is distinguishing the system's abilities to "bridge time and to bridge space (Baecker, 1993, p.3.)", illustrated in table 2.1. Along the time-dimension, the groupware systems can afford communication and co-operation that is either synchronous or "real-time", or asynchronous or "non-real-time" communication or co-operation. Regarding space, the groupware systems can either afford support of a group that is working face to face, or a group that is distributed in space.

Table 2.1 A taxonomy of groupware systems (Ellis, Gibbs and Rein, 1993)

	Same Time	**Different Times**
Same Place	Face-to-face Interaction	Asynchronous interaction
Different Places	Synchronous Distributed interaction	Asynchronous distributed interaction

Baecker (1993) claims that this taxonomy has met certain criticisms. One of them is that future groupware systems need to bridge the gaps between synchronous and asynchronous work, as well as the gap between working in a group that is spatially distributed, or in a group that works at the same location in space. One could also argue that the lines discerning synchronous and asynchronous work are ambiguous, and that it is a matter of how the tools are used by the persons using it, rather than a characteristic of the groupware system. Bridging the gap in space is, according to Baecker (1993), a matter of allowing for use of the same tools regardless of where one is located in space, in relation to the co-operating peers. Grudin (1991) suggest a taxonomy of groupware according to whether it manages the work process, or the work content, and whether it centres control with the users, or with the work itself.

2.1.2 Co-operative work

Bannon and Schmidt (1991) point to the lack of focus on co-operative work in the CSCW community and the pertaining strong technology orientation, and argue the fallacy of this tendency.

> "[W]e reject the equation of Groupware with CSCW because of its technological focus and its narrowness in the face of the multiplicity of social forms of co-operative work manifest in the world (Bannon and Schmidt, 1991, p. 52.)."

The problem with focusing on the technology, in the development of software for co-operative work, co-operative work is a phenomenon with many facets. Without having an understanding of the nature of co-operative work, one cannot easily know how to support it. Defining CSCW through the techniques being used "potentially draws on the whole field of computer science… (and) will inevitably dilute the field (Bannon and Schmidt, 1991, p, 51.)". Thus, the focus should instead be on understanding co-operative work, possibly with the objective of designing adequate technology.

Bannon and Schmidt (1991) claim that the term "Co-operative Work" has been criticised for being anything from an inadequate description of harsh worklife realities, to being an positively laden description of a goal, and to that it ignores the fact that all work, in essence, could be viewed as co-operative. Equating co-operative work with group work is no better, especially if one defines the group as a fixed ensemble of people sharing a goal (ibid.). Sharing a goal is not always a defining characteristic of co-operative work. For example, through using the example of the co-operative decision making in a hospital managerial group, Bardram (1998) shows how the decision making involves trade-offs between "multiple goals, preferences, values, incentives and inclinations (Bardram, 1998, p.90)".

Bannon and Schmidt (1991) suggest that co-operative work processes be viewed as related regarding the work *content,* instead describing it through the formal organisation of a group. They further divide the concept of co-operation into indirect and direct modes of interaction, and distributed and collective interaction. They define direct co-operative work as being mediated by interpersonal communication. Indirect co-operative work is mediated by the changing state of the transformation process. Collective co-operative work can be understood as direct interpersonal interaction, while indirect co-operative work is defined as being performed by "an ensemble of semi-autonomous workers changing their behaviour as circumstances change, and planning their own strategies (Bannon and Schmidt, 1991, p.51)".

Thus the term co-operative work can thus be described as the "general and neutral designation of multiple persons working together to produce a product or a service (Bannon and Schmidt, 1991, p. 51.)".

Bardram (1998) argues the need to focus on co-operative breakdowns as a mean to understand the dynamics of co-operative work, and as a mean to provide appropriate computer support. He claims that much of the work on co-operation in CSCW has an implicit focus on breakdowns, and seeks to address the phenomenon directly. He holds Activity Theory (AT) as an adequate theoretical framework for understanding breakdowns on co-operative work. Additionally Nardi (1996) has argued that the possibilities of using AT as a theoretical framework for understanding work in general might be fruitful.

2.1.3 Activity theory in CSCW research

Within the field of computer science, the ”information-processing” paradigm, or the ”cognitive approach” has been subject to a substantial amount of criticism (cf. Nardi, 1996, Wertsch 1995, Bannon 1991, Suchman, 1987), that the individual is modelled in the eye of the computer (Kaptelinin, 1996). The alternatives offered are views and theories that more extensively take into account the social context that people exist in. On the subject of context in the study of learning and work, Nardi (1996) states that.

> “A broad range of work in psychology (Leontiev 1978, Vygotsky 1978, Luria 1979. Scribner 1984, Newman, Griffin & Cole 1989, Norman 1991, Salomon 1993), anthropology (Lave 1998, Suchman 1987, Flor & Hutchins 1991, Hutchins 1991, Nardi & Miller 1990, 1991, Gantt & Nardi 1992, Chaiklin and Lave 1993), and computer science (Clement 1990, Mackay 1990, MacLean et. al. 1990) has shown that it is not possible to fully understand how people learn or work if the unit of study is the unaided individual with no access to other people or to artefacts for accomplishing the task at hand. Thus we are motivated to study context to understand relations among individuals, artefacts and social groups (Nardi 1996, p. 69)”.

Further, Bannon (1991) has identified possible remedies of improving research on human computer interaction (HCI). Kuutti (1996) sums these up as providing all aiming for “better contextuality (Kuutti, 1996, p. 22)”, as they all imply focusing on situations of actual use. Kuutti suggests three possible contributions from AT in design of computer systems; multilevelness, interaction in social context, and finally history and development. Shortly, multilevelness is the possibility of seeing a phenomenon as having facets on different levels, for example both the social and the individual level. Social context is seen as giving meaning to actors in a context, and the focus on history and development can inform the changing use of artefacts, for example the movement between operations and actions. The attention is hence turned to Activity Theory.

2.2 Activity Theory

Activity Theory (AT) has three main historical sources. One of them is the classical German philosophy of Kant and Hegel, who introduced the concept of activity and emphasised its role in constituting the relationship between the subject and the object, although in a subjective-idealistic way (Kuutti, 1994). Another is the historical-dialectical materialism of Marx and Engels, who further elaborated the concept of activity. The third influence is the Cultural Historical Psychology, founded mainly by Vygotsky, whose work was elaborated on and expanded by his students and colleagues Leontiev and Luria. Kari Kuutti defines Activity Theory as "a philosophical framework for studying different forms of human praxis as developmental processes, both individual and social levels interlinked at the same time" (Kuutti, 1994, p.52).

Activity Theory is discussed in the following sections, from the work laid down by Vygotsky within the cultural-historical psychology, and continued by Leontiev and Luria in their psychological theory of activity, and finally the reconceptualisation presented by Engeström in his work on activity systems.

2.2.1 Vygotsky and the Cultural Historical Psychology

Russian Lev Vygotsky lived from November 5, 1896, to June 11, 1934. He graduated from Moscow University in 1917, with specialisation in literature. He is most commonly regarded a developmental psychologist, but during his academic career, he also worked within the fields of literature and semiotics (Cole & Scribner, 1978).

His historical and philosophical influences, besides giving an account of the most important issues in his work, and its influences on Activity Theory.

Until the latter half of the nineteenth century, the study of mind was the province of philosophy (Cole & Scribner, 1978.), with the goal of giving an explanation of the mind. Cole and Scribner write that Locke developed an empiricist view of mind,

claiming that ideas originated in environmentally produced senses. The problem was to describe how simple stimuli could produce complex ideas. Kant on the other hand argued that some ideas, such as ideas of time, space, quantity, quality and relation originate in the human mind, and cannot be reduced into simpler elements. They were both working under the assumption made by Descartes, that scientific study of man could only apply to his physical body (Cole & Scribner, 1978.).

In the 1860's, the publication of three books flavoured the discourse in psychology, although neither of the authors considered themselves psychologists (Cole & Scribner, 1978.). Darwin's Origin of Species argued the essential continuation of man and animals, regulated by natural laws. Gustav Fechner's *Die Psychophysik* gave a "mathematically correct" account of the relation between physical change and verbalised psychic response. The Russian physician Sechenov's Reflexes of the Brain made an account of the isolated sensor–motor reflexes in frogs' nervous systems, the nervous system being an extension of the brain, and claimed that the same principles applied to man. These publications can be viewed the essential constituents of the psychological thought at the end of the nineteenth century; the linking of animals and humans in a single conceptual system regulated by natural laws, the description of a law regulating the relation of physical events and mental functioning, and a proposition of a physiological theory of mental processes (Cole & Scribner, 1978.), weakening the position of the mind and the body as separate entities.

The first psychological school, *per se,* was established by Wilhelm Wundt in 1880 (Cole & Engeström, 1993). Wundt wanted to describe the content of human consciousness, and their relation to external stimulation. Through introspection, he wanted to analyse the various states of consciousness into its basic elements. The introspective study of mind later came under attack from two directions (Cole & Scribner, 1978). From the behaviourist position emerging at the beginning of the 20th century, Pavlov and Watson, amongst others, claimed that the scientific study of mind had to focus on observable behaviour, how stimuli produced under controlled conditions evoked change in behaviour. Their project was, through description of the basic components of the human psyche, to understand the rules of complex behaviour. They also focused on processes shared by animals and humans (Cole & Scribner, 1978). The Gestalt psychologists, such as Köhler, Koffka, and Wertberger, made the

position that many mental phenomena could not be studied by reducing it into basic components, such as stimuli-response bonds (Cole & Scribner, 1978). This was, in promiscuous brevity, the position in psychology before Vygotsky.

2.2.2 Cultural-historical psychology

After the Russian Revolution, psychology in Russia was torn between contending schools (Cole & Scribner, 1978). The Institute of Psychology was headed by Chelpanov, a follower of Wundt's introspective study of consciousness, who was challenged by Kornilov, who wanted to subsume all branches of psychology under a Marxist framework. Kornilov replaced Chelpanov as head of the Institute of Psychology in 1923. The year after, Vygotsky gave a talk entitled "Consciousness as the Object of the Psychology of Behaviour", thus challenging newly established authority (ibid.).

Vygotsky often referred to a "crisis in psychology" (Cole & Scribner, 1978). He agreed with the Gestalt psychologists that analysis could not only be reducing phenomena to its constituent parts, but in addition, he felt that they failed to move from description to explanation of these phenomena. Explanation of psychological phenomena was Vygotsky's goal (ibid.).

Vygotsky did not wish to make a "blueprint" transformation of Marxism to psychology, but he clearly viewed historical-dialectic materialism as a fruitful theoretical resource (Cole & Scribner, 1978). Marx' notion of historical and material change as a predecessor of change in individual consciousness and behaviour was adopted by Vygotsky in his effort to see all psychological processes as having a developmental history, or phylogenesis, undergoing both qualitative and quantitative change. The preceding processes must be understood if one is to understand the psychological process itself (ibid.).

Vygotsky approach is based on a set of three basic principles, or general themes that run through his writings (Wertsch, 1991). The first is that human action is mediated by tools and signs, the second that higher mental functioning derives from social life,

and the third is the need for a developmental analysis in understanding psychological phenomena (Wertsch, 1991). It can be argued that these general themes are highly interlinked, and giving an account of one, precluding the others, is futile.

Vygotsky was influenced by Engel's idea about human tool use (Cole & Scribner, 1978) as the way we change nature, and thereby change ourselves. Vygotsky expanded Engel's idea of the tool as a medium in human-environment interaction, to include psychological aspects of the tool, more specifically sign systems, i.e. language, writing and number systems (Vygotsky, 1978). Internalisation of externally available culturally and historically produced sign systems, brought about change in the behaviour of the individual. The mechanism for individual development is thus rooted in society and culture.

The claim that higher mental functioning is rooted in social life is influenced by Marxist theory. Vygotsky wanted to affix Marx' assertion that humans psychological nature represents the aggregate of internalised social relations that have become functions and form the individual's mental structure, to psychology. Cole & Engeström (1993) remark that for Vygotsky, other human beings, both those present to the senses, and previous generations play a crucial role in the forming of human cognitive capacities. This point is stated in Vygotsky's *general genetic law of cultural development* (Vygotsky, 1978)

> "The history of the development of signs brings us, however, to a far more general law that directs the development of behaviour. (…) The essence of the law is that the child in the process of development begins to apply himself the very same forms of behaviour which others applied to him prior to that. The child himself acquires social forms behaviour and transposes those on to himself. (…) The sign is originally always a means of social contact a means of influence upon others, and only subsequently does it find itself in the role of a means for influencing oneself (Vygotsky, 1960, p. 192, cited in Cole & Engeström, 1993)".

Vygotsky argues that any function in a child appears on two planes, first on the social, then on the individual psychological plane, through the process of "internal reconstruction of external operations", the process being labelled internalisation (Vygotsky, 1978, p. 56). He is not claiming that humans' psychological functions are blueprints of socially organised processes, although they are essentially social in nature, but that there is a close connection between the inter-mental and intra-mental functioning. The connection is grounded in genetic transition, which adduces that different social practices give rise to different psychological functions (Glassman, 1996).

In relation to the social origin of psychological functions, Vygotsky's concept of "Zone of Proximal Development" (ZPD) is also important. It is defined as;

> "The distance between actual development level as determined by independent problem solving and the level of potential development as determined through problem solving under adult guidance or in collaboration with more capable peers (Vygotsky, 1978, p. 86)".

In other words, ZPD is the difference of the child's individual problem solving capability, and it's capability under the guidance of a more experienced teacher/learner. Vygotsky wanted, for example, that under assessment of intelligence, to focus more on the potential level of development, thus underscoring the social nature of learning. This can bee seen in opposition to the "western" idea of intelligence in instructional and learning situations as a property or characteristic of the individual, or simply a matter of "talent" located in the mind of the individual student (Säljö, 2000).

Another general theme in Vygotsky's writings, is that higher mental functioning, for example voluntary attention, thinking and memory, and human action, is mediated by artefacts such as tools and signs. Vygotsky expanded, Engel's writings about human labour and tool use as a way of shaping our environments, and thereby ourselves, to include psychological tools, or sign systems, as well as physical tools. His model of the mediated act (see figure 2.1), although bearing resemblance to the contemporary behaviourist stimulus – response (s-r) model of behaviour, is very different in that

"the s-r model supposes direct reaction to stimuli" (Vygotsky, 1978, p. 39) but the concept of mediated action requires a "second order stimuli (sign) …that creates a new relation between the s and the r" (Vygotsky, 1978, p. 39). The sign also indicates reverse action, in that it works on the individual in addition to mediating the individual's relation to the environment.

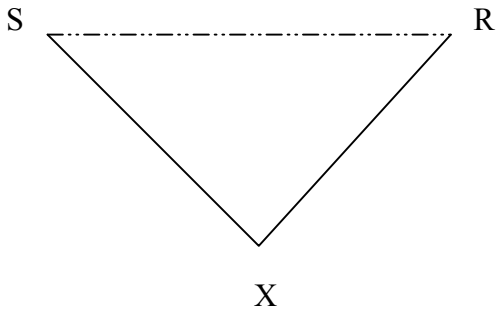

Figure 2.1 The Mediated Act, (Vygotsky, 1978)

Vygotsky, in his scientific work, paid particular attention to mediating sign systems such as language, semiotics and speech, or verbal behaviour.

Two theories that are strongly related to Activity Theory are Mediated Action (cf. Wertsch, del Rio & Alvares 1995), and Situated Learning (cf. Lave & Wenger, 1991). Their departing point from the sociocultural theory of action is Vygotsky's idea of behaviour as mediated by signs and other cultural artefacts, further elaborated by Bakhtin's notions of social language, speech genre and voice (Wertsch, 1991; Engeström, Miettinen & Punamäki, 1999).

Vygotsky viewed the mediational role of sign systems, such as language, or how they mediated action, rather than their structure or representational form in mind. Rather than viewing a sign to be the property of an individual, he focused on how the sign mediated the behaviour of the individual. The sign not only mediates the activity, it becomes an essential part of the activity, altering the courses of action altogether.

Kuutti (1996) expands on mediating artefacts, arguing that they carry with them the "history of the relationship between the subject and the object of the activity (p. 27)", shaping the action in both a limitative and facilitative way. The mediating tool catalyses the subjects' transformation of the object "with the historically collected

experience and skill "crystallised" into it (p. 27)", but it also restricts the transformation process to the perspective of the particular tool only (ibid.)

Cole and Engeström (1993), citing Vygotsky (1960), stress that "The process of historical development of human behaviour and the process of biological evolution do not coincide; one is not a continuation of the other. They are governed by their own laws (p. 71) as a way of distinguishing between animal and human development. They claim that the bottom line of Vygotsky's model of the mediated act, the relation between the stimuli and the response, represents natural (or unmediated) behaviour, while the functions between that rely on the "secondary stimuli", mediated by auxiliary means, are "cultural functions" (Cole & Engeström, 1993). The fact that there exists two kinds of behaviour, lays, according to Cole and Engeström (1993) focus on the fact that humans never cease being "phylogenetically evolved creatures (p. 5)", despite being capable of culturally mediated behaviour, leading to the concepts of history and development.

Taking a developmental, or genetic, approach to understanding mental processes was fundamental to Vygotsky (Glassman, 1996). His approach to phylogenesis was influenced by Darwin and Engels and he was occupied with understanding the transition from apes to humans. He used Köhler's work on comparison of tool-mediated practical action by chimpanzees to human action to elaborate the hypothesis that while apes remained "slaves of the situation" (Glassman, 1996), humans had the representational means to overcome the situation, representational means being a particular set of mediational tools distinguishing higher mental functioning from lower. Vygotsky viewed the distinction between higher and elementary mental functioning as emerging after a phylogenetic transition. He also distinguished between rudimentary and advanced mental functioning, the latter being uniquely human, and emerging in areas such as abstraction and decontextualization as means that mediate language and communication (Glassman, 1996.).

Ontogenesis, or development of the individual, however, is distinguished from phylogenesis and sociocultural history in that in ontogenesis several other forces play a part in the development. He viewed the development of the individual as a cultural, natural, and social dynamic interaction. Ontogenetic development is mastery of

mediational means provided by a culture, through social interaction, combined with natural development and maturation. Vygotsky identified transition points in the different genetic domains, which in themselves were development. The critical development point in apes was the emergence of tool use (phylogenesis), in primitive man it was complex labour and the use of signs, and in the child it is the division of the lines of development into natural-psychological and cultural-psychological development (Glassman, 1996).

2.2.3 Leontiev; A Psychological Theory of Activity

Leontiev, a major proponent of Activity Theory, was a student and colleague of Vygotsky. (Zinchenko, 1985; Glassman, 1996; Vygotsky, 1978). They were both influenced by the same theoretical background, namely Marx, Engels and Darwin. They both worked to develop a Marxist psychology, and shared many theoretical viewpoints. They separated near the end of Vygotsky's life, Leontiev and Luria to form a group in Kharkov. Zinchenko (1985) claims that their research can be held as different "strands of research" (Zinchenko, 1985, p. 40), and while Vygotsky is considered the founder of "Cultural-Historical Psychology", Leontiev (and Luria) are regarded the founders of the "Psychological Theory of Activity" (ibid.). While Vygotsky's main focus was on semiotic mediated action, Leontiev focused more on the social activity as a whole. The political environment, in which Vygotsky worked in at toward the end of his life, was becoming increasingly hostile to his ideas. Leontiev continued the work, shifting the focus to socially embedded activity, reconstructing the emergence of division of labour (Engeström, Miettinen & Punamäki, 1999).

They both felt that higher psychological functions could only be explained in terms of the internalisation of what had been an external, instrument based, collective activity. Vygotsky put the focus on instrumentation in terms of language and cultural symbols, while Leontiev moved in the direction of understanding human development, including semiotic mediation, as embedded in collective activity of social systems. (Glassman, 1996.) Through his classic example of medieval hunt, he elucidated the "insufficiency of tool mediated action as unit of analysis" (Engeström, 1987, p. 66).

Without taking the overall, collective activity into consideration, the individual actions seem "senseless and unjustified" (Leontiev, 1981, p. 213, cited in Engeström 1987).

Leontiev saw the relation between phylogenetic and ontogenetic development in the individual as linear, objective and materially based. (Engeström, 1987; Glassman, 1986; Zinchenko, 1985) In the earliest form of activity in non-humans, activity necessary for survival, there is a direct link between the biological need and the action (Glassman, 1986). There is nothing voluntary in it. As an example, a spider is drawn to the vibrations in its web made by a captured fly. It *has* to move toward the fly, because of the organisation of its biological structures. A transitional stage is the stage of the operation, where the animal is able to distinguish the basic need and the context where the need is pursued, or, the direction of which the animal carries out the activity is dependant on the contingencies in the environment (Glassman, 1986.). Leontiev labelled the highest stage of thinking in animals "manual thinking", or intellect. The need is approached in two phases, a planning phase considering the need and the context, and an actual operation of the activity (ibid.). Kohler's experiment with apes, showed that the ape is able to combine two activities that are not biologically connected to meet an end. For example, to pick up a stick and reach for a fruit with it. This is seen as a precedent to human tool use. Leontiev suggested a biological cause for the development of two-phase activity; the emergence of the cerebral cortex. The presence of biological prerequisites for later, distinguishable human mental functions in primeval man puts emphasis on the material driving force in evolution (Glassman, 1986.), although the later functions of man are qualitatively different (although not necessarily better).

The increase in brain size allowing for instrumentality and reflection on two-phase activity, led to the development of complex collective labour, thus making human development driven by sociocultural forces rather than biological forces (Glassman, 1996). The reflection on two-phase activity allowed for the development of social relationships, the sharing of motives, making the early phase of division of labour possible, for example that one group stayed at home watching the territory, while another group hunted. This is also connected to the shared planning of activities, and a shared collective of operations in activity (ibid.). Regarding tool use, the animal could

only see the tool as a physical object, while the human saw it as having a "socially developed mode of action" (Kaptelinin, 1996) tied to it.

Leontiev sees language development as the most important development of socially defined tools. Originally language was embedded in the activity. Through joint planning activity language obtained it's "theoretical" function, that is its capability to facilitate conscious generalisations of reality. A further separation of language from the activity of communicating with others, through transfer of language to the internal plane (internalisation), allowed for abstract, or decontextualised conceptions of reality, such as joint activity, and for the use of reflections in planning of activity. Language thus becomes the most important tool in planning of social activity as humans share motives.

The example of collective hunt for food where a group is allotted the task of chasing the game towards other hunters responsible for dealing with the animals in a way coherent with eating them at a later point. Both the acts, chasing animals away and waiting in the bush seem contradictory to the goal of hunting in themselves, but effective hunting is accomplished through the use of a collective rule system, based on shared internal representations and an abstract communication system. The collective rule system allows individual operations to be subordinate to the operations of the group.

Leontiev claimed that in primitive society thinking was largely undifferentiated, that there is a close relationship between thinking and the external world, characterised by a limited subordination of operations and a strong linearity of motive, goals and tools. Primitive is not meant as subordinate to complex because consciousness develops from activity in the world, and complex thinking emerges out of need. This is important to Leontiev, as he overcomes the Cartesian duality of mind and nature by suggesting that mind is a result of activity in the world, an epiphenomenon to social labour activity.

Evolution of labour through more complex labour activity and complex language systems is seen by Leontiev to have three major effects (Glassman, 1996). The first is the subordination of operations to more general operations. The second is the

development of operations together with higher motives, and the third is the movement of central human activity to the internal plane. The process of subordination of operations to become more general operations is characterised by an increasing reliance on historical precedence. This occurs as symbol systems in labour activity becomes more complex. The planning of operations is seen as connected to conscious motives, as there is a multitude of operations available. If one is planning an operation, one needs to be aware of why. The emergence of secondary objectives, or goals, is tied to this stage, and thus the development of higher motives. They might motivate an operation serving a purpose at a later stage for a person. For example if a person chooses to become a trumpet player he might read music history as a part end to his goal. The development of higher motives and conscious control of operations gives way for an expansion of consciousness. The central human activity is moved to the internal plane.

As Vygotsky, Leontiev suggests a strong relationship between phylogenetic and ontogenetic development. A roughly analogous relationship exists between the development from animal to higher order animal, or from primitive human to technological man, and ontogenetic development from prespeech to instrumentality to complex thinking to internalised conceptual thinking. The focus on the biological driving force, as for example the increase in brain size responsible for the emergence of complex thinking, puts emphasis on material causes in development, making close ties to Marxist ideology. He wanted to show how progressive evolution of consciousness could emerge naturally out of activity (Glassman, 1996). The qualitative differences in thinking are a result of sociocultural history.

Leontiev (1978) developed a three-level scheme for the analysis of activity, and proposes that consciousness and social relations play a mediating role in this activity. Leontiev distinguishes between activity, actions, and operations, corresponding to motives, goals and environmental contingencies or instrumental contingencies, respectively (see figure 2.2). Through his account of medieval hunt, Leontiev exemplifies how Vygotsky's notion of tool mediated activity is not in itself enough to explain collective human activity and "demonstrates the development from activity to action through the division of labour (Engeström, 1987)".

> "A beater taking part in primeval hunt does so stimulated by a need for food… His actions are directed at frightening the animals toward the hunters hiding in ambush. His activity in the hunt ends with this. This (frightening) in itself does not meet the beaters' need for food… What the processes of his activity were directed at did not coincide with what stimulated them… (Leontiev, 1981, cited in Engeström, 1987)"

> "What unites the direct result of (his) activity with the final outcome? Nothing other than his relation with the other members of the group …This relation is realised through the activity of other people (…) the connection between the motive and the object of an action reflects objective social relations, rather than natural ones (Leontiev, 1981, cited in Engeström, 1987)."

Activity has a social history, which through internalisation, obtains a subjective characteristic, but is never individual in itself. Actions can be individual, but activity is always collective. The three level scheme of activity can be seen in figure 2.2.

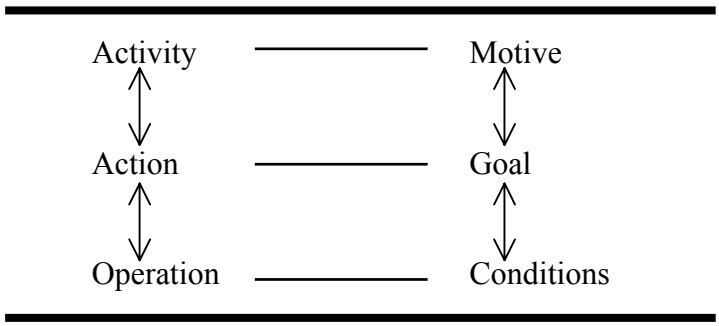

Figure 2.2 Hierarchical Structure of Activity (Leontiev, 1978)

These three levels facilitates analysis from both the internal to the external, and from the external to the internal (Glassman, 1996). The former suggests that human action is autochthonous to consciousness, the latter that in cases of learning, the internalisation process may be externalised, or made subject to consciousness, and reflected upon. The motive (or need) is, in all organisms, the impetus to take action in the world. But it is only in humans that a conscious understanding of the motive and

its relation to action, and an eventual coincidence between the motive and the goal[1] (Glassman 1996) is possible. Not all motives are conscious. Engeström (1987) claims that "under the conditions of division of labour, the individual operates mostly without being fully conscious of their objects or motives (p. 66)". Kuutti (1991) states that any activity may be realised using different actions, while one and the same action can belong to many different activities. In the latter case, an individual's actions may be distinguished by different "personal sense" for the individuals in the context of activity, or different motives for the same action.

Action is individual, has a clearly stated goal, i.e. a conscious representation of an outcome to achieve (Decortis, Noirfalise Saudelli, 1996), and is a subcomponent of an activity. They are realisations of activities, and chains of actions are tied to the activity by the same motive, and cannot be understood without reference to the corresponding activity (Kuutti, 1996). Before an action is carried out it is subjected to orientation, the process of carrying out the activity on a mental level using a model. Orientation is not to be understood in the cognitive psychological sense, of a rigid plan, but rather as an incomplete and tentative resource, the way Suchman (1987) uses the term[2].

Actions consist of many operations which are "well-defined habitual routines used as answers to conditions faced during the performance of the action (Kuutti, 1996)". Initially the operations are conscious activities, but through the process of internalisation and as a good model of the operation is achieved, they gradually become less subject to consciousness. New action is created at the same time, and the internalised operation becomes a subpart. If conditions of the internalised operation change, they may return to the level of conscious action again and be "relearned" (Kuutti, 1991, 1996), separating it from the behaviourist notion of conditioned reflex.

Leontiev introduced the notion of object-orientedness in activity, a concept that has become a constituent of Activity Theory (Stetsentko, 1990). The principle "specifies the activity theory approach to the environment with which human beings are

[1] I.e. that they are not necessarily materially or biologically connected, as the beaters' motive and goal in the primeval hunt.
[2] Suchman (1987) states that plans are retrospective constructions of activity, or a resource for reasoning about action.

interacting" (Kaptelinin, 1996, p. 107). According to Nardi (1996), the object of an activity is held by a subject and motivates the activity "giving it a specific direction (p. 73)". She further explicates that the object arises out of a need or motive to which the activity answers to. Kuutti (1996) stresses that activities can be distinguished by their objects. Kuutti also notes that objects may undergo change during the course of the activity, that they are not to be perceived of as fixed entities, but they are still relatively stable over time (Nardi 1996).

Objects are not to be conceived of as physical entities alone, but more in the Marxist meaning of the word, a more encompassing and inclusive concept. Marx postulated that any "phenomenon, action, state, etc., is related to an object or becomes an object by being recruited into the activity by a subject (Stetsenko, 1990, p. 55)". Leontiev (ibid.) included emotions as well as cognitive processes as corresponding to objects, and claimed that only after the "meeting" of a need with the corresponding object, is the mind capable of directing the activity. Leontiev labelled this phenomenon "directedness"; the orientation of activity realised by subjects to the objects of the external world (Stetsenko, 1990.).

Jonassen (1999) distinguishes between physical objects, "soft" objects and conceptual objects, and Kaptelinin and Nardi (1997) open for both social and culturally determined properties. The object of an activity can really be anything, as long as it can be "shared for manipulation (p. 5)" and transformed as a result of the activity, the process of which moves the subject(s) toward the completion of their goals.

2.2.4 The Activity System

Yrjö Engeström points out the fact that despite the communicative and instrumental aspect being important in Leontiev's work, it was never brought into a unified, complex model (Engeström 1987). The "essential elements and inner relations of activity" (Engeström, 1987, p. 70) were not comprehensively modelled and analysed by Leontiev. He also points out that Vygotsky's instrumental act; the person's relation to the object mediated by culturally acquired mediating tools, neither was brought into a unified and complex model. Zinchenko (1985) stresses that Leontiev was criticised

for over-simplifying the spiritual world of humans, treating it mechanistically by reducing it to object-oriented activity. He further claims that in Leontiev's three-level scheme of activity there is no "direct indication of the place of meaning, sense mediators, consciousness, personality and so forth (Zinchenko, 1985, p. 43.)". These entities lie outside of the psychological theory of activity, and the structure of this approach may be seen solely as a way to understand the relation between goal-means-result. The requirement for Leontiev and his colleagues was to develop research analogous to activity, with consciousness as a secondary property. Engeström (1987) explicates that the activity is the minimal meaningful unit of analysis. He claims that the lineage from "Vygotsky to Leontiev gives birth to the study of activity based on material production, mediated by technical and psychological tools as well as other human beings (ibid, p. 73)". He wants to develop this line through deriving a model of the structure of human activity, by genetic analysis. First, Vygotsky's mediated act is reformulated, as seen in figure 2.3. The stimulus is changed with subject, the response is changed with object, and the second order stimuli is replaced with mediating instruments.

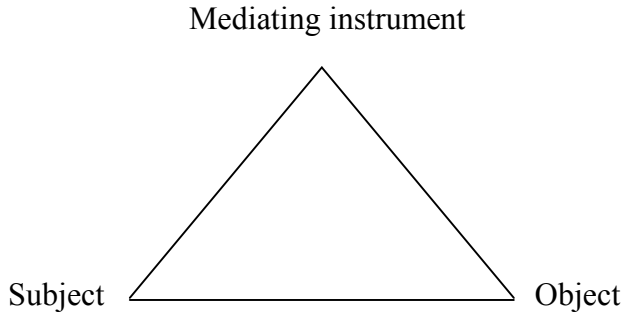

Figure 2.3 Reformulation of the Mediated Act (Cole & Engeström, 1993)

Engeström models the activity system of humans in a technological society, using a triangular model of activity as illustrated in figure 2.4. He labels the central human activity in an industrial, capitalist society consumption, which is subordinated to "the three dominant aspects of human activity; production, distribution and exchange" (Engeström, 1987, p. 78).

The relations between the three central components of an activity, subject, object and community are mediated in a reciprocal way (Kuutti, 1996).

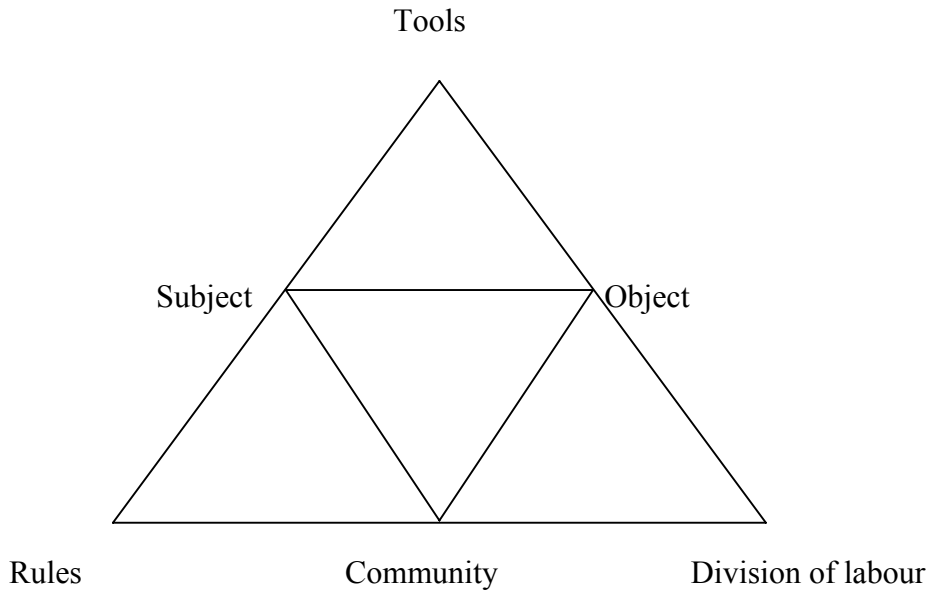

Figure 2.4 The Activity System (Engeström, 1987)

The *subject* in the activity system is the person or persons performing the activity (Nardi, 1996), depending on point of analysis, "seeking to fulfil goals or motives through action (if individual) or activity (if collective) (Holt & Morris, 1993, p. 93)". For instance, in Leontiev's hunting example, the subject would be the hunter. The *object* of the activity is the object to be transformed as a result of the activity, or at what the activity is directed, either physical or mental, resulting in an outcome. The object contains both the object in itself and, the motive or need (see chapter on object orientation). In the hunting example, the object would be to catch animals to be used for food. The *community*, according to Holt & Morris (1993), is "the interdependent aggregate of individuals who share a set of social meanings (p. 93)". In the example used here, it might be the group of hunters, or the larger social collective, such as those tending the camp, and so forth.

The relationships between these three nodes in the triangle are by definition mediated. The relationship between the subject and the object are mediated by *tools*,

psychological or technical (i.e., concepts, language, reasoning and physical instruments), or anything used in the transformation process (Kuutti, 1996). The relationship between the subject and the community is mediated by *sociocultural rules,* which are explicit and tacit norms, practices and social relations (Kuutti, 1996), or "incomplete guides for action shared by the community (Holt & Morris, 1993, p. 93)". The relationship between the object of the activity and the community is mediated by the *division of labour,* which is the organisation of a community around the transformation of an object into an outcome (Kuutti 1996). Or more specifically "task specialisation by individual members or groups contained in the community" (Kuutti, 1996, p. 93). Mediating tools in Leontiev's example of medieval hunt, might be the sticks and knives, and knowledge about animals, in addition to language and communication skills. Sociocultural rules could be the rules and "algorithms" for sharing the game and so forth, and the division of labour could be the division of tasks between hunters and runners.

Engeström (1987) claims that an analysis of any of the subtriangles is possible in itself, in that each triangle is potentially an activity in its own, but the essential task is always to grasp the "systemic whole" (p.78). Engeström labels the top of the triangle, the instrumentally mediated relationship between the subject and the object, *production*, and claims that production is an essential part of every activity system. Without the production, there will be no activity. Production, however, can also be sociality and communication, as well as production of tools/instruments created for and within the process of production. Engeström (1987) claims that the activity system is the smallest possible unit of analysis and that the model opens for analysis of inner dynamics and historical change, driven by changes in the activity, which leads to the concept of contradictions.

2.2.5 Contradictions

According to Kuutti (1994) the activity system in itself has a "rich and detailed internal structure (p. 57)". But it leaves a lot to de desired in terms of describing the workflow of an activity or the dynamics of a culturally embedded work situation. A concept within Activity theory that addresses the notion of dynamics is the concept of

contradictions. Although this has an intuitively negative sound, this is not the intention of the concept, quite the contrary.

Motivated by Ilynkovs (1979) claim that contradictions are "the principle of self-movement (in activity) and (…) the form in which development is cast (Ilynkov (1970) cited in Engeström, 1987, p. 91)", Engeström sees contradictions as "the means that new qualitative stages and forms of activity emerge as solutions to the contradictions of the preceding stage of form (Engeström, 1987, p. 91)". Thus, contradictions are the driving force in the development of an activity (Kuutti, 1994) responsible for creating qualitative changes and new forms of activity. They are manifested in "problems, ruptures, clashes, breakdowns, etc. (Kuutti, 1994, p. 56)". Development in activity occurs when contradictions are overcome (Kuutti, 1994).

Contradictions in activity originates from the paradox that every activity of production simultaneously is an *activity of consumption* (Engeström, 1987). In a capitalist society, the main source of contradictions is the division of labour because it causes the product of labour to take the form of a commodity (Kuutti, 1994). A commodity has an exchange value in addition to its use value. The exchange value "depends more on social relationships and mediational factors (Kuutti, 1994, p. 134.)" The double nature of the commodity "penetrates every thing, action and relationship (ibid. p. 134)". The exchange value is the source of internal contradictions in activity, which in turn manifest themselves in external contradictions.

Engeström (1987) distinguishes four levels of contradictions:

1 Primary contradictions of activities are the conflicts between the use value and the exchange value *within* each of the corners of the activity system (i.e. subject, object, mediating instruments, etc.). They can also be "within each member in the relations of an activity (Kuutti 1994, p. 134)". He gives an example of course grading in Finland. Getting a grade on a course has a use value for a student, meaning he has passed the course, and learnt the material. However, the teacher also uses his grade for deciding to which degree he will receive student financing for the coming semester.

The exchange value of the grade is not dependant on the use value of what the student has learnt.

2 Secondary contradictions appear *between* the corners of the activity system (I.e. between object and division). Engeström exemplifies this pointing to how the stiff division of labour in capitalist society limits the possibilities afforded by new and advanced instruments.

3 Tertiary contradictions appears when " representatives of culture introduce the object and motive of a culturally more advanced activity to the form of the central activity (Engeström, 1987, p. 87)" for a person, the "central activity" being the object of study. This contradiction is always located in the motive or objective of an activity. For example, the discrepancy that occurs when a child's motivation for going to school is playing with friends, and the teachers make him study hard at algebra in order to learn mathematics. Engeström adds that the culturally more advanced motive may also be sought by the subjects of the central activity themselves.

4 Quaternary contradictions emerge between the central activity and "neighbouring activities". Kuutti (1994) gives an example where "a situation which the conceptual instruments producing academic research, are unable to deliver instruments which can help an information systems design project that is in trouble (p. 135.)". Engeström (1987) gives an example where a medical practitioner is concerned with the health of a patient, asking him to change his "way of life" to be more consistent with the objective of health, while the patient may be concerned with other aspects.

The concept of contradictions is not easily understood, but much of what can be gained from them as a conceptual tool for understanding change in organisations will depend on the unit of analysis, or what Engeström calls the "central activity". The concept is clearly related to the idea and importance of development in activity theory, also paying attention to dynamics in activity. It implies that although the activity system can give a somewhat different impression, one should perceive of activities as constantly evolving, and contradictions as omnipresent. The four types of contradictions are illustrated by Engeström (1987) in figure 2.5 below.

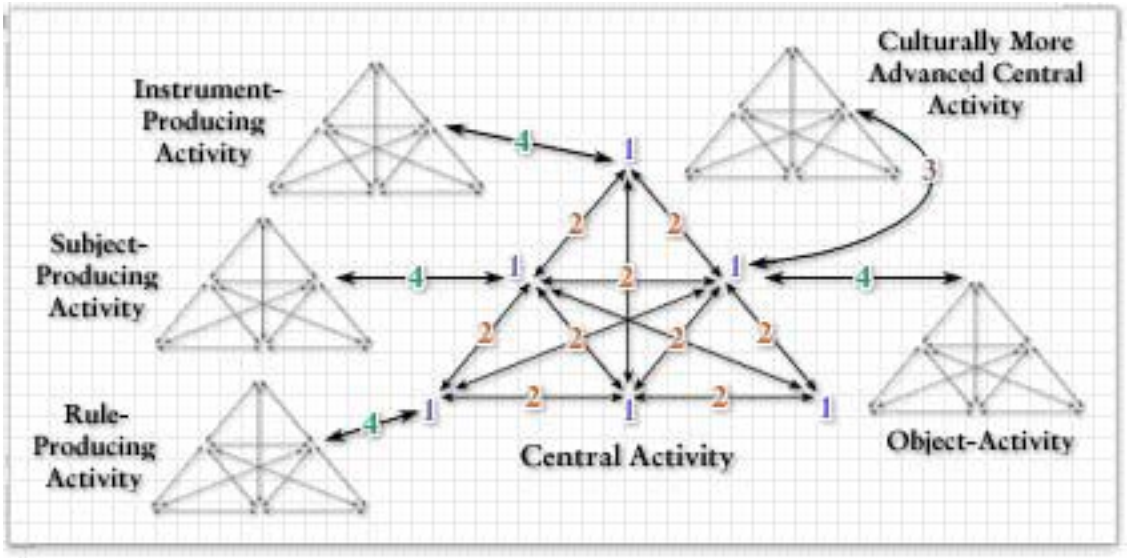

Figure 2.5 Four levels of contradictions in the human activity system (Engeström, 1987), figure copied at: http://www.edu.helsinki.fi/activity/6b.htm, (22.11.2001).

2.3 Methodological implications

As a conceptual framework, that can guide and mediate research, Activity theory leaves certain methodological implications. Kuutti (1996) states that "broadening the scope" of design and research (in computer science) is important, and that there is a lack of theoretical frameworks that deal with developmental and dynamic features of human practices. According to him, Activity theory has a lot to offer in this respect, in that these are fundamental issues. He further states that activities are "long term formations" where the objects are not transformed at once, but in several steps or phases (ibid.), discluding laboratory-experiment type research. Activity theory studies typically are occupied with studying activity in the environment where it naturally occurs, or *in situ*. Nardi (1996) sums up the theoretical implications of Activity theory as follows:

- Objects of the subjects in an activity change over time, and a research time frame long enough to understand these objects are necessary.

- A need for studying broad patterns of activity rather than "narrow episodical fragments" (Nardi, 1996, p. 95) is present, because the focus is on understanding the overall direction and import of the activity. One can certainly focus on fragments of the activity, but only after understanding the broad patterns.
- As one should focus on broad patterns of the activity, one should also use a varied set of data collection techniques, such as e.g. interviews, observation, video and historical material.
- One should commit to understanding the activity from the subject's point of view.

These methodological implications of Activity Theory guide the data gathering in my study, leading to the use of largely qualitative methods. The methods employed by in this study, are interviews, document analysis and also the analysis of computer logs of the instructors activities in the online learning environment (confer own chapter on methodological discussion). Activity Theory is also a useful tool in obtaining an understanding of the entire activity at hand, by using it as a "lens" for gaining insight, using Engeström triangle to model the activity. Identifying possible contradictions can also give an understanding of the development and dynamic change in the activity (confer chapter on data analysis for further discussion).

3.0 The context of VisArt

This chapter is dedicated to the description of the initial context for the study. The description contains a presentation of project DoCTA, an initial delineation of VisArt, and a short presentation of the Internet tool, TeamWave Workplace, used as a central mediator of communication in VisArt.

3.1 Project DoCTA

DoCTA (Design and Use of Collaborative Telelearning Artefacts) is a research project funded by the Norwegian Ministry of Education and Church Affairs (KUF), through their ITU (Information Technology and Education) programme. The project partners include the Department of Information Science (IFI), University of Bergen (UiB), Stord/Haugesund College (Høyskolen i Stord/Haugesund, HSH) Nord-Trøndelag College (Høyskolen i Nord- Trøndelag, HiNT) and Telenor Research and Development (Telenor FOU). Nine researchers and ten graduate students have been involved.

Project DoCTA (Wasson & Mørch 1999, Wasson, 1999, Wasson, Guribye & Mørch, 2000, see also; http://www.ifi.uib.no/docta) focuses on design and use of collaborative telelearning artefacts aimed at teacher training. The social, pedagogical, psychological and cultural aspects of where the learning takes place are considered important. Four different scenarios employing Internet technology were utilised, to engage students in collaborative telelearning activities. It is an explicit aim in DoCTA that students both gain practical experience in collaborative telelearning activities, and that theoretical reflection is done on the learning activity, ensuing active engagement.

From a research perspective, the studies associated with DoCTA seek an understanding of how students, instructors and facilitators organise their work, and to gain an insight into emerging patterns of collaboration. The community of study includes teachers, learners and facilitators participating in the various collaborative telelearning scenarios (Wasson & Mørch, 1999).

The aim of Project DoCTA is thus twofold; research and education. It is both a research project that is to generate data to be analysed and hopefully inform the researchers and the research community in the field of study. It is also a project that has outspoken pedagogical aims for the students taking part, in that they are to gain experience in collaborative learning mediated by Internet tools. The roles of the people involved in DoCTA during VisArt (cf. section 3.2) were then to act as instructors and facilitators, as well as researchers. My focus is on the former, explicitly how the instructors and the facilitators organise their work, although it may in some cases turn out to be problematic to assign some of the activity as belonging explicitly to one of the roles.

The four learning scenarios associated with DoCTA are IDEELS, Demeter, PedInfo and VisArt. IDEELS (http://www.ideels.uni-bremen.de/) is an EU Socrates curriculum development project, and it's goals include adding impetus to the curriculum development trend towards content and process-based learning and to enhance European competitiveness by providing students with opportunities to learn essential cross-cultural, linguistic and negotiating skills, through the use of a simulating game (cf. Guribye, 1999). Like project IDEELS, Demeter also is a European inter-cultural simulation, involving role-playing. It provides for cross-cultural education and communication in Europe and includes inter-cultural networks for democracy education, and education in European citizenship within the framework of teacher education (cf. Junge, 1999). IDEELS and Demeter scenarios were concerned with creating a textual artefact. PedInfo, which can be regarded a test scenario to VisArt, in addition to an evaluation of how TeamWave Workplace (TW) (http://www.teamwave.com/workplace/index.html) supports collaborative activity, took place between students who took a course in "Research issues in pedagogical information science", and the aim was to support the students in their creation of a distributed collaborative learning community (Wasson & Mørch 1999).

The four collaborative telelearning scenarios vary with respect to actor characteristics, aspects of the learning activity, the kinds of artefacts they have access to, and the kinds of artefacts they are to design (Wasson & Mørch 1999).

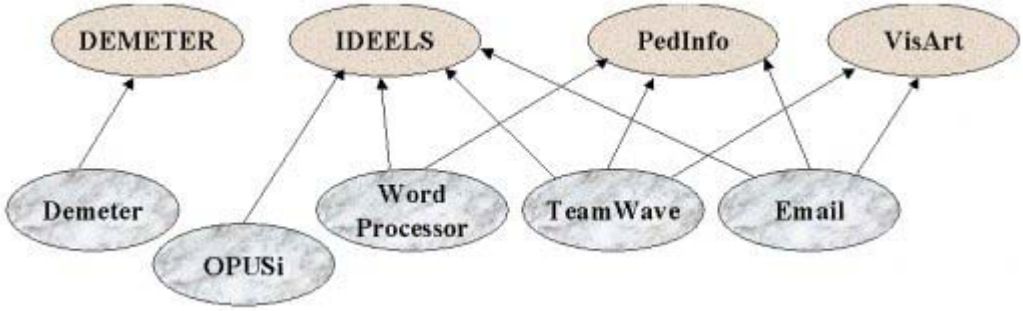

Figure 3.1, Learning Scenarios and Supporting Tools, (Wasson & Mørch, 1999)

3.2 The VisArt Scenario

VisArt was a collaborative telelearning effort between three Norwegian teaching institutions[3], and was deployed from March 25th to April the 26th, 1999. The three institutions were the Department of Information Science (IFI), at University of Bergen (UiB), Stord/ Haugesund District College (HSH), and Nordtrøndelag District College (HiNT).

The aim for the students taking part in the VisArt scenario was to create a visual artefact, a room in TeamWave Workplace, for teaching a subject of their choice. The students collaborated mainly via TW supplemented by e-mail. Separate e-mail addresses for each group was made available. The scenario can be seen as a continuation of the collaborative telelearning efforts IDEELS, Demeter and PedInfo[4].

The students were asked to bear in mind Salomon's (1992) concept of genuine interdependence while collaborating in VisArt. In his motivational paper on successful design and effects of CSCL (Computer Supported Collaborative Learning), Salomon points out the importance of not considering the computer as the sole tool in collaborative learning environments, and distinguishes two types of effects as a result of altering the environment, either by a computer or peers.

[3] For a map of the institutions' physical location in Norway, cf. Appendix F.
[4] As mentioned already (cf. section 3.1 on DoCTA above), the goals of VisArt were twofold; a pedagogical goal for the students, and a research objective for the researches.

Effects *with* a tool or a collaborative peer are the changes that occur as a result of being engaged in an intellectual partnership with the computer tool or the peers, that changes the nature of the activity, i.e. for example problem solving in teams vs. individual problem solving, and leaves a "long term cognitive residue" (Salomon, 1992, p. 1) that transcends the computer tool in use. Effects *of* are the lasting changes that take place as a result of interacting with a computer, and where the learner is able to gain knowledge to be used outside of the "computer" context. Effects *of* are more embedded in the technology, and Salomon claims that while focusing on the effects *with* one puts emphasis on the "lasting, generalisable abilities" (ibid. p. 1), downplaying the role of knowledge as highly situated and distributed. Salomon further goes on to stress the importance of mindful engagement as a factor of success in learning environments, to facilitate active construction of knowledge. To avoid indicated unwanted effects of collaborative learning environments Salomon underscores the need for genuine opportunities for interdependence. Interdependencies in learning situations are characterised by; 1. The need to share information, 2. A division of labour with complementing roles between the members, and 3. The "pooling of minds" or a joint activity thinking in terms that facilitates participation by all members of the group.

The VisArt activity was divided into five phases, regarding the activities of the students. Each phase is characterised by the dominating activity, or the aim of the period, expressed by the instructor (see table 3.1). The first assignment belongs to the preparation phase. The second and the third assignment sort under the training on tools and collaboration phase. In the design activity period, the students were to construct the visual artefact[5].

[5] This period was encompassed by questionnaires that the students who had consented were asked to fill in, for research purposes.

Table 3.1, Activities in VisArt, (Wasson, Guribye & Mørch, 2000)

VisArt Activity	**Date(s)**
Preparation	Week 8 (from February 25)
Training on Tools & Collaboration	Week 9 (March 1-5)
Pre-questionnaire	March 7
Design Activity	Week 10-12 (March 8-26)
Post-questionnaire	by March 26

The learning activities consisted of four assignments[6], one individual and three requiring discussions with the other members of the group. (See appendix G) The first assignment, which had the aim of introducing the group members to each other and getting them acquainted, easing further collaborative work, and also to introduce the most basic functionality of TW. The group members were to make an interview of one other person in the group, and present the information to the third student, in a room created by the student. The second assignment was a role-playing game, where the students were presented a fictous ”survival” situation. They were to first individually make a numbered list of preferred alternatives to solve the situation, and then collaboratively negotiate a team strategy, and arrive at a shared list of alternative courses of action ranged by priority. Finally, they were to perform statistical operations, calculating the group effectiveness according to a given answer. In assignment number three, solved individually, they were to familiarise themselves with the tools found in TW, presenting the results in their own room. For example, they were to create a database containing 5 to 6 of their favourite CD’s.

Finally, in the design activity, the students were to construct the visual artefact, which was aimed at teaching a subject of choice. They were to agree on a subject to be presented, find information on the World Wide Web, and create a document presenting the information. They were encouraged to bear in mind Salomon’s concept of genuine interdependence when working collaboratively on the internet; shared information, division of labour, and joint activity of thinking (Salomon, 1992).

[6] In addition to the learning assignments for the students, they were also engaged in activities aimed at research, as informants, and were to fill out questionnaires on tool use and collaboration in TeamWave, and most of the groups were interviewed after the completion of the scenario.

VisArt had five instructors and facilitators, three at UiB, and one from each college. At UiB there was the instructor responsible for the scenario as a whole (Head Instructor), one technically responsible facilitator (Technical Facilitator), and an instructor responsible for training and helping the students with questions (Training Instructor) located. At the colleges, the instructors (HiNT & HSH Instructors) were responsible for their students, preparing and motivating them for VisArt, and answering face to face questions.

The students participating in VisArt from UiB were graduate students, taking a graduate course in pedagogical information science. The students at Stord were undergraduate teacher students, also taking a senior level course in pedagogical information science. At HiNT, the students were undergraduate students taking a course in ”Information Supported Learning”. The idea was that a sound blend of backgrounds, or actor characteristics, should facilitate interdependencies in the group. The backgrounds varied with regards to pedagogical experience and knowledge, and also how accustomed they were to information technology.

The VisArt assignment was used differently in the three courses. At Stord, the teacher students were to create and continuously update an electronic diary on their work in the scenario, which would be part of their examination as well as an oral exam. At UiB, they were to give an individual report, having completed the scenario and utilising their experiences, discussing collaborative telelearning from a theoretical perspective. At HiNT, the students were free to elect handing in a semester assignment, on their experiences in VisArt.

The student body in the scenario consisted of 31 students[7], organised in nine groups of three students, and two groups of two. 4 teams had one student from each institution, while the rest had one student from Bergen and two from Stord. The students from Stord did not meet face-to-face, as they were taking a distance learning course. When the groups were organised, it was attempted to separate the students geographically, disallowing face-to-face communication and making them dependant of communication and collaboration mediated by TW, or the other tools available.

[7] Initially the scenario consisted of 32 students, but one student withdrew early due to illness.

Each group was assigned a room in TW, where they were to work collaboratively, and finally present their visual artefact.

The Internet tool made available to the students was TeamWave Workplace (TW) (Cf. own section on TW). In addition to TW, the students also had their own computer environment with tools such as a word processor, spreadsheet and e-mail available, and could also use the telephone.

A system for providing assistance to students in VisArt was designed before the start of the scenario. The tool used for mediating the assistance was e-mail. All e-mails requesting assistance was to be sent to an instructor with the overall responsibility for providing help. According to the content of the e-mail requesting help, this instructor would redistribute the e-mail to an instructor with the responsibility for the area in question. This could be questions about interpretation of the assignments, or technical questions. Figure 3.2 below illustrates the e-mail assistance system.

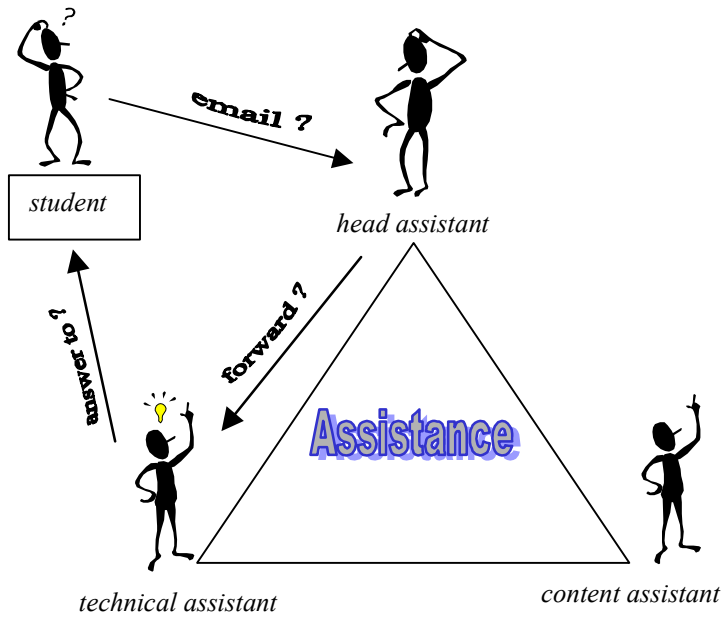

Figure 3.2 E-mail Assistance System in VisArt. (Wasson, Guribye & Mørch, 2000.)

3.3 TeamWave Workplace

The groupware system utilised in the VisArt scenario is TeamWave Workplace (TW). TW is an Internet groupware environment that uses a room metaphor to integrate a team's tools and tasks (Roseman & Greenberg, 1997). TW is created and marketed by TeamWare Software Ltd. that has its roots in the GroupLab's TeamRoom project, at the University of Calgary, Canada (Fjuk, Sørensen & Wasson, 1999). Johansen (1991) describes how the teamrooms have become an important tool used by teams to organise their work. Based on this, TW is developed using a "rooms" metaphor to integrate a team's tools and tasks (Roseman & Greenberg, 1997), which is based on the metaphor of shared network spaces (Fjuk, Sørensen & Wasson, 1999).

TW supports both synchronous and asynchronous communication and awareness (Fjuk, Sørensen & Wasson, 1999). To ensure this, it uses a persistence repository which stores information about the rooms and their contents, and allows retrieval of older versions of the room states (Roseman & Greenberg, 1997). It uses a room metaphor, making reference to a place, specifically to the classroom. It has a repository of tools for collaborative work, for example a shared whiteboard, web-browser, voting system, fileholder and viewer and a chat function.

TW is implemented using a client-server structure. An administration client is used to create and delete accounts, assign them to individuals, set access permissions, grant administrator privileges and also provide the set of tools for managing the persistence repository (Fjuk, Sørensen & Wasson, 1999). These were part of the tasks for the Technical Facilitator.

Gutwin, Stark & Greenberg (1995) have created a framework for awareness in collaborative learning, to discuss the types of awareness that can exist in a collaborative experience. He distinguishes four types of awareness: social task; concept and workspace awareness. Social awareness is the student's conception of the social connections in the group or the negotiation of individual roles in a social context. Task awareness is knowledge about "what is to be done". Concept awareness is awareness about how a particular activity or piece of knowledge fits into the

students existing knowledge. Finally, workspace awareness is the student's current perception about the other students' interaction with the shared workspace. It is maintained by providing "tracking information such as other learners' location in the workspace, their actions, the interaction history, and their intentions" (Gutwin, et.al., 1995, p. 147). TW provides a number of features to support workspace awareness. The interface displays lists of users in the current room, and a general list of other users on the server (Fjuk, Sørensen & Wasson, 1999). The room user's list contains the user name, and an optional picture. The time the user has been active or inactive is also displayed, in addition to the colour of the users' telepointers on the whiteboard. Clicking on the name or the picture gives access to the users, business card that displays the users, phone and fax number, email address, an URL homepage address and physical location. The general list of other users connected contains information such as name, current room and whether the user is active or for how long he has been idle.

TW provides a well integrated set of collaboration tools for both synchronous and asynchronous communication and work. It also augments existing user interaction tools such as e-mail, newsgroups and conferencing, and common applications such as word processors and spreadsheets. This can be both a strength and a weakness (Fjuk, Sørensen & Wasson, 1999). It is a strength in the way that students can continue to use applications they are familiar with, and use TW for supporting team interactions. As a weakness, this means that TW does not support the sharing of applications, as for example an editor for collaborative document writing, so that real- time collaborative writing cannot be carried out.

Students can either work in a designated group room, or create their own room. A newly created room consists of a blank whiteboard, a "pen tray", and a tool for chat. The students' shared network space is created through production of tool objects or artefacts in the room. The number of tools provided for the production of artefacts is 19, and include address book, calendar, chat, concept map, database, doorway, file holder and viewer, image whiteboard, meeting roster, message boards, personalised message, postit, To Do list, URLRef, vote, web- browser, and on- line help. The tools can be used for navigation, production, management, and consulting (Fjuk, Sørensen & Wasson, 1999). Navigation can be done either between rooms (Doorway tool) or

between information (Web-browser, URLRef tool). Production, i.e. production of knowledge representations, collaborative sharing of ideas and taking group decisions is supported for example by the brainstormer and concept map tools. Communication can be both synchronous, between one or more students, (Chat and Page/personalised message) and asynchronous (File holder, message board, postit). Management tools provide students the opportunity to coordinate their work (Address book, Calendar, Meeting Roster, To Do List). Finally consulting tools (Database, File Viewer, Image Whiteboard, Web-Browser, Online Help), provide access to shared information and help.

TW was prepared before VisArt. Several rooms were created, including the Classroom, the Training Room (see Appendix D). A Help Room, and an URL to the Help Pages (Appendix D), was also made available. The Help Pages were a guide to the tools found in TW. The instructors made the assignments for the training activity available, in addition to separate rooms for all the groups. There was also a room giving overview of all the rooms (Appendix D). Team e-mail aliases were set up for each team, and the Help Pages were created on the World Wide Web.

This chapter has been concerned with giving the background and initial context for the study, focusing on the project that organises the telelearning scenario in focus, DoCTA, an initial explanation of the telelearning scenario, VisArt, and a short account of the tools that were planned to be used, mainly TeamWave Workplace. The next chapter is dedicated to a discussion of methodological issues related to this study.

4.0 Design and Evaluation

In choosing an overall methodological strategy for this study, there was an omnibus of issues to take into consideration. It will be argued that there are several and intertwined reasons for using a qualitative ethnographic methodology. Some of the reasons that have influenced the methodological strategy chosen are the theoretical foundations of project DoCTA (Wasson & Guribye, 1999), the phenomenon at hand, and the research questions: which all indicate that a qualitative approach could be useful. The phenomenon at hand and the research questions - the intra group collaboration of a small group of people in interaction with artefacts - suggests that an ethnographic approach might be fruitful (Pettinary & Heath, 1998). Second, the theoretical approach chosen, Activity Theory, necessitates a qualitative methodology (cf. Jonassen & Rohrer-Murphy, 1999; Nardi, 1996). There is also some precedence of, and acceptance for, the use of qualitative methods and ethnography for studies conducted within the theoretical framework of CSCW (Hughes, King, Rodden & Andersen, 1994; Harper, 2000) and their appropriateness in understanding the imbroglio of the social phenomenon of people working together using artefacts.

The beginning of this chapter is dedicated to declaration and specification of the research questions and analytical focus, and an account of the level of analysis is given. A general discussion of qualitative methodology and ethnography is made, before the specific data gathering techniques that are employed in this study are explained. The analysis of the data gathered is organised as a narrative, focusing on events as they took place in time, and also using the central Activity Theoretical concept of activity systems (Engeström, 1987) and the evolutiuon of them during VisArt. The concept of contradictions in activities are also emphasised in the data analysis. Finally, the findings are discussed in terms of their implications, and the study as a whole is discussed and evaluated in terms of its reliability and validity.

4.1 Research Focus

The main question asked addresses the activity of organising a collaborative telelearning scenario.

> **"How do the instructors and facilitators of a collaborative telelearning scenario organise their work?"**

A second, subsidiary question is about the nature of the collaboration tool that mediated the online learning activity – TeamWave Workplace.

> **"Can TeamWave Workplace be used for gaining an understanding of the students' activity?"**

Yin (1994) makes the point that a research question has both substance and form, in that it points to a phenomenon, and is being asked in a certain manner, respectively. The *substance* or content sought through the main research question asked in this study, or the phenomenon referenced, is the organising of the collaborative telelearning activity of VisArt. The *form* of the main research question asked for this study is general, in that a "how" question is being asked. The form of the second, subsidiary research question is more specific in that the nature of the computer tool used for mediating the learning activity is investigated in terms of its capacity for giving feedback of the students' activity. The substance of the second question is TW and the way it mediates the instructors' contact with the students, which is part of the instruction activity.

Although a general main research question is being asked initially, the focus is specified onto several separate aspects of the activity of organising the telelearning scenario during the progression of the study, and the research questions were, hence, narrowed down. The specification of the focus has led to the questions

> "*What are the roles that the instructors assume during the scenario, and how were they arrived at*?"

"*What were the tasks of the different instructors during the scenario, and which tasks were associated with which roles?*"

"*What are the tools being used in mediating the communication between the instructors during the scenario?"*

"*Can TeamWave Workplace be used for providing the instructors with feedback on the students' activity?"*

The questions will direct the progression of the analysis.

For a study of this kind there are several alternative levels of analysis to consider, and these can mainly be divided in inter-group or intra-group levels of analysis, of which the latter can be specified further into several separate sub-levels. The focus in inter-group analysis would be on the groups involved in the scenario and the interaction between them, for example the students and the instructors. The second possible level of analysis is on the intra-group interaction. The intra-group level is a lower level of analysis than the inter-group, and can, as mentioned, be further specified into different sub-levels of analysis. One of them is to focus on the social actors involved in the scenario and the interaction between them, as mediated by artefacts. Some studies have been concerned with intra-group interaction as a matter of the analysis of discourse (Potter & Wetherell, 1987; Potter, 1997) or the analysis of conversation (Atkinson and Heritage, 1984). Alternatively, the focus could be on the individual level, emphasising the individual's interaction with the computer tools involved in the scenario. Such studies are typically within the tradition of Human Computer Interaction (Preece et. al., 1994) and often leans on the theoretical tradition of cognitive psychology (cf. Anderson, 1995) as an analytical tool.

The theoretical framework chosen for this study, Activity Theory, is not coherent with focusing on individual interaction with computer tools (Kaptelinin, 1996). AT suggests the activity system as the minimal meaningful unit of analysis (Kuutti, 1996). In considering distributed collaborative learning environments, Fjuk and Ludvigsen (2001) further hold out the necessity for including the social context in

which information and communication technology (ICT) is being used in the unit of analysis, in addition to technological and pedagogical aspects of the environment studied.

The unit of analysis chosen for this study is the collaboration of the instructors and facilitators of the telelearning scenario in question – VisArt, and on their collaboration as mediated by artefacts, in the social context that it occurs. The level of analysis is the intra-group collaboration. Special attention is given to the groupware tool chosen as a central tool in the learning activity, TeamWave Workplace.

A central AT conceptual tool is the activity system (Engeström, 1987), and it underscores sociocultural rules, tools and a division of labour as important aspects of the activity. Emergence of the object in the activity is also considered important when understanding the activity. These aspects of the activity will be taken into consideration whilst the study is conducted, and special focus will be given to the object of the subjects in the activity, and the corresponding division of labour.

When an activity theoretical approach to the study is involved, the dynamics in the activity is important, and the activity is considered a developmental phenomenon (Cole & Engeström, 1993). The notion of contradictions (Engeström, 1987) as drivers of change and development in an activity will be investigated in this study, in the sense of whether any contradictions can be identified, and if so their possible consequences.

On choosing an overall research strategy, Yin (1994) points out that the nature and type of research question asked is the most central issue to be considered, and that there are conditions under which certain strategies may have advantages compared to others. Further, "when a "how" or "why" question is being asked about a contemporary set of events over which the investigator has little or no control" (Yin, 1994, p. 9), the conditions are such that an exploratory case study design is advantageous. It is pointed out that the research question being asked for this study is general in nature, and it is a goal to try to gain an *understanding* of how the instructors and facilitators and instructors of VisArt organise their work in the context or environment specified. This understanding is pursued within an ethnographic

approach. An ethnographic approach (Pettinary and Heath, 1998) considers the research project an iterative process where the data analysis informs the data collection emphasis in several phases.

Before the analysis is conducted, a treatment of the methodology for the study is given. The structure of this treatment is an initial focus on qualitative methods in general, before the specific data gathering techniques employed are explained.

4.2 Approach to Evaluation

The goal for project DoCTA is, through employing a naturalistic study, to gain an understanding of how participants in collaborative telelearning scenarios organise their work and learning activities (Wasson & Guribye, 1999; Wasson, Guribye & Mørch, 2000). The former is also the objective for this study. In taking an ethnographic approach (Hammersley & Atkinson, 1995) there are suggestions for how to conduct the data collection (i.e. interviews and natural observation) and the analysis of the data gathered (i.e. textual analysis). The ethnographic research project is "an iterative process through which analysis informs the shape of the successive stages and focus on data collection" (Pettinary & Heath, 1998, p. 10).

Before explaining the actual data gathering techniques employed in this study, a general discussion of qualitative research is undertaken.

4.2.1 Qualitative Research

Finding a definition of qualitative research that is sufficiently exhaustive and circumscriptional can be a challenge. The qualitative approach to research is in some cases (no pun intended) regarded as the opposite, or indeed the alternative to, quantitative research. The two positions have historically been thought of as opposite poles in the social sciences, each with its group of adherent followers regarding their position as the most scientifically correct alternative (Grønmo, 1996). Others point to

the philosophical incommensurability between the two (Yin, 1994)[8]. Alternatively, and also more contemporarily, it is possible to assume a more pragmatic position to the different approaches. Grønmo (ibid.) distinguishes qualitative research from quantitative first and foremost regarding the characteristics and nature of the data collected and analysed. The characteristics of data are "quantitative if they are expressed in the form of pure numbers, or terms referring quantity (for example many/few, more/less, most/least, and so forth). Data that aren't expressed in this way are qualitative" (Grønmo, 1996, p. 74, my translation). Strauss & Corbin (1998) offer a similar definition of qualitative research labelling it "any type of research that produces findings not arrived on by statistical procedures or other means of quantification" (p.11). In practise, the dichotomy may be superficial, and may even inhibit and limit the quality of the research (Savenye & Robinson, 1996) if one dedicates oneself exclusively to one position. Yin (1994) states that case studies do not preclude the use of quantitative evidence, and others (e.g. Patton, 1987) states that there is a recent increase in the use of multiple methods including both qualitative and quantitative data.

In comparing the advantages of the two methodological approaches, it is often claimed that quantitative methods have their strength in describing a social phenomenon on a "high" analytical level, allowing for statistical aggregation and comparison of data on a general level (Patton, 1987). The qualitative approach is frequently cited as "thick descriptions" of situated phenomenon, providing in-depth and detailed descriptions (ibid.).

Leaving the issue of qualitative as compared to quantitative research, characteristics of qualitative research are searched for. Savenye and Robinson (1997) point out what they see as the methods typically associated with qualitative research, and they include interviews, observation, case studies, surveys, document, and historical analysis. Furthermore, they identify several characteristics of qualitative research.

> "Qualitative research (…) is conducted in a natural setting, without intentionally manipulating the environment. It typically involves highly

[8] For further discussion, confer e.g. discussion of "naturalism vs. positivism" in Hammersley & Atkinson (1995).

> detailed and rich descriptions of human behaviours and opinions. The perspective is that humans construct their own reality, and an understanding of what they do may be based on why they believe they do it. There is allowance for the "multiple realities" individuals thus might construct in an environment. The research questions often evolve as the study does, because the researcher wants to know "what is happening", and may not want to bias the study by focusing the investigation too narrowly. The researcher becomes part of the study by interacting closely with the subjects of the study. The researcher attempts to be open to the subjects' perceptions of "what is"; that is, the researchers are bound by the values and worldviews of the subjects. In qualitative research, it is not necessarily assumed that the findings of one study may be generalised easily into other settings. There is a concern for the uniqueness of a particular setting and participants" (Savenye & Robinson, 1996, p. 1172).

Research in natural settings is often, apart from quantitative approaches, contrasted to conducting experiments, where peripheral circumstances are attempted controlled, and variance in results upon manipulating a number of variables is measured. Silverman (1993) points out that although there are several traditions within qualitative research, they all "share commitment to naturally occurring data, and enquiry in naturally occurring settings" (p. 23), or in other words a dedication toward studying the phenomenon *in situ*.

The use of qualitative methodologies within Information Systems research has recently come into use. According to Hughes et. al. (1994) and Harper (1998), ethnography is also gaining ground within the community of CSCW, for both design and evaluation purposes. Although it still is more of a promising than a proven tool, there are several reasons to employ an ethnographic methodology if one is attempting to understand the nature of work. Part of the argument is that the development of distributed computing and networking technology into everyday use, necessitates "new methods for analysing the collaborative, hence social, character of work and its activities" (Hughes, et. al., 1994, p. 429). In other words, the inherently collective nature of work requires descriptive tools that regards work as just that – a social phenomenon. It is further stated that ethnography is a tool that is suitable for this

purpose, as it is concerned with providing descriptions of social actors within specific contexts.

Hammersley and Atkinson (1995) take a liberal position in defining ethnography on account of the diversity of the research performed under the more general term, or collective umbrella of qualitative research. Ethnography refers primarily to:

> "[A] particular method or set of methods. In its most characteristic form it involves the researcher participating, overtly or covertly, in people's daily lives for an extended period of time, watching what happens, listening to what is said, asking questions – in fact, collecting whatever data are available to throw light on the issues that are the focus of the research." (Hammersley & Atkinson, 1995, p. 1)

Hammersley and Atkinson's definition focuses on the tools and methods of ethnography. Additionally, one may make explicit the perspective that the goal of ethnographic research is understanding the world as the subjects of the ethnographic research project understand it (Harper, 2000), implying that one needs to understand the context and circumstances for the activities under scrutiny.

This is the issue also for Hine (2000) in her attempt to develop a methodology for studying computer-mediated interaction. The adaptivity of ethnomethodology is held as an advantage in describing and reflecting on the contexts of the Internet culture, and on the methodology in itself. The two possible ways of viewing the Internet as a place where one can undertake ethnographic fieldwork are either viewing it as a culture in itself or as a cultural artefact. The dichotomization is introduced as a tool for thinking about the phenomenon rather than as an exhaustive description. Jones (1999), in addressing the fluent nature of computer-mediated communication, makes a similar point in saying that the positions of being "digital" or not is a matter of perception rather than a dichotomy. The essential issue, it seems, is describing the way the historical and contemporary development has influenced the way we perceive the Internet.

A reference is made to the methodological implications of Activity Theory, treated in chapter 2 on theoretical aspects of the study. The focus on context, it has been argued, is essential in gaining an understanding of activities, as they are embedded in the cultural and social history that has been important aspects of the development of the activity. Nardi (1996) claims that the methodological implications of Activity Theory are to be engaged in the activity studied for a long enough time to identify and understand the objects and objectives of the subjects in the activity, and that broad patterns of activity carry more descriptive power than narrow ones. Further, a varied set of data gathering techniques is important as well as a commitment to understanding the phenomenon from the point of view of the subjects in the activity.

4.2.2 Data Gathering Techniques – Methodology in Practice

The specific techniques employed for gathering data will be treated in the following section. The techniques and their specifities for this study will be described successively, and ultimately a table summing up the descriptions will be presented.

Interviews were carried out with the six participating instructors and facilitators in VisArt. The interviews were loose and open-ended in nature, and a semi-structured interview guide was used (see Appendix A). Three of the interviews were carried out face-to-face. These were the interviews of the three instructors at the University of Bergen. The instructor at Stord/Haugesund District College was interviewed by telephone. The instructor role at Nord Trøndelag District College was divided between two persons, confer chapter 3 on initial context of the study for details. The two persons were interviewed simultaneously in a telephone conference. Some of the interviews were iterative in the sense that some points in the responses needed clarification, and new issues emerged through initial reviews of the transcripts. The interviews were all transcribed in length, and resulted in a large volume of textual documents. The interviews were carried out in the Norwegian language, and where citations are referred to for matters of analysis the transcripts are translated to English. The citations are available in Norwegian in Appendix B.

During the planning stage, a help system for students was designed[9]. The help was provided using e-mail as the tool mediating the communication in the help system. After the VisArt activity had concluded, the e-mail communication that took place from the instructor perspective during the scenario was collected. Arrangements were made with the instructors before the start of VisArt so that they saved the e-mail communication that they had with students and each other during VisArt, and forwarded them to the research group afterwards. The total volume of e-mail collected was large, and the number of e-mails differed among the instructors. The form of these data were in some cases textual documents such as MS Word or Notepad files, and in some cases the e-mails were forwarded using the e-mail reader in which the particular instructor received them. Where the e-mails were forwarded in their initial form, they were converted to MS Word documents.

A tool for analysing the log file created by the TW server was created by a research assistant attached to the DoCTA project (cf. Meistad, 2000). The tool, Server Log File Analyzer, read the ”server.log” file created by TW, and rendered transcripts of the activity carried out in the system. More concisely, the tool identified who was online at all times, and in which room they were at which time. By producing transcripts of the online activity, it is possible to identify whether members of a described group, such as the instructors, were online simultaneously, which may be taken as an indication of synchronous work (or asynchronous). The transcripts produced by the Server Log File Analyzer took the form of graphs with colour indicators distinguishing the members of the group of instructors, and MS Excel spreadsheets containing the same data describing it in numbers. The file describing the colours belonging to the instructors were kept separate and no names were used in the graph, to ensure anonymity of the instructors. In chapter 5 on conclusions, ethical considerations of using these kind of data are made.

The group of instructors created a number of artefacts that were used for various ends during VisArt. Some of the artefacts were produced as rooms in TW, and visual in nature. This would be rooms such as the Training Room, which contained exercises designed for the training of students on collaboration with each other and the tools of

[9] Confer chapter 3 on initial context for the study for further description of e-mail help system designed for VisArt.

TW. Another artefact is the Classroom that was a repository for all the Team Rooms, or the Help Pages that were created as an online help system. Another type of artefact collected was tables summing up the activities neccessary to ensure proper planning of VisArt. It contained descriptions of tasks and which of the instructors who were to perform them at which time. This artefact was provided by the instructors and takes the form of a table contained in a MS Word file, and the artefacts in TW were saved as pictures. The collection of artefacts are provided in Appendix D.

Participant observation is a method of gaining understanding of the phenomenon at hand that is often referred to in literature on ethnography and qualitative research in general. This data collection technique was also employed in this study. The observation took two different forms; observation of naturally occurring interaction between the instructors and what might be labelled as ”virtual ethnography” (Hine, 2000). The meetings that took place between the instructors during the planning of VisArt were attended, and also the meetings that took place during VisArt. The activity that took place in TW was also observed. The observations were invaluable in informing the study, and the data took the form of field notes in textual documents.

The data gathering techniques specific for this study are summed up in table 4.1 below. The information provided are the techniques of data gathering, the form of the data and specifications of each data gathering technique/form.

Table 4.1 Data gathering techniques employed in the study

Technique	Form of data	Specification
Interviews	Textual transcripts	Semi-structured interview guide
Log file collection	Graphs/spreadsheets	Digitally generated by Log File Analyzer
Collection of e-mail	Textual	Provided by instructors upon conclusion of VisArt
Collection of artefacts	Visual/tables	Produced by instructors/ facilitators
Participant observation	Field notes	Textual

Having specified the research questions and focus, discussed the methodological issues associated with and encountered in this study, and described the techniques of gathering data, the next chapter is continued with an analysis of the data collected. The analysis is succeeded with conclusions of the study, a discussion of implications of the findings and the reliability and validity of the study.

5.0 Data Analysis

The following chapter will be dedicated to analysis of the data gathered as a part of my study. The nature and characteristics of the data constructed are already treated in the previous chapter, this chapter will be devoted to a short discussion of data analysis in general, and analysis of qualitative data specifically. The discussion is followed by a presentation of the analytical strategy of my study, and presentation of the results of the data analysis. But first, a short recapitulation of the research questions initially asked, that has formed the basis for this study.

The question is twofold, one general question about the organisation of a telelearning scenario from an instructor's perspective, and one subsidiary, more specific question about the tool used for the scenario evaluated – TeamWave Workplace. The questions are:

> "How do the instructors and facilitators of a collaborative telelearning scenario organise their work?"

> "Can TeamWave Workplace be used to give the instructors feedback on the students' activity?"

Relating the nature of analysis to a scientific context, Denzin and Lincoln (1998) define data analysis as the following process.

> "Data analysis consists of the three linked sub-processes: data reduction, data display and conclusion drawing/verification. These processes occur *before* data collection, during study design and planning; *during* data collection as interim and early analyses are carried out; and *after* data collection as final products are approached and completed (Miles & Huberman, 1994, cited in Denzin and Lincoln, 1998, p. 180, italics in original.)".

Data *reduction* is reducing the macrocosm of potential data through choosing conceptual framework, research questions, cases, and measuring instruments. Second,

through selection and condensation of the array of gathered evidence, the data are reduced further. Data *display* is the process of putting the reduced data in such a form that the researcher is permitted to draw conclusions on it. These take the form of, for example, interview transcriptions, summaries of field notes, and semantic maps. In the *conclusion drawing and verification* process, the researcher interprets the displayed data. This activity may for example consist of comparison, the discovering of patterns, and double-checking with respondents (Denzin and Lincoln 1998).

A qualitative research study lays certain demands on the analysis. Yin (1994) underscores that in analysis of quantitative data, the structures and concepts for the analysis are already very much present in the gathered data. With qualitative data there are fewer such structures which may make the gathered data more dependent on the individual researcher's style of analytical thinking in this phase of the study, in comparison with a researcher engaged in analyses of quantitative data. Yin also argues that there is a weaker tradition for the researcher to lean on, within literature on analysis of qualitative data. There is also a difference between description and categorisation on one hand, and causal interpretation on the other. The analysis of qualitative data may be regarded as a deductive process, where the theoretical structures and concepts are available beforehand, but in many cases the analytical process is a process of induction, where the categories originate from the data gathered (Patton, 1987). It is important to keep in mind that the data constructed for a naturalistic inquiry gives no basis for postulating causal relationships related to the phenomenon studied, but this does not preclude speculation as long as it is based on the data, and specified as that.

The analysis of qualitative data involves the activities of "examining, categorising, tabulating, or otherwise recombining the evidence to address the initial propositions of the study (Yin, 1994, p. 102)". Analysis of qualitative data is not to be regarded as a separate part of performing the study, but rather as an iterative process of gathering or indeed construction of the data, and the examination of them. In the process of gathering data one discovers and formulates hypothesises. Through progression in the research process, some hypothesises may be discarded, and others reformulated. Categories constructed in the process may be defined and redefined (Frankfort-Nachmias and Nachmias, 1997). Denzin and Lincoln (1998) argue that designing the

study is part of the data analysis, because the design activity corresponds with the reduction of data, which is a part of the three sub-processes involved in the analysis of qualitative data.

Yin (1994) points to the need of having a general analytical strategy when analysing qualitative data for producing a valid interpretation of them. The goal is to strive for a fair treatment of the evidence, to produce compelling analytical solutions, and to rule out alternative interpretations. The strategy that Yin regards as the most desirable is relying on theoretical propositions that lead to the case study initially. The second analytical strategy is developing a case description. Relying on theoretical propositions is possible where the researcher initially has a set of theoretical propositions about the phenomenon under study, and where these propositions lead to more specific research questions. Clear ideas about a phenomenon will guide the researcher to focus attention on evidence found in places that informs the study, and ignore others. According to Yin, the strategy of developing a descriptive framework is used when no theoretical propositions are present. This strategy will still organise the analysis. In some situations the goal of the study is to develop a description of causal relations related to the phenomenon, and in others the goal can be to identify which causal relations that should be analysed further.

Yin (1994) also identifies four specific techniques, or modes of analysis to be used under the guidance of the general analytical strategy. These are pattern matching, explanation building, time- series analysis and program logic models. Shortly, pattern matching is the comparison of the empirical patterns with the one or more predicted patterns. Pattern matching presupposes the existence of predictions made explicit before the study, an existence that one may argue to be the case more often in studies based on theoretical propositions, or explanatory studies, than in descriptive, or exploratory studies. Explanation building is the process of "stipulating a set of casual links" (Yin, 1994, p.110) about a phenomenon. They are iterative in nature, and the documentation can be either a narrative, or reflect a theoretical proposition. Time-series analysis in qualitative studies is similar to time-series in experimental studies, and is the study of a phenomenon at different periods in time. In a case study there is a danger of not having any precise measuring points, and it is important to constantly evaluate the internal validity. Program logic is the stipulation of a chain of events over

time, and is most suitable for the studies that are based on predefined theoretical propositions, rather than descriptive case studies.

Yin (1994) identifies four essential factors in pressing for a high quality analysis; that the researcher uses all available evidence, includes major rival interpretations, addresses the most significant aspect of his case study, and employs her/his own previous expert knowledge. Using all available evidence can be seen in relation to treating the evidence in a fair manner, especially in relation to developing contesting hypotheses, ensuring that alternative interpretations of the data has been considered. Following this quality measure increases the internal validity of the study. Accounting for rival interpretations is significant if issues considered in your study has been addressed in another study, and the study has arrived at a different conclusion or interpretation of the evidence. The criterion of focusing on the most significant aspects of the study is perhaps self evident, and is a matter of guiding the analytical work as close as possible to the central aspects of where the interests investigated in the study are declared. Using own prior existing knowledge will help the researcher to guide her/his attention to the analysis, will ensure a higher quality of the study, perhaps also self evident. This may be especially important regarding the fact that qualitative analysis is a field where the outcome is very much dependant of the researcher's own skills and style in analytical thinking. This is partly because of the highly situated nature of data in qualitative studies, and the lack of "cookbook recipes" for conducting the analysis.

The balance between description and analysis is, according to Patton (1987), important to keep in mind while performing an analysis. It is a goal to give a holistic and narrative description of the matter studied, but this description should not last into the mundane and trivial aspects of the matter. In the analysis, it is a goal to give a description of the important events that occurred during the VisArt activity, and also to relate them chronologically. An attempt will be made to keep the focus on the emergent categories that can be constructed from the data material.

Patton labels the process of analysis as "bringing order to data, organising the data into patterns, categories and basic descriptive units" (1987, p.144). The process of analysis is distinguished from interpretation of the data, or defined as attaching

meaning or an understanding of the analysed data, although he points out that there is no obvious line of demarcation between the two processes. There are two main sources of the organisation of the data; the research questions initially asked as a starting point for a study, and the interpretations of the data that have taken place during the data collection. Strauss and Corbin (1998) point out the need for a microscopic analysis of the data. Data and interpretation of them are the separate elements in this process, apart from the iterative interplay that takes part in the data gathering process.

My analytical strategies and goal for the data analysis are thus through thorough investigation and disciplined organisation of the data, to provide an account of the data in the form of a narrative, and to arrive at a set of analytical concepts. Hopefully these concepts will give insight into the studied phenomenon, and create a basis for empirically grounded speculations about any possible related phenomenon, in the light of the set of initial research questions that were the basis for this study.

5.1 Phases

In the analysis, an initial distinction between different phases in time during and before the collaborative telelearning activity is made. The demarcation of the phases begins with the instructors' planning of VisArt, and is further distinguished by an alteration of the instructors' activities in the scenario. Each of the five instructors had distinct roles in VisArt, and a description of these roles is given. The responsibilities associated with each role varied with the phase in the scenario to a certain extent, and a further description of this will also be made. First a short description of the phases is given, succeeded by a description of the different roles of the instructors in the scenario.

It is functional to regard the VisArt activity as divided into four phases, with the perspective of the instructors' organising of the activity in mind. The shifts in phases are identified through shifts in the activity. More specifically, the shifts in the activities are mainly identified through altered objects of the activity. The altered

objects has entailed a slight variance in the subjects of the activity, and also more noticeably a change in the division of labour and mediating instruments.

The first phase, Planning Phase, is where the instructors co-ordinated the initial activities crucial to a successful run of the learning activity. This took place before the actual VisArt activity, or rather before the students were involved. The second phase, Preparation, is where the students got involved. In short, it was a phase where the students were prepared in the sense that the necessary software to participate in the VisArt activity was downloaded and installed. The third phase, Training on Tools and Collaboration, involved training of the students both on tools available in TeamWave Workplace and on collaboration between themselves. The fourth phase, Design Activity, is the actual design activity where the students were to design the visual artefact aimed at teaching a subject of their choice. Upon conclusion of the Design Activity phase, the students responded to a questionnaire, or a post-activity evaluation of their activities in the scenario. The different phases are summarised in the table 5.1 below.

Table 5.1 Phases in the VisArt scenario

Phase (VisArt activity)	Duration
Planning	01.02.1999 – 25.02.1999
Preparation	25.02.1999 – 29.02.1999
Training on tools and collaboration	01.03.1999 – 05.03.1999
Design Activity	08.03.1999 – 26.03.1999

5.2 Roles

The instructors had different responsibilities before and during the learning activity, and a label will be assigned to each of the roles, according to an understanding of their tasks and responsibilities. A short description of each is given, but the role of each varied with the different phases, and is subsequently looked into in the section touching the phases more thoroughly below. The instructor carrying the main

responsibility in the scenario is labelled the “Head Instructor”. The responsibilities of the Head Instructor included preparing the course and design activity, co-ordinating the activities of the instructors as a group, and set up the teams of students. Contacting the computer system administrative group, which was running the server that supported the software used in VisArt, and making the initial contact and introducing the scenario to the students were also some of the responsibilities. The Head Instructor was physically located at the University of Bergen.

There was also allocated an instructor with the responsibility of training the students on the tools in TeamWave Workplace (TW) and on online collaboration in general. This instructor is labelled “Training Instructor”. The main responsibilities were to prepare the training activities and exercises to be given to the students. The Training Instructor also participated in the preparation of the evaluation forms that the students were to complete at the conclusion of the scenario, and distributed e-mail from students requesting help during the scenario. The help e-mail were further distributed according to which type of help they requested, to either the instructor responsible for interpretation of the assignments or the facilitator responsible for technical questions. (The tasks of distributing e-mail in which assistance was requested to relevant instructors may also qualify this instructor to be labelled a facilitator, but for the sake of simplicity the label “instructor” is used). The Training Instructor was physically located at the University of Bergen.

The instructor associated with maintaining the software (TW) used in VisArt, is labelled “Technical Facilitator”. This person was not responsible for anything “pedagogical” during VisArt, but performed most of the physical operations in communication with TW, thus the label facilitator. Some of the responsibilities were setting up the TW server, creating user accounts for the students, and keeping the system “up and running” during VisArt. The Technical Facilitator was physically located in Bergen.

VisArt was a collaborative project between three institutions, the University of Bergen, Dept. of Information Science (IFI), District College of Stord and Haugesund

(HSH), and the District College of Nord Trøndelag (HiNT)[10]. The latter two institutions each had an instructor assigned[11], and these instructor's main responsibilities were tied to the students located at their respective teaching institutions. Typical tasks for them were to recruit students for participation in VisArt, and to prepare these students for the participation. The way their student's participation in the telelearning activity was integrated into their respective courses was an individual decision.

Table 5.2 Summary of instructor roles in VisArt

Role	Main responsibility
Head Instructor	Overall responsible, contact with UiB students
Training Instructor	Training the students
Technical Facilitator	Ensuring system stability
HSH Instructor	Contact with HSH college students
HiNT Instructor	Contact with HiNT college students

5.3 Phases unfolding

5.3.1 Phase 1: Planning Phase

Circumscription of the Planning Phase before the start of VisArt is based on documentation of the planned activities made by the instructors themselves. One

[10] Confer chapter 2 on initial context for the study for details.
[11] HiNT actually had two instructors, one with the formal responsibility, and one that was more practically involved. Cf. chapter 2 for details.

might argue that the Planning Phase started at a stage previous than the date given, as previous telelearning scenarios had taken place before VisArt, as tests for VisArt. One of these was a collaborative telelearning activity that took place at the Department of Information Science, in a course on Pedagogical Information Science. This issue has been treated in chapter 2, on general context for the study. The second objection to the date given as the start of the Planning Phase is that a meeting between representatives from the participating institutions took place during the fall of 1998, where time scopes, or the possible dates for when the unrolling of VisArt was to take place. This date might certainly have been given as the date demarcating the start of the Planning Phase, but no extensive planning was carried out after this meeting until 01.02.1999. The focus for the analysis, and in this section, in that respect is the planning and carrying out of VisArt *per se*.

Table 5.3, presented below, sums up the activities necessary in performing the planning of VisArt and which of the instructors were responsible for which activity[12]. The tables were constructed before and during the scenario by the Head Instructor, and served as a tool in keeping an overview on the planning. In other words an overview on the tasks that had to be completed, for the instructors to be able to view the scenario as prepared. The "task" column names the task, or what is to be done, the "date" column describes by when the task was to be completed. "Data source" indicates which form the object to be operated on possessed, and also where it was available. The "state of source" column describes whether the task has been completed or not, the "comments" column is self-explanatory. The column furthest to the right indicates which of the instructors were responsible for each task.

[12] The table resulted from modelling the VisArt scenario, cf. Wasson, Guribye and Mørch (2000) for details.

Table 5.3 Planning VisArt from the instructors' perspective

Task	Date	Data source	State of source	Comments	Responsible
Prepare Assignment: • Course • VisArt	01.02	Word file, VisArt activity is accessible in TW	Prepared	VisArt activity is part 2; instructors to choose how to use it	Head Instructor
Prepare Training Activities	15.02	Word files, accessible in TW	Prepared		Training Instructor
Prepare self-evaluation form	15.02	Form on the web	Prepared		Training Instructor
Prepare Help pages on the Web	15.02	Web page	Prepared		Research Assistant
Give out Assignment	16.02	Assignment document	Prepared	Each instructor to hand out & go through with stud.	Head Instructor > HSH Instructor HiNT Instructor
Set-up TW on server	08.02	TW	Up & running on grevling.ifi.uib.no		Technical Facilitator
Set up accounts in TW	23.02	Participant & Team lists from (Head Instruct.)	TO DO	Participant lists from HSH & HiNT Instructor	Technical Facilitator
Create classroom in TW	18.02		Prepared		Head Instructor (w/ Training Instructor)
Set up Teams	19.02	Team list (login names & teams)	Prepared	Received list from Instructors ; Assign login name and team	Head Instructor
Create team rooms in TW	22.02	Team01 to Team11 rooms in TW	Prepared	Make sure permissions are set properly	Head Instructor
Ask "drift" for email aliases	22.02	Team list	Prepared	Email list to "drift"	Head Instructor
Inform about TW license	24.02	License number	Received	Send email to participants	Head Instructor
Inform about start of the scenario	24.02		TO DO	To be sent by email to all	Head Instructor
Prepare for providing assistance	24.02		TO DO	Agree to assistance process	Training Instructor w/ Head Instructor & Technical Facilitator

The first task in the table was the responsibility of the Head Instructor, who was to prepare the course assignment and VisArt. At IFI, VisArt was part of a course in pedagogical information science, and the Head Instructor needed to fit VisArt into the scheme of this course. VisArt was also a part of courses at the other two teaching

institutions. How VisArt was to fit into the courses at the other educational institutions was up to the individual College Instructor, and will be treated at a later stage in the analysis. A task in preparing VisArt at this level was to design the assignment to be given to the students. The assignment was pedagogical in nature, to design a room in TW to be used for teaching a subject of the students' own choice. Originally the assignment was to design a web page with the same content, using a composer that was to be written and adapted to TW by two of the research assistants associated with DoCTA. It eventually became clear that this composer could not be finished in time before the start of VisArt due to technical problems beyond the instructors' control, and the Head Instructor made the decision that the assignment would be to compose a room in TW instead.

The Training Instructor designed the training course as a part of his master's dissertation. The aim for the training was to prepare the students by offering them training on the tools in TW, and on distributed collaboration. The assignments were prepared in co-operation with a research assistant attached to project DoCTA, and were implemented as MS Word, Mac and ".rtf" files made available for the students to download in TW. The objective of the training course was twofold; to familiarise the students with the tools and functionality in TW, and to strengthen the relations between the students. The assignments were designed in co-operation with the Head Instructor, and implemented by the Training Instructor. Four assignments were prepared; one to be responded to individually, and three assignments requiring collaboration.

In addition to the training that was given, a set of help pages was made available to the students. They were prepared by a research assistant in project DoCTA, and were to some extent a result of collaboration with the Training Instructor. They were implemented as web pages, readable through TW, and they were available at all times during the scenario.

The Head Instructor and the College Instructors administered the assignments to students. Some complications occurred at this stage in VisArt, as one of the College Instructors failed to give notice to his students about their participation in VisArt. This inevitably led to some confusion at the beginning of the scenario, which was most

evident during the week of training. For some students it took a week before they had logged onto TW for the first time.

Setting up the TW server was the task of the Technical Facilitator[13]. TW is based on a client – server technology. The Technical Facilitator installed the TW server on a Unix mainframe, property of IFI. He also created user accounts for each of the participating students, and used participant lists made available from the Head and College Instructors to complete this task. The students were also to be organised in teams of three persons per group, and the Technical Facilitator created these teams physically in TW. The Head Instructor composed these teams and assigned login names to each. It was important to the Head Instructor that the teams' composition disallowed for any physical meetings between the students. From HiNT, only five students participated, so this could seem like a problem. But at HSH, the students were distance students, so groups of persons located at different places could be composed. Each team was assigned a room in TW, a task done by the Head Instructor. E-mail aliases for the teams were prepared by "Drift" or the Systems Administration group at IFI upon request from the Head Instructor.

A classroom common to all the student groups was also created in TW, in collaboration between the Head Instructor and the Training Instructor, and a student assistant from DoCTA. Some of the documents required by students to complete the assignments were made available here, and it may also seem that it functioned as a place for synchronising communication between the students, and between the students and the instructors.

Having provided a short narrative of the Planning Phase of VisArt, the activities of the group of instructors and facilitators during the Planning Phase will be modelled employing Engeström's triangular model of an activity. For treatment of the subject of contradictions in VisArt, see section 5.4.2.

[13] Confer chapter 3 for details on TW functional structure.

Modelling the Planning Phase

Here the Planning Phase of VisArt will be modelled according to Engeström's triangular framework of an activity, and the planning activity will be dealt with in relation to each of the constituting parts of the triangle. An account of what is here seen as the subject, object and community will be given, and the function of the mediating elements such as the tools, sociocultural rules and the division of labour will be discussed.

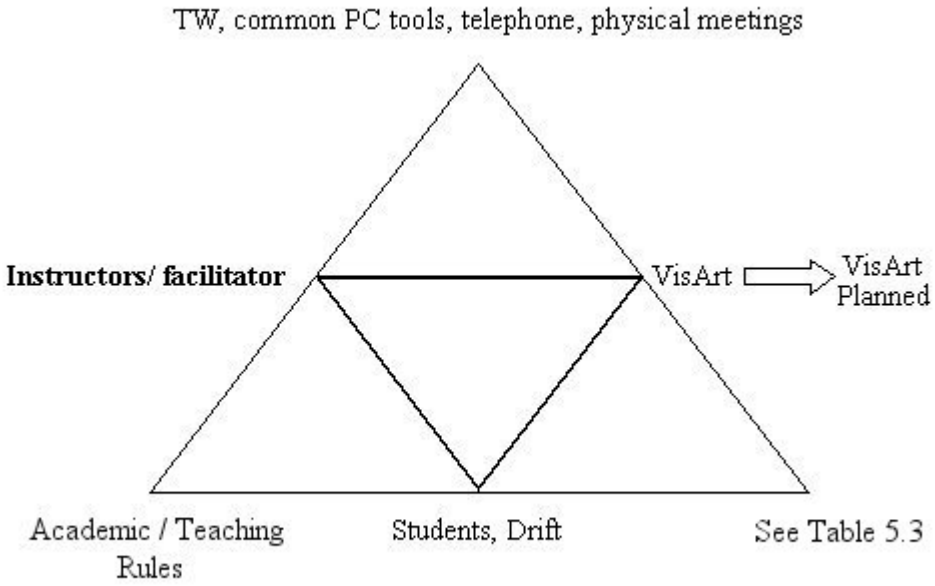

Figure 5.1 The Planning Phase Modelled

The subjects in my analysis of VisArt are the four instructors and the facilitator. Their roles have been dealt with previously in this chapter, and the definition of the subjects for this analysis is thus the mentioned group of five persons that had instructive and technical roles in VisArt.

The entity seen as the object in this analysis is VisArt, and is defined as the learning activity prepared for students at UiB, HSH and HiNT to be carried out at the previously given dates using TeamWave Workplace as a central mediating instrument. The outcome is conclusion of the planning involved in preparation of the scenario.

Demarcating the community related to the subjects in focus is perhaps a difficult task, as there is hardly a line that can be drawn between participating people, groups and organisations if the concept of a community is interpreted in the widest sense. With danger of being peculiar, one might also include the staff of the local coffee shop where the instructors had their lunch as part of the community. For the sake of simplicity, it is functional to include only the most important parts of the community to the instructors in the Planning Phase. The parts of the community considered in this analysis are the students participating in VisArt, and the respective institutions that affected the instructors at the different locations. For example the systems administrations groups at the involved locations which performed operations that were necessary for the preparation of VisArt, such as the systems administrations group at IFI setting up e-mail aliases for the student teams. The company producing TeamWave Workplace was also contacted fairly often during this phase, the reason being that the Technical Facilitator and a research assistant planned to implement an html composer as a tool in TW. More details on this follows in the section on division of labour.

Tools mediate the relationship between the subject and the object. The tools involved in mediating the instructor's operations toward VisArt in the Planning Phase depended, naturally, on the role of the actual instructor, and on the tasks that the instructors were performing. When describing the use of tools, these two aspects will illuminate the description. Most of the communication between the instructors took place during the Planning Phase. The communication between the instructors, and between the Head Instructor and the College Instructors largely amounted to co-ordinating events in time, and the telephone was the tool most used to facilitate this co-ordination, in addition to e-mail. E-mail was for example used to distribute the assignments to be used in the scenario to the different instructors in advance, so that the various instructors were able to fit VisArt into their respective courses. There were no physical meetings aside from the meeting early in the previous semester where they agreed to plan the scenario, and roughly when it would take place.

The Technical Facilitator was responsible for installing the TW server and preparing it for use in VisArt. The tool that mediated this was foremost TW itself. The Technical Facilitator communicated a great deal with the Head Instructor during the

Planning Phase, in order to co-ordinate the preparation of TW. E-mail and face to face meetings mediated this communication. He also initiated communication with the programmers of TW the semester previous to VisArt, which took place because of trying to remedy discovered bugs and problems. During the Planning Phase, the Technical Facilitator also, in conjunction with a research assistant attached to DoCTA, attempted to program a web-composer tool in TW using the programming language TCL. However, this attempt was eventually abandoned, and will be treated further in the section describing division of labour in the Planning Phase.

The Training Instructor was responsible for preparing the training assignments. The object of the training was to enable the students to become accustomed to TW, and also to familiarise the students with each other. The training, which consisted of four assignments, two of which were prepared earlier by the Head Instructor, were constructed in MS Word, and made available in a separate training room in TW. The Training Instructor planned them together with the Head Instructor, and implemented them himself.

The division of labour described here will focus on the co-ordination of the work performed by the group of instructors and the Technical Facilitator during the Planning Phase, toward the objective of completing the planning of VisArt. Table 5.2 describing the different roles of the instructors, together with table 5.3 indicates largely the division of labour in the Planning Phase, and so does the table describing the different tasks that were to be completed, and by whom. An overview account of the main issues that influenced the planning will thus be given.

The communication between the Head Instructor and the College Instructors amounted to finding dates that suited the instructors at the different institutions, for the carrying through of the scenario. The Head Instructor largely decided the contents of the scenario, and one might speculate that this reduced the need for physical meetings. The College Instructors were mainly responsible for recruiting students to VisArt, to be their students' contact person during the scenario, and also to fit VisArt into their respective courses.

The initial practical objective of VisArt, regarding the pedagogical activities to be engaged in by the students, was that the students were to produce a web page for teaching a subject of choice. The plan was to program a tool for producing the web page, a composer tool, and add it to the existing functionality of TW. Having such a tool in TW would allow the students to synchronously construct the page. The Technical Facilitator and a research assistant were to perform this task. The tool was nearly completed, but a few and crucial parts of the functionality could not be implemented. For example the means of saving unfinished or completed work. When the attempt was abandoned, it was getting close to the start of VisArt. The Technical Facilitator commented:

> Extract 1(16.04.1999, 10.00 a.m.)
> *"We were unable to store changes and so on. Version control was a problem. Additionally, when you minimised a window, everything was lost. So we wrote this to TW, we had quite a lot of communication with them during this phase. It was a real problem, because we had so little time to finish it. …We only had two months to finish it, it couldn't have worked".*

At a meeting where this, among other, issues were discussed, a research assistant came up with the idea that instead of the students composing a web page using a tool that was not going to be finished in time, the students could make a "room" in TW instead. The content of the objective for the students would remain the same, but they would employ different tools working towards it. The idea was very much appreciated.

Technical Facilitator, on the failed attempt to implement web composer tool in TW:

> Extract 2 (16.04.1999, 10.00 a.m.)
> *"Yes, it was during a meeting for everyone that we realised the limitations in what we could develop. And I thought this (designing a room in TW) was a great idea. It was totally ok. That we can use this medium to something other than just to communicate".*

The team of instructors and the research assistants decided that they would give the assignment of producing a room in TW. The solution to the problem of not being able get the web-composer finished in time was incidental; a response to an event that was not planned.

It is perhaps ambitious to try to describe in detail the evolution and development in culture, or sociocultural rules during an activity that lasted no more than a month. Especially given the segmentation of VisArt into four phases, intersticing each phase approximately one week. Trying to understand complex cultural rules in themselves over a short period of time is also ambitious. A very short account of sociocultural rules that mediated the relationship between the group of instructors and the community will be described. Very few formal rules can be found within the group, the rules are more implicit in nature. One of the rules that can be described is the notion of the instructors taking responsibility for the area that they attached to the conception of their role in VisArt.

The Technical Facilitator comments on rules between instructors:

> Extract 3 (16.04.1999, 10.00)
> *"You have your own tasks…Areas, or areas of responsibility. So I have tried to take responsibility for restarting the server and so on".*

The Head Instructor on rules between instructors:

> Extract 4 (12.04.1999, 10.00 a.m.)
> *"Like I said, maybe we should have had more discussions between us, but I got the responsibility for all this without it being explicit. But I told the others how they were to use the scenario on their own courses. They were responsible for this themselves. But I informed them what I was going to do. They were given a copy of the assignments that I made. Then we had a common part about VisArt, about participation, but what we chose to do with this was up to ourselves. We could actually decide ourselves how and if we were going to mark the participation regarding the exams and so on"*

The Training Instructor on rules between instructors

> Extract 5 (16.04.1999, 14.00 pm)
> *"We had this division of labour, but we agreed that I would receive all the e-mails and pass them on. This was… rules, actually informal, but no… But I was to be responsible for the training. And then after a while… "The Head Instructor" was there all the time, and she had most of the responsibility. She was… Yes, she is leader of the project, so… I don't know anything else."*

The statements made by the instructors and the Technical Facilitator on this topic, when asked to describe the rules between them, all point out that performing the tasks appointed to them independently was an issue. Acting in coherence with the division of labour planned in advance of VisArt may here seem essential to the instructors, save for the prerequisite of the individual instructor had an understanding of what was the division of labour. One might label this as an expression of "Professional Culture" or "Academic Culture". Sorting under the label of academic culture, the instructors' previous perceptions about how to act as instructors also are important.

Being an instructor in a distributed collaborative learning environment was a new experience for most of the instructors, and one can argue that some of their perceptions about instructor rules in learning environments that weren't collaborative or distributed were brought into VisArt. When regarding distributed collaborative environments as fundamentally different from natural learning environments, this may cause problems. For further discussion of this, confer section 5.4.1 and 5.4.2 on new work environment and contradictions in VisArt.

Additionally, one may argue that the student culture was of importance to the instructors in the later phases of VisArt, in particular the Training Phase and the Design Activity. The instructors' contact with the students increased during these phases. Knowledge about or expectations of student culture, or rules between students may have influenced instructor behaviour in VisArt, thus being part of mediating the relationship between the two groups. The matter of sociocultural rules is not investigated further in this study although it would be most interesting. Distinguishing the sociocultural rules from the division of labour in this case is thus a matter of the

participants' intentions of keeping to the planned division of labour and the planning compared to actual execution of the planned activities, respectively.

Instructors in TeamWave Workplace during the Planning Phase

TeamWave Workplace was operational for most of the duration of the Planning Phase. Figure 5.2 below illustrates the presence of the instructors in TW during the Planning Phase, starting from the 3rd of February, up until the day before the start of VisArt; 23rd of the same month. The vertical axis is time of the day, to be read from the bottom and upwards, starting and ending at midnight. The horizontal axis is the dates. The colours of the lines in the figure each represent an instructor, indicated at the bottom of the figure. The figure only describes online presence of the individual instructors, it does not indicate their activities whilst online. It also indicates simultaneous online presence, which may indicate contact between them, although it is not possible to use the log files as evidence of this. For further description of the log files, confer chapter on research methodology.

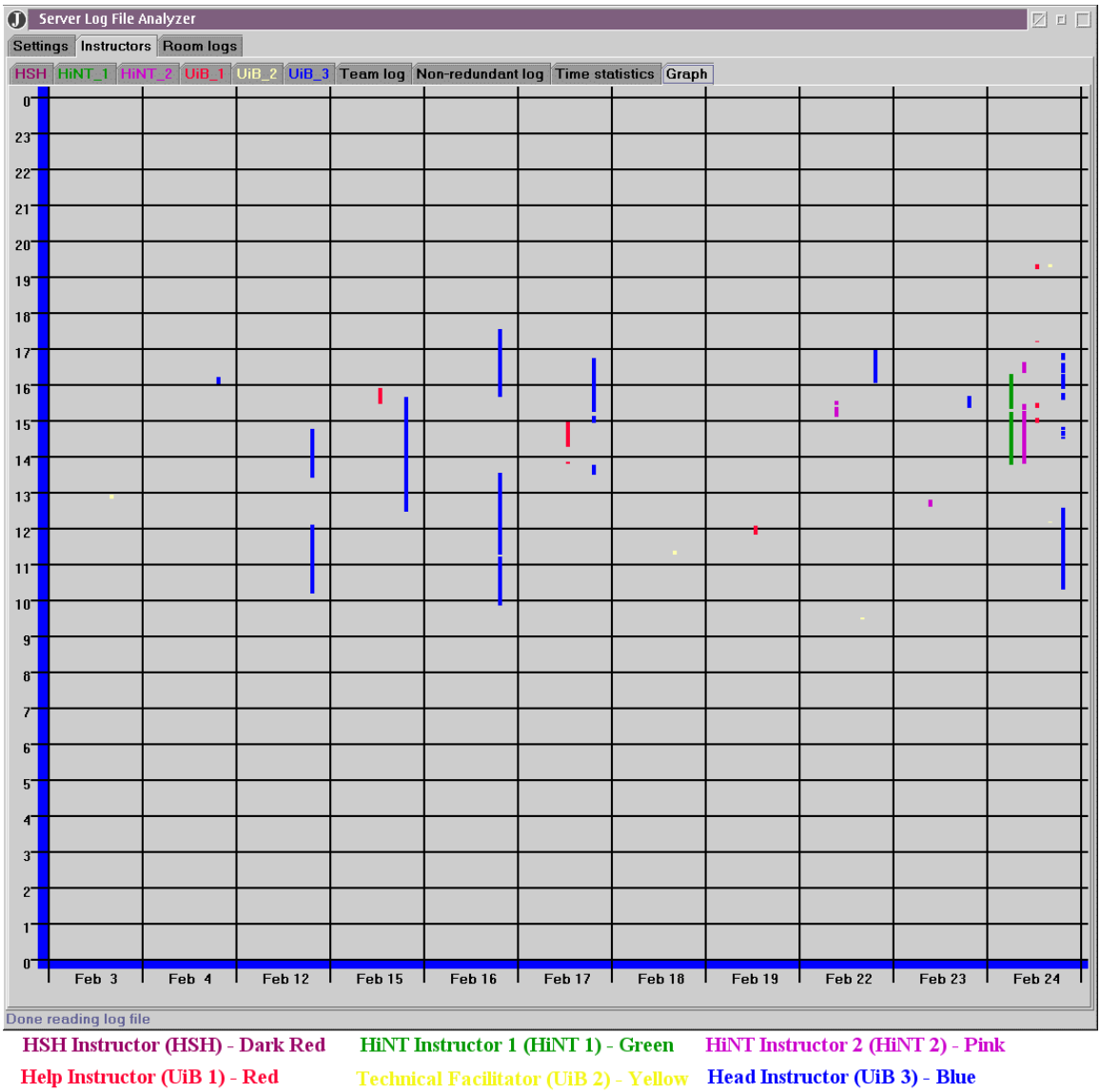

Figure 5.2 Log File Presentation of instructor presence in TW during Planning Phase

The figure indicates that one particular instructor, the Head Instructor at UiB was the person most active regarding the use of TW during the Planning Phase, and that the instructor at HSH did not use TW at all during the Planning Phase. The other instructors were all present at some time during the Planning Phase, and the online presence was most comprehensive as the start of VisArt drew closer. Little concurrent presence can be found during the Planning Phase, except perhaps for the last days before VisArt, which might lead to the conclusion that TW was of very little significance during the Planning Phase. The figure illustrating the instructors' online presence during VisArt, will be a stronger indicator of whether the tool was used widely as a collaboration tool between the instructors and the students.

Having described and analysed the Planning Phase of VisArt, the next phase of the collaborative telelearning scenario is the Preparation Phase. During this phase, which lasted from 25th to 29th, the students were given the necessary preparation to participate in VisArt, which included downloading and installing the software TeamWave.

5.3.2 Phase 2: Preparation Phase

During the Preparation Phase, the students downloaded and installed TeamWave Workplace, following instructions given by the Technical Facilitator on a web page that was created for this purpose. They were also given a *logon id* and a team e-mail address. In addition they were informed that any problems or questions could be directed to the Training Instructor[14].

The object of VisArt was, as mentioned, research in addition to the pedagogical aim of students gaining experience in computer mediated collaboration. The students were involved in the case that was researched, as informants. This meant that they were to fill out a number of questionnaires during the scenario if they consented to participation in the research. One example of the student participation for research was responding to questionnaires. One of the questionnaires, a profile questionnaire, was given during the Preparation Phase. The profile questionnaire was made available on a web page and comprised questions about background and experience with collaboration and technology.

[14] Confer chapter 3 for details on E-mail Assistance System

Modelling the Preparation Phase

The focus while modelling the Preparation Phase (see figure 5.3), is on the Technical Facilitator, as the activities of the Technical Facilitator were the most critical for realising the object of the Preparation Phase, within the perspective of the instructors as a group. The tasks for the instructors during this phase were circumscribed to helping the students install TW, and replying to any questions via e-mail.

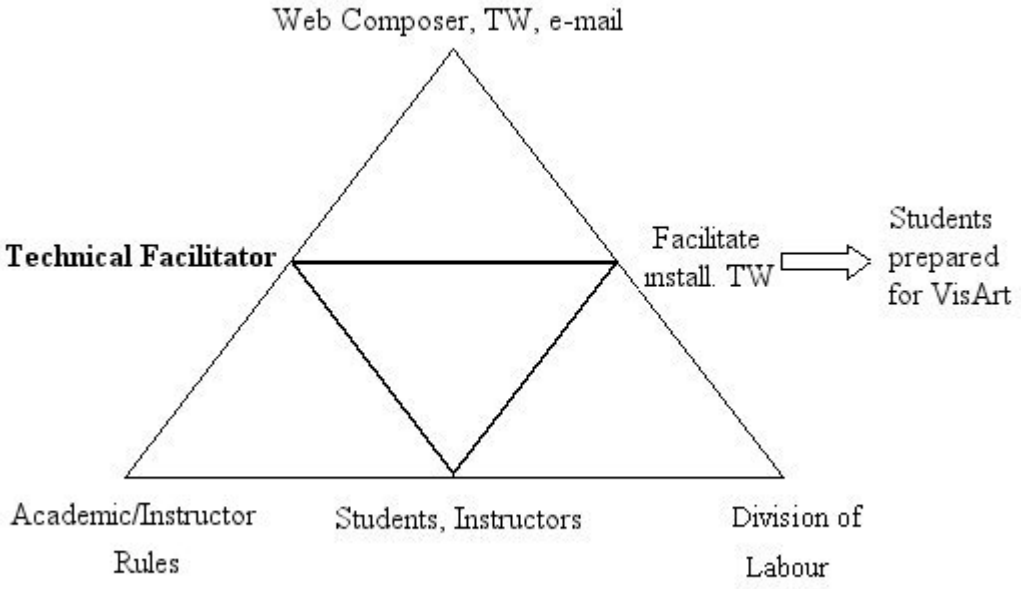

Figure 5.3 The Preparation Phase Modelled

The subject during the Preparation Phase of VisArt is the Technical Facilitator. The role and some of the characteristics of the Technical Facilitator important for the participation as instructor in VisArt are already described earlier in the analysis. One may also add the Training Instructor as a subject during this phase, as the Training Instructor was assigned to replying to e-mails requesting assistance during the Preparation Phase, in case of unforeseen problems. However, the Training Instructor is regarded as part of the community during this phase. The collection of e-mail communication between instructors and students during this phase will be dealt with at a later point in this section.

The object of the Preparation Phase from the instructor perspective was to guide the students in installing TW on their accounts, and logging on to the TW server using their assigned *logon id*. Having all the students install and prepared to log on to TW would indicate the completion of the objective of the Preparation Phase.

The community of the Preparation Phase is the students that were guided in the installation of the software, as well as the Training Instructor who was responsible for replying to e-mail requesting assistance from the students. The Training Instructor's role in working toward the objective of this phase was providing assistance in case of unforeseen problems, thus assisting the Technical Facilitator.

The sociocultural rules that mediate the relation between the subject and the community during this phase will not be dealt with in depth. The section describing the academic and instructor rules during the Planning Phase will not be complemented with further description for this phase.

The division of labour is very much described through the description of the role of the Technical Facilitator. The objective was to make the initial preparation of the students for participation in VisArt, through installing the software, and assigning necessary logon information. The Technical Facilitator completed these tasks, so a circumscription of the division of labour is restricted to the role of the Technical Facilitator. The systems administrations group at IFI physically created the groups that the students were assigned to.

The tools that were used in mediating between the objective and the subject of the Preparation Phase were mainly a web composer, e-mail and TW. The web composer was used for creating the page with downloading and installation directions. TW and knowledge of the functionality of TW were used, in guiding the composition of the page. The knowledge of TW functionality originated from a TW evaluation that the Technical Facilitator carried out a semester previous to VisArt, in collaboration with a fellow student. The Technical Facilitator also used e-mail to communicate with students who had problems following the instructions, and made contact addressing this issue. The HiNT Instructors also sent e-mail regarding this issue, as the students at their institution had problems with installing TW because of limitations to their

local computer resources. The Technical Facilitator on the e-mails received from students during the Preparation Phase:

> Extract 6 (16.04.1999, 10.00 a.m.)
> *"Most of the questions were technical. It was about downloading it, and installing it. And it turned out that when they were able to download and install it, some of them had misunderstood some things about the password, pressing the wrong buttons, that they hadn't read the instructions on the web page properly, where the whole thing was explained, and so on…"*

The Preparation Phase was the first phase in which student activity was involved. E-mail communication between students and instructors during the Preparation Phase was mostly related to technical problems. The main problem was that the e-mail addresses that had been submitted to the Head Instructor, to be included in the team e-mail aliases, were in some cases the wrong addresses. As a consequence, these students received no invitation to participate in the scenario, as they were expecting. This problem mostly affected the students at HiNT and HSH. To resolve the problems, the students contacted their College Instructor who in turn notified the Head Instructor of the problem.

E-mail Communication during the Preparation Phase

The day before the Preparation Phase, or the day before the start of VisArt, the Head Instructor informed the students that any problems such as these were to be reported to the Help Instructor. The Technical Facilitator answered the requests.

The Help Instructor received 13 e-mails during the Preparation Phase. Twelve of these were received during the first two days, and one on the last day of the Preparation Phase. Some of the e-mails from the students came as a consequence of misunderstandings of the online downloading and installing instructions, such as misinterpreting the web-page that explained how to download and install the software properly. The remainder of the e-mails from students during the Preparation Phase regarded technical problems with TW. One student used a Macintosh PC, and

experienced some problems in logging on to the server after installing TW. In addition, some students reported malfunctioning URL's, problems with downloading files from the TW server, and problems concerning entering rooms.

Instructors in TeamWave Workplace during Preparation Phase

Use of TeamWave by the instructors during the Preparation Phase is illustrated in Figure 5.4 below. The original figure, which is a transcript from the Server Log File Analyzer for the entire duration of the scenario from the perspective of an instructor or facilitator, is slightly modified. The modifications include removal of dates not included in the Preparation Phase [15], including the 28th and the 29th, as these dates included the weekend. Transcripts lasting from 12 am until 08 am are also removed, as the Server Log File Analyzer documents indicated no instructor activity in TW during these periods. The original figure is provided in Appendix C.

The Server Log File Analyzer transcript indicates that the instructors were most active in TW during the first two days of the Preparation Phase, the 24th and the 25th. It also indicates that they were online during the working day, mainly from 9 a.m. to 5 p.m. There was little concurrent presence in TW during this phase. The first day of the Preparation Phase there was three instructors present at the same time, at two different times of the day. There are however no reasons to speculate whether this indicates communication or was a matter of coincidence. The transcript also indicates that the instructor that was most online during the Preparation Phase was the Help Instructor. He was logged onto the TW server for between 3 and 4 hours each of the first three days of the Preparation Phase. This had to do with his role in the phase – to assist students who were experiencing problems with the downloading and installing of the TW client and logging onto the server.

[15] The dates are removed as far as possible without removing information about the instructors.

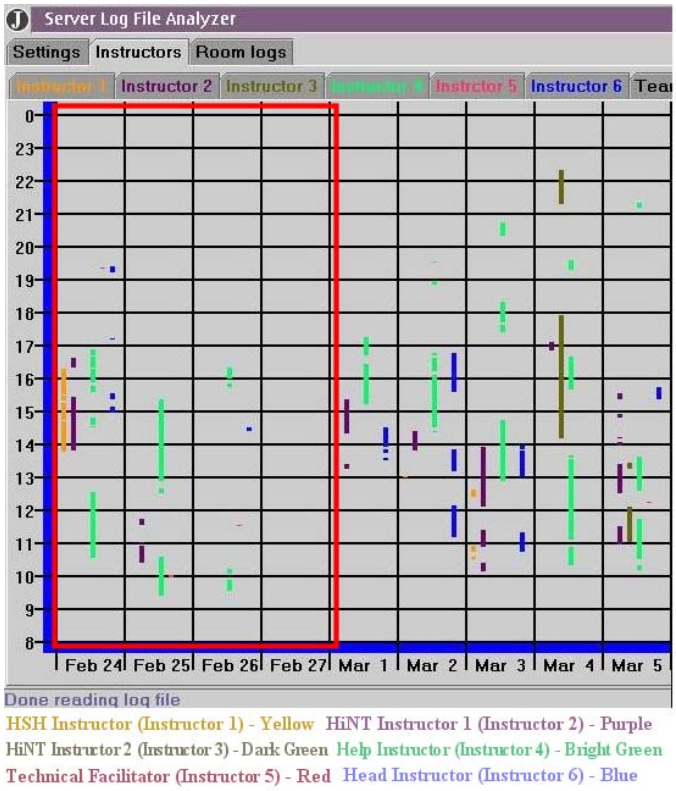

Figure 5.4 Online presence of instructors during Preparation Phase

The phase succeeding the Preparation Phase is the Training on Tools and Collaboration Phase. This phase had the objective of accustoming the students to TW tools and functionality, and to prepare them to collaborate using the assigned tool.

5.3.3 Phase 3: Training on Tools and Collaboration Phase

The Training on Tools and Collaboration Phase (Training Phase) took place between March the 1st and the 5th. The objective was to make the students familiar with the tools in TW, and to familiarise the students with the other team members. To achieve the objective a Training Room in TW was designed, that contained a number of exercises, see Figure 5.5. The Training Room mainly contained the objective of the Training Phase, a list of possibly helpful resources, and the four assignments.

The Training Room in TW contained information about the objectives for the students in the Training on Tools and Collaboration Phase. These are listed under the "Welcome to The Training Room" headline. A list of helpful resources was given; which contained points such as other group members, other student participants, TW Help Room FAQ in the Help Room and an e-mail address to the Training Instructor. The Help Room was linked from the Training Room in the top right corner. At the bottom of the Training Room the four assignments belonging to the phase were linked.

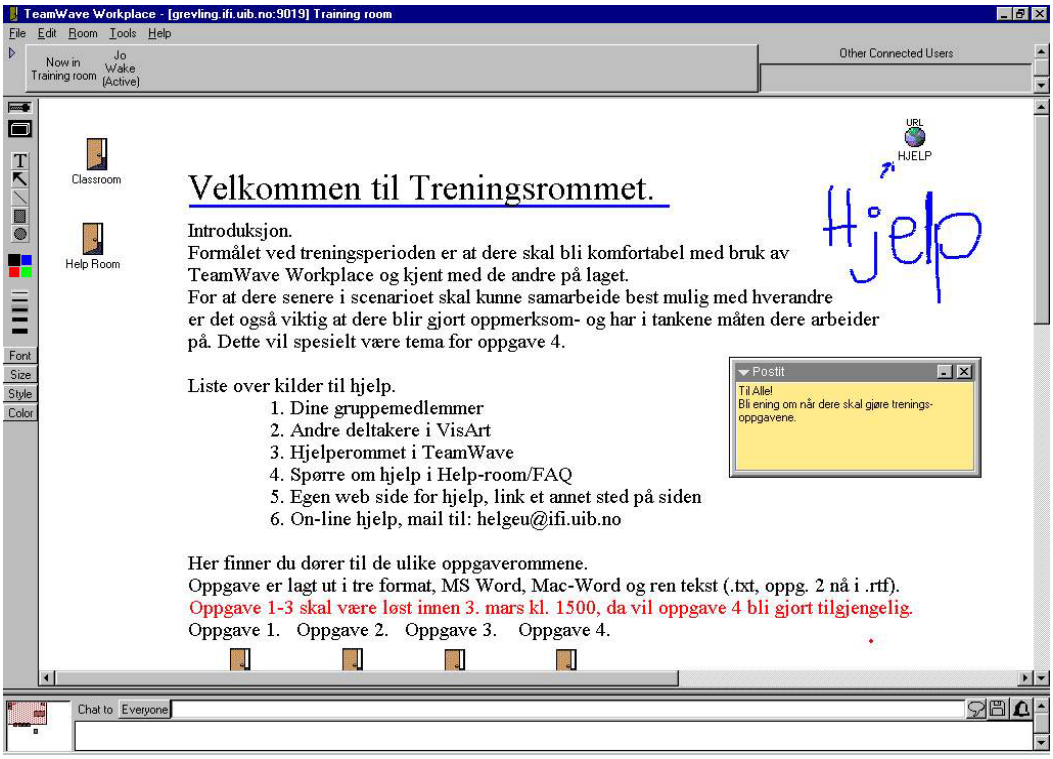

Figure 5.5 Training Room in TW

The assignments were available in MS Word, Mac Word and pure text, so that the students were able to download the version most suitable to their personal computer. The Training Room was created and kept by the Help Instructor. The Training Instructor made most of the assignments, after discussion with the Head Instructor.

Assignment 1 was designed with the intention of the students getting to know each other. Each of the students was to interview one other person in the group, and make a presentation of the interviewed student for the other person in the group. The

interview was to be performed using the chat function in TW, after scheduling it by using the calendar function. The interview was to be presented using the file viewer in TW.

Assignment 2 was a team building activity based on the adventure game Narg Island, developed Dr. Konrad Morgan, an associate professor at Department of Information Science, UiB, and adapted to the distributed computer environment by the Head Instructor. The situation presented to the group is a shipwreck, and the group is to negotiate the most desired alternatives from a list of salvageable items and salvageable alternatives. Afterwards, the groups' list of alternatives is compared to an "expert ranking" or a list of correct answers, and a group score is calculated.

Assignment 3 was individual and designed to accustom the students to tools they most likely had not tried to use during the first two exercises. The tools were, among others the Web-browser, the Database Tool and the Image Whiteboard. The exercises were for example "Load a web page into TW", "Create a simple database of at least 5 of your own CDs", or "Draw your house in the image whiteboard".

Assignment 4 was designed for the group to start practising collaboration, and held the objective for the group to choose and present any given theme to the other groups. The collaboration was to be done keeping Salomon's requirements for genuine interdependence in mind. The group was to brainstorm to find a theme, individually find information about the theme on the Internet, to arrive at a common understanding of the chosen theme and make a presentation of the theme to the other groups in VisArt.

Modelling the Training on Tools and Collaboration Phase

The focus in modelling the Training on Tools and Collaboration Phase (see Figure 5.6) is on the Training Instructor, as this person was the most central in completing the objective of this phase. The Training Instructor created and kept the Training Room, and was responsible for replying to e-mail requesting help from students. The assignments were created partly by the Training Instructor, and partly by other

instructors at Department of Information Science. Where the Training Instructor created the assignments, the contents were discussed with the Head Instructor.

The subject of the Training on Tools and Collaboration Phase is thus the Training Instructor. The Training Instructor's role in the Training Phase was twofold; to maintain and keep the room in TW designed to be a tool for the students in the Training Phase, and to be the instructor receiving e-mail from students experiencing problems.

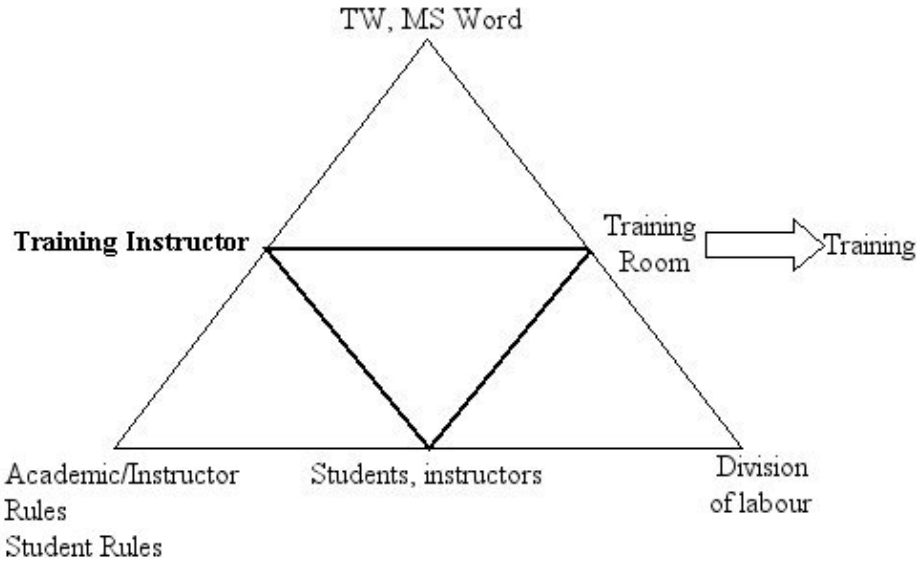

Figure 5.6 The Training on Tools and Collaboration Phase Modelled

The outcome of the Training Phase was for the students to have gained experience in use of TW tools, and to get to know each other in order to make further collaboration related to the design activity easier. The object of the scenario is the Training Room, as this was where the work in the Training Phase was to be directed. The Training Instructor commented on the objective:

> Extract 7 (16.04.1999, 14.00 p.m.)
> *"[N]ot only get to know TeamWave, but also to get to know each other. In other words, to try to build relations between them. So that it would be easier for them to collaborate, since they were acquainted with each other. That was the goal."*

The mediating tools during the Training Phase were the instruments that were used in creating and maintaining the Training Room, such as text, doorways, URL, and file viewer. The text tool was used to write the contents of the room, doorways were used to link up other rooms such as the Classroom, an URL was used to link up the Help Pages, and the file viewer was used to make the assignments available. The instrument used in creating the assignments was a text editor, as the assignments were textual documents. Two of the assignments, number 3 and 4 were created by the Training Instructor. The Head Instructor created the first assignment, and an associate researcher at DoCTA created the second assignment, modified by the Head Instructor.

Division of labour in the Training Phase is largely described already. The construction of the assignments was divided between the three persons already mentioned, and the creation and maintaining of the Training Room was the responsibility of the Training Instructor. Upon construction of the assignments intended for the Training Phase, the Training Instructor also discussed the content of the assignments the Training Instructor was to create with the Head Instructor.

Community of the Training Phase as modelled is the students going through the training period, and the instructors assisting in creating the assignments. The academic rules and student rules are not treated further for this phase, the section on planning includes a short discussion of the sociocultural rules in the scenario.

Instructors in TeamWave Workplace during Training on Tools and Collaboration Phase

The section captured in red in the Server Log File Analyzer transcript below, Figure 5.7, indicates the activity of the instructors in TW during the Training Phase. The transcript indicates when the instructors were logged on to the TW server. It does not indicate what they did when they were online, or whether they were actively using TW. Valid inferences on the nature of the activity of the instructors can not be made from the transcripts, although speculation can be supported by the interviews.

The transcripts indicate that the instructors were most active in TW between 10 and 17pm during the working day. The instructors that were most logged on to TW were the Training Instructor, the Head Instructor, and the HiNT Instructor. The pattern was that the instructors were online for one or two hours at the time, two or three hours a day. The Training Instructor displayed somewhat longer periods of time being online than the other instructors did during this phase. There is good reason to speculate whether this indicates a relationship between his role as a central instructor in the Training Phase, as he was responsible for creating and maintaining the Training Room, and to be the contact person for the students during this phase, and the time spent being online in TW. There was, however, no formal need for him to be online to be accessible for the students, as the communication was to be carried out via e-mail. The HSH Instructor had a long period of time being online on the second to last day of this phase, and a shorter period on the last day.

There is some concurrency in the online periods for the instructors during this phase, but not enough to speculate whether TW was used as a tool for communication between the instructors during this phase. There are strong indications that this was not the case, at least with the instructors as a group in its entirety. There may have been some coincidental communication with TW as the mediating tool during this phase, and the interviews also indicate this.

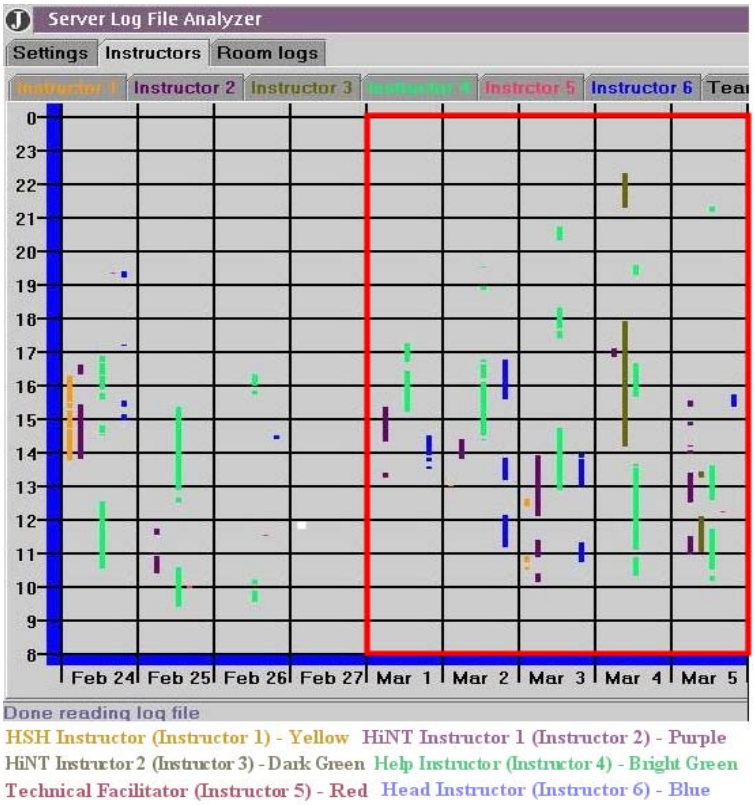

Figure 5.7 Server Log File Analyzer Transcript for instructors during the Training Phase

E-mail Communication during Training on Tools and Collaboration Phase

In the following section, the e-mail communication during the Training Phase will be analysed. The e-mail communication during this phase may seem somewhat more extensive than in the previous phases, particularly for the Training Instructor. The Head Instructor sent some "formal" information to the students in order to co-ordinate the learning activity, and some internal information to the group of instructors. The Training Instructor also sent out a number of formal e-mails to the students, and the Technical Facilitator responded to some questions of technical nature.

Problems with the stability of the TW server became evident during the Training Phase. The server became very slow, and would eventually stop working, causing the students to lose the work that they had performed since the last time they saved. The cause of the problem was that the structure of the server buffer file had been changed in conjunction with the publication of a newer version of the server software. Instead

of having many buffer files, it was reduced to one. When too much data was being kept in the buffer, it would become too large for the hardware to administer, causing the system to plummet. Daily routines of restarting the server were introduced. The suggestion was made from one of the research assistants, and the restarts were to be performed by the group of facilitator, instructors, and research assistants. The Head Administrator notified the entire group of students and instructors of the new routines via e-mail, as the students would lose unsaved work when the restart of the server was undertaken.

The Technical Facilitator received a relatively small number of e-mails during the Training Phase. The contents of the e-mails were technical in nature, specifically he received a few notifications of the slow functioning of the server, and questions about perceived malfunctioning of the TW software.

The Training Instructor had the most extensive e-mail communication of the instructors during the Training Phase. Some of the communication took place because he was the students' contact person and should make sure the students made adequate progress in the training schedule. From the e-mail correspondence transcripts it may seem that if the Training Instructor had the answer to the e-mail requesting assistance from a student, he would reply rather than forward it to any of the other instructors. For example, the Training Instructor received a number of e-mails with technical questions that he could have passed on to the Technical Facilitator, but chose to reply without forwarding them. Some of the e-mail communication was related to assignment number three in the training course, as the students were to be given a sheet of correct answers to the assignment to be compared with the groups' own answers when they were finished with the assignment.

5.3.4 Phase 4: Design Activity Phase

The phase where the students were to perform the design of the visual artefact is labelled the Design Activity Phase. From a student point of view, this phase is distinguished from the Training and Preparation Phase, as this phase was what they

had been trained and prepared for. The Design Activity Phase lasted nearly three weeks, from the 8th to the 26th of March.

The objective given to the students from the instructors was that they were to produce a room in TW for learning about a topic of their choice, labelled the Learning Room. The focus of VisArt was on collaboration as well as the Learning Room, so the students were asked to provide documentation of their major pedagogical decisions as well as the learning room. The Learning Room was to be created as a separate room linked from the groups' Working Rooms, and the documentation of the pedagogical decisions, discussing topics such as the intended audience and complexity of the chosen topic, were to be posted in the Working Room.

During the Design Activity Phase, the instructors took more of an observer role, as the students were to work towards the design of the visual artefact more independently than they had done during the previous phases. The system design for providing assistance as instructors via e-mail was still to be used, if any unforeseen problems were to occur.

Modelling the Design Activity Phase

The most noticeable difference in modelling the Design Activity Phase (see Figure 5.8), is the treatment of the instructors as a group, rather than focusing on an individual instructor as in the two preceding phases. The earlier phases had objectives that were more tied to the activity of a single instructor to ensure the desired outcome, whilst in this phase the entire group take on the role of observers in addition to their roles as technical facilitators, administrators, and assistance providers. The subject of the activity system modelling the Design Activity Phase is thus the group of five instructors.

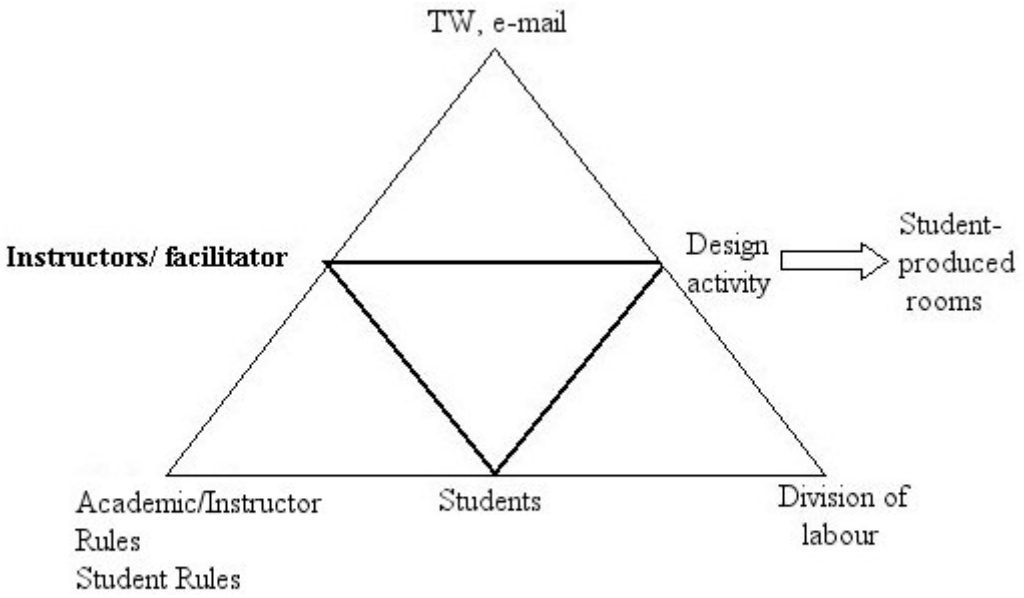

Figure 5.8 The Design Activity Phase Modelled

The object of the Design Activity Phase was for the students to design and produce a visual artefact for the teaching of a subject of their choice, and to document the pedagogical decisions made by the group. The latter as a course of the focus of VisArt being on the process of collaboration as well as it's products and artefacts. The outcome of the Design Activity Phase was thus the cluster of visual artefacts produced by the different groups, as well as the documentation of their pedagogical decisions, which were made available in the students' Working Rooms.

The tool that mediated the relationship between the instructors and the objective was TW, which was used by the instructors as a means of observing student activity. The nature of TW as a tool used toward the end of observing student activity in an online learning environment will be dealt with in a later section. A second tool was e-mail, and the e-mail system that was designed for providing help and assistance to the students during VisArt. The students were able to report problems and ask for assistance via e-mail, and the e-mail would be answered or redistributed to the most competent instructor. The design of the e-mail help system was closely tied to the roles of the individual instructors. In practice, it turned out that the instructor designated to receive the initial student requests for assistance answered all the e-

mails possible, and only forwarded instances where it was felt that other instructors could give a better answer. In some cases, both were done. This is documented in the section on the Training on Tools and Collaboration Phase.

The community of the Design Activity Phase was the students. The academic and student rules that mediated the relationship between the students and the instructors will not be dealt with more extensively than what has already been described.

Some of the tasks divided before the start of VisArt, such as assigning an instructor to keep the system running still applied to this phase. Since a new task had occurred out of need – the restarting of the TW server, a division of labour was made related to who was to perform this. Three daily restarts was a demanding task, not on amount of time needed to perform the actual task of restarting, but on the amount of time one needed to be able to reach the server that TW ran on. It was also a necessary task, as the system was required to be up at all times as the students were to be free to work when it suited them best. The restarts were to be made in the morning, in the afternoon and in the evening, and the task was divided between the Head Instructor and the research assistants. The other instructors had roles that coincided with the division of labour agreed upon during the Planning Phase. The task of observation during this phase was a task described as a perceived responsibility by all the instructors, although each instructor perceived the nature of the observation a little differently. This will be treated further in section 5.3.5 on contradictions during the Design Activity Phase.

Instructors in TeamWave Workplace during Design Activity Phase

The Server Log File Analyzer transcript below, Figure 5.9, indicates the amount of time spent by instructors being online during the Design Activity Phase. Significant patterns will be looked for, and an attempt will be made to explain them.

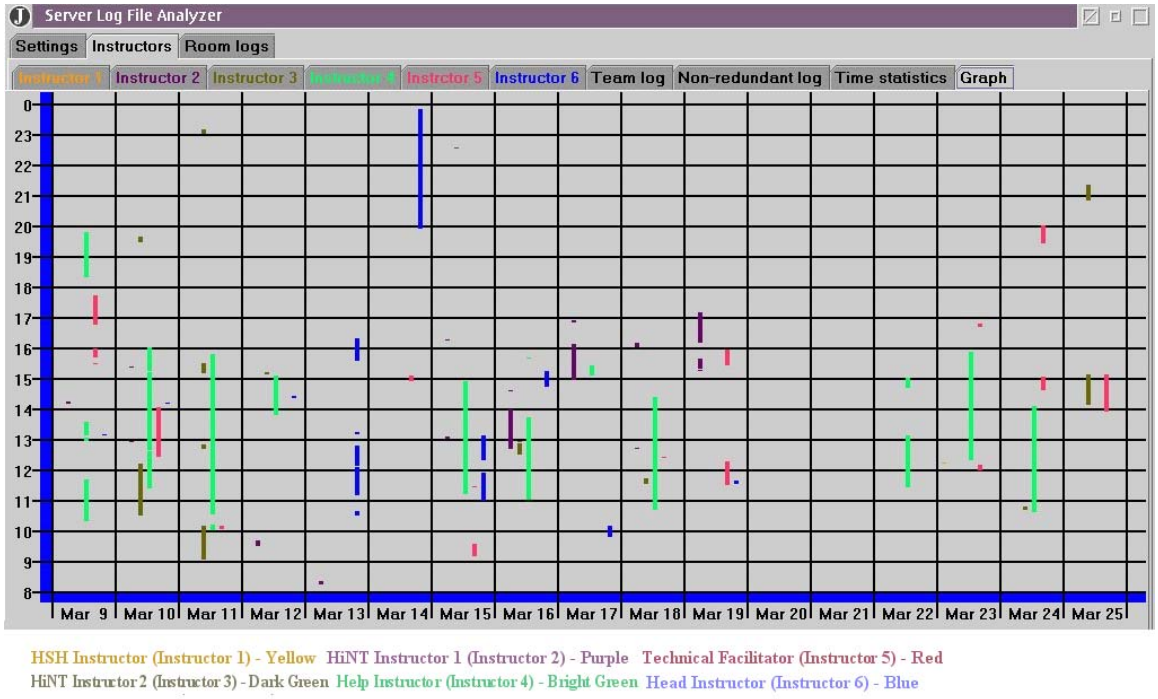

Figure 5.9 Server Log File Analyzer Transcript, Design Activity Phase

The overall picture indicates that the instructors were online the most during first 2/3 of this phase, more specifically until March the 19th. It also seems evident that the instructors were online mostly between 9 a.m. and 17 p.m. in the afternoon. There is probably no bigger secret to this than that this is normal working hours. The exception to the pattern of being online mostly during the first two weeks is the Training Instructor and the Technical Facilitator, who were present in TW to some extent during the last days. There are indications of the instructors being online concurrently, and again one may speculate whether this indicates communication between instructors using online as a medium, but data from the interviews does not support this to a large extent.

The transcript clearly indicates that the Training Instructor was the instructor that most extensively was online in TW both through the length of the day, and through the Design Activity Phase. The pattern is that the Training Instructor was online three to four hours every second day, including the weekends. Reasons for this may be that the Training Instructor perceived his role in the direction of being available for requests for help, and an end toward this object was to be online. In response to the question about this, the Training Instructor responded:

Extract 8 (16.04.1999, 14.00 p.m.)

"Yes. Quite a lot I did. Observed the way they worked together, solved the assignments. How far they had got. And I tried to be available for the students if they wanted questions answered, (...), and I was too, in TeamWave so that they could contact me."

E-mail Communication during Design Acitivity Phase

The communication by e-mail for the Design Activity Phase can be characterised by a stable amount of e-mails in time when counting them in numbers, while the distribution between the instructors is slightly different.

The Head Instructor had to approve the themes for the Learning Rooms, which lead to an increase in e-mail communication between the Head Instructor and the students. The students were offered a list of possible themes, and the opportunity to find a theme of their own. Most of the teams chose the latter of the two options. E-mail communication by the Head Instructor is thus characterised by numerous e-mails regarding the students' choice of theme or topic for their Learning Room. In addition there was a number of other e-mails sent out that fall under the role of the Head Instructor as overall administrator. This included administrative and co-ordinative information about the upgrading of the TW server and reminders to students who had not filled out questionnaires that belonged to the research side of VisArt.

The Technical Facilitator received a small number of e-mails with technical questions, nearly all of which were forwarded from the Training Instructor. The contents of the requests were mostly regarding what can be characterised as "perceived odd behaviour" of the TW, or the system behaving unexpectedly, with no immediate logical explanation. This could be an incident such as "my room suddenly disappeared" and "why does the text that I wrote disappear when I leave the room that I was in".

The Training Instructor received less e-mail during the phase in question compared to the earlier phases. This may indicate that the students' tacitly expressed a growing

familiarity with TW – that they needed less help. An observation that supports this is that the Technical Facilitator received an increased amount of e-mail forwarded from the Training Instructor during this phase. If one accepts the notion of the students' growing familiar with TW after a certain progression in the course, there is a probability that they would not ask for help unless it was a problem that they previously had not encountered, problems such as unexpected behaviour of TW. If a problem occurs that is unexpected after a initial training on the use of TW, the answer is more likely to be tricky than trivial. Thus, the *modus vivendi* for the Training Instructor is more likely to be forwarding e-mail to the Technical Facilitator, rather than to attempt to give an answer to the question, especially when it is not within the Training Instructors role perception to answer technical questions.

5.4 Interpretations of VisArt

Having provided a narrative of what happened during the planning and deployment of VisArt, interpretations of the described findings will be made. The focus will be on contradictions identified during VisArt, and arguing the case that the learning environment is a new work environment for the instructors involved.

5.4.1 Contradictions

It is a goal for the analysis to explore whether facets of the activity of organising VisArt can be described using the concept of contradictions in activities. It will be argued that contradictions, mainly in the Design Activity Phase but also the Planning Phase, have been identified. The concept of contradictions in the planning and deployment of VisArt will be discussed in the following paragraphs. According to Engeström (1987), contradictions are the driving force in an activity, and are thus closely tied to development. Contradictions in an activity can be one of four types. Primary contradictions exist within the different nodes of the activity triangle, for example within division of labour or within the subjects, and is characterised by Engeström as a "double nature" (Engeström, 1987, p. 85). Secondary contradictions

exist between nodes of the activity triangle, for example between the mediating instruments and the objects of an activity. The tertiary contradictions occur when a "more culturally advanced objective" (Engeström, 1987, p. 87) is introduced to the subject in an activity. Quaternary contradictions appear between different activity systems. For further theoretical treatment of the subject of contradictions, confer section 2.2.5.

Findings in the study may indicate that there is a primary contradiction for the instructors in VisArt, and that it is located within the object of the activity. This can be discovered using the Design Activity Phase as an example. This was the phase where the students were to collaborate more or less independently toward the object of producing a visual artefact for teaching a given subject. The object for the instructors was to provide instruction and to facilitate the students in reaching the desired outcome of this objective. In addition to that, the goal of Project DoCTA, that organised VisArt, was to gain data to be used in research on online collaboration from the learning activity. The group of instructors was also aware of this while in the planning of VisArt, where the goal was to both facilitate student participation and facilitate research, and planning the activities in consistence with both.

While keeping in mind the data gathering process, some of the researchers expressed reservation towards inadvertently interfering with the students' collaboration, and at least document the amount and type of help they offered. At the same time the students perceived them as instructors while online in TW, and the students would sometimes ask for help. The dual nature of the objective for the instructors created thus the contradiction of the instructors wanting to offer assistance to students while at the same time not interfering with the collaboration process. The Head Administrator commented on the online presence in TeamWave:

> Extract 9 (12.04.1999, 10.00 a.m.)
> *"You used to see the same people at the same time…But yes, I found it exciting to see that sometimes there were 16 students working at the same time. That was exciting. But I didn't like to go in… If I noticed that there were three students from a team logged on, and ready to co-operate on their… (assignment). Then I didn't like to go in [to their team room] and look at it".*

The contradiction within the object of VisArt for the instructors can be shortened to research vs. instruction. This manifested itself in different ways, for example in a request of the Head Instructor, who also was the research leader of project DoCTA, of the researchers/instructors to make a note of and write down any kind of assistance offered to students while online in TW. This encouragement came after it was learnt that the instructors offered help to some degree in some situations. Not all the instructors found providing this kind of documentation unproblematic. The HiNT Instructor commented:

> Extract 10 (4.05.1999, 10.00 a.m.)
> *"What I found a bit problematic as an instructor, was that it was difficult to know how to relate to a group in an online working process. I was unsure whether to help them or not. [The Head Instructor] sent out an e-mail that said that we had to document what was done. That wasn't always easy, for there was some bigger things and some smaller things. Some things that had to do with TW, and some things that had to do with working in a group… It was problematic to know when to help and when not to help, because I functioned as a… I was going to make (scientific) observation myself…"*

The HSH Instructor was less reluctant to be included in the picture when it came to interaction with the students, as this instructor had no intentions of carrying out research on what went on in VisArt. The instructor at HSH took a pedagogical role that may be characterised as based more on participation in relation to his students than the instructors at UiB and HiNT. Describing what went on in VisArt, the instructor at HSH comments:

> Extract 11 (06.06.1999, 09.00 a.m.)
> *"Yes, but you know, my role is more of the observer you might say. The role of the researcher is more peripheral for me."*

> Extract 12 (06.06.1999, 09.00 a.m.)
> *"The role was that we were actually supposed to have a… support function for the teams, in that when they saw us logging in and out of the system, we were to be available for questions, so it is more that side… So it is that role…"*

The HSH instructor points out that his perception of the role is to be of pedagogical aid and support for the students in VisArt. One might argue that his perception of the role as an online instructor occurred as a consequence of the fact that he was not interested in the research side of VisArt, or that such as the educational background of this particular instructor laid the ground for more active participation.

It has been stated that contradictions are seen as drivers of change and development in activities (Engeström, 1987). There is no support in the data for speculation on whether this contradiction led to evolution in the behaviour of the instructors, but one may argue that if VisArt had lasted longer than it did the instructors may have come to a different understanding and externalisation of the instructor role. The same case will be made if VisArt was to be deployed again at a later stage in time, with the same persons involved. This case is however rested at this point in the analysis of contradictions. The analysis has pointed at the different conceptions of the objective for the instructors, however, and how it led to an orientation toward it and questioning of their own behaviour. It was further speculated whether the background and initial personal motives for the instructors influenced the different conceptions and behaviour with this contradiction in mind.

5.4.2 New Work Environment

The previous section on contradictions can also highlight the argument that will be presented in the following section – that VisArt represented what might be labelled a new working environment for the instructors taking part.

The section on contradictions uncovered a discrepancy in the perception of how to behave as instructors in the group of instructors and a facilitator in VisArt. Most of the instructor group took the role of the observer as VisArt progressed, while one wanted to take actively part in the discussion and work in the groups of students. It is not the point to discuss whether one role perception is more valid than the other. But the fact that the individual instructors portrayed very different behaviours indicates that there was no discussion of the instructor role previous to VisArt. The lack of explicit rules between them (confer section 5.3.1 on sociocultural rules), may be taken

as an additional indication of this. One is also reminded that there was no training of the instructors prior to VisArt, and that the instructors were largely to decide for themselves how to interact with the students. During the initial planning stage, the focus was on tasks that needed to be performed in order to have the learning environment "up and running". Comparing Extract 10 to Extract 12, made by two different instructors, elucidates the discrepancies in role perceptions.

> Extract 10 (4.05.1999, 10.00 a.m.)
> *"What I found a bit problematic as an instructor, was that it was difficult to know how to relate to a group in an online working process. I was unsure whether to help them or not.(...)"*

> Extract 12 (06.06.1999, 09.00 a.m.)
> *"The role was that we were actually supposed to have a… support function for the teams, in that when they saw us logging in and out of the system, we were to be available for questions, so it is more that side… So it is that role…"*

Most of the instructors were familiar with the instructor role in traditional learning environments, and may be labelled as experienced lecturers and teachers at their respective teaching institutions. Although their actual behaviour and perception of the roles as instructors in natural learning environments is not documented by the data, the interviews document their formal experience as course instructors at their respective teaching institutions. Thus it would be natural to believe that the work as an instructor is well known to them. The HSH Instructor expressed a desire to interact closely with the students, perhaps a manner of instruction common at his teaching institution. The HiNT instructor expressed a somewhat vacillating attitude toward instructor behaviour in certain situations.

The evidence discussed, mainly the issues of little role declaration before VisArt and different behaviour during it, may indicate that being an instructor in a distributed collaborative learning environment is very different from being an instructor in a traditional learning environment. It is thus argued that VisArt represents a "new work environment" for the instructors, which necessitates a discussion of new kinds of

instructor behaviour in interaction with students and in interaction with other instructors.

It is argued that it also requires a different kind of co-ordination of the work as an instructor. The episode where TW stopped working, is an illustration of this. A large group, compared to the number of students, of instructors and research assistants became involved in keeping the groupware system stable and operative. This group was available by chance in the sense that VisArt was a research project in addition to a pedagogical activity. Performing restarts of the groupware system three times a day, so that the students could work online at any time of their choice, would have been laborious with a group of five instructors only.

5.4.3 Using TeamWave Workplace for Assessing Students' Progress and Providing Feedback

A short recapitulation of the subsidiary research question is given here, before it is investigated further. An explanation of the research question will be given in the following paragraphs, before analysis is carried on. The subsidiary research question for this study is:

> "Can TeamWave Workplace be used to give the instructors feedback on the students' activity?"

Before answering the subsidiary research question, it will be argued and emphasised that it in fact can be important to be able to get feedback on the students' activity, both in an online learning environment as well as a learning environment where the computer is not the central mediating tool. It is thus supposed that learning is a social phenomenon. The question address a different phenomenon from Question 1 in that the communication between instructors and students involved in VisArt was mediated solely by computer tools, were they used e-mail programs or TW workplace. By following the students' work, the instructors' ability to assess the activity in the designed learning environment is meant. The main reason for the necessity of assessment of the students' activity from the viewpoint of this study is that it is

necessary for being able to offer support and assistance in cases where the students are experiencing problems of any sort. The question is raised because of the assumption that in a "natural" learning environment the instructor will be in a social setting that will provide clues toward the activity of the students – a common sense idea. While in an online learning environment such as VisArt with the computer and TW as a central mediating tool, the social nature of the environment takes on a different character - the otherwise natural social contact with the persons involved goes through the computer tool or what can be observed on the computer screen. The computer screen offers ways of learning about other individuals that are different from natural social settings. The ways that TW mediate the learning activity from an instructor viewpoint will be expatiated in the following sections.

It was planned to use TW to follow the students' activity to a certain extent from the start of VisArt. As already treated, the students were to communicate the progression of their activity during the Training on Tools and Collaboration Phase, partly by using TW, and partly by using e-mail, thus leaving artefacts in the Team Rooms for the instructors to observe. An example of this is Assignment 1 in the Training Phase, where the group was to perform individual interviews of each other and present to the other people in the group. Assignment 3 that contained the team building activity, where the group would be offered a document containing the correct answers to the matters discussed by the group when the discussion was concluded, is also an example of this. The latter example indicates the activity of the group, as the products or residues of the discussion are group products that say little about how they arrived there.

The instructors knew that the students had been online and working when they observed the desired outcome of the activity, in this case when documents containing interviews or adventure game discussions, were available in the assigned Team Rooms for the different teams. Upon the event of a group failing to produce the desired outcomes, the instructor would take it as a clue that a problem had occurred somewhere in the process of the activity of the group, and investigate the matter. An example of this can be seen from the quotation of an e-mail sent from the Training Instructor to a group where this was the case.

Extract 13, (01.03.1999 16:31:47 p.m.)

> *>Hi everyone in Group 2*
> *>*
> *>It doesn't seem that any of you have been logged on to TW yet. If*
> *>there is anything that you wonder about, or have difficulties*
> *>with, just send an e-mail and I will try to help you.*
> *>*
> *>The training period lasts until Friday, and you are to have*
> *>completed four assignments by then, so you should just get*
> *>going.*

The artefacts of the group's work can be a fair indication of whether there has been any activity performed by the group at all, although one may argue that keeping track of the evolution of artefacts in thirteen different rooms can be a strenuous exercise. A failure to leave the desired artefacts behind in the room of the team certainly doesn't prove that there has been no activity at all, but nevertheless it tells the instructor that there is a problem of some sort, that should be clarified. The conclusion so far is that the artefacts left in the Team Room by the teams can be taken as an indication by the instructors that some activity has taken place in the group.

There are, however, greater difficulties relating to gaining an understanding of the individual level of activity in the different groups for the instructors. Taking group artefacts as tokens of individual activity is logically problematic. The artefacts left in the Team Room by the group is definitely a token of activity that has taken place in the group, and in some cases, such as the individual interviews in Assignment 1 in the Training Phase, a token of individual work in the group. It doesn't, however, say anything about "how the artefact got there", apart from that it obviously did. The problems lie hence in observing the students' activity while collaborating on the given assignments. This kind of observation meets a series of challenges while using TW as a central mediational tool in the learning activity. The aim for the rest of the analysis is to investigate problems related to this phenomenon.

Feedback

The matter of gaining feedback of the activity of collaborating in TW in VisArt for the instructors was sometimes perceived as a social challenge as well as a technical challenge, although attempts at circumscription of the two can be nebulous. One of the instructors reported a reluctance to enter rooms where students were collaborating because of the social implications of performing the same act in a natural, or non-computer mediated environment. The quotation implies that the instructor perceived the room metaphor[16] of TW very strongly, or that the instructor has concerns about the students perceiving the room metaphor strongly.

> Extract 14 (04.05.1999, 10.00 a.m.)
> "*I think that TW has a disadvantage in that you enter a room, look around, and then you leave the room. And you know that there are others present, and they know that you are present and so on, but it isn't…(…) I draw a parallel to working in an office, or in a conference room, and then another person enters the room, doesn't present himself, and then he just disappears."*

The instructor displays reluctance towards entering team rooms where students are collaborating as a course of a perceived lack of what might be labelled as "social tools" using a computer mediated form of communication, compared to a natural environment, and the problem is related to the instructor task of observation. If the learning activity took place in an ordinary classroom, the instructor would be able to walk in and present himself, or even indicate that he was just going to watch the collaboration for a while, TW lacks the possibility of expressing oneself in a silent, or tacit manner. TW had a range of tools for communication available such as a chat function and a very popular "postit note" function, but in some cases this may have been apprehended as interference with the collaboration by the instructors. The instructor admitted that if the students were able to "lock" rooms or restrict admission to the room, the problem would be smaller.

[16] Confer chapter 3 on context of study for details.

One other instructor reported what might be labelled as technical shortcoming of TW when it comes to using it as a tool for sharing an understanding of a problem in "real time", which this instructor very much interpreted his role as an instructor in this learning activity to be. This instructor wanted to be able to discuss the students' problem, or in other words what they chose to be the content of their Learning Room with the students.

> Extract 15 (06.06.1999, 09.00 a.m.)
> "*And here you really see another problem that touches the role of the instructor, that TW, the way I see it…It has a kind of janitor role. In the sense that it provides rooms and it provides a flip-over and some pens, and some telephones or channels and such. (…) Modelling, or working with a model, making a… yes, an economical system that they disagreed upon. And so on, there were no tools available for this. Then they had to leave their framework and fetch other tools, tools that aren't integrated in TW".*

This instructor's perception of the role as an instructor is closely tied to sharing the problem with the students, and to have a conversation with them about the issue that they are discussing, as compared to having a certain distance to them and letting them collaborate on their own. The role of the instructor is much closer to participation than facilitation in this sense. Hence, not being able to interact in close conjunction with the problem or task at hand with the students, is a clear limitation for this instructor. Getting feedback from students with this perception of the role as an instructor is thus dependent on getting questions tied to the problem, and also being able to see the problem. A constraint on the possibilities of interaction with students and an, in some sense, visible representation of their problem is thus a major limitation of the role as an instructor. (It is debatable whether the desired functionality for the software was realistic in this case.)

Another problem that is technical in nature, and addresses problems in gaining feedback from students, is a lack of tracking the history and development of the work performed by the students in the team rooms. The artefacts that are left there can be viewed as "footprints" of the activity. Speaking metaphorically, the artefacts indicate that someone has been there, but little information about how the "footprint" got

there, by whom it was made, and when it was made is available. When a large number of students are involved in a distributed learning activity, the reach of this problem increases, as it is naturally more difficult to keep track of many rooms in evolution than a few.

Taking the secondary research question as a starting point for looking at the instructors ability of gaining feedback on students activity, using TW as mediator, various issues has been discussed. Initially TW was clearly a part of giving the instructors an understanding of the students' progression in the learning environment, and TW can very well be used for this purpose to a certain extent, when the focus is on the group and the products of their activity. When trying to learn about individual activity of the students, a small number of problems occur. One problem is tied to the loss of tools of communication as compared to a natural learning environment, and can be described as a reluctance to interfere with students in collaboration for the fear of interference. Another problem is the technical shortcomings of the groupware tool that was used for this learning activity in comparison with an instructors desires and preferences in carrying out his role as an instructor.

5.5 Discussion

The past section has been concerned with the data analysis of the study. In the following section eventual implications of the study are discussed. The quality of the study is evaluated in terms of reliability and validity in chapter 6.

5.4.1 Discussion of the findings

The activity of organising a collaborative telelearning scenario has been described in the analysis of data so far in the study. Using an Activity Theoretical approach, the context of the activity and the people involved in it has been reached for. The activity has been described in its several identifiable phases, and the focus has been on the tools that mediated the organising of VisArt, and the roles of the individual

instructors. The central mediating tool, TeamWave Workplace, has been evaluated regarding its usability in affording feedback on the students' activity in the telelearning scenario.

One of the central findings in this study is resided in the link between the defined objective of the activity as a whole, and the planning of it from the instructor perspective. Through the activity theoretical concept of the object, it has been possible to see the planning of VisArt as a series of instrumental acts toward a defined end – for the students to gain experience in online collaboration using an Internet tool. Whether this end was achieved is a difficult question to answer as it depends on to what extent the collaboration is to be described, or what can be described as collaboration. This was not a central question for this study but, at a very basic level, describing VisArt in terms of providing a "pedagogical space" for a defined body of students, the online system of the rooms in TW has been kept operational for the duration of the scenario. An important factor in ensuring the system stability was the large number of research assistants that were available for technical assistance, such as when the unforeseen problems with the "server.log" file becoming too large, requiring daily restarts of the server. The focus of VisArt was also on a *process* of collaboration, not on the product of it, and one may argue that this limited the instructor role to providing tools and means for allowing the collaboration process to flow. How the students were evaluated on their contribution in VisArt depended on which institution they belonged to, although all the different institutions evaluated their students in some form or other.

When it comes to the instructors involved in VisArt, the activity of organising it can be characterised by a strong definition of roles, and which tasks and behaviour belonged to each of the roles. The tasks were defined in advance of VisArt, and included for example "keeping the system running", and maintaining the learning room. The tasks have been described in the data analysis. The behaviour of the instructors as "online instructors" besides the prescribed tasks, was a role that mostly was up to the instructors to fill themselves, and there was some individual variation in the behaviour as online instructors. These variations can to a certain degree be traced to the instructors' backgrounds. The objective of research on the students' activity in VisArt guided the conduct of the instructors to some degree, in that the instructors

performing research were sceptical towards interfering with students in collaboration, and all online help that was provided and unplanned were to be documented.

On the question of whether the organising of the activity best can be described as collaboration or co-operation, it would be safe to say that the latter holds more descriptive power. The tasks were divided between the instructors during the planning stage of VisArt, and were largely carried through as planned. The instructors performed the tasks associated with their role, and were not required to collaborate in "real time" for the objective of the activity to be realised. Where tasks that were unplanned arose, for example the need for daily restarts of the TW server, a plan for the division of labour was arrived upon, and carried through. These decisions were made in collective face-to-face meetings between the researchers located at UiB, and often took the form of a suggestion immediately being accepted by the consortium of instructors.

The subsidiary research question asked for this study was whether TW could be used to provide feedback on the students' activity. The *raison d'être* of the question was that it is supposed necessary for an instructor to stay updated on the individual student's activity in terms of progression to be able to provide the desired feedback and assistance to the student. The question is answered on two terms. Where the instructors planned in advance that TW would be used in gaining feedback on the activity of the group of students, the software could very much be used to it's planned function. For example by planning how the progress was to be documented in TW by the students. However, evaluating the individual activity through TW was more problematic. The findings rendered in this study indicate a number of issues that the instructors considered when involved in the students' Team Rooms. The issues involved scepticism toward interfering too much with the collaboration of the students, and a perceived lack of functionality in TW, as it couldn't be used for "handling" the objects on which the students were collaborating. Rather, in discussion with students about their pedagogical theme, the instructor felt that he was unable to enter their sphere of communication. This perceived lack of functionality is seen as related to the particular instructor's comprehension of the role as a participating instructor.

A similar finding is reported in Hine (2000), where it is explained how the experimental research on computer-mediated group decision making has lead to the "reduced social cues" model for understanding computer mediated communication (CMC), the model suggesting that CMC environments were lacking in social context cues. Social cues are for example intonation of voice, communication of social status and facial expressions. It is held that these environments lead to a social disinhibition. The "reduced social cues" model can, to a certain degree, be relevant for the findings in this study, although it's asserted *effect,* the social disinhibition, lacks evidence in this particular study. Several of the instructors reported what may be described as a perceived shortage of means of social behaviour whilst in TW compared to a "natural" learning environment, but the effect of this perception seemed to be carefulness and a strong consideration of one's own behaviour as an instructor. The alternative viewpoints to the "reduced social cues" model, is treated in the successive paragraph.

The studies expressing reluctance towards comparing CMC environments to face-to-face settings, holds a position which is in correspondence with this study. Some studies, still focusing on group decision making (e.g., Lea & Spears, 1991, referred in Hine, 2000), have focused on changing the experimental setting within the same CMC environment. It is here claimed that the group decision making is dependant on whether the decision makers feel part of the group or not, implying that researchers needed to focus on the context in which the technology is being used (Hine, 2000). Through the method of natural observation, a method often contrasted to experimentation, Mantovani (1994, cited in Hines, 2000) claims that CMC environments often reinforces pre-existing social phenomenon, thus implying that technology has few social effects outside it's context of use. Interpreting the persistent behaviour of the instructors using TW for gaining feedback of students' activity in VisArt in the light of this implication, despite the reported lack of "social cues", keeping in mind the disinhibition it is supposed to lead to, is interesting. The observation that the instructors behaved in a way presumably similar to the way they would behave in a "natural" learning environment does not support the postulated effects of the "reduced social cues" model.

6.0 Evaluation and Conclusions

Having performed the analysis and discussion of the empirical findings, this chapter is dedicated to evaluating the study in terms of its strengths and weaknesses, comparing and contrasting it to studies that are close in nature to it, make suggestions for further research, and conclude it with final remarks.

6.1 Evaluation of the study

The quality of the study will be evaluated in the following sections. Initially, the criteria for evaluating the quality of research are considered. The methodological issues of reliability and validity are discussed both in general, and in relation to the data gathering techniques employed in this study. The structure of the quality evaluation of the study will take the form of an initial discussion of techniques and criteria for evaluating studies in general and qualitative studies in particular, before the specific reliability and validity issues for this study are discussed. A distinction will be drawn between traditional qualitative data gathering techniques such as natural observation and interviews, and the methods of collecting digital data such as log files and e-mail communication.

Before the quality of the study is considered, the methods of evaluating studies in general must be identified. Criteria common to all strands of research are hard to find (Denzin & Lincoln, 1994). The debate is centred on the question of whether the same methods of evaluating research can be used both in qualitative and quantitative research (Holter, 1996). Yin (1994) may seem to fall within the position affirmative of this, suggesting four concepts for evaluating the quality of research, and further claiming that they are common to all empirical research in the social sciences. The concepts are construct validity, internal validity, external validity and reliability. Shortly and respectively, they are explained as validity in operationalisations of the concepts studied, validity in the causal explanations of central concepts in the study, whether the field researched on allows generalisation to other fields and whether the operations of the study can be repeated with the same results. These criteria for

evaluating research is often associated with quantitative methodology, which typically adheres to positivist logic (Guba & Lincoln, 1989), a logic that Hammersley and Atkinson (1995) claim that qualitative research does not match. The quantitative criteria for evaluating research originates from research in the natural sciences and aims for the goal of objectivity (Hammersley & Atkinson, 1995). The notion of objectivity, and especially the notion of objectivity within qualitative research, is often reported as dubious in terms of being a valid representation of facts of the matter when it is used to describe the work of the researcher (Kirk & Miller, 1986). One way of ensuring objectivity is to separate the process of observation from the process of validation, or to separate the methods of observation from the observer (Hammersley & Atkinson, 1995). From the perspective of the qualitative researcher these are steep demands. The world of social actors is typically seen as constructed (Guba & Lincoln, 1989), containing multiple perspectives (Patton, 1987), and not holding a *single truth* within it, but rather "multiple truths depending on point of view" (Patton, 1987, p. 166). Constructions are, according to Guba and Lincoln, "come about by the virtue of interaction of the knower with the already known and the still-knowable or to-be-known" (1989, p.143). Thus there is reason to tone the "benchmark test" of objectivity down. The goal should instead be to strive for neutrality, as in not being predisposed to certain findings before they are found (Patton, 1987).

Guba & Lincoln (1989) identify four criteria that are meaningful in evaluating evaluation. They are credibility, transferability, dependability and confirmability. The notion of credibility points to the closeness between the descriptions and the world as it is constructed by the respondents, as opposed to the "objective world". Some of the different ways of assuring credible data are to be engaged in the field over an extended period of time in order to reach the issues central to the respondents, discussing the findings with peers and search for alternative hypothesis. Transferability corresponds to the concept of generalisability. Transferability in qualitative research has different properties than in quantitative research (ibid.). The extent to which the concepts are applicable in several contexts are dependent on to which degree the conditions in the different contexts match (ibid.). Dependability is comparable to reliability, and is ensured by having a stable and consistent data gathering process. As the nature of qualitative studies often are explorative the

research design may change during the data gathering process, which makes it important to make the data available for inspection (ibid.). Confirmability is the fourth criterion for evaluation of the study presented by Guba and Lincoln (1989). Confirmable findings are findings rooted in the data.

When evaluating this particular study, the methods of gathering data are shortly recapitulated. Observation, interviews, e-mail collection, log-file collection and collection of artefacts produced by the instructors and facilitators during VisArt were the data collection techniques employed, confer table 4.1 for an overview of the data gathering techniques used in this study.

Email

The digital data gathered for this study was to some extent placed outside of the control of the researcher. The e-mail communication that took place between the instructors and facilitators themselves and between the instructors and the students were forwarded after the conclusion of VisArt. There is no guarantee that all the e-mail communication was forwarded, and there is a risk that some of it was withheld inadvertently or other, thus not giving a full an undistorted picture of the e-mail communication. Cross-checking to investigate is to a certain degree possible, as some of the postings were made to several respondents in the group of instructors and facilitators. Tracing the addresses in the header of the e-mail, one can ascertain whether the e-mail was a reply to another, a forwarded response and so on. As all the three instructors involved in the e-mail communication system designed for VisArt offered all the e-mail that they had saved at the end of VisArt, a good level of cross-checking is possible. These controls do not reveal that any number of e-mails are missing, although this does not preclude that e-mails sent or received from students are missing. However, as no other e-mails are missing, this can be taken as a fair indication that the e-mails offered are credible and dependable.

Log Files

The log files rendered from the server has been used to offer an indication of the instructors and facilitators activity in TW. There are, however, a few pitfalls to be

mentioned in relation to the use of this particular kind of data. The Server Log File Analyzer transcripts indicate the online presence of identifiable persons in TW. (The names are removed from the transcript and replaced with a code and colour for matters of anonymity and privacy.) A coloured column in a graph indicates the presence of the individual instructor or facilitator. The problems connected with this in terms of evaluating the study are both practical and ethical. The practical problems related to evaluating the transcript files when treating them as data are that they can be deceitful or give false impressions in terms of describing activity level. There is no way of knowing whether the particular instructor has been active within the system from just observing the transcripts, as it only registers whether the user account is active on the server. This can be a problem related to the credibility and dependability of the transcripts. Thus, the transcripts were merely used to provide a faint indication of the activity of the instructors during VisArt. The second practical problem connected to using the transcript files as indicators of activity is related to the fact that the transcript displays the information about the whole group of instructors and facilitators as a whole. When the colours of the different members of the instructor group appear next to each other at the same time of the day, one may be lead to believe that they are co-operating. Concurrency in this way can, however, not be taken as evidence of co-operation, although a very strong repetitive concurrent presence might lead to data founded speculation. The reason for this is the same as in the problem of activity level – one can only observe the presence, not the nature of the activity.

The ethical problems of using log file transcripts as indicators of activity in a co-operative environment will not be dealt with exhaustively here, but a short comment will be made for issues that might be touched and that are related to this study[17]. It is generally held that information about the self is the property of the person him or herself. Log Files create information about people, with the possibility of them not knowing about it. Some of the ethical problems related to this are hence problems of surveillance and privacy, and may arise to the attention of the people involved when the nature of the activity is value-laden, i.e. one form of activity is generally held as more preferable in a setting or a context than another. Non-activity for example,

[17] Confer Meistad (2000) for more extensive treatment of ethical issues of using log file information in a collaborative learning environment.

which it may be argued is a less valued form of activity in professional contexts, will be reported from the log file transcripts, as long as presence in the system is the evaluative criteria. Non-activity, while being online will not be reported, thus giving an unfair representation of the activity level. It therefore seems that one can adduce that when the use of log files is being practised, the people affected should be notified in advance that such information is being recorded, the nature of the information recorded, and to which ends the information is being used.

Observation and Interviews

Leaving the discussion of the digitally generated data, the attention is turned towards the observation and the interviews undertaken for the purposes of this study. Participant observation was conducted, and went on for the duration of the activity including the Planning Phase. One would be inclined to believe that it is a strength to the study that both face-to-face meetings between and online activity of the group instructors were observed for the duration of the organising process. The observation also helped to inform the interviews, where questions arose out of ideas about the context of the activity that was being observed. It is argued that this had lead to increased credibility and dependability of the data, as an engagement toward the field in research was made for the duration of the organising process. The observation largely informed the interviews, in creation of the interview guide, the interviews all being undertaken in retrospect of VisArt.

A reference is made to the initial discussion of criteria for evaluating the quality of studies, where the point was made that when considering people, there is the most sense in regarding the world as constructed. It further contains multiple perspectives and truths, formed on the basis of expectancy, as opposed to an objectivist and monist view. The same point must be made about the data from the observation and the interviews undertaken here – they are constructions of a perceived reality, and dependant of the observer. This is not to say, however, that the observer was predisposed toward certain findings. The point that the data were constructed by the researcher may also be made about the responses of the interviewees, with risk of stating the obvious, as they also went into the interview situation carrying beliefs about what they might be asked, and what their opinions about the enquiry were. The

opinion referenced here might be interpreted in the light of Goffman's (1967) distinction between different modes of communication in impressions to *give*, and impressions to *give off*. To give impressions refers to communication in the traditional sense. Impressions that are *given off* refer to communicational acts that are performed where the content is "something more" than what is actually communicated, where the communicator expects the receiver to understand something more than what is said in words, or meaning implicit in them.

At two separate interviews, references were made toward the theory that is used as an analytical lens in this study. It is noted that the goal and some characteristics of the study were stated initially in the interviews. The first reference to Activity Theory is made by a respondent who expressed concerns of a discrepancy related to the nature of VisArt, and his conception of Activity Theory. The second reference to Activity Theory arose when a respondent was initially asked to discuss motives for participating as an instructor in VisArt. The comment might be explained as a "justification" of the question raised grounded in personal knowledge of Activity Theory, and was discussed afterwards.

> Extract 16 (06.06.1999, 09.00 a.m.)
> *"[W]e have spent a long time on arriving at valid approaches, that will be conceived of authentic problems (for the students).That is a problem in itself. And there… It is actually struck… By the… If you read Activity Theory, then this (VisArt) is affected by the experiment, as an activity. That is, the experiment is different from the authentic activity. You see? We have a discrepancy, perhaps, between a controlled experiment and a natural setting that might lead us to find hypothesis"*

> Extract 17 (04.05.1999, 10.00 a.m.)
> *"I know that it is a central part of the Activity Theory"*

Going back to Goffman's distinction, one may see these comments as seeking to communicate a certain impression toward the researcher in these interviews. A discussion of the reason, or the backdrop for these comments is not attempted in this study, but it is held that there may be discrepancy between a view held by the

interviewed instructor and the view that was communicated to the researcher. These comments were few, however, and although arriving on such a derived category of findings would subject the study to problems of credibility, regarding the closeness of the data and the respondents' conceptions and constructions of reality.

The discussion of the findings and the discussion of the quality of the study in general are concluded here, using concepts for evaluating it that are relevant to a qualitative research study. A discussion of the strength and weaknesses is undertaken in the next section.

6.1.1 Strengths and weaknesses

The strength of the study is largely held to be, through an activity theoretical perspective, the evaluation of an an actual co-operative activity supported by technological artefacts. Initial statements were made about the complex phenomenon of people working together, and how one should not view technology as isolated from the use of it, and from the use of it within a context. Further, a reminder of the activity theoretical notion of looking at real activities in real situations (Kuutti, 1996) is made. A multiplicity of data gathering techniques, both digital and traditional has been used to inform the study, allowing for an evaluation of the studied pheonmenon from a range of different perspectives. The study has evaluated the co-operation of a group of instructors using technological artefacts, and the focus has been on the artefacts in use. The way the artefacts created a new work environment, and the instructors reservation regarding how to act in relation to students in this new environment has been one of the central findings. Thus, a strong relationship between the phenomenon at hand, the research questions, the unit of analysis, theory and methodology use can be argued.

When considering the weaknesses of the study, the activity theoretical necessity for evaluating phenomenon *in situ* is again referenced. The case that VisArt was not a real situation, in that it was a constructed learning environment that lasted a given period in time can be made. If VisArt was a scientific experiment constructed for the sole sake of research, the study would have less credibility and transferability.

However, there are several arguments against the case of looking at VisArt as an experiment. One is that it was arranged as a learning activity to be incorporated into different courses, part of other courses at the respective teaching institutions taking part. The students were evaluated, in one form or another, on their efforts and experiences in VisArt. Secondly, from a design perspective, one may question what would have been planned differently if the scenario was to be carried through as a learning activity alone.

6.1.2 Suggestions for further research

In performing a similar study in the future, there are however certain aspects that may have been treated differently. The treatment of the cultural rules between the instructors proved interesting, in the way that it permitted focus on the learning acitivity as a phenomenon distinguishable traditional learning activities. The focus, however, was on the perception of rules that could be assigned to VisArt. An investigation of the background context of the instructors previous experiences as instructors, and a further investigation of how they related to the student culture may have proven interesting. It is believed that it would elucidate distibuted collaborative learning environments as an environment and cultural phenomenon separable from other learning environments. A research design with a series of studies of a learning activity such as VisArt, prerequisting that the activity was deployed at several stages in time, may also help inform these speculations.

6.2 Related studies

Studies that can be related to this study will be investigated in this section. The study can shortly be characterised as an evaluation of a collaborative distributed learning activity, with the organisation of the work by instructors and facilitators in focus, the evaluation and research design being informed by activity theory, and method of data collection being qualitative.

First and foremost, for obvious reasons, the studies conducted within project DoCTA should be mentioned. For information of these studies, confer Wasson, Guribye and Mørch (2000).

Collis (1993) analyses different aspects of conferencing as means for mediating distributed training. She looks into different technologies for conferencing, such as audio, audiographic, computer and videoconferencing technologies, and different dimensions for distributed group activity, such as structured vs. unstructured, synchronous vs. asynchronous and instructor led vs. instructor absent. She also consider possible critical concerns and issues tied to the different actor perspectives within a conferencing environment, the latter being the most interesting point of comparison to my study. The roles of the learner, the instructor, and the course organiser, among others are discussed.

Teles, Ashton and Roberts (2000) investigate the kind of activities, in which instructors in collaborative online teaching environments were engaged. Berge's (1996, cited in Teles, Ashton & Roberts, 2000) framework for instuctor roles in the same kind of environments, divided between pedagogical, managerial, technical and social roles, is used as a starting point for analysing postings made by instructors in an online setting. The methodology used was largely qualitative, with focus on arriving at coding that could, after textual analysis, describe instructor postings as belonging in each of the four categories. The study is similar to this, in that instructor roles in online teaching environments are investigated, through use of a qualitative methodology. The study is different in that it focuses on role and role behaviours alone. It is also different from this study in that here a multitude of data gathering techniques are employed. Teles, Ashton and Roberts (2000) arrives at some similar conclusions as this study in holding out the time spent on, and work directed at handling technological aspects in an online teaching course is not to be underestimated. The study also suggests that typically there is a distribution of different role areas between different instructors, such as for example assigning technical work to a "technical instructor". This corresponds to the initial roles and tasks described in this study.

6.3 Conclusions

Within an activity theoretical perspective, this study has been concerned with how the instructors and facilitators of a collaborative telelearning scenario organise their work. In addition, the groupware tool for mediating the collaboration in the same learning environment has been evaluated in relation to how it could be used by instructors for gaining feedback on the students' activity. More specifically, the focus has turned to the emergence of perceptions of roles for the instructors, the tasks that were associated with the roles, and the tools that were used in mediating the communication and facilitating the instruction. Further, they way in which the environment can be regarded a new working environment has been discussed.

The theoretical approach taken in this study Activity Theory, presented in chapter 2, has proven to be a useful resource in informing the study. The presentation of the theoretical approach focused on the distinction of the historical and developmental influences and the contemporary tenets of Activity Theory and its use within the field of CSCW, both of which were believed to be important. Through using the tenets of activity theory, the aspects that are believed to be central in the activity of organising the scenario have been highlighted, although not separating them from the context in which they occured. The organising of the activity is largely seen as planned and instrumental, and activity theory has proven itself as a tool that permits the focus on defined objectives, and a derivation of an emerging division of labour. The theoretical approach is centered around the ideas of viewing the activity as fluent, dynamic and developmental, and has proven fruitful in holding out the conctextual issues of the instruction. Events that were unplanned and unexpected, and that changed the activity has been accounted for. Through the notion of contradictions in activities, tensions that were central in the organising of the learning scenario have been illucidated. It is thus believed that activity theory can be a useful resource in evaluating co-operative work between people using artefacts, through it's focus on the context in which the co-operation occurs, viewing it as fluent and developmental as well as focusing on the instrumental nature of the actions of the actors involved in the co-operation.

The background context for the organising activity presented in Chapter 3, focused on mainly three aspects that were believed to be important for the instructors in VisArt. These were the research project that provided the basis for the instructors, and acted as both a limitation and a facilitation of their work as instructors. An initial discription of the telelearning scenario was provided, and a short account of the computer tool that was used is given. The focus in this study, however, has not been technological aspects other than how it mediated the activity of the instructors and the facilitators, or how it was used.

The methodological approach chosen was a central tool in arriving upon the description of the scenario that has been presented. Through using, for example, the guidance that is provided by the theoretical approach taken, the nature of the research questions asked, and the level of analysis a qualitative or ethnographical methodology was arrived upon. The nature of the phenomenon under study, the distributed and online co-operation of a group of instructors, precluded the sole use of methods traditionally understood as ethnographic. Through applying the use of a ”virtual ethnography” (Hine, 2000), multiple methods of gathering electronical data such as log file transcripts and e-mails were employed, in addition to the more common methods such as face-to-face interviews and observation. The methodological approach allowed for gaining an understanding of the phenomenon while it unfolded and developed, and also for scrutinising events retrospective of their occurance.

The data analysis, presented in chapter 5, has focused on the instructors emerging perceptions of their roles and how they were dependent on both contextual issues in the activity and issues outside of it. The initial role perceptions were closesly tied to the tasks of the different instructors, and later, through the investigation of contradictions in VisArt, a discrepancy of role perceptions within the instructor group was uncovered. The finding was used as an argument for viewing the learning environment in question as a phenomenon in it’s own right – that it cannot be viewed as phylogenetically subordinate to traditional learning environments.

The goal for the analysis has been to give a thorough and holistic account of the organising of VisArt from the perspective of the instructors. The focus has also been on changes in the activity while it unfolded, and how these changes in the activity can

be described by employing the notion of phases, mainly through change in the objective of the activity. The textual analysis and the analysis of artefacts such as planning documents and visual artefacts has provided a basis for the description of the activty as evolving through several phases and allowing the focus to be held on the division of labour between the instructors, the objectives of their activity, and the tools that mediated it. One of the tools that mediated the co-operation was TW, and this tool was also evaluated regarding it's usefulness in protraying the students' progress to the instructors, where both limitative and facilitative facets of the groupware system were held out.

It can be held from the discussion of TW that the feedback that was necessary to glean from the system for the progress of VisArt from a pedagogical perspective, was available although it held certain limitations within. On evaluating individual activity, the challenges were far greater, both for technical reasons and because of behaviour that can be described as cautiousness by the instructors. It is therefore argued that the online environment is largely inseparable from it's own context, and that there are no single characteristic of the environment that defined the activity of the instructors. Knowledge about how to behave as instructors in the learning environment must be learnt from this context.

Some general experiences from an evaluation of the organisation of a collaborative telelearning scenario have still been made. One of them is not to underestimate the amount and flexibility of instructors and technical personnel needed to sucessfully carry through the activity, for the reasons that the workload is greater than one intuitively might expect and the fact that unstability in the employed technologies can cause the activity to halt. The other is that a thorough discussion of the nature of the learning environment, including an evaluation of the students taking part, is essential for the instructors in gaining an understanding of how to act as instructors, and what it means to be an instructor co-operating with other instructors in an online environment.

This concludes the final remarks made in this study. The study has been done as a part of a larger research project (DoCTA), and hopefully the findings and their implications from this study will help inform and supplement the other studies

performed for the same project, and together constitute a larger body of research that are of value when attempting to understand the phenomenon of people working together using artefacts.

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